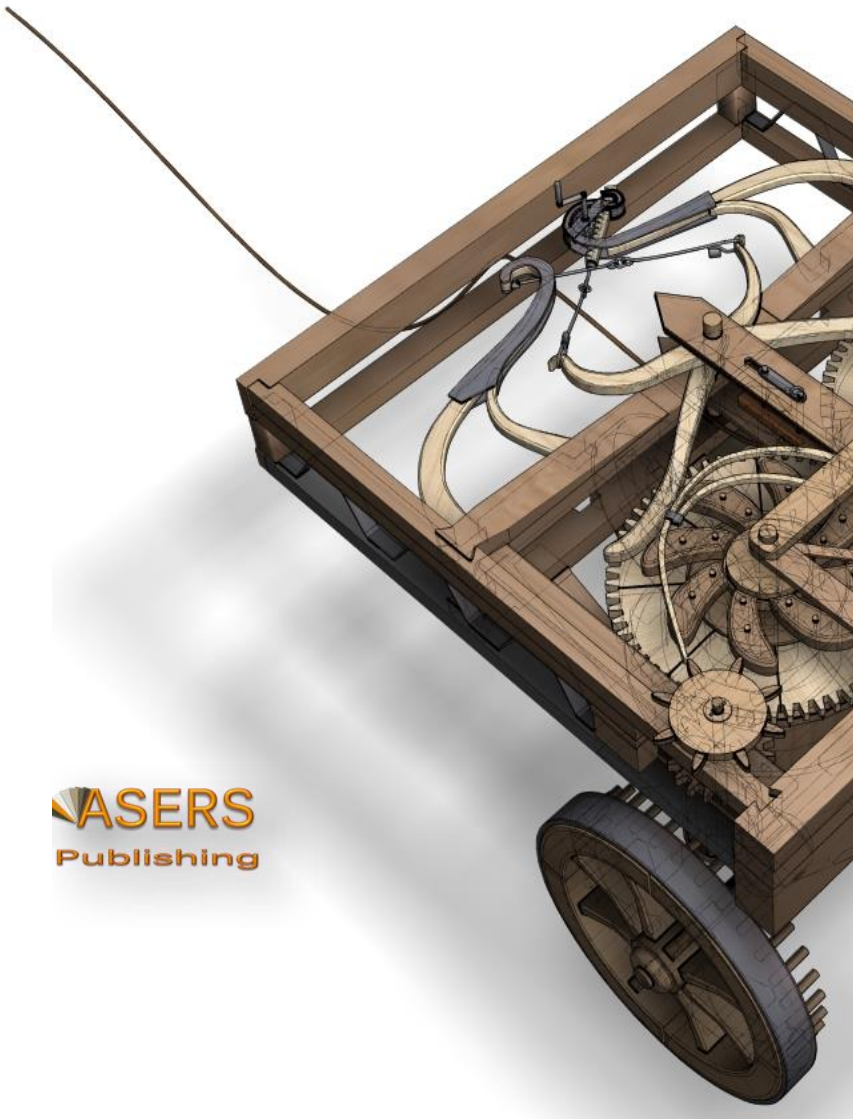
Theoretical and Practical Research in Economic Fields



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I.J. Good's Claim, That Keynes's Evidential Weight of the Argument, V, a Logical Relation, is a Number, is False

Michael Emmett BRADY
California State University, Dominguez Hills
College of Business Administration and Public Policy, Carson, California, USA
mebrady@csudh.edu

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Abstract: All current assessments of how Keynes's weight (evidential weight of the argument) concept is measured are erroneously based on a metaphor ignored by I.J. Good, which Keynes used before he presented the mathematical analysis involved in measuring weight in chapter 26 of the A Treatise on Probability, on page 77 of chapter 6 to measure weight.

Keynes's chapter 26 is the omega while chapter 6 is the alpha. It is impossible to fully grasp Keynes's evidential weight of the argument concept, first presented as a logical relation designated as V, which is then measured through the construction of an index of weight in chapter 26, without a detailed study of pp. 310-315 of chapter 26 of the A Treatise on Probability.

The misbelief that Keynes 's concept of the evidential weight of the evidence, V=V(a/h), in chapter 6 of the A Treatise on Probability, represented a measure of the absolute amount of Knowledge, defined as K by Good to represent a gross measure of weight, can be traced back to numerous book and journal article contributions made by I.J. Good between 1950 and 2000.

The most severe errors about chapter 6 of the A Treatise on Probability were repeated again and again by Good from 1950 to 1990 (Good 1950, 1960, 1962, 1965, 1967, 1967, 1968/70, 1970/71, 1975, 1983a, 1983b, 1985, 1988, 1988, Good and Toulmin 1968).

Good completely overlooked Keynes's footnote 1 on page 76 of chapter 6 to chapter 26 of the A Treatise on Probability, where Keynes stated that he would discuss how to integrate weight into a discussion of "…the application of probability to practice." This would require a mathematical analysis and, obviously, would require the restriction that V(a/h)=w, $0 \leq w \leq 1$, and w is the degree of the completeness of the information so as to be able to combine it with $0 \leq \alpha \leq 1$, where P(a/h)=α and α is the probable degree of rational belief.

Keywords: evidential weight of the argument; weight; logical relation; mathematical variable; metaphor.

JEL Classification: B10; B12; B14; B16; B18; B20; B22.

Introduction

The paper will be organized in the following manner. Section One will examine the original error made by I.J. Good, as presented by him first in 1950 and then repeated in a series of articles and books. I will concentrate on the errors that appear in a paper in a collected volume published in 1988 and republished in 2012, as well as a book written in 1983. Section Two will examine the mathematical confusion created by setting V, a logical relation, equal to K, K/I or K/[K+I], all of which are mathematical equations involving the amount of Knowledge, K, and the amount of Ignorance, I. It is impossible to normalize V on the unit interval [0,1] as done repeatedly since 2011 by A. Vercelli (2011, 2013, 2016, 2018). Section Three will examine Runde's error of treating V as a mathematical variable. Section Four will examine the impact on the literature that results from the failure to correct past errors. The conclusions end the paper.

1. I. J. Good's Mistaken Understanding of Keynes's Initial, Logical Treatment of the Evidential Weight of the Evidence, V, Relation in Chapter 6 of the TP

Philosophers and economists continue to erroneously claim that Keynes's Evidential Weight of the Argument, V=V(a/h), which is a logical relation holding between the h and a proposition, is always increasing monotonically over time. This doesn't make any sense because a logical relation can't increase or decrease. The false claim that weight is monotonically increasing is based on a severe misreading of a metaphor Keynes used in chapter 6 of his A Treatise on Probability to help explain why the Evidential Weight of the Argument is different from probability. The logical strength of an argument, which has more relevant evidence, will be stronger when compared to the logical strength of an argument with less relevant evidence. It is also the case that we will know more eventually if we later discover additional relevant evidence that establishes that we, in fact, did not really know what we thought we knew regarding the logical strength of the two arguments. However, Keynes's point, that an argument with more relevant evidence is stronger, has nothing to do with measurement because logical or mathematical relations are not variables that can take on different numerical values.

What is required to actually measure the evidential weight of an argument, V, mathematically, as opposed to logical considerations, is to define an index for the evidential weight of the argument that is normalized on the unit interval between 0 and 1, an approach which is identical to the normalization of probability on the unit interval between 0 and 1, so that one can talk about different degrees of probability and different degrees of weight. Any attempt to discuss Keynes's concept of weight is an exercise in futility unless the correct logical and mathematical structure has been provided first, so that one can talk about different degrees of probability and different degrees of knowledge and ignorance. Such a structure was not provided by Keynes in Chapter 6 of the A Treatise on Probability. However, Keynes did create such a structure in chapter 26 of the A Treatise on Probability. First, Keynes had to define V(a/h), a logical relation, to be equal to a range of different degrees. Keynes designated this mathematical variable as w,where w is first normalized on the unit interval [0,1] and represents the degree of completeness of the relevant information on which the probability is based.Therefore, $V(a/h) = w$,$0 \leq w \leq 1$ performs the same task for Keynes as α does for his other logical relation, $P(a/h) = \alpha$,$0 \leq \alpha \leq 1$.

Given that w measures the degree of the completeness of the relevant information, so that $V(a/h)=w, 0 \leq w \leq 1$, Keynes can then combine P and V in chapter 26 into his "conventional coefficient of weight and risk, c", where c is also normalized on the unit interval between 0 and 1 for the specific form chosen by Keynes that integrates both non additivity, sub additivity, and non linearity in the decision weights chosen by Keynes, which were [2w/(1+w)] and [1/(1+q)], respectively. It is mathematically impossible for w to be monotonically increasing in w. Keynes's c coefficient was chosen by Keynes to illustrate the non additivity and non-linearity of the decision weights, where w=K/(K+I) and K denotes the absolute amount of knowledge while I denotes the absolute amount of Ignorance. This is practically the same format Keynes used to define α, $\alpha = p/(p+q)$, where p is the probability of success and q is the probability of failure.

The complement of α is $1-\alpha = q/(p+q)$. The same type of analysis shows that the complement of w= K/(K+I) is 1-w=I/(K+I), since K+I=1 allows for the normalization of w on the unit interval.

The major error committed in all journal articles and books, published over the last eighty-eight years that deal with Keynes's V relation, starting with the severe errors regarding Keynes made by I.J. Good in his 1950 Probability and the Weighing of Evidence, is to completely confuse the logical relation of Keynesian weight, V, with its measurement by w. This error follows directly from Good's complete misinterpretation of the following quote from page 77 of the A Treatise on Probability: "The fundamental distinction of this chapter may be briefly repeated. One argument has more weight than another if it is based upon a greater amount of relevant evidence; but it is not always, or even generally, possible to say of two sets of propositions that one set embodies more evidence than the other. It has a greater probability than another if the balance in its favour, of what evidence there is, is greater than the balance in favour of the argument with which we compare it; but it is not always, or even generally, possible to say that the balance in the one case is greater than the balance in the other. The weight, to speak metaphorically, measures the sum of the favourable and unfavourable evidence, the probability measures the difference." (Vercelli 2011).

Keynes is talking, as he himself so clearly stated, metaphorically about weight, V. Keynes's statements were completely and totally misinterpreted by I.J. Good, as well as by all of the academicians who followed him, who dealt with Keynes's weight concept.

Consider the following two statements by Good, which are representative of all of Good's assessments of Keynes's 'weight' relation in the period 1950-1990 (Edgeworth 1922b; Good 1950, 1950, 1960, 1962, 1965, 1967, 1967, 1968/70, 1970/71, 1975, 1983a, 1985, 1988, Good and Toulmin1968).

First, we have the following claim:

"The expression was used by J. M. Keynes (1921, 71) in a less satisfactory sense, to apply to the total bulk of evidence whether any part of it supports or undermines a hypothesis, almost as if he had the weight of the documents in mind." (Good 1983a, 160).

Second, we have another version of the above statement:

"I don't interpret the expression "weight of evidence" as proportional to the weight of the paper that the evidence is written on. Such a definition would not be worth the paper on which it (Good's emphasis was placed in italics) is written. Even J.M. Keynes (1921, 71-78, 312), who toyed with this essentially uninteresting interpretation, though he usually called it "the weight of argument…." (Good 1988, 28).

Good then goes on to string 6-7 individual sentences, taken out of context from Chapter Six of Keynes's *A Treatise on Probability* (Keynes 1921, Kasser 2016, Joyce 2005), that ignore that V is a logical relation and presents this as evidence substantiating his interpretation made about Keynes's V concept, an interpretation that is never even mentioned, in the far, far superior work on chapter six of the TP combined with chapter 26 of the TP, done by Edgeworth, Russell, and Broad in 1922 (see Brady 2018a, 2018b, 2020a, 2020b). Edgeworth (1922a, 1922b) given his request that the readers of *Mind* needed to assist him in figuring out the importance of Keynes's new conventional coefficient of weight and risk, c, would reject every single one of Good's numerous criticisms of Keynes, given that Keynes had restricted the MEASURE of V to w to the unit interval between 0 and 1,so that $0 \leq w \leq 1$ in the c coefficient .Any claim about Keynes's chapter 6 discussions, about some purported absolute measure of weight, is the result of a reader having overlooked the mathematical, technical developments undertaken by Keynes in chapter 26. Nowhere in the corpus of Good's work in his lifetime is there any evidence that he read either of Edgeworth's book reviews of the TP (Edgeworth 1922a, 1922b). It would have saved Good from having made a number of erroneous statements about Keynes's V concept.

We can now go into greater detail about the nature of Good's errors.

Keynes's 'weight of the argument' in chapter 6 of the TP refers to a logical relation while the measurement of V in chapter 26 of the TP refers to a mathematical analysis. Keynes's V=V(a/h) is a LOGICAL RELATION. It is not a MATHEMATICAL VARIABLE. The application of the logical relation, V, as it relates to an argument's strength(major premises, minor premises, and conclusion, where a is the conclusion and h are the premises),is different from the mathematical analysis of w,where w is defined as the degree of the completeness of the relevant information and is MEASURED on the unit interval between [0,1] in chapter 26 on page 315.w is a mathematical variable; V is a logical relation. V does not MEASURE anything. It simply shows that one argument is logically stronger than another argument if it is based on more relevant evidence. Therefore, $V(a/h_1,h_2,h_3,h_4,h_5,h_6,h_7)$ is a stronger argument than the argument $V(a/h_1,h_2,h_3,h_4)$,by definition of the logical relation, V, because it has more relevant evidence supporting it, while the other argument has less evidence supporting it. Therefore, $V(a/h_1,h_2,h_3,h_4,h_5,h_6,h_7)$ is a stronger LOGICAL ARGUMENT than $V(a/h_1,h_2,h_3,h_4)$.

However, NO MEASUREMENT is being engaged in at this point by Keynes.

Contrary to Good and all of his supporters in the economics and philosophy professions, Keynes has presented no MEASURE. where V(a/h) = K is purported to be a MEASURE of the absolute amount of relevant knowledge. This argument is where Good gets into big trouble. Good takes K =7 from $V(a/h_1,h_2,h_3,h_4,h_5,h_6,h_7)$ and K=4 from $V(a/h_1,h_2,h_3,h_4)$. Of course, we then have the claim that $V(a/h_1,h_2,h_3,h_4,h_5,h_6,h_7)$ is stronger because 7 individual pieces of knowledge are greater than 4 individual pieces of knowledge, and 7-4=3 means there are 3 more pieces of knowledge in the first argument. Good has converted V from a logical relation into a mathematical variable. Good apparently never realized that this is impossible to do.

From this, Good jumped to the queer conclusion that is provided above, that "I don't interpret the expression "weight of evidence" as proportional to the weight of the paper that the evidence is written upon. Such a definition would not be worth the paper on which It is written…"

Good would also have erred egregiously and most severely in claiming that, since the argument $V(a/h_1, h_2,h3_3,h_4,h_5)$ has five pieces of knowledge, it is a stronger LOGICAL argument than $V(a/h_1,h_2,h_3,h_4)$,which only has four pieces. Good is presenting Keynes as arguing that his MATHEMATICAL MEASURE for the weight of the argument, V, is given by the absolute amount of total relevant evidence, K. Only in chapter 26 is Keynes's entire presentation and discussion completed.

Good never bothered to read chapter 26 and, as a result, his analysis does not hold water.

Good's argument would only make some sense if there was no chapter 26 in the TP.

Of course, it is in chapter 26, sections 7 and 8, where Keynes provides a MEASURE of V. Keynes's MEASURE of V is that V(a/h) = w, where w equals K/(K+I) and w has first been normalized on the unit interval [0,1].

One can now combine the analysis of both chapters six and twenty-six of the TP to obtain Keynes's complete analysis, which is given below:

Given V=V(a/h) =V(a/h_1,h_2,h_3,h_4,……h_n,h_{n+1}….), we can normalize, so that V(a/h)=w,0≤w≤1,where w=K/[K+I] and 1-w=I/[K+I].We can now incorporate this into a mathematical decision rule that combined both probability and weight. Of course, what results is Keynes's very complex and complicated c coefficient. This is easily seen by using *Mathematica* to generate three dimensional contours.

Good's erroneous analysis shows up continuously in academic works. An example is the book, edited by S. Brandolini and R. Scazzieri, titled *Fundamental Uncertainty* (Vercelli 2011). Parts of this book are based on using Good's papers, as well as Runde's work, who, like Good, accepts the evaluation of K as representing a MEASURE of the absolute amount of relevant knowledge, as the foundation for analyzing and evaluating Keynes's concept of weight. This is most pronounced in the first two contributions, by H. Kyburg (2011), and I. Levi (2011). However, this error, either directly or indirectly, is implicit whenever there is a discussion of weight in the other chapters in the book. No where in the book is the correct mathematical specification, V(a/h)=w,0≤w≤1, stated or even suggested.

2. A. Vercelli's Confused Mixing up of Keynes's Logical and Mathematical Analysis in Chapters 6 and 26

The mathematical errors committed, as regards the analysis of the measurement of Keynes's 'weight of the argument', by A. Vercelli, have been made by him repeatedly in many articles and book contributions over and over again since 2011 (Vercelli 2011, 2013, 2016, 2018). This paper will concentrate on (Vercelli 2011) in Brandolini and Scazzieri.

A. Vercelli's major error is to confuse a logical argument with a mathematical analysis. It is mathematically impossible to claim, as A Vercelli does, that the logical relation, V, is a mathematical variable, like Keynes's w. V and w are, for Keynes, two completely distinct and different parts of the analysis. Keynes separates the analysis into two different chapters. Chapter 6 of the TP provided the logical analysis of V. There is no mathematical analysis of a decision rule that would incorporate both probability and weight into a single equation, as Keynes does with his c coefficient in chapter 26, in chapter 6. Chapter 26 provided the mathematical analysis of w that allows Keynes to demonstrate the great complications that result when one attempts to combine both variables into one mathematical analysis. The result is extreme complexity.

Keynes thus demonstrated how the integration of 'weight' mathematically creates difficulties regarding the application of probability in practice. Keynes does this by the creation of his conventional coefficient of weight and risk, c, which was the first decision weight approach made in the history of decision making. Keynes demonstrated that the incorporation of weight created significant complexity for formal methods of analyzing decision making. The result was that the linear and additive approach based on probability alone was turned into a non - linear and non -additive approach that severely complicated the formal analysis of ALL decision making. Vercelli ignores all of this. It will be demonstrated below that Vercelli's analysis is mathematically incorrect. Vercelli uses the notation V(x/h), instead of Keynes's V(a/h). Vercelli's V(x/h) will be replaced by Keynes's V(a/h) without any loss in generality.

Following Runde (1990), Vercelli (2011) reconsiders Runde's three versions of the evidential weight of the argument, V:

V(a/h) =K, V(a/h)=K/I, or V(a/h) =K/(K+I).

Following in the footsteps of Runde (1990), Vercelli (2011) claimed that Keynes was vague and ambiguous in his discussions of V. This led to three possible ways of MEASURING weight.

All three specifications are not only wrong, but impossible, since it is impossible for V=V(a/h)= V(a/h_1,h_2,h_3,h_4……h_n,h_{n+1}….), a logical relation, to equal the mathematical variables K, I, or K+I, or any combination of them. It is impossible for V(a/h) =1 or 0 as claimed by A. Vercelli on p.154 of [45]. Further, it is impossible for V to be normalized on the unit interval, so that 0 < V(a/h_1,h_2,h_3,h_4,….h_n h_{n+1}….)<1, as also claimed by A. Vercelli on page 154. It is like claiming that the equality sign can be restricted to a specific interval, 0 <=<1.

Keynes's conventional coefficient of risk and weight is specified as the following mathematical equation:

$$c=p\,[1/(1+q)]\,[2w/(1+w)], \qquad 2.1$$

where p, q, w, and c are all defined on the unit interval between 0 and 1. That is because Keynes has defined a mathematical variable, w, that MEASURES the completeness of the relevant evidence. V is not w. V does not MEASURE ANYTHING.V=w.

A. Vercelli's final mathematical error occurs on page 163 Vercelli (2011). He claims that "…as suggested by Dow and Werlang:

c(P,A)=I-P(A)-P(Ac).....1-V(a/h)." 2.2

Of course, it is quite impossible to subtract or add a logical relation like V. A. Vercelli's mathematical error can be corrected to read as

"….c(P,A)=1-P(A)-P(Ac).....(1-w), 2.3

where V(a/h)=w, and w is defined on the unit interval 0≤w≤1.V can't be defined on the unit interval.

Vercelli's footnote on page 168, referring to his page 154, argues that he can apply the criterion of normalization to V =K/(K+I), since Keynes did something like this this on p.348 of Keynes (1973) to w. He fails to point out that Keynes's application on p.315 of Keynes (1921) is to a mathematical variable, w, and not a logical relation, V. The error appears on some pages of his article. For instance, on p.155, he states:

"The range of values of V(a/h), as defined…goes from 0 to 1…"

This means that A. Vercelli is defining $0 < V(a/h_1,h_2,h_3,h_4\ldots\ldots h_n, h_{n+1}\ldots.)<1$,which is mathematically and logically impossible.

In fact, such a definition is impossible since V(a/h) is not MEASURING anything. It represents the LOGICAL strength of an argument.

3. Runde on the Evidential Weight of the Argument

The original misrepresentation of Keynes's analysis in chapters 6 and 26 of the TP was contained in the many works of I.J. Good. In Runde (1990) sought to show that Keynes's analysis was even more confused and confusing than the original claims of Good (1950). Runde completely ignored the work on chapters 6 and 26 contained in the 1922 reviews of the TP in Edgeworth (1922a, 1922b, Russell 1922, and Broad 1922). NONE of the faulty claims of Good and Runde are mentioned in those reviews.

Runde completely overlooked that an index to measure V by w was required in order to specify the mathematical equation that Keynes called his conventional coefficient of weight and risk, c. V is never mentioned in chapter 26 of the TP because it is not a mathematical variable. w is never mentioned in chapter 6 because it is a not a logical symbol, but a mathematical variable.

It was Good, who originally introduced the contradictory and inconsistent claims about

V(a/h) = K 2.4

which is basically a mathematical statement about a logical relation, into the literature.

The same conclusion holds for the Runde, who introduced the claim that:

V(a/h)=K/I 2.5

and the claim that

V(a/h)=K/(K+H). 2.6

The total absence in Runde (1990) of any serious assessment/analysis of Keynes's conventional coefficient of weight and risk, c, which might have led him to ask the question," What is w doing in the c coefficient formula?", might have possibly averted the numerous, erroneous results that appear in Runde (1990). Runde (1990) also overlooked all of the early 1922 reviews of the TP by Broad, Russell, and Edgeworth.

Reading those contributions might well have saved Runde, and all of the economists and philosophers who have built on his foundation, from making the errors that they did.

Runde's crucial oversight was his inability to grasp that:

V=V(a/h)=w,0≤w≤1 2.7

In 1990, Runde (1990, 279-283) claimed that Keynes had made statements in both chapters 6 and 26 of the TP that were ambiguous, unclear and confusing when compared with each other. This resulted in there being three possible definitions of evidential weight according to Runde.

The three different, supposed ways of measuring weight were:

V=K 2.8

V=K/ 2.9

V=K/(K+I) 2.10

Runde then claimed that one could divide both the numerator and denominator in (10) by K to obtain

$$V=1/[1+(I/K)]. \quad 2.11$$

Runde then created possible confusion by setting w=I/K to obtain

$$V=1/(1+w). \quad 2.12$$

Runde's w is obviously in direct conflict with Keynes's w contained in Keynes (1921, 315).

None of this makes any sense. Runde had erred by failing to normalize on the unit interval [0,1], so that K+I=1.

The only correct way to measure Keynes's evidential weight of the Argument is by Keynes's method, where one obtains the following answer:

V=w,0≤w≤1, where w is the degree of the completeness of the information on which the probability is based on, so that w=K/(K+I), where 0≤K/(K+I)≤1and 1-w =I/(K+I).

It is simple to check that.

$$w+(1-w)=1=[K/(K+I)]+[I/(K+I)]=(K+I)/(K+I)=1. \quad 2.13$$

Runde (1990) has continued to be cited in hundreds of articles and books since 1990. Its spread in academia for 34 years is covered in the following section.

The latest appearance of the erroneous results in Runde (1990) appears in Derbyshire, Feduzi & Runde in 2022 with two co-authors, A. Feduzi and J. Derbyshire. The paper is published as Derbyshire, *et al.* 2022. The errors appear in disguised form on pp. 4-7 in the journal, *European Management Review*. V appears nowhere in the article. Derbyshire, Feduzi & Runde in 2022 substitutes for Keynes's V relation, the Evidential Weight of the Argument, the variable EW, which is defined as Evidential Weight.The claim made is that EW can serve as a measure of uncertainty.

The correction of Runde's errors in 1990 was originally made in Brady (2004a, 2004b). In 2011, Vercelli (2011) attempted to correct Runde's mistaken and flawed analysis by normalizing V on the unit interval, so that:

$$0≤V≤1. \quad 2.14$$

However, this makes no sense at all because you can't restrict a logical relation to the unit interval.

4. On the Negative Consequences and Impacts of the Good and Runde Errors about Keynes's Evidential Weight of the Argument on Young Scholars just Starting Work on Keynes

This section will have two parts. Part A will cover (Brekel 2022). Part B will cover (Harris 2021).

Both Brekel (2022) and Harris (2021) have been negatively impacted, when reading Keynes's chapter 6 of the TP, because they built their work on errors originally made by I.J. Good and J. Runde. Good and Runde were accepted in the academic literature, that was published in academic journals and books, as having made correct assessments of Keynes's analysis, which was demonstrated to have been riddled with confusion and ambiguity.

Both Brekel and Harris have no understanding about what Keynes is doing in Chapter 26 of the TP at the technical, mathematical level. Both Brekel and Harris accept the basic, fundamental error made by both Good and Runde, that Keynes's V logical relation of evidential weight of the argument can be treated as a mathematical variable and made to equal numbers. Just as in Good and Runde, Brekel and Harris fail to normalize on the unit interval Both Brekel and Harris overlook Keynes's definition of V as equal to w, the degree of the completeness of the information upon which the probability is based, which requires that w is normalized the unit interval.

There is only correct answer about how to measure weight. The answers given by Good and Runde do not appear anywhere in Keynes's *A Treatise on Probability*. They are invented in much the same way as the numerous false claims that litter both of F P Ramsey's 1922 and 1926 reviews.

Part A)-Brekel

Brekel's assessment of Keynes's evidential Weight of the Argument is in direct conflict with the 1922 assessments made by Edgeworth, Russell, and Broad, which Brekel is completely ignorant of.

The title of his thesis gives away the confused nature of his assessment. Consider a few the Brekel's statements:

- "a concept that is often immersed in confusion, Keynesian weight requires thorough philosophical explication prior to any sort of legitimate use in decision-making, legal proceedings, or scientific inquiry. In this thesis, I attempt to explicate Keynesian weight by arguing in favor of Jochen Runde's relative interpretation of Keynesian weight. The aim of Chapter 1 is to introduce the basic idea of Keynesian weight. In Chapter 2, I demonstrate that Keynes's initial analysis of Keynesian weight creates an interpretative puzzle - two viable

interpretations of Keynesian weight exist. Chapter 3 aims to solve the interpretative puzzle by consideration of how the interpretations of Keynesian weight respond to I.J. Good's criticism of Keynesian weight." (Brekel 2022, ii).

- "Unfortunately, Keynes's logical approach to probability faces potentially insurmountable problems. Since the outset, Keynes faced criticisms for his unusual idea that probability arises from a rational assessment of the relation between the premises and conclusion of an argument.[2] Those criticisms, which began in earnest with Frank Ramsey's review of TP,.." (Brekel 2022, 1).

I note that Keynes's so called"… unusual idea that probability arises from a rational assessment of the relation between the premises and conclusion of an argument "follow directly from page 1 of Boole's 1854 *The Laws of Thought.*

- "Regrettably, Keynesian weight faces substantial challenges prior to any sort of legitimate application. Due to the inherent difficulty of the concept, the debate surrounding Keynesian weight tends to generate more heat than light. When it comes to weight, concepts get conflated, and interpretations of concepts tend to become muddled together.

In this thesis, my most basic goal is to shed more light on Keynesian weight while attempting to avoid conflation and confusion. Although this thesis cannot solve every problem faced by Keynesian weight, I think it can help illuminate the way forward for solving many of those challenges. Illuminating Keynesian weight is not an easy task, and I do not expect to perfectly meet my aim. To briefly summarize what is to come, I will say that this is a thesis largely focused on the challenge of how best to interpret Keynesian weight." (Brekel 2022, 4).

- At this point, it is worth noticing all the different concepts intertwined with Keynesian weight. The previous paragraph shows that Keynesian weight is closely related to confidence and surprise, but that the relationship between weight and these concepts is fuzzy at best." (Brekel 2022, 19-20).

- "It is a tangential issue to this, but the potential conflation between weight of argument and weight of evidence implies that translating Keynesian weight to a different probability framework might cause us to lose valuable insight into what Keynes actually took the concept to mean. If O'Donnell's conflation argument is right, perhaps none of the interpretations discussed in this thesis are what Keynes himself meant by weight. However, whatever I say in what follows should still be useful for subjective Bayesians who wish to add a concept like Keynesian weight in their epistemological toolkit." (Brekel 2022, 26).

- "In Chapter 3, I attempt to use Runde's relative weight interpretation in response to Good's critique of Keynesian weight. Good's critique will familiarize us with net weight of evidence. Ultimately, I think a careful reading of Good's critique demonstrates the way in which Keynesian weight remains a measure of gross weight, even on Runde's relative weight interpretation of Keynesian weight. By remaining a form of gross weight, the relative weight interpretation of Keynesian weight becomes the best interpretation of Keynesian weight available. Be that as it may, this chapter shows that Keynesian weight is shrouded in confusion." (Brekel 2022, 30).

Brekel needed to have carefully read pp.310-315 of the TP in order to recognize the erroneous nature of Runde's work. Reading and comprehending these pages would have saved Brekel a lot of confusion:

"We could, if we liked, define a conventional coefficient c of weight

and risk, such as c =2pw/[(1+q)(1+w)], *where w measures the 'weight,'which is equal to unity when p = 1 and w = 1, and to zero when p = 0 or w = 0, and has an intermediate value in other cases*. (Keynes 1921, 315; Keynes 1973, 345; italics added].

The only correct answer is that V=V(h/a)=w , 0≤w≤1.

All of the answers listed by Brekel (2022) in his chart on Brekel (2022, 47) below appear NOWHERE in the TP:

"Keynesian weight.

Table 2.1: List of names, suggested notations, and textual support of the considered interpretations of Keynesian weight. In the notation column, K is short for 'Knowledge' and I is short for 'Ignorance'. Suggested notation is based on Runde's "Keynesian Uncertainty and the Weight of Arguments," 280-1.

Interpretations of Keynesian Weight

Name Suggested	Notation	Textual Support (pages)
Monotonic Weight :	K	TP: 78, 79, 85
Relative Weight (odds):	K/ I	TP: 78, 85
Relative Weight (comp):	K/(I+K)	TP: 85, 357-8, 358." (Brekel 2022, 47)

The pages being cited by Brekel are from the problematic CWJMK 1973 edition with the intellectually dangerous, disingenuous and extremely flawed editorial foreword by the Ramsey advocate and supporter,

Richard Braithwaite. Reading this editorial foreword can only severely bias any new reader considering the task of reading Keynes's book.

Part B)-Harris

The assessment made by Harris (2021) of Keynes's evidential weight of the argument, V, is very similar to the assessment made by Brekel (2022):

"…according to Keynes an argument from premises E to conclusion H has, in addition to a probability Pr(H|E), also a weight V(H|E).

However, despite this passage is often quoted to allude to what Keynes has in mind with his notion of the weight of an argument, what this concept actually consists in according to Keynes is far from clear; for as Runde (1990) remarks, one can distinguish two conceptually different notions of the weight of an argument in Keynes's Treatise." (Harris 2021, 207).

Unfortunately, Harris is completely confused here because she has failed, like Brekel, to read pp. 310-315, where Keynes actually defines weight very clearly in an unambiguous manner as a measurable, mathematical variable, w: V=V(a/h)=w,0≤w≤1, where w measures the degree of the completeness of the information upon which the probability is based.

Runde's so called three different interpretations of weight are due to Runde's mathematical and logical confusions. The Runde formulations have absolutely nothing to do with anything that appears in Keynes's book, just as I.J. Good's interpretation of evidential weight as gross weight doesn't appear anywhere in Keynes's TP. There is no such measure defined by Keynes as V=V(a/h)=K that appears in anything written by Keynes in the TP or in his lifetime. This formulation involves a gross error that was repeated by Good for 40 years. Harris simply repeats this error.

In conclusion, the many errors of Good and Runde, like the immense number of errors committed by F P Ramsey (1922, 1926) in his 1922 and 1926 reviews of the Keynes (1921, 1973), were never corrected by any academician, philosopher or economist at anytime in the 20th or 21st century. These errors presently serve in 2023 as the foundation upon which current assessments of Keynes's TP are based. The only refutation of Ramsey's attacks on Keynes was made by Russell in 1922.

This result leads to a conclusion that is precisely identical to I. Hishiyama's observation in Hishiyama (1969) - the fundamental problem that appears in practically all work done on Keynes, starting with Baylis (1935), is that Keynes's A Treatise on Probability was never actually read. I am simply extending Hishiyama's observation, first made in 1969 to the year 2023.

Conclusions

The crucial error made from Baylis (1935), in 1935 through Derbyshire, Feduzi and Runde in 2022 is the failure to deal with the analysis on p. 315 of the TP. The philosophers listed in my references (Hishiyama 1969, Joyce 2005, Peden 2018, Weatherson 2002) make the same types of mistakes as originally made by Baylis, I.J. Good and Runde. I do not see the need to duplicate the analysis in demonstrating what the basic problem is in their work. However, the interested reader can read (Brady 2012, 2018a, 2018b, 2020a, 2020b). The basic problem involves three mistaken mathematical representations of Keynes's logical relation, V:

K, K/I, and K/(K+I).

The result of these errors in the literature can be seen in the latest work in the philosophy field produced by Brekel (2022) and Harris (2021). Brekel (2022) and Harris (2021) base their work on, and just pass along, the erroneous results of Good (1950, 1960, 1962, 1965, 1967, 1967, 1968/70, 1970/71, 1975, 1983a, 1983b, 1985, 1988 Good and Toulmin 1968 and Runde (1990). They analyze V as a mathematical variable and have NO IDEA that Keynes measures the evidential weight of the argument by w, where w is defined on the unit interval and must come in degrees based on his index to measure the weight of the evidence, which appears in the h propositions of the premises contained in Keynes's relational, propositional, symbolic logic.

The major error made by I.J. Good was to insist that Keynes's V relation of weight, V, was equal to the absolute amount of the knowledge, K, so that V=K.

Isaac Levi, in 1967 in his *Gambling with Truth*, claimed that Keynes had never constructed an index to measure the evidential weight of the Argument, V, which Keynes did. Keynes's index appears in (Keynes 1921, 315; Keynes 1973, 345).

The reason for the constant and continuing 100 years of misrepresentation and misinterpretations of Keynes's work in the TP is the utter and complete failure of all economists and philosophers writing on Keynes to have covered what can be called the Keynes-Boole (1985) connection. Keynes's research program was based on

extending and applying the work of Boole in logic and probability to probability, statistics, and economics. The *General Theory* is built on Keynes's inexact measurement and approximation approaches that appeared in chapters 15, 17, and 26 of the TP.

These errors were then picked up by economists and philosophers and made the foundation for all of their assessments of Keynes's work starting with a paper by J. Runde (1990). It is quite impossible to add, subtract, divide, and multiply logical relations like P and V. This obvious fact has gone unrecognized in the literature for 73 years.

The latest authors to integrate the errors of Good and Runde into their work are Berkel (2022) and Harris (2021). Both Berkel and Harris conclude that discussions of Keynes's concept of weight, V, are a hopeless, intellectual mess of confusion and contradiction. The reality, based on what Keynes actually wrote, is the exact opposite.

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An Economic Theory of Disinformation

Taiji HARASHIMA
Department of Economics, Kanazawa Seiryo University, Japan
harashim@seiryo-u.ac.jp

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Abstract: The impacts of misinformation and disinformation have rarely been studied in economics. In this paper, I examine these impacts using a model constructed on the basis of the concept of ranked information. The value of information is changeable and differs across people; therefore, disinformation can be used as a tool to manipulate people's behaviors. I first define misinformation and disinformation and then show the mechanism through which disinformation decreases efficiency by manipulating ranked information. Decreases in efficiency are observed as decreases in total factor productivity, lowered success rates of investment, and increased costs of bad speculations. In addition, disinformation generates economic rents and, as a result, increases inequality, possibly by a great deal. Furthermore, disinformation can cause large-scale economic fluctuations.

Keywords: disinformation; economic fluctuation; economic rent; inequality; misinformation; ranked information.

JEL Classification: D24; D63; D72; D80; E32.

Introduction

In information economics, information is usually assumed to be correct or at least its correctness is not regarded to be important. Therefore, the main question asked is what happens if information is possessed exclusively only by some persons, not if it is correct; that is, it is the problem of asymmetric information (*e.g.*, Grossman and Stiglitz 1980; Greenwald and Stiglitz 1986; Edlin and Stiglitz 1995; Stiglitz 2017). Furthermore, even if some pieces of information are not correct, the main question in information economics does not change because information is assumed to have the same value for anybody regardless of its correctness. In other words, the assumption is that, when a piece of information is given, anybody can equally utilize it.

However, Harashima (2022b) showed that the value of information differs across people even if the same information is given. That is, when a piece of information is given, people utilize it differently. For example, some people think it is important, but others do not. Because the value of information varies across people, the correctness of information is very important economically because people's personal judgments on its correctness significantly influences its value. That is, if a person judges the correctness of information more accurately, the value the person places on that information will be more accurate. An important point is that the value of information can be manipulated by malicious persons who intentionally disseminate incorrect information to confuse people's personal judgments on the value of information.

The reason why the value of information differs across people is because people's abilities with regard to information literacy differs. Again, a malicious person can manipulate some people whose abilities regarding information literacy are relatively low by confusing them with incorrect information.

The problems of fake news, disinformation, and misinformation have been emphasized recently, and they have been reported widely by the media, particularly regarding recent elections in the U.S. Nevertheless, it is difficult to appropriately define what fake news, disinformation, and misinformation are. Although many definitions have been proposed (see *e.g.*, Karlova and Fisher 2013; Fallis, 2015; Wardle and Derakhshan, 2017; European Commission 2018; Andersen and Søe 2020; Ryan, *et al.* 2020; van Hoboken and Fathaigh, 2021), there is no universally agreed-upon definitions. Nevertheless, many proposed definitions of disinformation seem to have the following common components: they are (1) false or misleading, (2) intentional, and (3) cause harm. Definitions of

misinformation seem to include element (1) but exclude elements (2) and (3).

Politically and socially, the problems of fake news, disinformation, and misinformation have been regarded to be very important and have to be taken seriously, but they are rarely studied in economics. The reason for this neglect may lie in the difficulty of definition as discussed above; in addition, the assumption that the value of information is equal to everybody (*i.e.*, correctness of information does not matter economically) has probably also contributed to the lack of study of this issue. As mentioned above, Harashima (2022b) showed that the value of information is changeable and differs across people and, taking this nature into consideration, presents the concept of "ranked information". Using this concept, I examine misinformation and disinformation from the point of view of economics in this paper.

For a person to achieve a purpose, that person will first have to collect and select relevant pieces of information according to their importance; that is, the person ranks pieces of information by importance. Even if the purpose is the same for many people and given available pieces of information are identical, different persons select different pieces of information for the reasons stated above.

The importance of information is not pre-determined by, for example, an authority and is not judged equally by people. It has to be evaluated individually and personally by each person in each period for each purpose. In this process of individual evaluation, disinformation can be utilized as a tool to manipulate people's behaviors and exploit the opportunities these confused people provide. In this paper, the mechanism of how disinformation works in this process and what impacts it has on the economy are examined.

Before examining them, however, I first define misinformation and disinformation. Next, I examine the mechanism of how disinformation decreases the efficiency of economy by manipulating ranked information on the basis of the model of ranked information presented in Harashima (2022b). Decreases in efficiency are observed as decreases in total factor productivity (TFP), lowered success rates of investment, and increased costs of "bad" speculations. Disinformation not only decreases efficiency but also generates economic rents. Because of these economic rents, inequality can be widened, possibly greatly. Furthermore, disinformation can cause large-scale economic fluctuations through the channel of bad speculation.

1. Ranked Information

In this section, I briefly explain the nature of ranked information and its model on the basis of Harashima (2022b).

1.1 Utilization of Information

At the present time, people can access many pieces of information, but only some of that information is useful for each particular purpose. People must select a small number of important pieces of information from the enormous number of available pieces for any given purpose. Furthermore, they have to use pieces of information with different levels of importance or "weights". The necessity of selecting pieces of information by weighted importance means that there are ranks among pieces of information by purpose. To properly retrieve important pieces of information, it is first necessary to rank them according to their importance.

1.2 Retrieving and Ranking Information

Even if people select important pieces of information for a common purpose, their selections will be quite different from one another, much like different Web search engines generate different search results for the same topic. This occurs because people's abilities to rank and select pieces of information are highly likely to be heterogeneous. In psychology and psychometrics, the importance of fluid intelligence and crystallized intelligence has been particularly emphasized (Cattell 1963, 1971). The ability to rank and select pieces of important information seems to require both types of intelligence.

The ranks and selections of pieces of information will largely differ across people even if they collected the same pieces of information because people have to carefully analyze and evaluate the collected pieces of information. To analyze and evaluate information, fluid intelligence is indispensable, and fluid intelligence is highly likely to differ across people similar to most other kinds of abilities. A person whose fluid intelligence is higher should be able to rank and select pieces of information more correctly than those whose fluid intelligences are lower.

1.3 Correctness

There are many possible sets of selected pieces of information for each purpose, and for a given purpose, some sets have higher probabilities to achieve the purpose than others. I define "correct" with regard to ranked information such that a set is deemed to be correct if its probability to achieve a purpose is the same as that of

the top-ranked set for that purpose. Furthermore, the correct ranks of pieces of information for a purpose are those that are consistent with the correct ranks of sets for the purpose. For the purpose of this paper, "achieve a purpose" means that, under given constraints, an objective is met at the least cost in the shortest amount of time. For simplicity, it is assumed that a set that is always correct for anybody exists for any purpose.

1.4 The Model of Ranked Information

I refer to a piece of information as an "Inf-piece". A serial number $q(\in \mathbb{N})$ is assigned to each Inf-piece, and let $IP_{i,q}$ be an Inf-piece with the serial number *q* for purpose *i*. Furthermore, I refer to a set of Inf-pieces as an "Inf-set". It is assumed for simplicity that all Inf-sets consist of *n* Inf-pieces. Let IS_i be the Inf-set that is selected for purpose *i* from among all existing Inf-pieces. Let $IS_{i,q}$ indicate that Inf-piece *q* (*i.e.*, $IP_{i,q}$) is included in IS_i.

In addition, let $y(\cdot)$ be the Inf-set production function, where the production function represents the probability to achieve a purpose. A higher value of *y* for an Inf-set corresponds to a higher probability that the Inf-set will achieve the purpose; therefore, the Inf-set is more correct than Inf-sets with lower values of *y*. It is assumed that for purpose *i*, if the Inf-pieces in $IS_{i,s}$ and $IS_{i,r}$ are identical except for IP_s and IP_r and $s < r$, then

$$y(IS_{i,s}) > y(IS_{i,r}) \tag{1.1}$$

for any *s* and *r*. Inequality 1.1 implies that an Inf-piece has a particular value that depends on its serial number such that the value of an Inf-piece is larger if its serial number is smaller.

Suppose that each Inf-piece has a particular value, and the value of an Inf-set is equal to the sum of values of the Inf-pieces of which the Inf-set consists of. Note that the value of an Inf-piece is different from the serial number *q* assigned to it. On the basis of inequality 1.1, I define the relative value of $IS_{i,q}$ such that, if

$$y(IS_{i,s}) > y(IS_{i,r})$$

then

$$IS_{i,s} > IS_{i,r} \tag{1.2}$$

for any *s* and *r*. By inequality (2), the relative value of $IP_{i,q}$ is indicated such that, for purpose *i*, if

$$y(IS_{i,s}) > y(IS_{i,r})$$

then

$$IP_{i,s} > IP_{i,r} \tag{1.3}$$

because the value of an Inf-set is equal to the sum of values of Inf-pieces of which the Inf-set consists, and $IS_{i,s}$ and $IS_{i,r}$ are identical except for IP_s and IP_r. Inequality 1.2 means that $IS_{i,s}$ is more correct for purpose *i* than $IS_{i,r}$, and inequality 1.3 means that $IP_{i,s}$ is more important for purpose *i* than $IP_{i,r}$.

If inequalities 1.2 and 1.3 hold for any *s* and *r* for purpose *i*, the absolute value of $IP_{i,q}$ is a decreasing function of *q* for purpose *i*. This means that $IP_{i,q}$ can be ranked by *q* for purpose *i*. Therefore, if the serial numbers of Inf-pieces are appropriately assigned for each purpose such that the serial number of $IP_{i,q}$ is equal to its rank for purpose *i*, the rank of $IP_{i,q}$ for purpose *i* is *q*. In this case, the value of $IP_{i,q}$ is an increasing function of $N - q$ where *N* is the lowest rank; that is, it increases as the rank of Inf-piece *q* rises. Remember that "as *q* rises" actually means as *q* (the number) gets smaller. In the following sections, it is assumed that the serial numbers are assigned as such.

1.5 Rank–Size Distribution

How the values of Inf-pieces are distributed over their ranks is an empirical question. However, it seems likely that the value of $IP_{i,q}$ will be described by an exponentially increasing function of $N - q$ as described below.

1.5.1 Exponentially increasing value of Inf-sets

Suppose that there is a total of *N* Inf-pieces in an economy, and for any purpose, each Inf-set consists of *n* Inf-pieces selected from among the *N* Inf-pieces. There are many possible combinations of *n* Inf-pieces in an Inf-set. Suppose that the number of possible combinations in which Inf-piece with rank *q* is included in an Inf-set as one of *n* Inf-pieces is *Λ* for any purpose. A serial number is assigned to each of *Λ* possible combinations in order from

1 to Λ. Note that the number of possible combinations is commonly Λ for any q, Inf-set, and purpose. Let $\widetilde{IS}_{i,q}$ be the average value of Inf-sets in which the Inf-piece with rank q is included and let $IS_{i,q,\lambda}$ be the value of the Inf-set that corresponds to combination λ ($\in \Lambda$). Hence,

$$\widetilde{IS}_{i,q} = \Lambda^{-1} \sum_{\lambda=1}^{\Lambda} IS_{i,q,\lambda} \ .$$

Because the impact of a higher rank Inf-piece on $\widetilde{IS}_{i,q}$ will be larger than that of a lower rank Inf-piece, it seems likely that

$$\widetilde{IS}_{i,q} - \widetilde{IS}_{i,q+1} > \widetilde{IS}_{i,q+1} - \widetilde{IS}_{i,q+2} \ . \qquad 1.4$$

That is, the increase in the average value of the Inf-set when rank q + 1 Inf-piece is replaced with rank q Inf-piece is larger than that when rank q + 2 Inf-piece is replaced with rank q + 1 Inf-piece. Of course, there will be many cases that do not actually satisfy inequality 1.4, but inequality 1.4 seems to be satisfied in general because the top-rank Inf-piece seems to be by far the most important and useful in many cases.

Inequality 1.4 indicates that the value of the Inf-set can be approximated by an exponentially increasing function of $N - q$; that is, $\widetilde{IS}_{i,q}$ increases exponentially as the rank of Inf-piece q rises. Furthermore, if the production function $y(\cdot)$ is a monotonously increasing function of the value of $IS_{i,q}$, the average value of $y(IS_{i,q})$ can be also approximated by an exponentially increasing function of $N - q$; that is, it increases exponentially as the rank of Inf-piece q rises.

1.5.2 Exponentially increasing value of Inf-pieces

If inequality 1.4 holds, the value of $IP_{i,q}$ can also be approximated by an exponentially increasing function of $N - q$. $\widetilde{IS}_{i,q}$ can be divided into two parts: one is attributed to the Inf-sets in which the Inf-piece with rank q + 1 is included, and the other is attributed to the Inf-sets in which the Inf-piece with rank q + 1 is not. Let $\widetilde{IS}_{i,q,q+1}$ be the former and $\widetilde{IS}_{i,q,q}$ be the latter. Thereby,

$$\widetilde{IS}_{i,q} = \widetilde{IS}_{i,q,q+1} + \widetilde{IS}_{i,q,q} \qquad 1.5$$

$\widetilde{IS}_{i,q+1}$ can similarly be divided into two parts: one attributed to the Inf-sets in which the Inf-piece with rank q is included and the other in which the Inf-piece with rank q is not. Let $\widetilde{IS}_{i,q+1,q}$ be the former and $\widetilde{IS}_{i,q+1,q+1}$ be the latter. Thereby,

$$\widetilde{IS}_{i,q+1} = \widetilde{IS}_{i,q+1,q} + \widetilde{IS}_{i,q+1,q+1} \ . \qquad 1.6$$

Because the Inf-sets in which both Inf-pieces with ranks q and q + 1 are included in Inf-set are common in $\widetilde{IS}_{i,q}$ and $\widetilde{IS}_{i,q+1}$, then

$$\widetilde{IS}_{i,q,q+1} = \widetilde{IS}_{i,q+1,q} \ . \qquad 1.7$$

By equations 1.5, 1.6, and 1.7,

$$\widetilde{IS}_{i,q} - \widetilde{IS}_{i,q+1} = \widetilde{IS}_{i,q,q} - \widetilde{IS}_{i,q+1,q+1} \qquad 1.8$$

for any q. Therefore, by equation 1.8 and inequality 1.4,

$$\widetilde{IS}_{i,q,q} - \widetilde{IS}_{i,q+1,q+1} > \widetilde{IS}_{i,q+1,q+1} - \widetilde{IS}_{i,q+2,q+2} \ . \qquad 1.9$$

Inequality 1.9 means

$$IP_{i,q} - IP_{i,q+1} > IP_{i,q+1} - IP_{i,q+2} \ . \qquad 1.10$$

Inequality 1.10 indicates that the value of an Inf-piece can be approximated by an exponentially increasing function of $N - q$; that is, the value of $IP_{i,q}$ increases exponentially as the rank of Inf-piece q rises.

1.6 Heterogeneity in Inf-sets

1.6.1 Inf-set distance

Inf-sets other than the top-rank Inf-set for a purpose are interpreted to be deviating from the correct Inf-set (*i.e.*, the top-rank Inf-set). The distance between each Inf-set and the correct Inf-set can be defined as follows.

As assumed above, each Inf-set consists of *n* Inf-pieces. A serial number is assigned to each Inf-set, and let $\Theta_{i,h}$ be the Inf-set with the number $h(\in \mathbb{N})$ for purpose *i*. Here, let $IS_{i,q}\big|_{\Theta_{i,h}} = \sum_{IP_{i,q}\in\Theta_{i,h}} IP_{i,q}$ and $IS_{i,q}\big|_{q=1,2,\dots,n} = \sum_{q=1}^{n} IP_{i,q}$; that is, $IS_{i,q}\big|_{\Theta_{i,h}}$ means the value of Inf-set *h* (*i.e.*, $\Theta_{i,h}$), and $IS_{i,q}\big|_{q=1,2,\dots,n}$ means the value of the Inf-set that consists of the top *n* Inf-pieces for purpose *i*. The "distance of Inf-set" (DIS) of Inf-set $\Theta_{i,h}$ is defined by

$$D_{i,h} = 1 - \frac{y\left(IS_{i,q}\big|_{\Theta_{i,h}}\right)}{y\left(IS_{i,q}\big|_{q=1,2,\dots,n}\right)} = 1 - \frac{y\left(\sum_{IP_{i,q}\in\Theta_{i,h}} IP_{i,q}\right)}{y\left(\sum_{q=1}^{n} IP_{i,q}\right)} . \quad 1.11$$

Equation 1.11 indicates that the DIS of Inf-set $\Theta_{i,h}$ ($D_{i,h}$) is the magnitude of deviation of $\Theta_{i,h}$ from the top-ranked Inf-set (*i.e.*, the Inf-set whose value is largest for purpose *i*). As Inf-pieces with lower ranks (larger *q*) are included in Inf-set $\Theta_{i,h}$, its DIS ($D_{i,h}$) increases. If the top *n* Inf-pieces are all included in Inf-set $\Theta_{i,h}$ (*i.e.*, $\sum_{IP_{i,q}\in\Theta_{i,h}} IP_{i,q} = \sum_{q=1}^{n} IP_{i,q}$), $D_{i,h} = 0$.

1.6.2 Average distance

Let $\boldsymbol{\Theta}_{i,m}$ be the set of all Inf-sets in which the highest rank Inf-piece is commonly $IP_{i,m}$. In addition, let $\boldsymbol{D}_{i,m}$ be the average DIS of $\Theta_{i,h} \in \boldsymbol{\Theta}_{i,m}$ such that

$$\boldsymbol{D}_{i,m} = E\left(D_{i,h}\big|_{\boldsymbol{\Theta}_{i,m}}\right) \quad 1.12$$

where *E* is an operator and means that $\boldsymbol{D}_{i,m}$ is the average DIS of all Inf-sets that are included in $\boldsymbol{\Theta}_{i,m}$. Evidently, if *m* > *l*,

$$\boldsymbol{D}_{i,m} < \boldsymbol{D}_{i,l} .$$

That is, $\boldsymbol{D}_{i,m}$ is a decreasing function of the value of $IP_{i,m}$, which means that it is an increasing function of $D_{i,m}$ because $D_{i,m}$ is a deceasing function of $IP_{i,m}$. Because $\boldsymbol{D}_{i,m}$ and $D_{i,m}$ similarly decrease as $IP_{i,m}$ increases, $\boldsymbol{D}_{i,m}$ will basically be linearly proportional to $D_{i,m}$.

1.6.3 Correct selection

The degree of correct selection (DCS) is defined as

$$\boldsymbol{C}_{i,m} = 1 - \boldsymbol{D}_{i,m} \quad 1.13$$

That is, $\boldsymbol{C}_{i,m}$ means how correct a selected Inf-set is when the highest rank inf-piece in the Inf-set is $IP_{i,m}$.

Here, as shown in Section 1.5, the value of $IP_{i,q}$ can be approximated by an exponentially increasing function of $N - q$. Taking this property into consideration, the average value of Inf-sets that are included in $\boldsymbol{\Theta}_{i,m}$ can be most simply modeled by

$$E\left(IS_{i,q}\big|_{\boldsymbol{\Theta}_{i,m}}\right) = \frac{v}{e^{wm}} \quad 1.14$$

and

$$\sum_{q=1}^{n} IP_{i,q} = \chi E\left(IS_{i,q}\big|_{\boldsymbol{\Theta}_{i,1}}\right) = \chi\frac{v}{e^{w}} \quad 1.15$$

where *v*, *w*, and $\chi(>1)$ are positive constants. $\sum_{q=1}^{n} IP_{i,q}$ in equation 1.15 indicates the value of the top-rank Inf-set for purpose *i* as shown in equation (11). In addition, the production function is modeled most simply such that

$$E\left[y\left(IS_{i,q}\big|_{\boldsymbol{\theta}_{i,m}}\right)\right] = y\left[E\left(IS_{i,q}\big|_{\boldsymbol{\theta}_{i,m}}\right)\right] = x\left[E\left(IS_{i,q}\big|_{\boldsymbol{\theta}_{i,m}}\right)\right]^{z} \quad 1.16$$

where *x* and $z(0<z<1)$ are positive constants. By equations 1.11, 1.12, 1.14, 1.15, and 1.16, therefore,

$$\boldsymbol{D}_{i,m} = E\left(D_{i,h}\big|_{\boldsymbol{\theta}_{i,m}}\right) = 1-\chi^{-z}e^{1-m} \quad 1.17$$

Hence, by equations (13) and (17),

$$\boldsymbol{C}_{i,m} = 1-\boldsymbol{D}_{i,m} = \chi^{-z}e^{1-m} \quad 1.18$$

Equation 1.18 means that $\boldsymbol{C}_{i,m}$ is most likely approximately an exponentially increasing function of $N-m$; that is, DCS exponentially increases as the rank of Inf-piece $IP_{i,m}$ rises.

2. Misinformation and Disinformation

2.1 Distinguishing Misinformation from other Information

Generally, misinformation is recognized as information that is false, incorrect, inaccurate, and furthermore, misleading, or biased. However, it is not easy to precisely distinguish misinformation from other information because it is not easy to discern the genuineness, authenticity, or accuracy of information.

2.1.1 Support of the majority

One criterion that can be used to distinguish misinformation from other information is if the majority of people agree that the piece of information is true (*i.e.*, it is not misinformation). However, this criterion is very problematic. Even if the majority agree that it is correct at the present, it may be proved to be wrong and not accepted by the majority in the future. Mainstream theories that are supported by the majority have often changed over time. If there are two opposite theories, one or the other or both must be wrong (*i.e.*, misinformation).

In addition, the views that the majority support will differ not only temporally but also spatially, for example, across countries. Therefore, even if a piece of information is treated as misinformation in one country, it may not be in other countries.

2.1.2 Costs and efforts

Verifying the correctness of information entails costs. Some misinformation can be easily found to be false at a small cost, but other misinformation may not easily be uncovered even if large expenditures are made to uncover the truth. Furthermore, some misinformation can never be identified as such no matter how hard you try because of its nature, for example, because it is impossible to verify it physically or methodologically. In these cases, it is difficult to distinguish misinformation from other information.

2.1.3 Unexpected phenomena

Unexpected phenomena are frequently observed. Because they are unexpected, they can be hard to explain by the current orthodox, standard, or mainstream theories. This implies that any current mainstream theory may be shown to be wrong in the future. On the other hand, there are always heterodox or unconventional theories, even though a very small number of people believe in them. If a significant unexpected phenomenon is observed, an existing heterodox theory may be used to explain it, and that theory may begin to be supported and believed far more widely than before, if only temporarily.

2.2 Distinguishing Disinformation

Common sense recognition of the difference between disinformation and misinformation is that the former is a part of the latter, and it is disseminated with malicious intent (*i.e.*, the difference between them lies in the intention of dissemination). However, it is difficult to discern whether a piece of misinformation is disseminated with malicious intent or not because it is not easy to know another person's intentions.

In addition, although some people may indeed disseminate misinformation with malicious intent, other people may disseminate that same information without it because they wrongly believe that it is not

misinformation. This type of behavior can often be observed in the context of political activities. The question arises whether this kind of dissemination of misinformation with benevolent intentions should also be categorized as disinformation.

2.3 Definition of Misinformation and Disinformation

2.3.1 Misinformation

Defining misinformation is equivalent to defining "correct" information. However, for the same reasons discussed in Section 2.1, it is not easy to define what is correct. Nevertheless, it is highly likely that information that is objectively correct and true exists, even if humans cannot verify it. The validity of this claim cannot be proved, but in this paper, I assume such objectively correct information as follows:

Assumption: There are objectively correct pieces of information regardless of whether people know them.

Even though nobody may know a truth or fact, the truth or fact itself exists. Based on this assumption, I define "misinformation" in this paper as follows:

Definition 1: Misinformation is a part of information that is not objectively correct.

2.3.2 Disinformation

Common sense definitions of disinformation usually depend on existence of malicious intentions, but because it is difficult to judge people's intentions as discussed in Section 2.2, in this paper I define disinformation as follows,

Definition 2: Disinformation is a part of misinformation that is deliberately disseminated by a person to obtain utility by making other people's behaviors change.

Definition 2 means that even if a person does not have a malicious intention (*e.g.*, the person does not know that the information he or she is deliberately disseminating is misinformation), it is disinformation if the person disseminates it to obtain some utility by making other people's behaviors change. That is, even if a person believes that a piece of information is not misinformation, it still can be considered to be disinformation, depending on how it is used. Note that Definition 2 indicates that misinformation that is disseminated with a malicious intention is of course included in disinformation and will be an important component of disinformation.

2.4 Value of a Piece of Misinformation

Definition 1 implies that the value of misinformation in the model of ranked information shown in Section 1 is zero. Hence, it is assumed that the value of $IP_{i,q}$ is zero if $IP_{i,q}$ is misinformation.

3. Mechanism of Impact of Disinformation

3.1 Manipulation of Information

Disinformation can manipulate people's process of ranking and selecting important pieces of information, and as a result, it changes or distorts the Inf-sets that people select.

3.1.1 First phase: manipulation in Step 1

In real life, people may not be easily manipulated in most cases. This means that for disinformation to be effective, subterfuge may be necessary so that the disinformation makes it into the set of pieces of information people collect in step 1 of the process of ranking and selecting pieces of information. Alternatively, a piece of disinformation may be camouflaged as a correct one. Such tricks or camouflages may resemble search engine optimization (SEO) and spamdexing for Web search engines. The first phase of disseminating disinformation is successful if a piece of disinformation infiltrates into the pieces of information collected in step 1.

3.1.2 Second phase: manipulation in Step 2

To make disinformation effective eventually, the process of ranking and selecting pieces of information must be manipulated after the information is collected (step 2). One way of manipulation is to include information that cannot be easily verified or is intrinsically unverifiable. Even if the information looks incorrect, it is hard to disprove it. Its correctness can be only perceived with probabilities, and people therefore become more uncertain because of the disinformation. If the level of perceived uncertainty increases sufficiently, the disinformation succeeds, and DCS will be made furthermore different among people.

There are other ways to manipulate information. One is to use "borrowed" authority. For example, people of authority who have already passed away may have presented views when they were alive that have been proved to be wrong. If the disinformation includes these incorrect views, it may confuse people who only know the

name of the person but not exactly what they said and did. Another way is to include information that is closely related to a belief or faith that is held by some people but regarded to be scientifically incorrect by others.

These ways of manipulation, and others, take advantage of uncertainty, ambiguity, ignorance, prejudice, and bigotry. If the influence of these factors is increased by some external changes in the surrounding environment (*e.g.*, a severe economic recession), the probability that the manipulation works effectively may greatly increase.

3.2 Effect of Manipulation

As a result of manipulation in the second phase, a person may reach an incorrect conclusion, although the person would not have reached that conclusion in the absence of being exposed to the disinformation. Consequently, the person wrongly gives higher ranks to disinformation and other pieces of information that are connected to the disinformation. That is, the Inf-pieces ranks are distorted, and DCS decreases because of the disinformation.

Suppose that for purpose *i*, a person selects Inf-set *x* if a piece of disinformation *z* is not disseminated, but selects Inf-set *z* if it is. Disinformation will degrade the value of the Inf-set and increase DIS, and therefore,

$$D_{i,x} \leq D_{i,z} \tag{1.19}$$

Equation 1.19 means that an Inf-piece in Inf-set *x* can be replaced with disinformation *z* whose value is zero. It is also possible that some other Inf-pieces in Inf-set *x* will be accordingly replaced with Inf-pieces whose values are relatively low. Note that if Inf-set *x* already includes some pieces of disinformation and one of them is replaced with disinformation *z*, $D_{i,x} = D_{i,z}$. In addition, if no piece of information in Inf-set *x* is replaced when disinformation *z* is disseminated, also $D_{i,x} = D_{i,z}$. Nevertheless, in many cases, strict inequality in equation 1.19 will hold.

Inequality 1.19 means that the probability of achieving a purpose decreases because of disinformation, and therefore,

$$y\left(IS_{i,q}\big|_{\Theta_{i,x}}\right) \geq y\left(IS_{i,q}\big|_{\Theta_{i,z}}\right) \tag{1.20}$$

The degrees of decrease in the probability of achieving a purpose by disinformation will be heterogeneous across people because fluid intelligences are heterogeneous across people, and the probability is essentially influenced by fluid intelligence as discussed in Section 1. If the fluid intelligence of a person is higher, the decrease in the probability for the person will be smaller.

3.3 Inefficiency

Inequality 1.20 indicates that, because of disinformation, the levels of efficiency in not only various individual economic activities but also the entire economy are lowered.

3.3.1 Decrease in productivity

Decreases in efficiency indicated by inequality 1.20 in the process of production are observed as decreases in productivity. If disinformation affects only a small number of people, the decrease in productivity of the entire economy may be negligible, but if it affects a large number of people simultaneously, the productivity of the entire economy can significantly decrease.

In the model of TFP developed in Harashima (2009, 2012b)[1], the production function is described as

$$Y = \bar{\sigma}\omega_A\omega_L A^{\alpha} K^{1-\alpha} L^{\alpha}\,, \tag{1.21}$$

where *Y* is outputs, *K* is capital inputs, *L* is labor inputs, *α* is a constant and indicates labor share, *A* indicates technologies (mostly scientific technologies), ω_A and ω_L indicate productivities of laborers with regard to technology and labor inputs, respectively, and $\bar{\sigma}$ indicates the accessibility to capital and represents the efficiency of various kinds of economic and social institutions and systems.

Equation 1.21 indicates that TFP can be divided into three elements, *i.e.*, *A*, ω_A and ω_L, and $\bar{\sigma}$. Of these three elements, *A* is basically irrelevant to ranked information, but the elements ω_A, ω_L, and $\bar{\sigma}$ matter (see Harashima, 2022b). Because all three are significantly influenced by fluid intelligence as shown in Harashima

[1] Harashima (2009, 2012b) are also available in Japanese as Harashima (2016, 2020b), respectively.

(2009, 2012b), they are affected by ranked information and thereby disinformation (see Harashima, 2022b). That is, because of disinformation, ω_A, ω_L, and $\bar{\sigma}$ (and therefore TFP) can be decreased.

3.3.2 Decrease in the success rate of investment

As indicated in Harashima (2021b), the success rate of investment is also influenced by fluid intelligence. Hence, as with the cases ω_A, ω_L, and $\bar{\sigma}$, disinformation can lower the success rate of investment.

3.3.3 Inefficiency due to "bad" speculation

Taking risks can provide rewards - innovations. Taking risks can be interpreted as "speculation", and there are two kinds of speculation: "good" and "bad". Good speculations are those undertaken to help generate innovations and technological progress, and bad speculations are those undertaken even if there is no intention to create innovations. Instead, they are used to exploiting other people's economic resources by confusing them, intentionally misleading them, or even deceiving them.

Harashima (2022a) presented a model of bad speculation in which bad speculators obtain utility from bad speculations as well as from consumption. That is, undertaking a risky project itself makes a bad speculator happy, in much the same way a gambler enjoys playing games in a casino. However, bad speculations not only give utilities but also incur costs because bad speculations do not contribute to productive activities in an economy and, moreover, disturb economic activities and generate inefficiencies. Harashima (2021b) showed that bad speculations reduce production and consumption at steady state or on a balanced growth path.

Clearly, bad speculations are closely related to disinformation. Disinformation is an important tool of bad speculation because disinformation can be used to confuse, mislead, or even deceive other people to exploit their economic resources. That is, disinformation can reduce the efficiency of an entire economy through the channel of bad speculations.

3.4 Economic Rents

Inequality 1.20 also indicates that disinformation increases economic rents that are generated because of ranked information. Economic rents originating in disinformation take various forms. One is through the channel of mistakes in business dealings. Harashima (2020c) showed that mistakes in business dealings generate economic rents such that winners can receive excess payments and presents a model of these rents. Because mistakes in business dealings are largely influenced by fluid intelligence, this type of economic rent can be increased by disinformation. Inequality 1.20 indicates that disinformation will increase the probability of mistakes in business dealings.

Harashima (2020c) showed that because fluid intelligence is heterogeneous across people, the effect of the same piece of disinformation can also be heterogeneous across people. Hence, even if two parties are exposed to the same disinformation, changes in the probability of mistakes in business dealings will differ between them.

In the model in Harashima (2020c), the degrees of honesty of persons also matter when considering the economic rents generated by mistakes in business dealings. Disseminating disinformation basically means a lower degree of honesty. Harashima (2020c) showed that a lower degree of honesty in a person increases the economic rents of that person.

Finally, other non-economic extra gains (*e.g.*, political gains) can be obtained by disseminating disinformation.

3.5 Economic Fluctuations

As discussed in Section 3.3.3, disinformation and bad speculation are closely related. Nevertheless, as Harashima (2022a) indicates, the costs of bad speculation may usually stay at a relatively low level because governments keep the cost of bad speculation at a low level. Until the cost of bad speculation exceeds a critical point of a government's tolerance, the government overlooks bad speculations. Even so, bad speculators will always strongly desire a much larger amount of bad speculations, along with their higher risks and higher returns. Hence, they may occasionally undertake bad speculations whose costs greatly exceed the government's tolerance. In some cases, their attempts may succeed because a government overlooks them due to a lack of competency or some kinds of corruption. Hence, as Harashima (2022a) indicates, bad speculation can be an important source of economic fluctuations; therefore, disinformation also can be a source of fluctuations.

3.6 Incentive

Despite the negative effects on an economy (*i.e.*, decreases in efficiency and increases in economic rents), disinformation is rampant because people who want to exploit the opportunities that disinformation provides always exist. Although some of the economic rents generated by disinformation will spill over to other people without compensation, similar to technology spillover, there is no doubt that the person who disseminated it receives a considerable amount of those rents if the disinformation dissemination is successful.

In addition, incentives for disseminating disinformation without any malicious intent can exist if some utilities are obtained, as indicated in Assumption 2. For example, a person may disseminate disinformation because the person wants to guide other people onto a perceived "right" path without knowing that it is misinformation.

When a person disseminates disinformation, the probability that the person obtains economic rents and other non-economic gains is not negative. On the other hand, the income of the person who disseminates it may accordingly decrease because the efficiency of the entire economy (*i.e.*, TFP) decreases. If the expected amount of economic rents and values of other non-economic gains due to disinformation exceeds the decrease in incomes due to the decrease in TFP, an incentive to disseminating disinformation is generated. Furthermore, if disseminating disinformation is not punished by authorities, the incentive will become stronger.

Nevertheless, there is a risk that it will become known that a person is disseminating disinformation, and that the person may be criticized, blamed, and possibly punished in various forms by society. This risk can be seen as a kind of cost to disseminating disinformation. The incentive will remain, however, if the expected net rents, gains, or incomes are still positive even after considering all the costs.

4. Macro-Economic Impact of Disinformation

4.1 Purpose

Many pieces of various kinds of disinformation have been disseminated, but most of them have not had a large impact on the entire economy. The reason for the small impact is probably that the number of people concerned for each individual piece of disinformation is usually small. However, if many people are concerned with a piece of disinformation, it can have a large impact on the economy. This means that if disinformation is disseminated for a purpose that is commonly shared by most people, the scale of the. impact of the disinformation can be large.

As shown in the model of ranked information in Section 1, purpose is an important element in the value of information. Most purposes are individual and personal, but some purposes are common to a large number of people (*e.g.*, a national goal). Disinformation aimed at this type of common purpose can have a large impact on the macro-economy. In this sense, the scale of the impact of disinformation will depend on the number of people who share a common purpose.

In addition, if pieces of disinformation are independent of each other but very similar, they will collectively be able to have a greater effect on the economy. For example, each instance of fraud is usually small, but the combined amount of money obtained in similar kinds of fraud can be very large. Disinformation can affect the entire economy through this channel. Note that similar kinds of fraud basically target the corresponding similar kinds of purpose (*e.g.*, insurance fraud).

Similar to individual and personal purposes, commonly shared purposes will change temporally and spatially. For example, a purpose may be pursued in one period or country but not in others. Purposes will change over time, regardless of whether the purposes were achieved or not, and new ones will emerge.

It is unlikely that rent seekers will disappear from the economy; therefore, it also unlikely that disinformation that is disseminated to obtain economic rents will disappear. Because disinformation is disseminated aiming at specific purposes, the pieces of disinformation will change as the purposes change. In addition, the number of pieces of information can fluctuate according to changes in the surrounding economic, political, or social environments, possibly greatly.

4.2 Combined Inefficiency

According to equation (20), the value of the economic impact of a piece of disinformation z for purpose i ($\Gamma z,i$) can be most simply modeled by

$$\Gamma_{z,i} = -P_i \left[y\left(IS_{i,q}\big|_{\Theta_{i,x}} \right) - y\left(IS_{i,q}\big|_{\Theta_{i,z}} \right) \right],$$

where P_i is the outcome if purpose i is achieved. Because of the successful dissemination of a piece of

disinformation z, the outcome decreases by $|\Gamma_{z,i}|$ even though the amounts of inputted resources are the same; that is, efficiency decreases.

Suppose that many pieces of disinformation that are very similar to z are also widely and ubiquitously disseminated. In this case, the combined impact of these pieces of disinformation can be approximately described as the aggregation of $\Gamma_{z,i}$ over such pieces of disinformation. However, it may not be easy to aggregate $\Gamma_{z,i}$ because there may be redundancy among the impacts. Hence, the value of the economic impact of the pieces of disinformation that are very similar to z ($\widetilde{\Gamma}_{x,z}$) can instead be modeled as

$$\tilde{\Gamma}_{x,z} = -(\Lambda_x - \Lambda_{x,z}),$$

here Λ_x is GDP if the pieces of disinformation that are very similar to z are not disseminated under environment x, and $\Lambda_{x,z}$ is GDP if they are disseminated and all other things are equal. Note that under environment x, many pieces of disinformation other than those that are very similar to z can also be disseminated.

4.3 Economic Inequality

Harashima (2022b) indicates that it seems highly likely that a very few people with very high fluid intelligences will select exceptionally more correct Inf-sets for most purposes; therefore, this select group of people can enjoy exceptionally high productivities and large amounts of economic rents. That is, because information is ranked, the level of economic inequality will be increased. An important point is that even if the same information is equally given to all people, economic inequality will still increase.

As Becker (1980) and Harashima (2010, 2012a, 2020d)[2] showed, in dynamic economic models, heterogeneous rates of time preference, degrees of risk aversion, persistent rents, and success rates of investment result in extreme economic inequalities if they are left alone; that is, all capital will eventually be possessed by the most advantaged household. Of these four factors, heterogeneous persistent rents and success rates of investment are generated by ranked information and therefore by disinformation. That is, disinformation can cause an extreme economic inequality.

4.4 Economic Fluctuations

Bad speculations can occasionally fluctuate largely and therefore generate large economic fluctuations as shown in Harashima (2022b). Because bad speculations are often executed using disinformation, disinformation can be seen as a source of large economic fluctuations. For example, an unrealistically optimistic economic view that is actually disinformation may be appealing to many people. If people change their behaviors largely and wrongly, an economic bubble may eventually be generated, which was the original purpose of the bad speculators. Many such attempts will fail, but the probability of success is not zero.

Conclusion

The value of information is changeable depending on situations and differs across people. This variability is economically very important because it means that a malicious person can manipulate the value of information a person expects by disseminating disinformation. The problems of fake news, disinformation, and misinformation have been recently widely reported in the political scene, particularly in elections in the U.S. Politically and socially, the problems of fake news, disinformation and misinformation have been regarded to be serious, but they are rarely studied in economics. I examined misinformation and disinformation from the point of view of ranked information (Harashima 2022b) and its impact on economics.

The importance of each piece of information has to be evaluated individually and personally by each person in each period for each purpose. I defined misinformation and disinformation, and then showed the mechanism of how disinformation decreases efficiency by manipulating ranked information on the basis of the model of ranked information presented in Harashima (2022b). Decreases in efficiency are observed as decreases in TFP, lowered success rates of investment, and costs of bad speculations. Disinformation not only decreases efficiency but also generates economic rents. Because of these economic rents, inequality widens, possibly by a great deal. Furthermore, disinformation can cause large-scale economic fluctuations.

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Divine Development: The Impact of Religion on Madagascar's Growth

R. Josué ANDRIANADY
Ministry of Economy and Finance, Madagascar
jravahiny@gmail.com

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Abstract: This paper examines the role of religion and the church in Madagascar's history of conflict and argues that their role has been largely overlooked in efforts to find solutions. With a significant portion of the population being animist, Christian, or Muslim, churches hold considerable influence in the country through various means, including media, education, and social support for vulnerable members of society. The paper explores whether religion plays a role in the country's current crises and assesses its quantitative contribution to Madagascar's economic growth and development.

Keywords: Madagascar; GDP; religion; conflict; economic growth.

JEL Classification: A10; A12; R11.

Introduction

Since World War II and Madagascar's independence in 1960, the country has experienced numerous episodes of conflict and violence, with notable occurrences in 1947, 1971, 1972, 1975, 1985, 1991, 1996, 2002, and 2009. Although most efforts to find solutions have been focused on political and institutional means, such as mediation, negotiation, and dispute-resolution initiatives, the role of religion and the church has been largely overlooked. In Madagascar, religion and churches play significant roles in the political, social, and cultural aspects of society. The most recent census indicates that 52% of the population are animists, 41% are Christians, and 7% are Muslims. Churches exert their influence not only through television, radio stations, and newspapers but also through education and socio-economic assistance to the most vulnerable members of society. Given the importance of religion in daily life in Madagascar, it is reasonable to assume that the church plays a role in the country's economic growth and development.

This paper seeks to answer the question of whether religion is involved in the multiple crises in Madagascar and to determine the quantitative contribution of religion to economic growth in the country.

1. Literature Review

The literature on the relationship between religion and economic growth is complex and multifaceted, with a variety of factors influencing the ways in which faith can impact economic outcomes. While some studies suggest that religion can be a positive force for economic development, others highlight the potential risks and challenges associated with the intersection of faith and growth.

1.1 Religion can Contribute to Economic Development

In his book "The Wealth of Nations," Adams Smith (1937) argued that religion can promote economic development by creating a virtuous circle of hard work, savings, and investment. Smith believed that religion can instill a strong work ethic in people and encourage them to save and invest their earnings, which can lead to economic growth. Additionally, Adams Smith (1937) argued that religious institutions, such as churches, can promote education and moral values that are beneficial for economic development. Max Weber (1920) argued that certain religious beliefs, such as the Protestant work ethic, could directly influence economic behavior and contribute to economic development. According to Weber, the Protestant work ethic emphasized the virtues of hard work, discipline, thrift, and frugality, and encouraged individuals to pursue 1 worldly success as a sign of

God's favor. This ethic could foster a culture of entrepreneurship and innovation, as individuals sought to maximize their economic potential and build their own fortunes. Weber suggested that this cultural mindset played a significant role in the rise of modern capitalism in Western Europe and America.

In his book "The Wealth and Poverty of Nations: Why Some Are So Rich and Some So Poor," David Landes (1995) argued that religion has played a significant role in shaping economic development throughout history. David Landes (1995) suggested that religions that emphasize hard work, thrift, and education have been more conducive to economic development than those that emphasize other values. For example, Landes argued that Confucianism, with its emphasis on education, discipline, and the importance of saving, played a key role in the economic development of East Asia. Similarly, Landes suggested that Protestantism, with its emphasis on the virtues of hard work and thrift, played a significant role in the economic development of Europe and America. David Landes (1995) also discussed the role of religion in promoting technological innovation, which is a key driver of economic development. Landes argued that religions that promote curiosity, experimentation, and the pursuit of knowledge have been more successful in promoting technological innovation than those that discourage these values. For example, Landes suggested that Islam played a key role in preserving and transmitting scientific knowledge during the Middle Ages, but that it later became less supportive of scientific inquiry and innovation, which may have contributed to its relative decline in economic development. Overall, David Landes (1995) suggests that religion can influence economic development through its impact on cultural values and attitudes, including attitudes toward work, education, and innovation. However, he also acknowledges that the relationship between religion and economic development is complex and multifaceted and that many other factors also play a role in shaping economic outcomes.

More recently, Barro et Mckinley (2003) in their research on the relationship between religion and economic growth, argued that religious institutions can foster social capital, which refers to the networks of trust, norms, and cooperation that enable economic activity. Religious institutions can provide a sense of community and social support that can help individuals overcome economic challenges and pursue their goals. Additionally, religious institutions can promote education and moral values that are beneficial for economic development.

In his book "The Victory of Reason: How Christianity Led to Freedom, Capitalism, and Western Success," Stark (2005) argued that Christianity played a key role in the rise of Western civilization and its economic development. According to Stark, Christianity encouraged rational thinking, scientific inquiry, and individualism, which were crucial for the development of capitalism and the modern world. Christianity also emphasized the importance of property rights and contract law, which provided a legal framework for economic activity. Wang and Lin (2014) Examine the impact of religious beliefs on economic growth using local panel data from 2001 to 2011 for China. This idea is also studied by Ungureanu (2023). Their results show that, among the various religions, Christianity has the greatest impact on economic growth. This conclusion is consistent across different estimators and has long-term stability. However, no consistent and firm conclusions can be drawn about other religions.

1.2 Religion can Have a Negative Impact on Economic Growth and Development

There are some authors who argue that religion can have a negative impact on economic growth and development. In his book "The God Delusion," David Landes (1995) argues that religion can be a hindrance to economic development by promoting irrational beliefs and practices that are counterproductive. Dawkins suggests that religions often promote supernatural beliefs and practices that are at odds with rational thinking and scientific inquiry, which can hinder technological innovation and progress. Additionally, Dawkins suggests that religion can promote tribalism and conflict, which can be detrimental to economic growth and stability. David Landes (1995) also argues that religion can promote anti-intellectualism and discourage critical thinking, which can make it more difficult for individuals to acquire the skills and knowledge needed for economic success. Dawkins suggests that the influence of religion can create a culture of obedience and conformity, which can be harmful to economic development by discouraging entrepreneurship and innovation. Overall, David Landes (1995) suggests that religion can have a negative impact on economic development by promoting irrationality, tribalism, and anti-intellectualism. However, it is important to note that Dawkins' views are controversial and have been challenged by other scholars who argue that religion can have positive effects on economic development, depending on the specific cultural and historical context.

Cragun (2015) argues that religion can be a barrier to economic development by promoting conservative social values and hindering progress on issues such as gender equality and LGBT rights. Cragun (2015) suggests that religious institutions often promote traditional gender roles and discourage women from pursuing careers and entrepreneurship, which can limit their economic potential and hinder overall economic growth. Additionally, he argues that religious institutions often oppose LGBT rights and other progressive social policies,

which can create a hostile environment for diversity and innovation and discourage talented individuals from contributing to the economy.

1.3 The Complexity of the Relationship between Growth and Religion

The relationship between religion and growth is complex for several reasons:

- Different religions have different beliefs and values: Religion is not a monolithic entity, and different religions have different beliefs, values, and practices. Some religious beliefs and practices may encourage economic growth, while others may discourage it.
- Causality is difficult to establish: It is difficult to establish a clear causal relationship between religion and economic growth. Economic growth can be influenced by many factors, including government policies, technological advancements, natural resources, education levels, and cultural norms. While religion may be a factor, it is not the only one.
- Correlation does not equal causation: Even when a correlation is observed between religious affiliation and economic growth, it does not necessarily mean that religion causes economic growth. Other factors, such as education levels and cultural norms, may be influencing both religious affiliation and economic growth.
- Conflicting values and priorities: Religion may prioritize values such as charity and compassion over economic growth, leading to tensions between economic development and religious values. Additionally, some religious traditions may view material wealth and economic growth as a distraction from spiritual pursuits.

1.4 Synthesis of the Review

In conclusion, religion can play a role in economic development by influencing cultural values and attitudes toward work, education, and innovation. Some religious values, such as hard work and thrift, have been seen as contributing to the development of capitalism and modern economic systems. Additionally, religion can contribute to economic growth by promoting education, trust, and social capital. On the other hand, some argue that religion can hinder economic development by promoting irrational beliefs, anti-scientific attitudes, and tribalism. Furthermore, religion can be a barrier to progress on social issues such as gender equality and LGBT rights, potentially limiting the economic potential of marginalized groups. It is important to note that there is a range of perspectives on the relationship between religion and economic development. The specific cultural and historical context may influence the impact of religion on economic growth and prosperity.

2. Religion in Madagascar

2.1 History and Evolution of Religion in Madagascar

The history of religion in Madagascar is diverse and complex, with various beliefs and practices coexisting and evolving over time. Prior to the arrival of Europeans in the 16th century, Madagascar was inhabited by various ethnic groups, each with their own religious traditions.

One of the dominant religions in Madagascar prior to European contact was animism, which involved the belief in spirits and the worship of ancestors. With the arrival of European missionaries in the 19th century, Christianity began to spread rapidly throughout the island, with the Roman Catholic and Protestant denominations gaining the most adherents. During the colonial period, Christian missionaries played a significant role in the education and social services provided to the Malagasy people, leading to the growth of the Christian population. However, traditional beliefs and practices, such as ancestor worship, continued to be practiced alongside Christianity. In the post-colonial era, various religious movements emerged in Madagascar, including revivalist and Pentecostal movements, as well as the revival of traditional Malagasy beliefs and practices.

Today, Christianity remains the dominant religion in Madagascar, with the Roman Catholic and Protestant denominations comprising the majority of Christians. However, traditional beliefs and practices, such as ancestor worship and the veneration of nature, continue to be an important aspect of Malagasy culture and religion.

2.2 The Significance of Religion in Madagascar

Religion has had a significant impact on the culture, society, and politics of Madagascar. Christianity, in particular, has played a significant role in shaping the country's social and political landscape. One of the most important impacts of Christianity in Madagascar has been on education and literacy. Christian missionaries established schools and educational institutions throughout the island, which helped to increase literacy rates and provide access to education for many Malagasy people. Religion has also played a role in shaping the country's political history. During the colonial period, Christian missionaries were often aligned with colonial powers, and their presence contributed to the erosion of traditional Malagasy power structures and the spread of Western values

and norms. Today, religion continues to be an important aspect of Malagasy culture and identity. Traditional beliefs and practices, such as ancestor worship and the veneration of nature, remain deeply ingrained in Malagasy society, alongside the dominant Christian denominations. Religious institutions also continue to play a role in providing social services and support to communities in Madagascar. Churches and other religious organizations are often involved in providing healthcare, education, and other forms of assistance to those in need. Overall, religion has had a significant impact on the history, culture, and society of Madagascar, shaping the country's social and political landscape, and contributing to the development of its unique identity and traditions.

2.3 Religion and Conflict in Madagascar: The Complex Roles of Churches

The role of religion in Madagascar's conflicts is a complex and multifaceted phenomenon, with the involvement of churches being varied and sometimes contradictory. Churches have acted as both active participants in violent conflicts and as peacemakers and mediators in episodes of violence, resulting in a perplexing situation that defies simple explanations. The interweaving of religion, politics, class, and socio-economic issues in Madagascar has further heightened the complexity of the situation.

2.3.1 Times When Religion Was Involved in Conflict

At times, Malagasy Churches have directly participated in violent conflicts in order to gain more followers. For example, in the year 2000, a conflict arose between the Protestant Church known as FJKM (Church of Jesus Christ in Madagascar) and one of its congregation leaders. This dispute resulted in the formation of a new Church of revivalists called FPVM (New Protestant Church of Madagascar). The politician Marc Ravalomanana, who was one of the main parties involved in the 2009 conflict, was also the FJKM's Vice-President. Both sides engaged in symbolic and direct violence, including physical violence against pastors and catechists of the FJKM, confiscation of their properties and Church funds, and street violence. In Madagascar, politics, religion, class, and 4 socio-economic issues are closely linked. As a result, religious institutions have occasionally become involved in politics, with religious leaders taking sides and supporting various political factions. For instance, in 2002, during a period of violence, the Catholic Church openly backed Ravalomanana's bid for the presidency. However, during the political crisis in 2009, the Protestant Church supported Ravalomanana, while the Catholic Church changed course and supported opposition leader Andry Rajoelina. Religious actors have been instrumental in mobilizing support and devotion during conflicts, using religious symbols, myths, and rituals for political purposes, leading to a burst of mobilization among followers. For example, the former president Ravalomanana used a verse from the Gospel of Marc 5:36 'Be not afraid, only believe' as a political slogan, which attracted many followers. Additionally, during the conflict in 2002, Fifohazana shepherds belonging to the revivalist movement were called upon to exorcise governmental buildings, which had a significant impact on mobilization processes and the creation of a strong basis of supporters and devoted followers. More recently, Andry Rajoelina used catholic song "tena fitia" in his campain for presidential election in 2018 after that he get elected president.

2.3.2 Times When Religion Preaches Peace

Despite their involvement in conflicts, churches have also acted as powerful peacemakers in Madagascar. Religious leaders have frequently used their political, social, and cultural influence to call for peace, invoking values of tolerance, empathy, and understanding. They have been particularly effective in resolving local conflicts and have been seen as trustworthy mediators due to their societal importance. For example, during the violent episode in 1972, churches urged for reforms and the revision of cooperation agreements between France and Madagascar, in an effort to bring peace and stability to the country. In 1991, the Christian Council of Churches successfully mediated high-level negotiations that led to the establishment of a transitional government towards the third republic, and even acted as powerful decision-makers drafting and writing the new constitution. The complex and intertwined nature of religion, politics, and societal issues in Madagascar means that building sustainable and lasting peace in the country cannot be achieved without the contribution and participation of religious actors. Despite their contradictory roles in conflicts, churches have proven to be influential in mobilizing support and devotion, as well as in mediating and resolving conflicts. Their societal importance and influence make them key players in conflict and peacebuilding in Madagascar, and their involvement is crucial for achieving lasting peace in the country.

2.4 Synthesis of Religion in Madagascar

In summary, religion has had a significant impact on Madagascar's history, culture, and society. Christianity, in particular, has played a prominent role in shaping the country's education, politics, and social services. Traditional beliefs and practices, such as ancestor worship and the veneration of nature, remain deeply ingrained in Malagasy society alongside dominant Christian denominations. Religious institutions continue to play an important role in providing social services and support to communities in Madagascar. However, religious differences have also led to tensions and conflicts between different religious groups, such as between Catholics and Protestants. Religious leaders have acted as political actors in some instances, and their support for different political parties has further contributed to political instability and conflict. Despite this, religious institutions have also played a role in peacebuilding and conflict resolution in Madagascar. In conclusion, religion's impact on Madagascar has been complex, with both positive and negative consequences. While religious institutions have provided support and assistance to communities in need, religious differences have also contributed to conflict and political instability.

3. Religion and Growth Using a Quantitative Approach

3.1 Methodology

To examine the relationship between religion and economic growth in Madagascar in a quantitative way, we conducted a regression analysis using data from multiple sources.

3.1.1 Data Sources

Our primary data sources include the World Bank's World Development Indicators (WDI), the world religion database, and the global economy.com. We collected data on the following variables:

- Economic growth: We measured economic growth using the annual GDP growth rate, which represents the percentage change in GDP over the course of a year.
- Religion: We used data from the world religion database and the Pew Research Center's 2010 Global Religious Landscape survey to determine the percentage of the population that identifies as Christian, Muslim, or follows traditional beliefs.
- Control variables: To control for other factors that may influence economic growth, we included education level as a control variable in our regression model.

3.1.2 Regression Model

We used a multiple linear regression model to examine the relationship between religion and economic growth in Madagascar. Our model is as follows:

$$GDP = \beta0 + \beta1Christian + \beta2Muslim + \beta3Traditional + \beta4EducationLevel + \varepsilon. \quad (3.1)$$

where: β0 is the intercept term β1, β2, and β3 are the coefficients for the percentage of the population that identifies as Christian, Muslim and follows traditional beliefs, respectively. β4 is the coefficient for the control variables: education level. e is the error term.

3.2 Results

The results of the econometric model show that there is a positive relationship between Christianity and economic growth in Madagascar. The coefficient of the Christianity variable is 0.34, which indicates that a one percent increase in the proportion of Christians in the population is associated with a 0.34 percent increase in GDP per capita. On the other hand, the results show that there is a negative relationship between Islam and economic growth in Madagascar. The coefficient of the Islam variable is -0.23, which indicates that a one percent increase in the proportion of Muslims in the population is associated with a 0.23 percent decrease in GDP per capita. There is no significant relationship between traditional beliefs and economic growth in Madagascar. Additionally, education is positively related to economic growth, with a stronger effect.

3.3 Discussion

The positive relationship between Christianity and economic growth in Madagascar is consistent with previous studies that have found a positive relationship between religion and economic growth. One explanation for this relationship is that religion promotes social capital, which can lead to increased economic growth. Social capital refers to the networks, norms, and trust that facilitate cooperation among individuals and groups. Religious institutions can provide a space for social interaction, and the shared values and norms of a religious community

can foster trust and cooperation. The negative relationship between Islam and economic growth in Madagascar is more difficult to explain. Previous studies like Khalfaoui (2015), Kuran (2018) have found mixed results regarding the relationship between Islam and economic growth. Some studies have found a positive relationship, while others have found a negative relationship. One possible explanation for the negative relationship in Madagascar is that the Muslim community in Madagascar is relatively small and may not have the same social capital as the Christian community. Another possible explanation is that the Muslim community in Madagascar may face discrimination or other barriers to economic participation. some scholars have argued that Islamic law can be a barrier to economic growth because it restricts certain economic activities and transactions. For example, the prohibition on interest-based transactions (riba) can make it difficult for Islamic financial institutions to compete with conventional banks and may limit access to credit for individuals and businesses. Moreover, Islamic law also places restrictions on 6 trade and investment in certain sectors, such as gambling, alcohol, and pork.

Conclusion

In conclusion, religion has played a significant role in the history, culture, and society of Madagascar. From the traditional animism beliefs to the introduction of Christianity by European missionaries and the emergence of various religious movements, religion has evolved and diversified in Madagascar. The impact of religion on economic growth and development in Madagascar is complex and multifaceted, with both positive and negative effects. While some religious values can promote economic growth and prosperity, other beliefs can hinder progress on social issues and limit the economic potential of marginalized groups. Despite the challenges and complexities, churches and religious organizations have been actively involved in proviSding social services and support to communities in Madagascar. However, the role of religion in conflicts in Madagascar remains a perplexing phenomenon, with the involvement of churches being varied and sometimes contradictory. Overall, the significance of religion in Madagascar cannot be overlooked, and a deeper understanding of its role and impact is crucial for addressing the country's economic, social, and political challenges.

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A Basic Two-Sector New Keynesian DSGE Model of the Indian Economy

Anshul KUMAR
Department of Humanities and Social Sciences, IIT Guwahati, India
anshul18@iitg.ac.in, 9anshulyadav@gmail.com

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Abstract: Indian economy is going through underlying changes in the post-pandemic recovery process. Effects of policies, monetary or fiscal, on macroeconomy need a thorough analysis in these recessionary times. In this context, this study develops a closed-economy DSGE model to see the impact of monetary policy on the Indian economy. The model includes price rigidities, and parameters are calibrated using the data on Indian economy. The model includes two sectors – intermediate goods and final goods producers, an inflation-targeting regime following the Taylor rule. Model is simulated for a positive productivity shock and an expansionary monetary policy shock. Results show that a positive productivity shock improves overall economic activity, and an expansionary monetary policy shock increases output for the short term only.

Keywords: DSGE models; monetary policy; general equilibrium; Indian economy; calibration.

JEL Classification: C32; E32; E37; E52; R11.

Introduction

One of the main objectives of macroeconomics is to learn how the overall economy works and to analyse how certain changes in one sector affect others and the economy as a whole. Like in natural sciences, economists are also interested in carrying out experiments to study the impacts of specific changes and disruptions on the economy. But unlike economics, researchers in other fields like Physics or Chemistry have the luxury of conducting experiments in laboratories where they can replicate real-world conditions and complete their experiments. The Dynamic Stochastic General Equilibrium or popular as DSGE models provide macroeconomists with such laboratories where they also conduct experiments to know in advance the effects of certain policy changes, disruptions and anticipated or unanticipated shocks at the aggregate level. We can call these models macroeconomic laboratories because they are grounded in microeconomic theory and construct a model economy in such a way that allows for more structural analysis and evolution of business cycles. Though prone to criticism, the DSGE approach is the core of present-day macroeconomic modelling.

The present study builds and calibrates a closed economy New-Keynesian DSGE model for the Indian economy. The Model presented in the later section is at an early stage and includes only two economic agents – households and firms along with a monetary authority which sets the interest rates. Model parameters are calibrated following the literature based on Indian quarterly data. Model is tested for productivity and monetary policy shocks. Results of our calibrated model are in line with the economic theory and existing literature on India. Impulse responses generated after productivity shock shows an increase in consumption and investment. An expansionary monetary shock increases output as well as inflation but decreases the demand for government bonds.

The paper is arranged in three sections. The following section gives a brief review of existing literature. Section two lays out the basic framework for the model with separate subsections dedicated to representative household, firm and monetary authority. Section 3 discusses the simulation results.

1. Literature Review

Kydland and Prescott (1982) were the first proponents of DSGE modelling. They originated out of the real business cycle (RBC) theory which argues that exogenous shocks can help explain economic fluctuations. RBC models held unrealistic assumptions like perfect competition, absence of asymmetric assumptions etc. These assumptions have been relaxed in later New-Keynesian versions of DSGE models, which include nominal rigidities in pricing, investment adjustment costs and include different shocks to bring the models closer to the real economy as close as possible. More refined models by Christiano, Eichenbaum, and Evans (2005), Fernández-Villaverde and Rubio-Ramírez (2006), Smets and Wouters (2007) are some examples of DSGE models with New-Keynesian flavour.

There is a plethora of DSGE literature dedicated to explaining the business cycles in developed economies. But it is sparse in emerging market economies. These economies have different characteristics than developed ones. Developing nations economies face different frictions and distortions, which poses more challenges in developing such models. In the Indian context, DSGE literature is even sparser. In the first such attempts, Peiris, Saxegaard, and Anand (2010) estimate a small open economy DSGE model with macro-finance linkages for the Indian economy. They include a financial accelerator proposed by BGG (Bernanke, Gertler, and Gilchrist 1998) where firms can borrow in domestic as well as in foreign currency. They estimate the model using Bayesian for the post-1996 to 2008 data. V. J. Gabriel *et al.* (2011) build a more Indianised version of the DSGE model by including the informal sector and financial frictions due to the presence of credit-constrained consumers. They find that inclusion of financial friction and informal sector improves the model fit significantly. In later years, there have been efforts to develop DSGE models for specific objectives, such as to analyse monetary policy transmission, fiscal policy effects and impacts of financial intermediation on potential output growth. Banerjee, Basu, and Ghate (2020) try to understand weak aggregate demand channel of monetary policy transmission in India by building a New Keynesian monetary business cycle model. They calibrate the model using the quarterly data for 1996-2016 and find that informal sector hinders the monetary policy transmission in India. Sarkar (2020) calibrate the NK-DSGE model using Indian quarterly data to understand the short-run relationship between the stock market and economic growth. He incorporates the Lucas (1978) asset pricing framework within the general equilibrium model with two additional features of international borrowing and domestic shareholdings by foreign firms.

To trace the effects of COVID-19 pandemic, Sarkar (2022) builds a theoretical general equilibrium model to include three pandemic related shocks – obstruction of interregional migration, supply disruptions and reduced demand. He shows that supply shocks are contagious and create demand constraints in other sectors of the economy. He further finds that monetary transfers are helpful in mitigating unemployment and increasing output. Shah and Garg (2023) test the effectiveness of monetary and fiscal policy in the aftermath of COVID-19 in a New Keynesian DSGE framework. They find expansionary monetary policy to be more effective in growth revival from both demand and supply side, while expansionary fiscal policy to be effective from the demand side only. To trace the post-pandemic recovery, Sharma and Behera (2022) analyse the output gap using the DSGE model and find it to be superior to the traditional HP filter method.

Our paper contributes to this evolving DSGE literature for the Indian economy. We build a basic model to analyse different shocks, *i.e.*, productivity and monetary shocks. Our model can provide a basic structure to build upon and to include other economic agents, *i.e.*, government and the external sector.

2. Model

This section lays out the underlying DSGE model. We build a closed economy New-Keynesian DSGE model following Smets and Wouters (2007) and Costa (2018). Our model is in the early stage and consists of only two agents - households and firms. Model is discussed in the following subsections.

2.1 Households

There is a closed economy with no government sector. The economy is populated by a continuum of households indexed by jϵ[0,1]. The household maximises his utility function which is additively separable in consumption and labour. Household consumes goods and supply labour to the firms. Household maximises the following utility function:

$$\max_{C_{j,t},L_{j,t},B_t,K_{j,t+1}} u_t = E_t \sum_{t=0}^{\infty} \beta^t \left[\frac{C_{j,t}^{1-\sigma}}{1-\sigma} - \frac{L_{j,t}^{1+\psi}}{1+\psi} \right] \qquad 2.1$$

where,
E_t – Expectation operator,
C – Consumption,
L – Labour supplied by household (in number of hours),
β – Discount Factor,
σ – Coefficient of relative risk-aversion (reciprocal to the elasticity of substitution of consumption),
ψ – Marginal disutility of labour (reciprocal to the elasticity of substitution of labour supply)

In line with the RBC models, the utility function chosen is a constant relative risk-aversion (CRRA)[3] utility function. CRRA utility functions are widely used in DSGE models because they are compatible with balanced growth[4] along with the optimal steady-state. It is a concave utility function with the properties of $u_C>0, u_L<0$ and $u_{CC}, u_{LL}<0$. $u_L<0$ means that labour has a negative effect on the utility *i.e.*, the more labour household supplies, less satisfaction he drives. Household maximises the utility function subject to the budget constraint:

$$P_t\left(C_{j,t}+ I_{j,t}\right) + \frac{B_{j,t+1}}{r_t} = W_tL_{j,t}+ R_tK_{j,t}+ B_{j,t}+ \Pi_t \qquad 2.2$$

where,
P – General Price level
I – Investment
W – Wages
K – Capital Stock
B_t – One maturity bond issued by the government
R – Return on Capital
r – Interest rate set by the central bank
Π – dividends to households by firms

In budget constraint Equation 2.2, $\left(\frac{1}{r_t}\right)$ is the price of the government bond[5]. Our household derives his income from three sources - supplying labour, renting capital and holding the government bond. In the economy, capital is accumulated following the rule:

$$K_{j,t+1} = (1-\delta)K_{j,t}+ I_{j,t} \qquad 2.3$$

where δ is the depreciation rate of capital. Next, we form the Lagrangian to solve the above maximisation problem. After substituting $I_{j,t} = K_{j,t+1}-(1-\delta)K_{j,t}$ from Equation 2.3 in the budget constraint, Lagrangian is –

$$\mathcal{L} = E_t \sum_{t=0}^{\infty} \beta^t \left[\frac{C_{j,t}^{1-\sigma}}{1-\sigma} - \frac{L_{j,t}^{1+\psi}}{1+\psi}\right] - \lambda_{j,t}\left[P_tC_{j,t}+ P_tK_{j,t+1} - P_t(1-\delta)K_{j,t}+ \frac{B_{j,t+1}}{r_t} - W_tL_{j,t}- R_tK_{j,t}- B_{j,t}- \Pi_t\right] \qquad 2.4$$

λ is the Lagrangian multiplier. First-order conditions for consumption, labour, capital and bond are:

$$\frac{\partial \mathcal{L}}{\partial C_{j,t}} = C_{j,t}^{-\sigma} - \lambda_{j,t}P_t = 0 \qquad 2.5$$

$$\frac{\partial \mathcal{L}}{\partial L_{j,t}} = -L_{j,t}^{\psi}+ \lambda_{j,t}W_t = 0 \qquad 2.6$$

$$\frac{\partial \mathcal{L}}{\partial K_{j,t+1}} = - \lambda_{j,t}P_t + \beta E_t\lambda_{j,t+1}[(1-\delta)E_tP_{t+1}+ E_tR_{t+1}] = 0 \qquad 2.7$$

$$\frac{\partial \mathcal{L}}{\partial B_{j,t+1}} = -\frac{\lambda_{j,t}}{r_t} + \beta E_t\lambda_{j,t+1} = 0 \qquad 2.8$$

from Equation 2.5 and 2.6, solving for λ gives the following equation:

$$C_{j,t}^{\sigma}L_{j,t}^{\psi} = \frac{W_t}{P_t} \qquad 2.9$$

[3] Following (King, Plosser, and Rebelo 1988), (Gali and Monacelli 2008) and (Gertler and Karadi 2011) among others.
[4] In balanced growth, growth rate is constant at steady-state.
[5] Bond price is inversely related to the interest paid on holding the bond.

Equation 2.9 can be interpreted as the labour supply equation because it equates the marginal rate of substitution between consumption and leisure on the left-hand side to their relative prices on the right-hand side. In next step, we try to find the inter-temporal consumption/saving Euler equation. To get the Euler equation, we substitute the value of Lagrangian multiplier ($\lambda_{j,t}$) from Equation 2.5 in Equation 2.7. After some algebraic manipulation we get the Euler equation:

$$\left(\frac{E_t,C_{j,t+1}}{C_{j,t}}\right)^{\sigma} = \beta\left[(1-\delta) + E_t\left(\frac{R_{t+1}}{P_{t+1}}\right)\right] \qquad 2.10$$

As we see, the above equation is an inter-temporal condition which can be interpreted that households must be indifferent between consuming one more unit today (in period t) and saving that unit, earning some interest on it, and then consuming it in the next period (t+1). From Equation 2.8, we can get the Euler equation for government bond:

$$\frac{\lambda_{j,t}}{r_t} = \beta E_t \lambda_{j,t+1} \qquad 2.11$$

2.2 Firms

The proposed model is a New-Keynesian model. It features imperfect competition in the production sector. In NK models, prices are temporarily rigid and adjusts with a lag. We assume price stickiness in the model. There are two types of firms - final goods producing firms and intermediate goods producing firms. We discuss both types of firms as follows:

2.2.1 Final Goods Firms

Final goods producing firms operate in a perfectly competitive market. Firms follow Dixit-Stiglitz (Dixit and Stiglitz 1977) aggregator function:

$$Y_t = \left(\int_0^1 Y_{j,t}^{\frac{\xi-1}{\xi}} dj\right)^{\frac{\xi}{\xi-1}} \qquad 2.12$$

where, $Y_{j,t}$ is intermediate good and Y_t is the final good after aggregating goods. $\xi>1$ is the elasticity of substitution between intermediate goods. If P_t is the nominal price of final goods and $P_{j,t}$ is the price of intermediate goods, then the profit maximising problem of the final goods firm is:

$$\max_{Y_{j,t}} P_t Y_t - \int_0^1 P_{j,t} Y_{j,t} dj \qquad 1.13$$

substituting the expression for Y_t from Equation 2.12 yields:

$$\max_{Y_{j,t}} P_t \left(\int_0^1 Y_{j,t}^{\frac{\xi-1}{\xi}} dj\right)^{\frac{\xi}{\xi-1}} - P_{j,t}\int_0^1 Y_{j,t} dj \qquad 2.14$$

first order condition for the above problem leads to:

$$P_t \left(\int_0^1 Y_{j,t}^{\frac{\xi-1}{\xi}} dj\right)^{\frac{1}{\xi-1}} Y_{j,t}^{\frac{-1}{\xi}} - P_{j,t} = 0 \qquad 2.15$$

rearranging the aggregator function in Equation 2.12 gives the following expression for Y_t:

$$Y_t^{\frac{1}{\xi}} = \left(\int_0^1 Y_{j,t}^{\frac{\xi-1}{\xi}} dj\right)^{\frac{1}{\xi-1}} \qquad 2.16$$

substituting the R.H.S. of this equation in Equation 2.15 and after doing some algebraic manipulation gives the demand function for intermediate goods:

$$Y_{j,t} = Y_t \left(\frac{P_t}{P_{j,t}}\right)^{\xi} \qquad 2.17$$

This demand function is directly proportional to aggregate demand Y_t and indirectly proportional to the relative price level. Now, substituting this expression for $Y_{j,t}$ back in the aggregator in Equation 2.12:

$$Y_t = \left[\int_0^1 \left\{Y_t \left(\frac{P_t}{P_{j,t}}\right)^{\xi}\right\}^{\frac{\xi-1}{\xi}} dj\right]^{\frac{\xi}{\xi-1}} \quad 2.18$$

again, after some algebraic manipulation,

$$P_t = \left[\int_0^1 P_{j,t}^{1-\xi} dj\right]^{\frac{1}{1-\xi}} \quad 2.19$$

2.2.2 Intermediate Goods Firms

Firms in this sector produce differentiated intermediate goods and sell them to final goods producing firms. Due to the differentiated nature of their products, they enjoy some degree of market power. Therefore, there is monopolistic competition in this market structure. In first stage, intermediate firm determines the amount of labour and capital to minimise its production cost. Firms use both labour and physical capital and follow the Cobb-Douglas production function:

$$Y_{j,t} = A_t K_{j,t}^{\alpha} L_{j,t}^{1-\alpha} \quad 2.20$$

where, A_t is the technology and follows an AR(1) process:

$$\log A_t = (1-\phi_A) \log \bar{A} + \phi_A \log A_{t-1} + \epsilon_t \quad 2.21$$

where, $\bar{A}$ is the productivity at steady-state, ϕ_A is the autoregressive parameter ϵ_t is the productivity shock with $\epsilon_t \sim N(0,\sigma_a)$. Cobb-Douglas production function has some properties - It is strictly increasing and concave function, which means $F_L, F_K > 0$ and $F_{LL}, F_{KK} < 0$. Production function gives constant returns to scale and follows Inada[6] conditions. The problem of the firm is to minimise the production cost subject to the production function in Equation 2.20:

$$\min_{L_{j,t}, K_{j,t}} W_t L_{j,t} + R_t K_{j,t} \quad 2.22$$

subject to,

$$Y_{j,t} = A_t K_{j,t}^{\alpha} L_{j,t}^{1-\alpha} \quad 2.23$$

The Lagrangian for this problem is:

$$\mathcal{L} = W_t L_{j,t} + R_t K_{j,t} + v_{j,t}\left(Y_{j,t} - A_t K_{j,t}^{\alpha} L_{j,t}^{1-\alpha}\right) \quad 2.24$$

where, $v_{j,t}$ is the Lagrangian multiplier. First-order conditions for labour and capital are:

$$\frac{\partial \mathcal{L}}{\partial L_{j,t}} = W_t - (1-\alpha) v_{j,t} A_t K_{j,t}^{\alpha} L_{j,t}^{\alpha} = 0 \quad 2.25$$

$$\frac{\partial L}{\partial K_{j,t}} = R_t - \alpha v_{j,t} A_t K_{j,t}^{\alpha-1} L_{j,t}^{1-\alpha} = 0 \quad 2.26$$

Here, the Lagrange multiplier $v_{j,t}$ shows the shadow prices of change in the ratio of capital and labour used. Therefore, we can consider the Lagrangian multiplier as the marginal cost ($mc_{j,t}$). Now the above equations are:

$$L_{j,t} = (1-\alpha) mc_{j,t} \frac{Y_{j,t}}{W_t} \quad 2.27$$

[6] $\lim_{L\to 0} F_L = \infty$; $\lim_{L\to \infty} F_L = 0$ and $\lim_{K\to 0} F_K = \infty$; $\lim_{K\to \infty} F_K = 0$ conditions.

and

$$K_{j,t} = \alpha mc_{j,t} \frac{Y_{j,t}}{R_t} \quad 2.28$$

Since total cost for the firm j is:

$$TC_{j,t} = W_t L_{j,t} + R_t K_{j,t} \quad 2.29$$

substituting Equation 2.27 and 2.28 in total cost function and dividing by output, we get the expression for the marginal cost:

$$mc_{j,t} = \frac{1}{A_t}\left(\frac{W_t}{1-\alpha}\right)^{1-\alpha}\left(\frac{R_t}{\alpha}\right)^{\alpha} \quad 2.30$$

2.2.3 Calvo Pricing

In the next stage, firm defines the prices of intermediate goods. In our model, we assume that firm decides the prices following the Calvo rule (Calvo 1983). Under this rule, in a period, only a fraction of total firms selected are allowed to change the prices when they receive the random signal. Remaining firms define their prices following the stickiness rule, like maintaining the previous period's price or updating the price based on previous period's inflation rate. We follow the previous period's price rule $P_{j,t} = P_{t-1}$ to introduce price stickiness.

Following the Calvo pricing rule, we assume that there is a φ probability that a firm keeps its price fixed in the next period and a $1-\varphi$ probability that it receives the random signal and resets the prices. For the firm which reset its prices, there is φ probability that the price remains fixed in time t+1 and φ^2 probability to remain fixed in t+2 and so on. The maximisation problem of the firm which reset its prices can be defined by subtracting total costs from the total revenue in the following way:

$$\max_{P^*_{j,t}} E_t \sum_{i=0}^{\infty} (\beta\varphi)^i \left(P^*_{j,t} Y_{j,t+i} - TC_{j,t+i}\right) \quad 2.31$$

where $P^*_{j,t}$ is the optimal price. Substituting the expression for $Y_{j,t}$ from Equation 2.17 in Equation 2.31 and replacing the $TC_{j,t+i} = mc_{j,t+i} \times Y_{j,t+i}$ gives:

$$\max_{P^*_{j,t}} E_t \sum_{i=0}^{\infty} (\beta\varphi)^i \left[P^*_{j,t} Y_{t+i}\left(\frac{P_{t+i}}{P^*_{j,t}}\right)^{\xi} - Y_{t+i}\left(\frac{P_{t+i}}{P^*_{j,t}}\right)^{\xi} mc_{j,t+i}\right] \quad 2.32$$

taking the first derivative and solving for $P^*_{j,t}$ gives:

$$P^*_{j,t} = \left(\frac{\xi}{\xi-1}\right) E_t \sum_{i=0}^{\infty} (\beta\varphi)^i mc_{j,t+i} \quad 2.33$$

Since all the firms which reset the prices face the same marginal cost. Therefore, $P^*_{j,t}$ is the same price for all $(1-\varphi)$ price resetting firms. Now, from Equation 2.19, the expression can also be written as: $P_t^{1-\xi} = \left[\int_0^1 P_{j,t}^{1-\xi} dj\right]$ and the equation for the aggregate price level can be solved in the following way:

$$P_t^{1-\xi} = \int_0^{\varphi} P_{t-1}^{1-\xi} dj + \int_{\varphi}^{1} P_t^{*1-\xi} dj \quad 2.34$$

solving the equation gives the expression for general price level:

$$P_t = \left[\varphi P_{t-1}^{1-\xi} + (1-\varphi) P_t^{*1-\xi}\right]^{\frac{1}{1-\xi}} \quad 2.35$$

2.3 Central Bank

Now, we introduce a monetary policy authority, typically a central bank in any economy which sets the interest rates. We assume that central bank follows a simple Taylor rule (Taylor 1993) and sets the interest rate keeping in mind two broad objectives - price stability and economic growth. We follow the Taylor rule defined in (Costa 2018) and (Banerjee, Basu, and Ghate 2020) as:

$$\frac{r_t}{\bar{r}} = \left(\frac{r_{t-1}}{\bar{r}}\right)^{\gamma_r} \left[\left(\frac{\pi_t}{\bar{\pi}}\right)^{\gamma_\pi} \left(\frac{Y_t}{\bar{Y}}\right)^{\gamma_Y}\right]^{(1-\gamma_r)} s_t^m \qquad 2.36$$

where, γ_r is the smoothing parameter, γ_Y is the interest rate sensitivity of output, γ_π is the interest rate sensitivity of inflation. s_t^m monetary policy shock which follows AR(1) process:

$$\log s_t^m = (1-\rho_m) \log \bar{s}^m + \rho_m \log \bar{s}^{m_{t-1}} + \epsilon_{m,t} \qquad 2.37$$

Since there is symmetry in the preferences of both households and firms, so they are represented by representative agents. So, we can remove the j subscript from the equations. Model equations removing the j subscript can be written as:

$$C_{j,t}^{\sigma} L_{j,t}^{\psi} = \frac{W_t}{P_t} \qquad \text{Labour Supply}$$

$$\left(\frac{E_t, C_{t+1}}{C_t}\right)^{\sigma} = \beta\left[(1-\delta)+E_t\left(\frac{R_{t+1}}{P_{t+1}}\right)\right] \qquad \text{Euler Equation}$$

$$K_{t+1} = (1-\delta)K_t + I_t \qquad \text{Law of Capital Accumulation}$$

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha} \qquad \text{Production function}$$

$$mc_t = \frac{1}{A_t}\left(\frac{W_t}{1-\alpha}\right)^{1-\alpha}\left(\frac{R_t}{\alpha}\right)^{\alpha} \qquad \text{Marginal Cost}$$

$$L_t = (1-\alpha) mc_t \frac{Y_t}{W_t} \qquad \text{Labour Demand}$$

$$K_t = \alpha mc_t \frac{Y_t}{R_t} \qquad \text{Capital Demand}$$

$$P_t^* = \left(\frac{\xi}{\xi-1}\right) E_t \sum_{i=0}^{\infty} (\beta\varphi)^i mc_{t+i} \qquad \text{Optimal Price level}$$

$$\pi_t = \frac{P_t}{P_{t-1}} \qquad \text{Inflation Rate}$$

$$K_t = \alpha mc_t \frac{Y_t}{R_t} \qquad \text{Capital Demand}$$

$$P_t^* = \left(\frac{\xi}{\xi-1}\right) E_t \sum_{i=0}^{\infty} (\beta\varphi)^i mc_{t+i} \qquad \text{Optimal Price level}$$

$$\pi_t = \frac{P_t}{P_{t-1}}$$ Inflation Rate

$$Y_t = C_t + I_t$$ Equilibrium Condition

$$\log A_t = (1- \phi_A) \log \bar{A} + \phi_A \log A_{t-1} + \epsilon_t$$ Productivity Shock

2.4 Steady State

Next step in solving the model is to define the steady-state[7] values. We remove time subscript and solve above equations for steady-state for households:

$$\bar{C}^{\sigma}\bar{L}^{-\psi} = \frac{\bar{W}}{\bar{P}} \quad 2.38$$

$$1 = \beta\left[(1-\delta) + \left(\frac{\bar{R}}{\bar{P}}\right)\right] \quad 2.39$$

$$\delta\bar{K} = \bar{I} \quad 2.40$$

For firms:

$$\bar{Y} = \bar{K}^{\alpha}\bar{L}^{1-\alpha} \quad 2.41$$

$$\bar{L} = (1-\alpha)\overline{mc}\frac{\bar{Y}}{\bar{W}} \quad 2.42$$

$$\bar{K} = (\alpha)\overline{mc}\frac{\bar{Y}}{\bar{R}} \quad 2.43$$

$$\overline{mc} = \left(\frac{\bar{W}}{1-\alpha}\right)^{1-\alpha}\left(\frac{\bar{R}}{\alpha}\right)^{\alpha} \quad 2.44$$

Solving from Equation 2.33, $E_t \sum_{i=0}^{\infty}(\beta\varphi)^i = \frac{1}{1-\beta\varphi}$. Substituting this value in the optimal pricing equation and defining steady-state:

$$\bar{P} = \left(\frac{\xi}{\xi - 1}\right)\left(\frac{1}{1 - \beta\varphi}\right)\overline{mc} \quad 2.45$$

and equilibrium condition

$$\bar{Y} = \bar{C} + \bar{I} \quad 2.46$$

where, a bar over a variable shows it's steady-state. For some variables, it is easy to get the steady state values analytically, but for most variables, it's not possible. The standard practice is to solve for steady states numerically for such variables. For e.g.in equation 2.21, it's difficult to solve for steady state value of productivity. In literature, $\bar{A}$ is given the value 1. Following the literature, we also assign unit value to the productivity steady state. We also normalise general price level to 1 $(\bar{P} = 1)$ which is again a standard practice in literature to simplify the model.

With these equations ready, we try to solve for steady states for our variables of interest. From Equation 2.11, steady -state value for interest rate simply is:

$$\bar{r} = \frac{1}{\beta} \quad 2.47$$

Next, we start with $\bar{R}$, as in Equation 2.39, $\bar{R}$ depends only on parameter values and $\bar{P} = 1$. Rearranging Equation 2.39:

$$\bar{R} = \bar{P}\left[\left(\frac{1}{\beta}\right) - (1-\delta)\right] \quad 2.48$$

[7] A variable is said to be in steady-state, if it's value doesn't change over time, i.e., $E_t z_{t+1} = z_t = z_{t-1} = \bar{z}$.

It's easy to find steady-state values for $\bar{R}$ by putting calibrated values of parameters. Next, we can find the steady-state values for $\overline{mc}$ with the help of $\bar{R}$. So, from Equation 2.45:

$$\overline{mc} = \left(\frac{\xi-1}{\xi}\right)(1-\beta\varphi)\bar{P} \qquad 2.49$$

Next, we solve for $\bar{W}$, from Equation 2.44, the expression for $\bar{W}$ can be written as:

$$\bar{W} = (1-\alpha)\overline{mc}^{\frac{1}{1-\alpha}}\left(\frac{\alpha}{\bar{R}}\right)^{\frac{\alpha}{1-\alpha}} \qquad 2.50$$

So far, we get the steady-state values for the capital, labour and general prices. Now, we can aim for consumption and investment demands. $\bar{I}$ can be obtained by substituting Equation 2.43 into Equation 2.40:

$$\bar{I} = \left(\frac{\delta\alpha\overline{mc}}{\bar{R}}\right)\bar{Y} \qquad 2.51$$

and solving for $\bar{C}$ and $\bar{Y}$, we get:

$$\bar{C} = \frac{1}{\bar{Y}^{\frac{\psi}{\sigma}}}\left[\frac{\bar{W}}{\bar{P}}\left(\frac{\bar{W}}{(1-\alpha)\overline{mc}}\right)^{\psi}\right]^{\frac{1}{\sigma}} \qquad 2.52$$

$$\bar{Y} = \left(\frac{\bar{R}}{\bar{R}-\alpha\delta\overline{mc}}\right)^{\frac{\sigma}{\sigma+\psi}}\left[\frac{\bar{W}}{\bar{P}}\left(\frac{\bar{W}}{(1-\alpha)\overline{mc}}\right)^{\psi}\right]^{\frac{1}{\sigma+\psi}} \qquad 2.53$$

2.4 Calibration

To get the variables' steady-state values and solve model numerically, we need to assign values to the parameters. There are two methods in the literature - calibration and estimation of the parameters. Though estimation is the most recommended method, we restrict to the calibration method for the study. Calibration is a popular method in DSGE literature. In this method, parameters are given values based on the standard literature which are observed from the data. We also follow the existing literature in assigning the parameter values.

Table 1. Calibration of Parameters

Parameter	Meaning	Value	Source
σ	Coefficient of Relative Risk Aversion	1.50	(V. J. Gabriel *et al.* 2011; Das and Nath 2019)
ψ	Inverse of Frisch elasticity of labour supply	2.7	(Anand and Prasad 2010; Sharma and Behera 2022)
β	Discount Factor	0.98	(V. Gabriel *et al.* 2012)
δ	Depreciation rate	0.025	(Banerjee, Basu, and Ghate 2020)
α	Share of capital	0.30	(Banerjee, Basu, and Ghate 2020)
ξ	Elasticity of substitution between intermediate goods	7.02	(V. Gabriel *et al.* 2012)
φ	Price stickiness parameter	0.75	(Smets and Wouters 2003)
γr	Interest rate smoothening parameter	0.80	(Banerjee, Basu, and Ghate 2020)
γ_Y	Interest rate sensitivity of output	0.50	(Banerjee, Basu, and Ghate 2020)
γ_π	Interest rate sensitivity of inflation	1.20	(V. Gabriel *et al.* 2012)
ρ_A	Productivity shock autoregressive parameter	0.95	
ρ_m	MP shock autoregressive parameter	0.95	

Value of depreciation rate for capital (δ) is taken as 0.025 which means around 10% capital depreciation per annum is broadly in line with literature (V. J. Gabriel *et al.* 2011; Das and Nath 2019). Discount factor (β) is set to 0.98 following V. J. Gabriel *et al.* (2011) (literature broadly defines the value of discount factor between 0.97 to 0.99). Share of capital in production (α) is 0.30 taken from Banerjee, Basu, and Ghate (2020). Value of coefficient of relative risk-aversion (σ) is again in line with Indian case from V. J. Gabriel *et al.* (2011). Smets and

Wouters (2007) take the price stickiness parameter (φ) value 0.75 which is around the estimated value using Indian data by V. J. Gabriel *et al.* (2011). The value of Frisch elasticity of labour supply (inverse of ψ) is contested in literature and is in the range between 0.25 to 1.28[8]. We take the value 2.7 following Indian studies (Anand and Prasad 2010; Sharma and Behera 2022). Table 1 below gives the description of calibration of the structural parameters.

2.5 Log-linearisation of the Model

After getting the steady-states, next step is to log-linearise the model around the steady-state. Solving the linear model is relatively simple compared to non-linear models. To get the intuition of linear model is often easier than the non-linear version of the model. Therefore, it is a standard practice in literature to solve the model with log-linear approximations[9]. In the log-linearisation process, we replace all the necessary equations in the model by approximations, which are linear in the log-deviation form. We use Uhlig's method (Uhlig 1999) for our log-linearisation. In this method, a variable is replaced in this way: a variable Z_t is replaced by $\bar{Z}e^{\tilde{Z}_t}$, where $\tilde{Z} = \log Z - \log \bar{Z}$. Uhlig method gives the following set of tools to solve for more than one variable:

$$e^{(\tilde{Y}_t + b\tilde{Z}_t)} \approx 1 + \tilde{Y}_t + b\tilde{Z} \tag{2.54}$$

$$\tilde{Y}_t \tilde{Z}_t \approx 0 \tag{2.55}$$

$$E_t\left[be^{\tilde{Z}_{t+1}}\right] \approx b + bE_t\left[\tilde{Z}_{t+1}\right] \tag{2.56}$$

We log-linearise our model equations using the Uhlig method and apply these tools. First solving for the labour supply equation

$$C_{j,t}^{\sigma} L_{j,t}^{\psi} = \frac{W_t}{P_t}$$

replacing C_t by $\bar{C}e^{\tilde{C}_t}$ and following the same for other variables, we get

$$\bar{C}^{\sigma}\bar{L}^{\psi} e^{(\sigma\tilde{C}_t + \psi\tilde{L}_t)} = \frac{\bar{W}}{\bar{P}} e^{(\tilde{W}_t - \tilde{P}_t)}$$

using the rule in Equation 2.54, above equation can be transformed into

$$\bar{C}^{\sigma}\bar{L}^{\psi}\left(1 + \sigma\tilde{C}_t + \psi\tilde{L}_t\right) = \frac{\bar{W}}{\bar{P}}\left(1 + \tilde{W}_t - \tilde{P}_t\right)$$

since at steady-state, $\bar{C}^{\sigma}\bar{L}^{\psi} = \frac{\bar{W}}{\bar{P}}$ (Equation 2.38), we get the final log-linearised form of the labour supply equation:

$$\sigma\tilde{C} + \psi\tilde{L} = \tilde{W} - \tilde{P} \tag{2.57}$$

Calculating in similar ways, we can get the log-linearised form of other model equations in the following way:

Euler equation:

$$\frac{\sigma}{\beta}\left(E_t\tilde{C}_{t+1} - \tilde{C}_t\right) = \frac{\bar{R}}{\bar{P}} E_t\left(\tilde{R}_{t+1} - \tilde{P}_{t+1}\right) \tag{2.58}$$

Euler equation for government bonds:

$$\tilde{\lambda}_t - \tilde{r}_t = \tilde{\lambda}_{t+1} \tag{2.59}$$

Marginal cost:

$$\widetilde{mc}_t = (1-\alpha)\tilde{W}_t + \alpha\tilde{R}_t - \tilde{A}_t \tag{2.60}$$

Capital demand:

[8] (Christiano, Eichenbaum, and Evans 1996; Rotemberg and Woodford 1997)

[9] (King, Plosser, and Rebelo 1988; Campbell 1994) are among the firsts to solve RBC models through log-linearisation.

$$\tilde{K}_t = \widetilde{mc}_t + \tilde{Y}_t - \tilde{R}_t \quad 2.61$$

Labour demand:

$$\tilde{L}_t = \widetilde{mc}_t + \tilde{Y}_t - \tilde{W}_t \quad 2.62$$

Production function:

$$\tilde{Y}_t = \tilde{A}_t + \alpha\tilde{K}_t + (1-\alpha)\tilde{L}_t \quad 2.63$$

Law of capital motion:

$$\tilde{K}_{t+1} = (1-\delta)\tilde{K}_t + \delta\tilde{I}_t \quad 2.64$$

Optimal price level:

$$\tilde{P}_t^* = (1-\beta\varphi)E_t\sum_{i=0}^{\infty}(\beta\varphi)^i\widetilde{mc}_{t+i} \quad 2.65$$

General price level:

$$\tilde{P}_t = \varphi\tilde{P}_{t-1} + (1-\varphi)(1-\beta\varphi)E_t\sum_{i=0}^{\infty}(\beta\varphi)^i\widetilde{mc}_{t+i} \quad 2.66$$

Monetary policy rule:

$$\tilde{r}_t = \gamma_r\tilde{r}_{t-1} + (1-\gamma_r)(\gamma_\pi\tilde{\pi} + \gamma_Y\tilde{Y}_t) + \tilde{s}_t^m \quad 2.67$$

Inflation rate:

$$\tilde{\pi} = \tilde{P}_t - \tilde{P}_{t-1} \quad 2.68$$

Equilibrium condition:

$$\bar{Y}\tilde{Y}_t = \bar{C}\tilde{C}_t + \bar{I}\tilde{I}_t \quad 2.69$$

Productivity Shock:

$$\tilde{A}_t = \rho_A\tilde{A}_{t-1} + \epsilon_t \quad 2.70$$

Monetary policy shock:

$$\tilde{s}_t^m = \rho_m\tilde{s}_{t-1}^m + \epsilon_{m,t} \quad 2.71$$

3. Results and Discussions

After transforming the model equations in log-linearisation form, we simulate the model for monetary policy and productivity shocks. Model is simulated using Dynare 5.1 in Matlab. This section discusses the results of impulse response functions to one std. deviation to the productivity shock and monetary policy shock. Impulse responses are simulated for 40 periods.

3.1 Productivity Shock

Figure 1. Impulse response function (IRF) of a positive productivity shock (part 1)

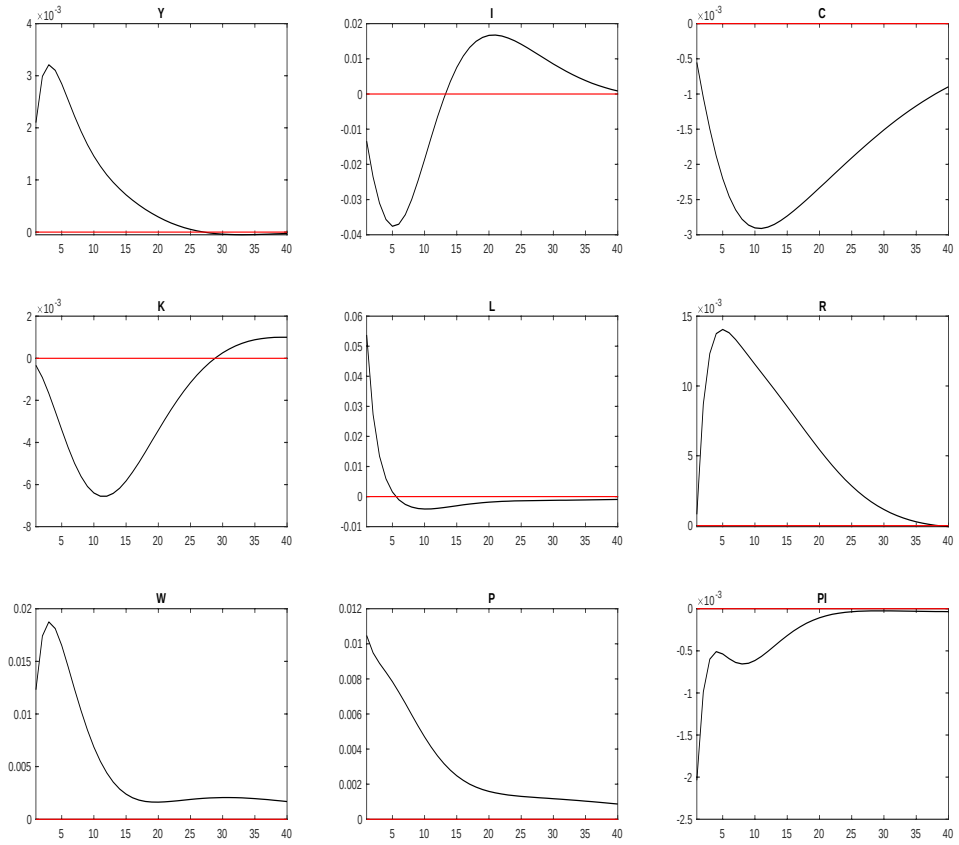
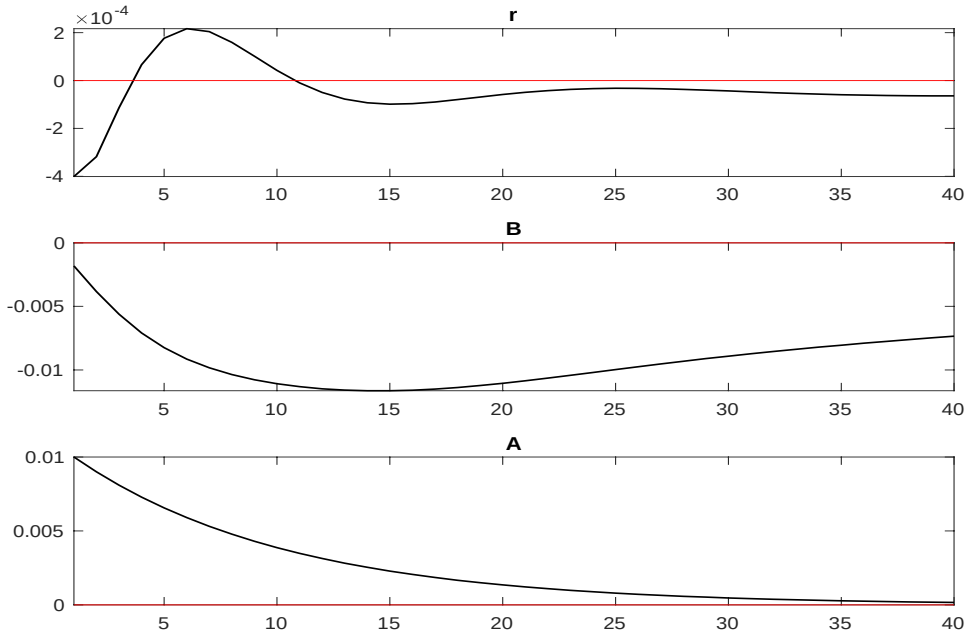


Figure 2. Impulse response function (IRF) of a positive productivity shock (part 2)



Response of macro variables to the exogenous productivity shock ϵ_t are shown in Figure 1 and Figure 2. A positive productive shock makes means of production more efficient, *i.e.*, increases marginal productivities of

labour and capital. This leads to an increase in the demand of labour and capital by firms, leading to a spike in the prices of labour and capital *i.e.*, wages and rent. Higher wages and rent on capital increase household income resulting in higher inflation. Higher inflation binds the central bank to increase the interest rate. Increased wage rates induce households to consume more leisure due to the income effect, thereby supplying less labour. Higher aggregate supply in the economy due to productivity growth increases investment. In summary, we see that a positive productivity shock increases spending variables like investment and consumption as well as input prices.

3.2 Monetary Policy Shock

Figure 3. Impulse response function (IRF) of an expansionary monetary policy shock (part 1)

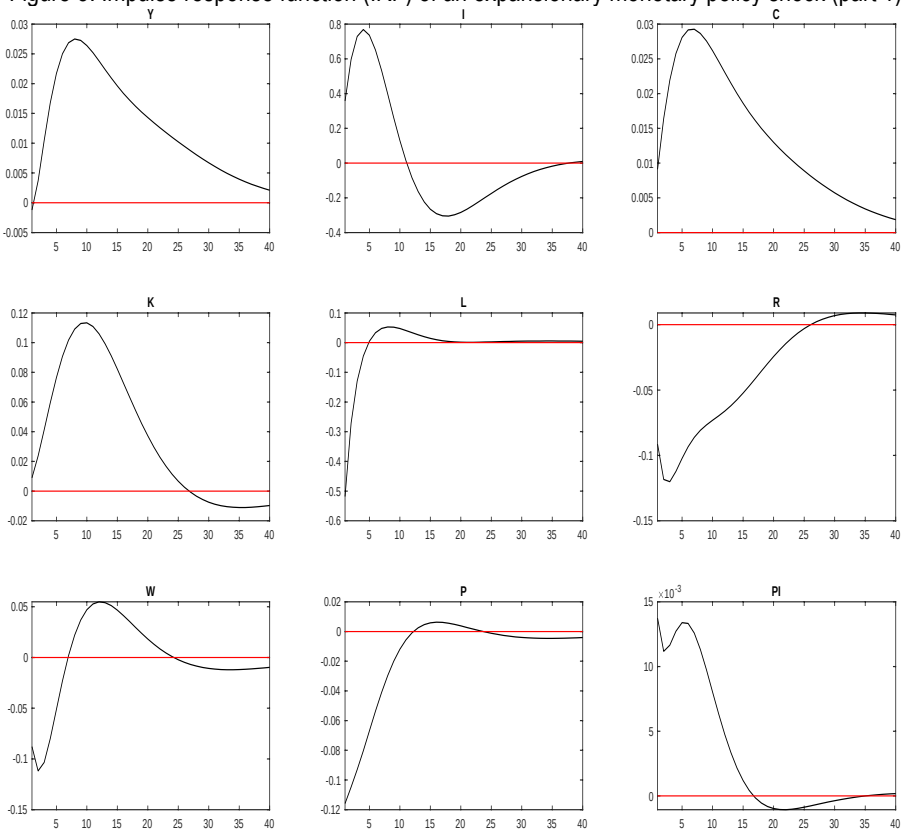


Figure 4. Impulse response function (IRF) of an expansionary monetary policy shock (part 2)

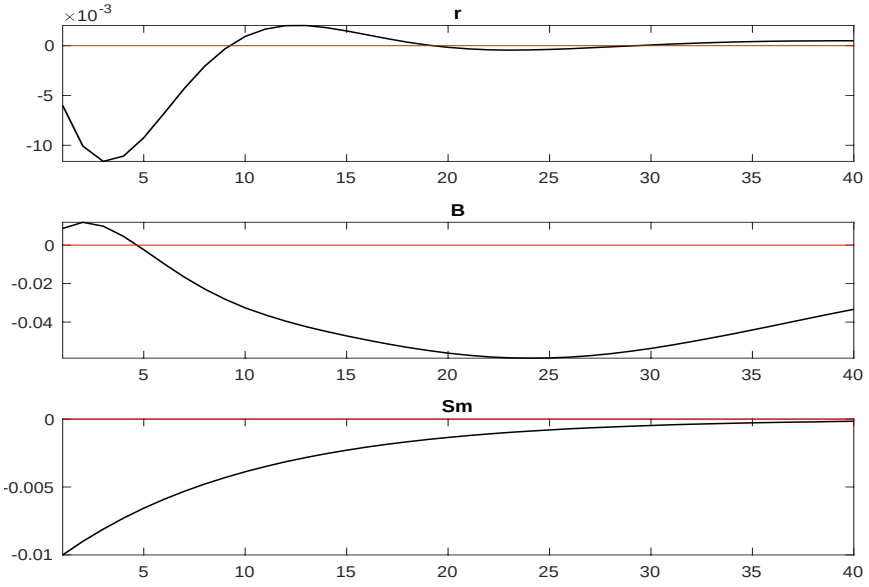


Figure 3 and Figure 4 plot the simulated impulse responses of an expansionary monetary policy shock s_t^m. An expansionary monetary policy increases the money supply base and lowers the short-term interest rates. As the graphs show, expansionary shock triggers a positive response to output and prices, so high inflation. Taylor rule specified in the model works as an automatic stabiliser because higher inflation increases the policy rates via the Taylor rule, keeping the inflation in a defined band. The lower short-term interest rate increases the price of the government bonds $\left(P_t^B = \frac{1}{r_t}\right)$, which decreases household demand for these bonds. Now, households purchase less bonds and save more by investing in physical capital. While a lower interest rate incentivises more private investment, on the other hand, it lowers the opportunity for government bonds. We see a positive response of majority of endogenous variables. Not only consumption and investment, but also capital accumulation and employment respond positively.

Conclusions and Further Research

This study presents a basic set-up of a New-Keynesian dynamic stochastic general equilibrium (DSGE) model. DSGE models are state-of-the-art models in macroeconomic analysis. These models are based on theoretical foundations, hence more capable of providing structural analysis than their counterpart reduced form vector autoregressive (VAR) models. The present study builds a two-sector closed economy DSGE model with nominal price rigidities. In the model, two economic agents, households and firms interact with each other, and a monetary authority sets the interest rate. The model features imperfect competition in intermediate firms' production sector where firms follow the Calvo rule to set their prices. To make model equations more intuitive and to take the model to computational techniques, it is transformed in the log-linearised form. Model is solved numerically by assigning parameter values. Simulation of the model presents interesting results which are in line with the economic theory. A positive productivity shock improves overall economic activity, however, putting upward inflationary pressure. An expansionary monetary policy seems most appropriate option to revive growth for the short-term. But it discourages households to invest in government bonds due to lower interest rates, hence leaving little room for fiscal expansion from the government side.

The current model can be extended by including the government sector which will enable to analyse fiscal policy shocks along with monetary shocks. Certain improvements, like habit persistence in the utility function and integration of term-structure dynamics, can improve the model's performance by making it more competitive for policy analysis and forecasting.

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Health Financing and Household Financial Protection in D.R. Congo: A Vector Autoregressive Model (VaR) Analysis

Emmanuel BINENE SABWE
Quantitative Economics Research Unit, Institute of Economic and Social Research
Faculty of Economics and Management, University of Kinshasa, D.R. Congo
emmanuelbinene08@yahool.fr

Logas LOWENGA KOYAMODJA
Quantitative Economics Research Unit, Institute of Economic and Social Research
Faculty of Economics and Management, University of Kinshasa, D.R. Congo
logas.lowenga@unikin.ac.cd, lowengak@gmail.com

Yannick LUBONGO MBILU
Public Economics Research Unit, Institute of Economic and Social Research
Faculty of Economics and Management, University of Kinshasa, D.R. Congo
yannick.mbilu@unikin.ac.cd, yannickmbilu@gmail.com

Floribert NTUNGILA NKAMA
Public Economics Research Unit, Institute of Economic and Social Research
Faculty of Economics and Management, University of Kinshasa, D.R. Congo
floribert.ntungila@unikin.ac.cd

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Abstract: This paper examines the health-related expenditures of economic agents in the Democratic Republic of Congo (households, government and its external technical and financial partners). Given health care high costs of health care in the DRC, access to appropriate health care is hindered due to low income. As a result, government and its external technical and financial partners indispensably step in to ensure that vulnerable households are protected from ruinous expenses.

At the same time, the paper provides an overview of public finances in the DRC health sector using a theoretical approach and analyzes government intervention effects and their external technical and financial partners intervention effects using a vector autoregressive model (VaR) through random shock simulations and variance decomposition. This analysis is carried out assuming that socioeconomic environment is constant "all things being equal".

The result is that household health-related expenditure per capita forecasts can be significantly improved at 0.05 threshold by public health-related expenditure per capita and by health-related expenditure per capita forecasts engaged by external technical and financial partners.

Keywords: funding; government; external technical and financial partners; households; health; protection; income; causality; VaR.

JEL Classification: C32; C52; C87; D18; E21; H51; I15; R11.

Introduction

Health financing remains complex. It is a cross-cutting issue in several Sub-Saharan African countries with multidisciplinary constraints (socioeconomic, political, environmental, health, etc.). In many cases, there is a gap between scarce available resources and multiple health care needs (International Labor Office, 2008) and this requires governments to make rational choices about health financing.

The WHO conceptual framework describes the health system as a whole based on several pillars, including financing, which is one of the core pillars of universal coverage and households' financial protection.

In the specific case of the DRC, health financing remains a stumbling block to quality of care in health facilities, whether public or private, as the public resources allocated to the health sector and their disbursement are so low. Risk-sharing mechanisms are almost non-existent, ranging from 5% to 7% of coverage[1].

As the literature indicates, the health problem is identified in economics by issues related to financing, costs, supply and demand, production and consumption of goods and health services, quality and pricing of health services, as well as low households' income and financial inaccessibility to health care (Ntungila 2023, 6). Therefore, to address them, governments must intervene directly and indirectly.

However, it is important to conduct analyses of the evolution of public finance aggregates in the health sector in order to fully understand the behavior of health care supply and demand in the DRC. In the same vein, it is appropriate to ask questions about the financial protection of households against the costs of health care.

But also, the financing gap for health coverage, which we qualify as the financing needs of the health sector to redress the current precariousness of access to health care in a medium- or long-term perspective.

The objectives of this reflection are:

i. to draw up an inventory of public finances in the health sector in terms of public, private and external expenditure

ii. to analyze the relationship between household financial protection and health financing in DR Congo for the period under study.

The study examines the direct effects of health financing by economic agents on household income protection in the DRC. It hypothesizes that increased public spending on health per capita would positively influence household income protection in the DRC.

1. Literature Review

Current reflections in the debate demonstrate that a key question several Sub-Saharan African countries are facing is: how to achieve the goal of universal health coverage adopted since December 2012 by the United Nations General Assembly[2]? We know that a financing system that relies primarily on out-of-pocket payments does not only prevent the poor from accessing health care but further impoverishes them (Iyeti 2013, 2).

The Enabel Report on access to health care in the DRC reveals that health care commercialization plays a role in amplifying inequalities between rich and poor, the weakly regulated fee-for-service system engages a vicious cycle leading to a progressive deterioration of access to quality health care (Enabel, 2015).

The National Health Accounts provide information that is used in the decision-making process, because it is an assessment of current resource use, and can also be used to compare the DRC's health financing system with that of other countries (Ministry of Public Health-DRC, 2022).

2. Methodology

Analytical and descriptive methods are adopted to calibrate this reflection, combined with the documentary technique and the econometric analysis, with a Vector autoregressive (VaR) model, to verify the significance of the health expenditure forecasts influence for each economic agent on the household income protection captured by the per capita income. Observations are considered quarterly for the period 2011 - 2020.

3. Presentation and Results Analysis

3.1. Overview of Selected Public Finance Indicators in the Health Sector in the DRC from 2012 - 2017 *(in millions of $USD and % of GDP).*

Health financing consists of mobilizing the resources necessary to implement preventive measures and medical care that meet the needs of households (World Bank 2015).

According to the law on the organization of the health system in the DRC, health financing in the DRC relies mainly on public financing (central government budget, provincial government and/or decentralized territorial entities budgets), private financing (direct payment by households, community participation or mutual health insurance companies and businesses), and external financing (donations and official development aid, special funding and programs).

[1] *Ministry of Health-DRC, Study on the budgetary space of the health sector in the DRC, it can if it wants to achieve Universal Health Coverage, letter n°1, 2019.*

[2] *Resolution adopted by the United Nations General Assembly at the sixty-seventh session, 67/81, global health (universal health coverage) and foreign policy, in December 2012.*

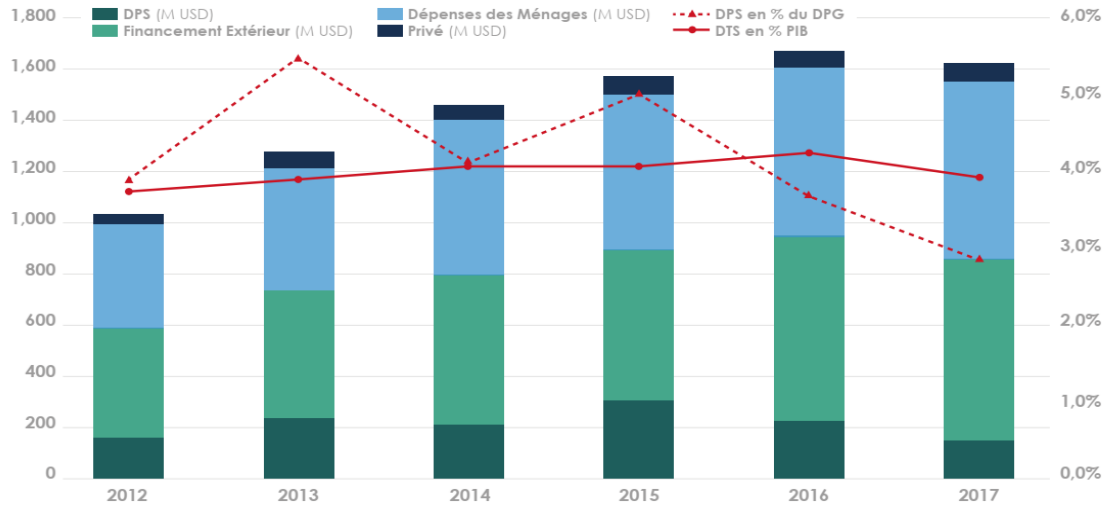
3.1.1. Health Expenditure by Economic Agent: State - Households – External

The balanced health stock of the population reflects the need for the actors; this explains the need for their involvement through health expenditures to maintain this balance.

Private and household financing of health care includes the various categories of individuals or legal entities involved in this sector like mutual health insurance companies, religious denominations (churches), private companies and households.

External financing is provided by bilateral and multilateral partners and cooperation agencies that support health financing in the DRC through donations and Official Development Aid (ODA). Among the direct stakeholders: Governments (from USA, Europe, Africa and Asia); regional organizations, Agencies and NGOs.

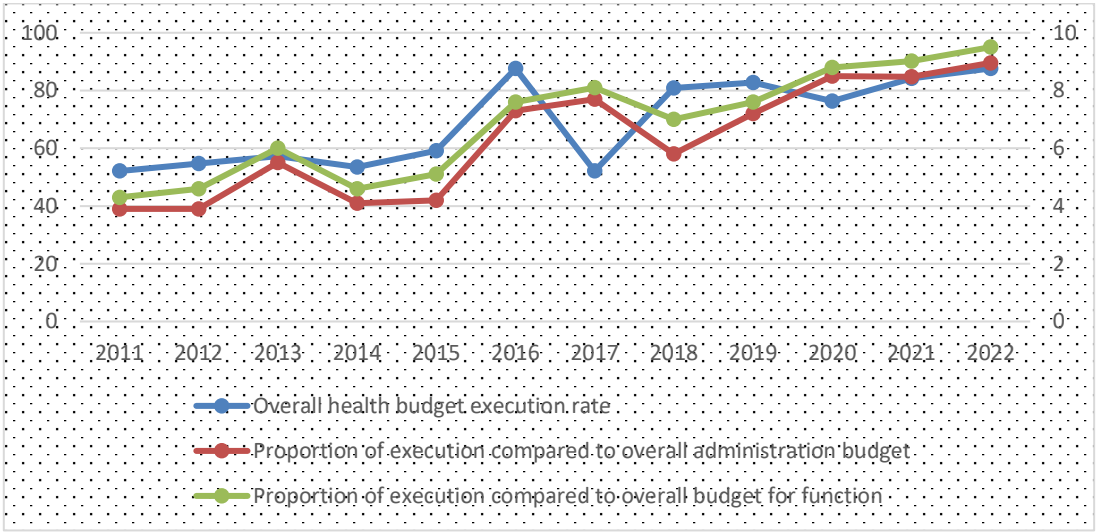
Graph 1. Public Health Expenditures 2012 - 2017 (in millions of $USD and as % of GDP)



Source: DRC, Ministry of Public Health (2019)

The above graph shows that the health sector has several constraints, including: low budget allocation; low spending of between USD 100,000 and 400,000. Between 3% and 6% of overall spending, averaging 4% of public health spending over the sub-observation period.

Graph 2. Budget execution rate for the health sector (administration and function)



Source: DRC, Ministry of Budget (2020)

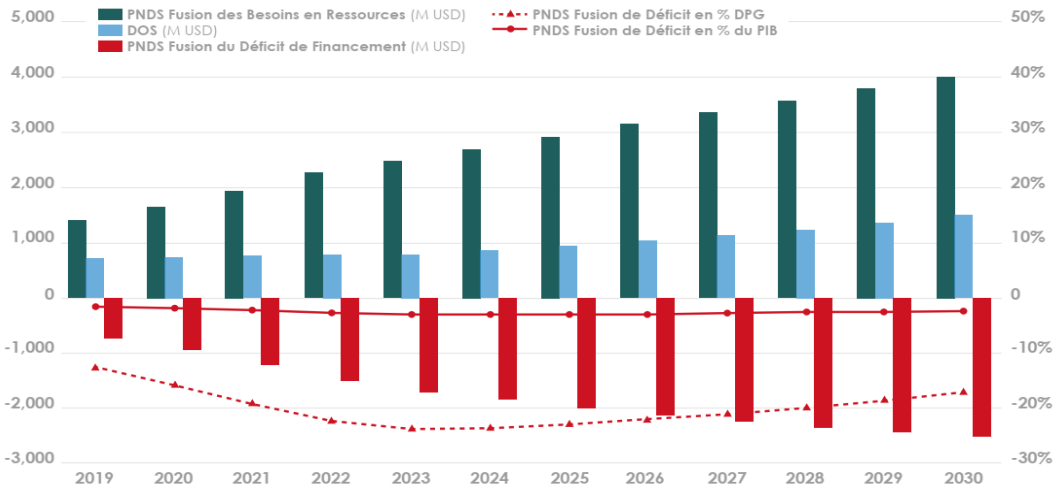
They did not reach 5% of GDP and represent nearly 3.7% of GDP for the same observed period. Households spending is very high, close to 6% of SDRs and in thousands of USD amounts to between 600,000 and 1,600,000 associated with those of the private. Also, a dependence on external financing for this sector.

The health budget execution rate varies from year to year, both up and down. It ranges from 52% to 90% and did not reach 100% implementation during the period under observation. The execution rates of the health budget for the administration and the function remain low, between 2% and 10%, to meet the health needs of households and even to protect their income.

3.1.2. Health Sector Financing Deficit

The health financing gap reflects, to some extent, the sector's need for financing to achieve financial protection and universal coverage.

Graph 3. Health sector financing gap in 2030 perspective (in millions of USD and as a % of GDP)



Source: DRC, Ministry of Public Heath (2019)

According to the Ministry of Public Health, the priorities have been defined in the National Health Development Plan (PNDS)/2019-2022. This PNDS gives an average financing gap of US$1.8 billion per year from 2019 to 2030. The financing gap is equivalent to 20% of the budget and 2.4% of GDP over this period, combined with the health sector growing needs which may reach 40% in order to achieve universal health coverage by 2030.

3.2. Descriptive Statistics

Table 1. Descriptive Statistics

	Ext. Health Exp. /capita.	Pub. Health Exp. /capita.	Household Health Exp. /capita.	Rehab.
Mean	8.111828	3.099152	8.199610	395.8998
Median	8.370000	3.150000	8.760000	408.1072
Maximum	9.760000	4.300000	10.20610	423.6403
Minimum	5.950000	1.500000	5.300000	345.2661
Observations	10	10	10	10

Source: Authors using EVIEWS software

On average, each economic agent in this study spends USD 8.2, USD 8.11 and USD 3.1, respectively the households, the external financial and technical partners system and all governmental sources.

Table 2. Comparisons of the level of health expenditures in some Central African countries

Country	Public health expenditure per capita	Household expenditure on health per capita	External health expenditure per capita
Republic of Congo	18%	82%	4.02%
Angola	24%	64%	2.63%
Gabon	22%	68%	0.82%
D.R Congo	39%	37%	38.7%

Source: Authors based on Global Fund statistical report

Considering other Sub-Saharan African countries, the DRC public spending on health is lower than comparable countries. Households bear the brunt of health expenditures and depend on the external financial and technical partners system for health care.

3.3. Econometric Results

The econometric analysis establishes causal relationships between per capita income and health expenditures for each economic agent (government, households and external partners).

Table 3. Results of the ADF test stationarity

Variables	Model[3]	optimal Lag	T-Student	Decision
Per capita income	2	1	-2.3138	I(2)
Public expenditure per capita	1	1	0.0749	I(1)
Household expenditure per capita	2	2	-0.8260	I(2)
external expenditure per capita	1	9	0.1904	I(2)

Source: From authors using EVIEWS software

The table above informs us that no variable is stationary, and the different variables are integrated of order 2 except for public expenditure per capita which is integrated of order 1.

Table 4. Determination of the optimal Lag

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-69.33550	NA	0.000776	4.190600	4.368354	4.251961
1	-32.34322	63.41533*	0.000236*	2.991041*	3.879812*	3.297845*
2	-31.03584	1.942396	0.000568	3.830620	5.430406	4.382866
3	-22.99683	10.10618	0.000991	4.285533	6.596336	5.083222

* indicates lag order selected by the criterion

Source: From authors from EVIEWS, NHA data, 2021

Looking at the table above we notice that the optimal number of lags for our VaR model is 1.
Causality analysis allows us to know whether the prediction of the health expenditures of an economic agent can be significantly improved by considering the expenditures of another economic agent.

Table 5. Causality Analysis

Null Hypothesis:	Obs	F-Statistic	Prob.
D(DEP_PUB,1) does not Granger Cause D(REVENU_HAB,2)	37	2.04666	0.1617
D(REVENU_HAB,2) does not Granger Cause D(DEP_PUB,1)		0.02766	0.8689
D(DEP_MEN,2) does not Granger Cause D(REVENU_HAB,2)	37	0.00924	0.9240
D(REVENU_HAB,2) does not Granger Cause D(DEP_MEN,2)		0.01076	0.9180
D(DEP_EXT,2) does not Granger Cause D(REVENU_HAB,2)	37	0.08751	0.7692
D(REVENU_HAB,2) does not Granger Cause D(DEP_EXT,2)		0.01055	0.9188
D(DEP_MEN,2) does not Granger Cause D(DEP_PUB,1)	37	0.24682	0.6225
D(DEP_PUB,1) does not Granger Cause D(DEP_MEN,2)		6.09281	0.0188
D(DEP_EXT,2) does not Granger Cause D(DEP_PUB,1)	37	0.36014	0.5524
D(DEP_PUB,1) does not Granger Cause D(DEP_EXT,2)		5.81928	0.0214
D(DEP_EXT,2) does not Granger Cause D(DEP_MEN,2)	37	0.00106	0.9742
D(DEP_MEN,2) does not Granger Cause D(DEP_EXT,2)		0.00997	0.9211

Source: From authors using EVIEWS software

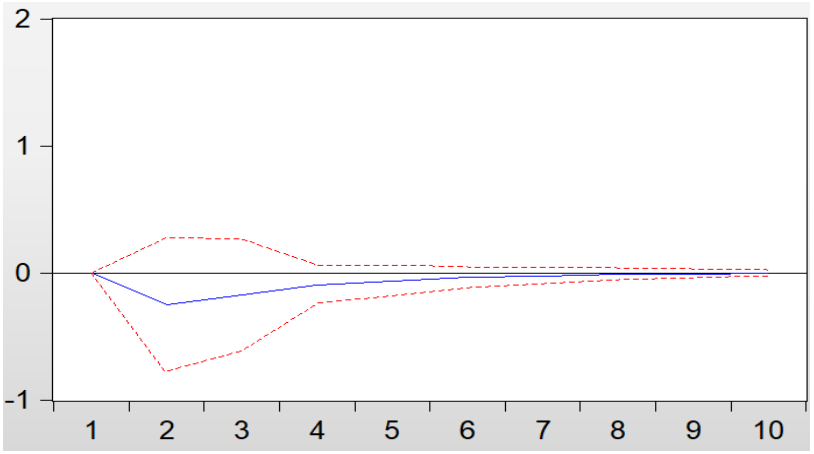
Considering the variables under study, according to the causality analysis resulting from the above table, public health expenditure per capita does not significantly improve, at the 5% threshold, the prediction of income per capita. We also find that household health expenditure per capita and external health expenditure per capita do not significantly improve per capita income at the 5% threshold. However, public spending on health per capita

[3] There are three models to check the stationarity, more details see Bosonga 2021

significantly improves, at the 5% threshold, not only the forecast of household spending on health per capita but also external spending on health per capita.

3.3.1. Impulse Analysis

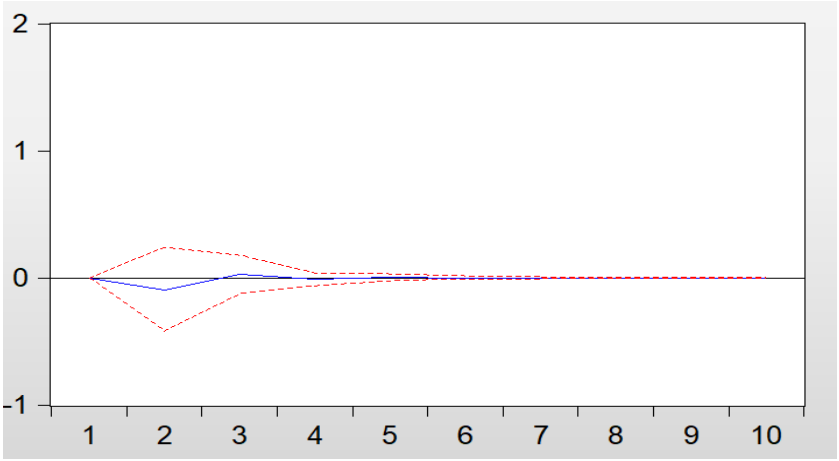
Graph 4. Response of per capita income to the shock on per capita public health expenditure



Source: From the authors from EVIEWS software

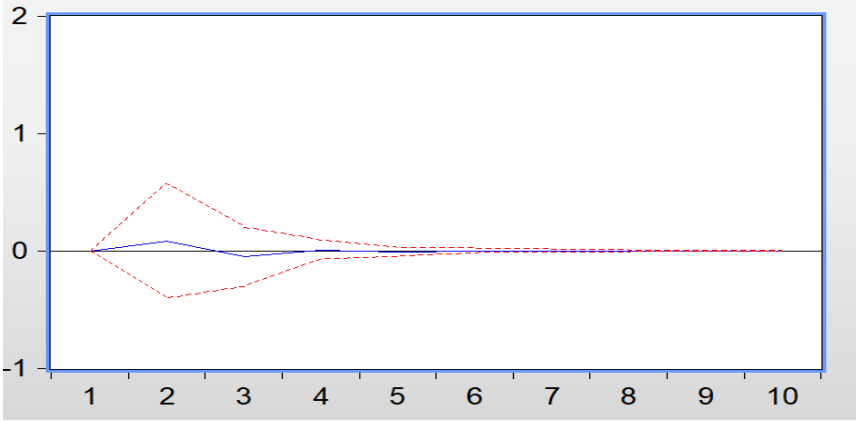
The above graph shows that if the government decides to increase public spending on health per capita, this will have a negative impact on per capita income from the first quarter until it returns to its equilibrium level between the seventh and eighth quarters. He thus translates that public intervention is important since, at first sight, it negatively influences per capita income, before returning to equilibrium.

Graph 5. Response of per capita income to the shock on per capita household spending on health



Source: From authors using EVIEWS software

Graph 6. Response of per capita income to the shock on external health expenditure per capita



Source: From authors with EVIEWS, NHA data, 2021

Households' decision to increase their per capita spending on health causes a negative impact on per capita income from the first quarter onwards, followed by slightly positive effects from the third quarter onwards before returning to equilibrium. We note here that household spending on health is significant and could further keep households in a critical cycle.

If the external sector decides to increase its health spending, there will be positive effects on per capita income for a very short period, then upward fluctuations will occur before returning to equilibrium. External health spending per capita is only a stopgap measure and cannot be a real answer to the health sector in the DRC.

3.3.2. Variance Decomposition

In the context of this study, the analysis of the variance decomposition allowed us to identify the proportion of shocks on studied variables.

Table 4. Analysis of variance decomposition

Period	S.E.	D(REVEN...	D(DEP_P...	D(DEP_M...	D(DEP_E...
1	1.550924	100.0000	0.000000	0.000000	0.000000
2	1.612794	96.95267	2.462284	0.334330	0.250713
3	1.623612	95.66873	3.622599	0.352836	0.355834
4	1.626964	95.34929	3.937077	0.358601	0.355033
5	1.628332	95.20249	4.082296	0.358000	0.357215
6	1.628825	95.15204	4.132793	0.357996	0.357171
7	1.629018	95.13187	4.152928	0.357934	0.357269
8	1.629091	95.12433	4.160470	0.357919	0.357284
9	1.629118	95.12142	4.163377	0.357912	0.357294
10	1.629129	95.12031	4.164483	0.357909	0.357297
11	1.629133	95.11989	4.164907	0.357908	0.357298
12	1.629135	95.11973	4.165068	0.357908	0.357298
Cholesky Ordering: D(REVENU_HAB,2) D(DEP_PUB,1) D(DEP_MEN,...					

Based on the above results table, for quarterly taken three years, we note that on average per capita income contributed 95.76% to its own forecast, per capita public health expenditure contributed only 3.60% and per capita household health expenditure 0.33% as well as per capita external health expenditure 0.32%.

Conclusion and Therapy

Concluding this study, which was devoted to the analysis of health financing dedicated to households' financial protection in the Democratic Republic of Congo using the VaR model, it emerged from theoretical analyses that public health financing faces several constraints, in particular low levels of expenditure allocation and execution, increased dependence on external resources and a relative financing deficit.

Health spending ranges from 3% to 6% of overall spending; on average 4% of overall public spending: it should be noted that it did not reach 5% of GDP during the period under review. It was also noted that the average financing gap is USD 1.8 billion a year for the period from 2019 to 2030. This represents almost 20% of the budget and 2.4% of GDP during the period (DRC Ministry of Public, 2019).

Considering the variables under study, according to the causality analyses, public health spending per capita does not significantly improve, at the 5% threshold, the per capita income forecast. We also find that household health expenditure per capita and external health expenditure per capita do not significantly improve per capita income at the 5% threshold. This effectively reflects the lack of income protection for households faced with high health care costs.

However, public spending on health per capita significantly improves, at the 5% threshold, not only the forecast of household spending on health per capita but also external spending on health per capita. All other things being equal, when governments increase their public health expenditure per capita, this effectively reduces the health expenditure borne by households as well as that borne by external technical and financial partners.

These results show that it is imperative for the government to increase its per capita health expenditure in order to significantly improve the health situation in the DRC. Our conclusions are supported by the WHO (2022), which noted that the proportion of the population in financial difficulty tends to be lower in countries that rely more on a public health expenditure policy. Indeed, these countries demonstrate that the health coverage of the population must imperatively pass through a political consensus aiming at limiting the participation of households in health expenditure and through efficient health financing measures (targeting of beneficiaries, exhaustiveness

of benefits, free mother-child care, etc.). These are all essential elements to advocate for an increase in public spending on health in the DRC.

As with other developing regions, further reflection on reducing the gap in outpatient drug coverage would be crucial in the case of the DRC to reduce the financial hardship of financially vulnerable households. Recent evidence confirms the importance of medicines as a factor in direct health spending and is consistent with existing evidence from around the world.

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List of abbreviations

ODA : Official Development Assistance
BCC : Central Bank of Congo
ILO : International Labor Office
NHA : National Health Accounts
UHC : Universal Health Coverage
Ext. health exp./ capita : External health expenditure per capita
Households' heath exp. / capita: Household health expenditure per capita
Pub. health exp. per capita : Public health expenditure per capita
GHE : Global Health Expenditure
PHE : Public Health Expenditure
THE : Total Health Expenditure
FASEG : Faculty of Economics and Management
Min. PH : Ministry of Public Health
SDG : Sustainable Development Goals
WHO : World Health Organization
AIMP : Aid and Investment Management Platform
GDP : Gross Domestic Product
GDP/capita or Rev/capita : Income per capita
NHDP : National Health Development Plan
TFP : Technical and Financial Partners
DRC : Democratic Republic of Congo
SCP : WHO Country Cooperation Strategies
UNIKIN : University of Kinshasa
USD : US Dollar

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Enjoying a Quiet Life Even During a Great Recession? Evidence From the Greek Olive Oil Industry

Ioanna KERAMIDOU
Department of Economic and Regional Development
Panteion University of Social and Political Sciences, Greece
ikeram@panteion.gr

Angelos MIMIS
Department of Economic and Regional Development
Panteion University of Social and Political Sciences, Greece
mimis@panteion.gr

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Abstract: The research investigates the link between market concentration and efficiency by analyzing the Greek olive oil industry data from 2006 to 2014. Unlike previous research on this issue, which focused on the impact of overall company efficiency on market power, we study the association between the three types of firm efficiency (profit, technical, and scale) and market concentration. Our theoretical framework and research assumptions were not predefined but were generated by modelling the data from the Greek oil olive sector through data mining techniques. The predicted causal relationships constructed in the preceding stage were investigated using partial least squares path modeling (PLS-PM) regression. The results show a significant negative relationship between market concentration and technical and profit efficiency. The paucity of completion resulted in prolonged firm inefficiencies, demonstrating that Greek enterprises, even during a severe recession, refrained from rigorous efforts to enhance technical and profit efficiency as they would in a competitive market, preferring instead to live a quiet life (QL). This study has several policy implications for regulators and policymakers, such as extending antitrust rules, which may enhance company efficiency and competitiveness.

Keywords: efficiency; concentration; quiet life hypothesis; Greece; partial least squares path modeling; Bayesian network.

JEL Classification: L13; L25; L44; L52; L66; O25; O43; R11.

Introduction

At the end of the 2000s, the Greek government imposed an internal devaluation policy to improve firms' efficiency. Nonetheless, even though the basic salary fell by 20.8%, the contribution of net exports to recovering growth and employment was insufficient, and the Greek real GDP decreased by -23.1% from 2008 to 2019 (Word Bank data). During this period, the idea that Greece's economic reforms would achieve a significant acceleration in growth was increasingly called into question in public debate. Does competition failure due to high market concentration in the Greek industry impede economic reforms from gaining a substantial acceleration in growth? Rapid reduction of salaries seems reasonable to improve cost efficiency, but what if monopoly profits remain unchanged due to high market concentration and firms enjoy a quiet life (QL) without making intensive efforts to improve efficiency, as they would in a competitive market?

The paper attempts to answer these questions within the theoretical framework of firms' profitability in imperfectly competitive markets. Market power's effects on efficiency have been debated for decades (for this discussion, see Schmalensee 1989; Sutton 2007). Despite this lengthy literature, more field observations are necessary to adopt adequate policy objectives and choose the right tools for fostering efficiency.

In response to this demand, significant contemporary research extensively analyses the relationship between concentration, competition, and efficiency in the financial sector. A negative link was discovered for American banks between profit efficiency and market power (Berger and Hannan 1998; Ariss 2010). Delis and Tsionas' research (2009) suggests that concentrated EMU banks are among the least profit-efficient financial institutions. Coccorese and Pellecchia (2010) published analogous findings for Italian banks, demonstrating that

market power incurred inefficiencies that persisted long. Ferreira (2013) examined the relationship between efficiency and concentration for 27 European countries between 1996 and 2008 and concluded that market power resulted in bank inefficiencies because of less competition, supporting the quiet life hypothesis. Comparable results were reported by Asongu *et al.* (2019) for African banking and Setiawan *et al.* (2012) for the Indonesian food and beverages industry.

On the other hand, the Spanish industry (Gumbau and Maudos 2002) and the EU-15 banking sector (Maudos and de Guevara 2007) have not seen particularly notable effects of efficiency on market power. According to Färe *et al.* (2015), the quiet life is a reality only for some Spanish financial organizations. However, this assumption was not confirmed according to Casu and Girardone's (2009) evidence for commercial banks in Germany, France, Italy, the UK, and Spain. They found that low competition, as the Lerner index shows, is positively associated with high efficiency, while efficiency does not affect competition. In the same direction, Giorgis Sahile *et al.* (2015) found that the more efficient banks in Kenya obtain market share and are the most profitable. The outcomes that were reported by Fu and Heffernan (2009) for the EU banking sector, Koetter *et al.* (2012) for American bank holding companies, Williams (2012) for Latin American banks and Kouki and Al-Nasser (2017) for African economies rejected the QL hypothesis. This substantial scholarly interest, however, focused primarily on the banks. Uncertainty exists regarding the current impacts of market power on the efficiency of firms across various industrial sectors.

This study contributes to the existing body of knowledge in various ways. Firstly, the paper assesses companies' technical and profit scores in the Greek olive oil sector from 2006 to 2014. This action is critical as it sheds more light on the implications of the economic reforms effectuated in Greece on various types of firm efficiency. The present research is the first to comprehensively and systematically address the linkages between concentration, competition, and different efficiency types in one industrial sector in Greece, the olive oil industry, where the country has a competitive advantage. Additionally, the article is devoted to examining the empirical validity of the QL hypothesis and determining if the imperfect market structure in the olive oil industry in the Greek context raises questions about enterprises' effectiveness and competitiveness. Several lessons may be drawn from whether competition failure due to high market concentration in an industrial sector in Greece incurred inefficiencies, making the production process less competitive.

Due to the two-way causation between market structure, company behaviour, and performance, the study also employed a novel research methodology to prevent biases in interpreting the findings. Instead of empirically validating a solid theoretical framework, the background information for developing research assumptions was constructed through a data mining technique like a Bayesian network. The key benefit of this strategy is the capacity to enrich the theoretical framework by identifying the variability of company behaviour and social group actions in various settings. Last, we may obtain precise estimates of each factor's influences and the relative effects among elements in the presence of endogeneity by testing the postulated causal links generated in the preceding stage through a partial least squares path modeling (PLS-PM) regression. To our knowledge, no literature on this topic uses a comparable methodology. The results show that quiet life is a reality for the Greek olive oil industry during the study period. Our sample companies were technical and profit-inefficient and did not capitalize on economies of scale to reduce the cost of products. On the contrary, they enjoyed an easy life by abandoning intensive efforts to increase efficiency, as they would in a competitive market. This research provides important policy implications to the regulators and policymakers to strengthen the competition through structural changes and antitrust policies as they relate to the efficiency and competitiveness of firms.

The rest of the paper is organized as follows: Section 2 summarises the literature on concentration, competition, and efficiency. Section 3 sets out the research methodology and measurement of critical variables and explains the data. Section 4 presents the results of the empirical analysis. Finally, Section 5 concludes and develops policy implications.

1. Literature Review

The theoretical framework of firms' profitability in imperfectly competitive markets has been built upon the amalgamation of four strands of literature: the paradigm of Structure-Conduct-Performance (SCP), quiet life (QL), relative market power (RMP), and efficiency structure (ES).

The SCP paradigm (Mason 1939; Bain 1956) attributes the higher firms' profitability in concentrated markets to their collusive behaviour and high barriers to entry. The theoretical proposition that served as the foundation for the chain of reasoning of this older generation of Industrial Organization (IO) economists is that market structure directly affects firms' economic behaviour, impacting their performance (Mason 1939; Bain 1956). Recent literature verifies the collusion assumption (Bikker and Haaf 2002; Resende 2007; Maudos and de

Guevara, 2007; Beck *et al.* 2008; Anzoategui *et al.* 2010; Setiawan *et al.* 2012; Khan *et al.* 2018) and proposes an antitrust intervention for protecting the consumer interest.

The second line of research is based on Hicks's (1935) theory of a "quiet life, arguing that lower competition lessens companies' incentives to maximize operating efficiency. Therefore, a negative relationship between concentration and efficiency is expected. The evidence on QLH is relatively scarce and controversial. A negative relationship was found between profit efficiency and market power measured by the Learner index for American manufacturing industries (Caves and Barton 1990) and banks in the USA (Berger and Hannan, 1998; Ariss, 2010). Banks of EMU appear to be the least profit efficient, according to evidence by Delis and Tsionas (2009). Comparable results were reported by Coccorese and Pellecchia (2010) for Italian banks and Asongu *et al.* (2019) for African banking, revealing that the market power incurred inefficiencies that persisted long.

Similarly, Ferreira (2013) examined the relationship between efficiency and concentration for 27 European countries between 1996 and 2008 and concluded that market power resulted in bank inefficiencies because of less competition, supporting the quiet life hypothesis. On the contrary, Färe *et al.* (2015) estimated that the quiet life was a reality only for some Spanish financial institutions. Gumbau and Maudos (2002) also found that the efficiency impact on market power is not particularly remarkable in the Spanish industry, while the same evidence was provided for the EU-15 banking by Maudos and de Guevara (2007). A rejection of the QLH has been observed according to Casu and Girardone's (2009) results for commercial banks in Germany, France, Italy, the UK, and Spain. Similar outcomes were reported for the EU banking sector (Fu and Heffernan 2009), the American bank holding companies (Koetter *et al.* 2012), as well as for the banks in Kenya (Sahile *et al.* 2015) and the Latin American banks (Williams 2012).

The third strand of literature verifies the validity of the relative market power (RMP) theory (Delorme *et al.* 2002; Garza-García 2012; Khan *et al.* 2018). It provides evidence that firms with outstanding market shares and diversified products exert market power to determine prices and make abnormal profits (Shepherd 1983; Rhoades 1985). The fourth stream of research shows the influence of efficiency gains on profitability and market concentration (Demsetz H. 1973; Peltzman 1977; Carter 1978). From this perspective, a firm's efficient structure implies more favourable consumer prices, higher producers' profits, and a more significant consumer and producer surplus. Efficient companies' outstanding profits and market share gains result in a higher concentration (Koetter *et al.* 2012, Fu and Heffernan 2009; Casu and Girardone 2009). For that reason, antitrust policies should be avoided not to decrease the most efficient or innovative firms' efforts to reduce costs or enforce their products' innovation and quality.

3. Methodology

3.1 Modeling the Relationship between Concentration, Firm Conduct, and Performance

Faced with an evolving experience resulting from the interrelations between market structure, company conduct, and performance, the causalities between the variables exploring the sources of monopoly rents remain uncertain. For this reason, instead of empirically validating a solid theoretical framework, we applied the methodological proposition of Wu *et al.* (2012) of constructing the background information for developing research hypotheses through data mining techniques.

More specifically, the potential factors influencing profitability in the Greek olive oil sector were modelled as a Bayesian network (BN). The BN is a graphical model representing the probabilistic relationships between variables of interest. A BN structure is a directed acyclic graph (DAG) comprising nodes connected by arrows, which indicate causality. In a DAG, the connected nodes represent conditionally dependent variables, and the arcs indicate direct causal relations and dependencies between the related variables. A Bayesian Network S encodes the joint multivariate probability of random variables $\{X_1,...,X_n\}$. Let a node X_i in S means the random variable X_i and pa_i the parent nodes of X_i, from which dependency arcs come to the node X_i. Then, the joint probability of $\{X_1,...,X_n\}$ is computed by the multiplication of local conditional probabilities of all the nodes and given as follows:

$$P(X_1,...,X_n)=\prod_{i=1}^{n}P(X_i|pa_i)$$

Bayesian network's structure and connected parameters are an output of a data mining process that can provide inter-causal reasoning. This study estimates conditional probability distributions in the BN structure obtained from the Tree-Augmented Naïve Bayes (TAN) algorithm with a test mode of 10-fold cross-validation

incorporated in the WEKA data mining package (Wu *et al.* 2012). The TAN is an extension of Naive Bayes because it removes the assumption that all the attributes are independent (Baesens *et al.* 2004). With the TAN algorithm application, a causal-effect graph is created, in which the only and most significant parent node for all other nodes is placed on the top in the DAG (Friedman *et al.* 1997). The TAN search algorithm's causal-effect graph is computed using the Chow–Liu method (Wu *et al.* 2012). This graph, calculated with the aid of the Weka software, represents the actual causal relationships in the Greek industry between all the variables used as measures of the latent variables included in the PLS analysis. Thus, our research hypotheses were generated accordingly.

The BN represents a promising and practical way of identifying the variability of actors' behaviour and social groups' actions in space and time and formulating causal relationships among the variables when studying uncertainty phenomena (Wu *et al.* 2012). From a methodological view, the BN, further provides a way to avoid the risk of reverse causality bias. Furthermore, BN has the advantage of obtaining scientific knowledge on the reciprocal relationships between firms' behaviour, performance, and market structure, without needing the application of the instrumental variables techniques, capable of providing consistent estimates only in extensive sample conditions, intense instrumental variables situations, and under restricted assumptions, often unrealistic for empirical research (Chao and Swanson 2005).

3.2 Testing the Quiet Life (QL) Hypotheses

Some early studies tested the SCP relationships by estimating each factor's influence on profitability separately in different fixed-effect models (or random-effects) and controlling for the impact of other factors (Casu and Girardone 2009; Setiawan *et al.* 2012; Williams 2012). Nevertheless, this econometric approach, incapable of dissociating each factor's influence from the relative effects, reduced the decomposition results' reliability and accuracy, leading to confusion.

The current investigation followed previous research steps (Geroski1982, Delorme *et al.* 2002; Ressende 2007; Garcia 2012) and used a Structural Equation Modeling (SEM) approach as the most appropriate to demonstrate each factor's impact as well as the relative influences among elements in the presence of endogeneity. Specifically, a PLS-PM regression and a bootstrap resampling with 500 resamples are effectuated with the SmartPLS software developed by Ringle *et al.* (2005). Several reasons lead us to this selection. First, the PLS-PM regression is suitable for exploring phenomena without fully developed theoretical models (Chin 1998). It also has the following advantages: it can handle small sample sizes, place minimal restrictions on measurement scales, and about the statistical distributions of data sets (Ringle *et al.* 2005). Furthermore, it provides valid results when highly skewed distributions or the independence of observations is seriously violated, or multicollinearity exists among the independent variables (Chin 1998).

3.3 The Measurement of a Firm's Efficiency

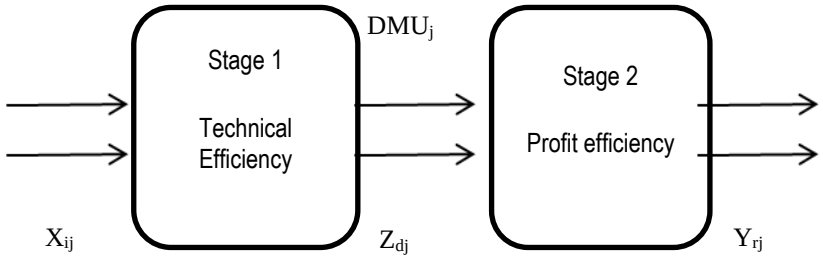
The traditional test of the SCP relationships is often relayed on indirect indices of firm efficiency. The calculation of a firm's efficiency by using the data envelopment analysis (DEA) or stochastic frontier analysis (SFA) methods (Berger and Hannan 1998; Delis and Tsionas 2009; Williams 2012; Casu and Girardone 2009; Nyangu *et al.* 2022) was an improvement over previous research relying on efficiency indirect and possible invalid indices. Despite this progress, the results' accuracy cannot be guaranteed due to the possibility of parametric specification bias in the SFA and sampling variation and the omission of random error in the DEA (Simar and Wilson 2000). These methods have the additional disadvantage of not identifying the firm's internal procedures with less (or more) satisfactory performances because they treat firms as "black boxes" for which input and output parameters are central (Castelli *et al.* 2010).

Kao and Hwag (2008) and Chen *et al.* (2009) are taking innovative steps by developing the two-stage methodology seen in Fig. 1, capable of providing accurate measures of the actual production process composed of stages. In this framework, there are n decision-making units (DMU_j, with $j= 1,2 \dots, n$). The DMU have m inputs x_{ij} $(i = 1,2, \dots, m)$ into the first stage and D outputs z_{dj} $(d = 1,2, \dots, D)$. The first stage is based on pure technical efficiency, namely, the firm's ability to minimize input amounts for a given output. The second stage is devoted to profit efficiency, namely, the firm's capacity to maximize profits by the created revenue (Seiford and Zhu, 1999; Kumar and Gulati, 2010).

In the first stage, one output and four inputs were employed. The selection of output and input variables followed previous studies. The cost of capital, calculated as the sum of depreciation and interest, the number of full-time employees, the cost of goods sold, and other operating expenses (Badunenko 2010), are used as the input variables of the first stage. The total sales value is the first stage's output (Caves and Barton,1990). The

output of the first stage is input into the second stage and produces outputs y_{rj} $(r = 1,2,..,s)$. In this study, the output in the second stage is the profit. More specifically, the total value-added as a profit proxy decreased by the total expenditure on salaries and depreciation (Boyer and Freyssenet 2000).

Figure 1. A two-stage performance evaluation model



Before the first step that the authors did for decomposing a firm's overall efficiency in various components and identifying the causes of inefficiencies within a company more accurately (Castelli *et al.* 2010), a non-parametric bootstrap test suggested by Simar and Wilson (2002) to examine returns to scale) was performed[13]. Using Simar and Wilson's bootstrap resampling method with 100 resamples for each year in the 9-year study period, we find that in the 9 cases, the null hypothesis that the technology exhibits globally constant return scales (CRS) is not valid. The given sample's olive oil manufacturing firms' underlying technology is globally or globally variant return scales (VRS).

Under this condition, the VRS model of Chen *et al.* (2009) is the appropriate formulation that should be chosen. According to this model, the overall efficiency score under the input-oriented VRS model is given by:

$$E_0 = \max \sum_{r=1}^{s} u_r\, y_{rj0} + \sum_{d=1}^{D} w_d\, z_{dj0} \qquad 3.1$$

s.t.

$$\sum_{d=1}^{D} w_d\, z_{dj} - \sum_{i=1}^{m} v_i\, x_{ij} \le 0$$

$$\sum_{r=1}^{s} u_r\, y_{rj} - \sum_{d=1}^{D} w_d\, z_{dj0} \le 0$$

$$\sum_{i=1}^{m} v_i\, x_{ij0} + \sum_{d=1}^{D} w_d\, z_{dj0} = 1$$

$$v_i, w_j, u_p \ge 0, d = 1,2,\dots,n\ .$$

So, by evaluating E_0 we can proceed to calculate the efficiency of the first stage E_0^1 (or E_0^2) and then derive the efficiency of the other stage E_0^2 (or E_0^1). These calculations are achieved by assuming that the relative contribution of stages 1 and 2 to the overall performance is w^1 and w^2 respectively and are given by:

$$w_0^1 = \sum_{i=1}^{m} v_i\, x_{ij0} / \left(\sum_{i=1}^{m} v_i\, x_{ij0} + \sum_{d=1}^{D} w_d\, z_{dj0}\right)$$

$$w_0^2 = \sum_{d=1}^{D} w_d\, z_{dj0} / \left(\sum_{i=1}^{m} v_i\, x_{ij0} + \sum_{d=1}^{D} w_d\, z_{dj0}\right) \qquad 3.2$$

Therefore, in the case where stage 1 is considered more important, the first stage's efficiency score, E_0^1, is given by:

$$E_0^1 = \max \sum_{d=1}^{D} w_d\, z_{dj0} \qquad 3.3$$

s.t.

$$\sum_{d=1}^{D} w_d\, z_{dj} - \sum_{i=1}^{m} v_i\, x_{ij} \le 0$$

$$\sum_{r=1}^{s} u_r\, y_{rj} - \sum_{d=1}^{D} w_d\, z_{dj} \le 0$$

[13] The bootstrap-based test regarding return scales was not described here; interested readers can find detailed information in Simar and Wilson's original paper (2002).

$$\sum_{r=1}^{s} u_r\, y_{rj0} + (1 - E_0) \sum_{d=1}^{D} w_d\, z_{dj0} = E_0$$

$$\sum_{i=1}^{m} v_i\, x_{ij0} = 1$$

$$v_i, w_j, u_p \geq 0, j = 1,2, \dots, n.$$

Then, the efficiency of the second stage, E_0^2, is calculated by the formula:

$$E_0 = w_0^1 E_0^1 + w_0^2 E_0^2 \quad (3.4)$$

A similar approach can be written by giving priority to stage 2. To estimate the efficiency, profit efficiency, and overall performance of the Greek olive oil industry, we adopted models (1)–(4) of Chen *et al.* (2009) to assess profit and technical efficiency, as they are two crucial factors for a firm to gain a competitive advantage and improve its performance

3.4 The Variables in the PLS - PM Regression

One latent variable, profitability (PROF), represents the dependent variable in the PLS-PM regression. Two measurement variables constructed PROF: i) the annual proportionate changes in the price-cost margin, which equals the ratio of total sales decreased by the total cost (material, labour cost, overhead costs, and other costs) to sales (Asongu *et al.* 2019), and ii) the ratio of the price-cost margin of each company in each year to the average price-cost margin of the total sample firms during the period 2009-2014 (Boyer and Freyssenet 2000). The demand elasticity was not included in the regression due to the non-availability of data. Under this limit, we followed the Cowling and Waterson (1976) proposition to assess the effect of changes in the variables of interest on the industry's profitability with the assumption that the demand's elasticity remains relatively constant during the study period (2009-2014),

The independent variables in the PLS-PM regression are four latent variables: industrial concentration (CON), overall efficiency (OE), scale efficiency (SE), and product differentiation (Divers). OE comprises TE and PE, estimated through the Chen *et al.* model (2009). SE was calculated by applying Simar and Wilson's method (2002). Product differentiation (Divers) was constructed by two measurement variables, the advertising/sales ratio and the prestige from known brands' consumption, often employed by prior studies (Delorme *et al.* 2002).

The measurement of market power

The primary methods for measuring market power are the SCP and the NEIO research methodology, each with advantages and defects. The SCP approach proposes using market concentration indices, such as Hirschman-Herfindahl index, as a proxy for market power by assuming that the higher the market concentration, the higher the market power (Delorme *et al.* 2002; Resende 2007; Garza-García 2012; Setiawan *et al.* 2012; Nyangu *et al.* 2022). While the NEIO research methodology deduces market power from observing firms' conduct and, more explicitly, comparing some form of price mark-up over a competitive benchmark (Maudos and de Guevara 2007; Koetter *et al.* 2012; Williams 2012; Casu and Girardone 2009; Färe *et al.* 2015; Khan *et al.* 2018; Nyangu *et al.* 2022). However, the absence of price information hinders us from inferring the level of competition directly from firms' behaviour using non-structural measures (Panzar–Rosse H-statistic (1982) or Lerner Index, 1934). Under this limit, we constructed a latent variable for market concentration (CON) which was built by two measuring variables: the changes in the aggregate of the four most significant industry companies' market shares (C4) and the Hirschman- Herfindahl index (Graddy 1980).

3.5 Data Collection and Sample

This research's database covers the period from 2006 to 2014, when since 2008, Greece has sustained a significant economic recession, and from 2011, economic reforms occurred in the Greek economy. With the selection of this period, we can, firstly, include in the PLS-PM analysis the impact of the economic reforms on firms' conducts and their performance and study, secondly, some aspects of the subject that are less investigated, such as firms' conduct in more concentrated markets during an economic recession that a country has rarely seen.

Our dataset was compiled from both primary and secondary sources. Data were drawn from the annual balance sheets of companies, and information that was not readily available (such as the number of employees etc.) was collected through a questionnaire survey conducted from December 2018 until March 2019 by Panteion University of Athens. Specifically, 195 Greek oil manufacturing firms randomly selected, operating in different regions of Greece, were contacted, and 82 of them provided us with the relevant information (a response rate of

42.0 %). Our sample included three size groups of firms. The first group consisted of the seven most prominent companies with a market share of over 87%. The other two groups comprised several medium-sized (*i.e.*, 50–249 employees) and small companies (*i.e.*, fewer than 49 employees) selected randomly by size. Our panel data was balanced and included 738 observations. It is worth noting that the DEA convention was satisfied, stating that the minimum number of DMU should be greater than three times the number of inputs plus outputs. Our sample size also is consistent with the rule of thumb specified in the PLS path modelling literature. The sample size is ten times the most significant number of structural paths directed at any construct (Chin 1998).

4. Empirical Results

4.1 Market Concentration and Efficiency Measures

The bootstrap test by Simar and Wilson (2002) was initially performed to determine the production technology type in the Greek oil olive industry. The results show that we can reject the null hypothesis of the constant scale of return (CRS) at any conventional significance level after conducting 100 bootstrap replications because the p values were less than 0.01 for each year in the 9-year study period. Under the condition of globally variable returns to scale VRS, the overall efficiency (OE), technical (TE) and profit efficiency (PE) scores of olive oil manufacturing firms in Greece were estimated via the VRS model of efficiency decomposition proposed by Chen *et al.* (2009).

Table 1 shows a high market concentration characterized by the Greek olive oil market. The share of global market sales earned by the four most prominent companies in this industry (the so-called C4) approached, on average, about 62,15% from 2006 to 2014 (see also Figure 2). As Table 1 demonstrated, the OE of the firms operating in this market registered at 0.69, indicating room for improvement. Profit inefficiency amounted to about 0.60-0.62 during the study period, while concerning technical inefficiency, the exact output of this industry could have been produced for different years by using 9%–19% less than the observed inputs.

Encouraging is that OE grew slightly by 1.43% between 2006 and 2014 when the average four-firm concentration ratio had a higher increasing trend of 3% in the same period. However, OE deteriorated by -9.64% in 2008 compared to 2006, when the sector's four largest firms (C4) rapidly increased their market share by ten percentage points (from 58.10% in 2006 to 68.30% in 2008). Then, as the competition has risen since 2009, OE experienced low progress.

Lastly, it should be noted that before the global financial crisis, the average level of OE was high (0.70) in 2006-2007, then fell to 0.63 in 2008. From 2009-2010 it improved to 0.72, but when economic reforms effectuated in 2011, the OE worsened again, reaching 0.64 in 2013 and increasing only in 2014 to 0.71.

Table 1. The average technical efficiency, profit efficiency, overall efficiency scores and concentration ratio for the period 2006-2014

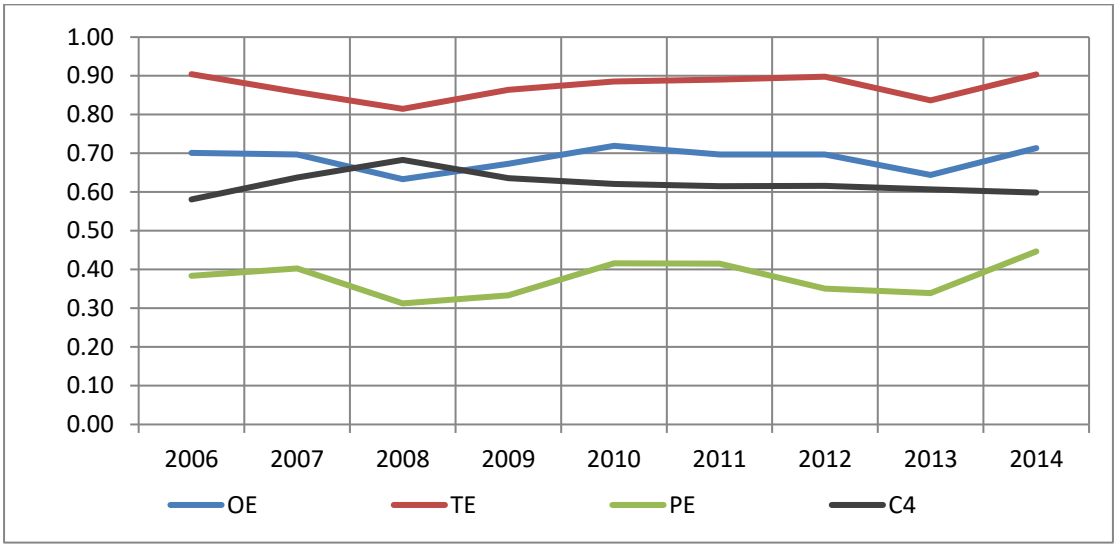
Years	OE			w1	w2	E^{1*}			E^{2*}			E^{1}			E^{2}			C4
	Mean	Min	Std.-Dev			Mean	Min	Std.-Dev	Mean	Min	Std.-Dev	Mean	Min	Std.-Dev	Mean	Min	Std.-Dev	Mean
2006	0.70	0.43	0.19	0.62	0.38	0.90	0.55	0.10	0.38	0.01	0.31	0.90	0.55	0.10	0.39	0.01	0.31	58.10
2007	0.70	0.22	0.21	0.65	0.35	0.86	0.18	0.15	0.40	0.01	0.32	0.85	0.18	0.16	0.42	0.01	0.31	63.74
2008	0.63	0.22	0.20	0.64	0.36	0.81	0.24	0.17	0.31	0.03	0.26	0.81	0.24	0.17	0.31	0.08	0.25	68.30
2009	0.67	0.26	0.20	0.63	0.37	0.86	0.34	0.15	0.33	0.03	0.27	0.85	0.34	0.15	0.35	0.02	0.28	63.58
2010	0.72	0.35	0.18	0.60	0.40	0.89	0.20	0.18	0.42	0.01	0.29	0.81	0.20	0.26	0.50	0.01	0.32	62.09
2011	0.70	0.32	0.19	0.62	0.38	0.89	0.37	0.14	0.41	0.01	0.32	0.89	0.36	0.14	0.42	0.04	0.31	61.50
2012	0.70	0.25	0.19	0.61	0.39	0.90	0.29	0.15	0.35	0.00	0.30	0.89	0.29	0.16	0.36	0.00	0.29	61.58
2013	0.64	0.22	0.19	0.62	0.38	0.84	0.27	0.15	0.34	0.00	0.29	0.82	0.22	0.17	0.37	0.02	0.31	60.66
2014	0.71	0.36	0.20	0.59	0.41	0.90	0.50	0.12	0.45	0.01	0.32	0.91	0.50	0.12	0.44	0.01	0.32	59.84
Mean	0.69	0.22	0.20	0.62	0.38	0.87	0.18	0.15	0.38	0.00	0.30	0.86	0.18	0.17	0.40	0.00	0.30	62.15

Table 2. Percentage distribution of firms by the average technical, profit and overall efficiency for the years 2006-2014

	Overall Efficiency					E1(based on 1)					E2(based on 1)				
Years	>70	71-80	81-90	>91	Total	>70	71-80	81-90	>91	Total	>70	71-80	81-90	>91	Total
2006	67.1	3.7	2.4	26.8	100.0	2.5	13.9	29.1	54.4	100.0	2.5	13.9	34.2	49.4	100.0
2007	59.8	8.5	4.9	26.8	100.0	13.9	21.5	20.3	44.3	100.0	12.7	26.6	17.7	43.0	100.0
2008	73.2	7.3	0.0	19.5	100.0	22.8	25.3	15.2	36.7	100.0	22.8	27.8	15.2	34.2	100.0
2009	64.6	8.5	6.1	20.7	100.0	14.1	19.2	15.4	51.3	100.0	17.9	15.4	17.9	48.7	100.0
2010	56.1	11.0	7.3	25.6	100.0	11.5	9.0	14.1	65.4	100.0	26.9	10.3	16.7	46.2	100.0
2011	61.0	12.2	3.7	23.2	100.0	11.1	8.6	25.9	54.3	100.0	12.3	8.6	24.7	54.3	100.0
2012	52.4	19.5	6.1	22.0	100.0	10.8	4.8	24.1	60.2	100.0	9.6	6.0	24.1	60.2	100.0
2013	70.7	6.1	3.7	19.5	100.0	14.3	26.2	21.4	38.1	100.0	20.2	21.4	22.6	35.7	100.0
2014	57.3	9.8	3.7	29.3	100.0	6.0	10.8	26.5	56.6	100.0	6.1	9.8	24.4	59.8	100.0
MO	61.8	9.2	3.9	25.0	100.0	12.7	16.5	19.0	51.9	100.0	15.2	15.2	21.5	48.1	100.0

OE stands for Overall Efficiency, and w1 and w_2 are weights that capture each stage's importance. E^{1*} and E^{2*} stood for the technical efficiency and profit efficiency measures when priority was given in the first stage, and E^{1} and E^{2} for the technical efficiency and profitability measures prioritized in the second stage.

Figure 2. The average market concentration ratio and technical (TE), profit (PE) and overall efficiency (OE) scores for the period 2006-2014

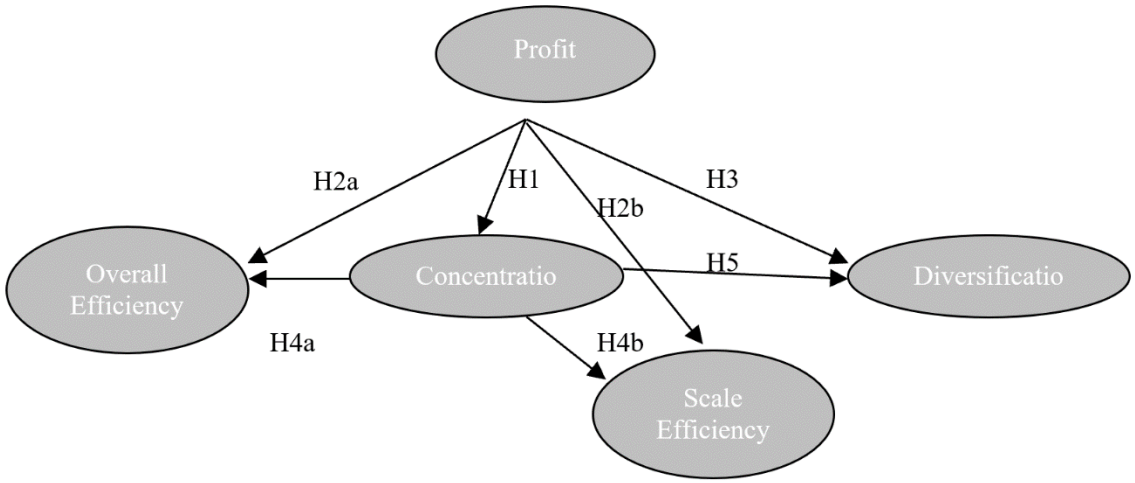


In light of the above, Greece's reforms do not substantially improve efficiency in this sector. The structural weaknesses of the Greek economy seem to be not addressed and remain the most crucial factor behind the difficulties of adjusting to intense international competition.

4.2 The Research Model and our Hypotheses

The current study emphasized and supported the Bayesian network's application for shedding light on the causal relations among interest variables (Wu *et al.* 2012). The causal diagram resulting from the Bayesian network is exhibited in Fig. 3. It should be noted that before applying the PLS approach, the causal directions obtained by the TAN search algorithm should be reversed (Wu *et al.* 2012). Based on this diagram, our hypotheses are created accordingly.

Figure 3. Causal diagram acquired by Bayesian Network TAN classifier

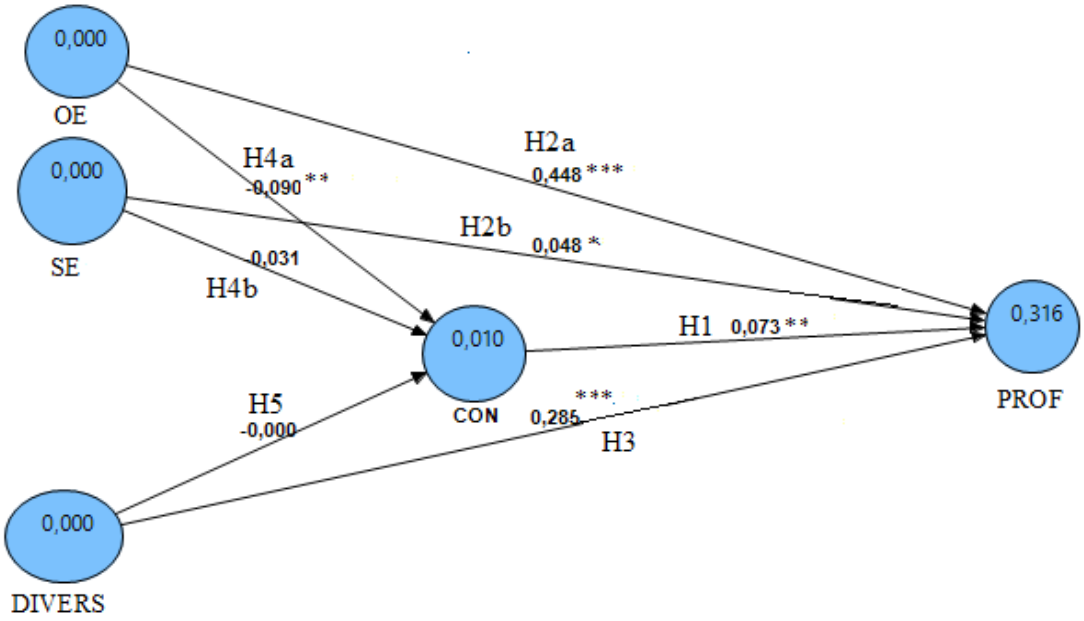


The Bayesian network findings suggest that seven crucial relationships may be valid in the specific spatial and temporal horizon, namely Greece's olive oil manufacture from 2006 to 2014. Four of these assumptions show a direct effect on the profits of concentration (H1), overall efficiency (H2a), scale efficiency (H2b), and product diversification (H3). Thus, the SCP, the RMP, and ES hypotheses described in the literature must be part of our research model (see Section 2). Additionally, three assumptions that indicate the impact on the concentration of overall efficiency (H4a), scale efficiency (H4b) and diversification (H5) were also formulated. The sources of concentration are the subject of dispute between economists. The literature on this controversy was dominated for a long time by opposing Hicks's and Chicago's approaches, known as the quiet life theory and efficiency paradigm respectively (see Section 2).

4.3 Testing the Structural Model

Figure 4 shows the hypothesis testing results by employing PLS path modeling. Based on them, we observed that the combination of four factors examined, market concentration (CONC), overall efficiency (OE), scale efficiency (SE), and product differentiation, has a moderate predictive ability of 31.6 % for the profits (PROF).

Figure 4. The results of PLS path modeling



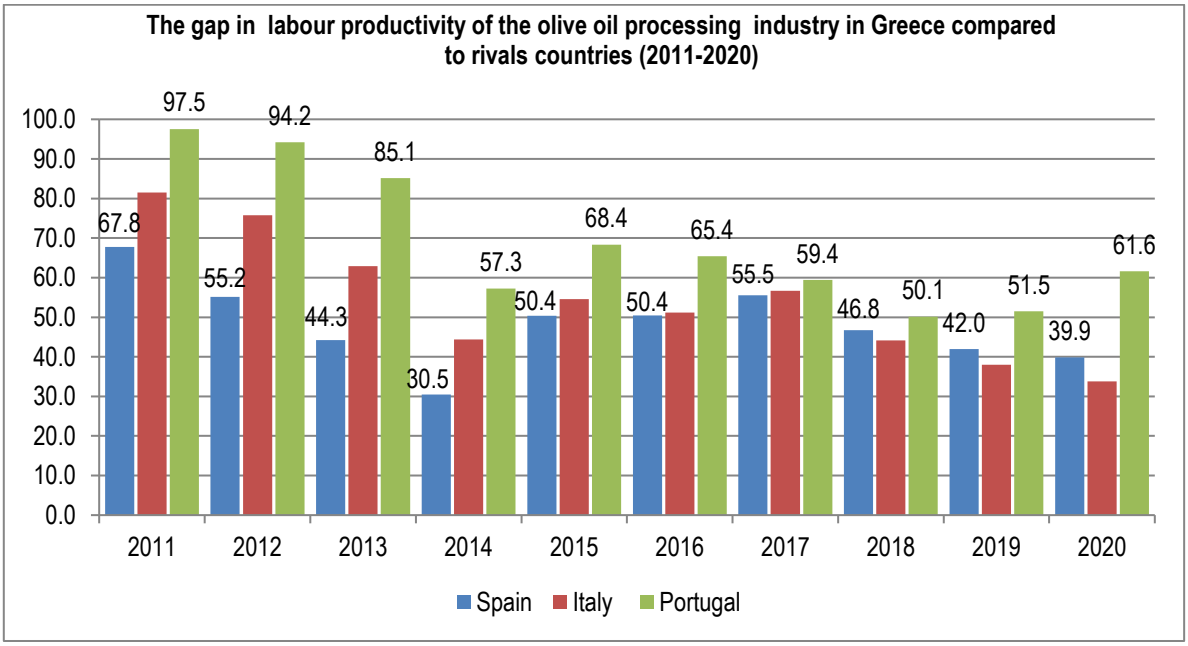
* significant at p < 0.10; ** significant at p < 0.05; *** significant at p < 0.001

From this Figure, it is also clear that the hypothesis of a positive effect on profitability of overall efficiency (H2a) and the scale efficiency (H2b) are supported at p<0.001 and p < 0.1 since their standardized coefficients are statistically significant, with H2a (β=0.448, t= 16.0184, p<0.001) and H2b (β=0.048, t= 1.65986, p<0.1). Moreover, diversification (DIVERS) permits meaningful interpretations of profits as its path coefficient is positive and more than 0,25, suggesting the acceptance of the H3 hypothesis (β=0.285, t= 6.90970, p<0.01). Furthermore, the collusion hypothesis (H1) also prevails because concentration is significantly correlated with profits (β=0.073, t=1.98836, p>0.05). Hence, the evidence of this study confirms the links suggested by the theories of SCP, relative market power and efficiency structure. Looking at causal relations between the potential determinants of concentration, we discover that concentration exhibits a slight ability to be explained by this model (R2 = 0,010%), and in particular, by three factors, overall efficiency (H4a) and scale efficiency (H4b) and product diversification (H5). Specifically, the empirical evidence revealed that H5 should be rejected, as diversification was found to have an insignificant negative relationship with concentration (β=-0.000, t= 0.008922, p>0.1).

A further intriguing finding is a statistically significant but adverse link between total overall efficiency and concentration (β=-0.090, t=2.1852, p<0.05), demonstrating the lack of support for the H4a hypothesis. A statistically insignificant negative influence of scale efficiency on concentration (β=-0.031, t=1.282, p>0.1) is also signalled, leading us to reject hypothesis H4b. These results verify the quiet life theory's assumption, which partially explains why a trend of fall in the labour productivity of the olive processing industry in Greece is observed from 2011 to 2020 (see Fig. 5).

As a result of the quiet existence of the Greek olive oil processing business, the productivity of companies that process olive oil in Greece in 2020 corresponds to 39.9% of the productivity of the Spanian sector (when this index was 67.8% in 2011), to the 33.8% of the productivity of the Italian industry (from 81.5% in 2011) and to the 61.6% of that of the Portuguese olive oil processing industry (from 97.5% in 2011). However, despite the widening of the gap in the labour productivity of the Greek olive oil industry compared to the international competitors, the companies in Greece over 2015- 2020 continued to enjoy a higher average gross operating surplus to value-added ratio, which amounted to 60.2%, more significant than the average profits businesses in Spain (49.0%), Portugal (57.6%), and Italy (54.5%).

Figure 5. The gap in labour productivity of the Greek olive oil processing industry (2011-2020)



Lastly, it should be noted that in the Greek context, after 2015, there is a trend toward a low rising the value of production of the olive oil industry (on average, by 1.5% annually). At the same time, the gross operating surplus to added value ratio (0.6%), the apparent labour productivity (0.8%), and the total number of firms (0.2%) of this sector in Greece trend to stagnation (Eurostat, Structural Business Statistics, 2022). During the COVID-19 pandemic, even though the number of firms is nearly unchanged (0.06%), the production value of the olive oil industry in Greece declined by -10.6% in 2019, along with the operating margin to added value ratio (-9.9%). However, in the subsequent calendar year, in 2020, there were enhancements in the operating margin to added value ratio (1,4%) and the output value (2,5%), with the number of enterprises declining -2.5% from the prior year serving as the sole exception.

Conclusion

Whether increased firm concentration leads to inefficiency due to expanded market power is critical in developing anti-competitive policies. The paper investigates this question by examining the relationship between market concentration and efficiency. In particular, the article discusses the dynamics and effects of concentration on the different types of firm efficiency: technical, scale, and profit efficiency. For this purpose, we employed a new research methodology which might be used in future research to identify the interaction between firms' behaviour, performance, and market structure in Greece's olive oil industry from 2006 to 2014.

Several policy implications and regulations arise from this study. Based on the research results, their anti-competitive conduct contributed to higher profitability. Although effective resource management and product differentiation increased profits within Greece's olive oil manufacturing enterprises, these features were not the primary sources behind industrial concentration. Instead, the findings supported the QLH by demonstrating a negative link between efficiency and concentration. The olive oil manufacturing companies that opted for a peaceful existence continued to be both technically and profitably inefficient. They have been discovered to fail to exploit economies of scale to reduce the cost of production. Because of our evidence concerning the effects of market concentration on various types of efficiency, anti-competitive actions are necessary to prevent companies from gaining excessive profits. The restoration of Greek industry competitiveness necessitates the adoption of regulations that support the competitive function of the market. We can get similar conclusions if we examine the currently available data for the evolution of the Greek olive oil sector from 2015 to 2020. Therefore, increased competition is necessary to improve organizational and technical changes in the production process, motivate managers to cut cost inefficiencies and resource waste and encourage the discovery of new products if combined with the promotion of an integrated government policy of productive reconstruction at the micro-region level.

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International Tourism, Financial Deepening and Economic Growth: Insights from Southern African Countries

P. K. MISHRA
Central University of Punjab, Punjab, India
pkmishra1974@gmail.com

Himanshu B. ROUT
Mizoram University, Mizoram, India
himanshurout78@gmail.com

Debasis SAHOO
Central University of Himachal Pradesh, HP, India
debasis_chef@yahoo.com

Pradip KUMAR
Assam University, Assam, India
pradipkumar567@gmail.com

S. R. CHAINI
SOA University, Odisha, India
susanta_chaini@yahoo.co.in

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Abstract: The impact of tourism development on financial development via its effects on economic growth and country openness in Southern African countries for the period 1995 to 2019 was examined relying on pooled mean group-based estimation of panel ARDL regression, and the results lend supports to the tourism-led financial development hypothesis in these countries in the long-run. The findings infer that the development of the travel and tourism sector can spur financial development as the former by contributing to output, employment and income warrant an enhanced role of the financial sector.

Keywords: international tourism; financial deepening; economic growth; Africa.

JEL Classification: G15; G29; N17; N27; O47; O55; Z32.

Introduction

In the Southern African region, the economic development among the nations is quite uneven with Botswana, Namibia and South Africa labelled as upper-middle-income countries, and Eswatini and Lesotho as lower-middle-income countries by the World Bank as per the list released in July 2022. As per the Gross Domestic product of 2021, South Africa ranks 31, Botswana 122, Namibia 139, Eswatini 164 and Lesotho 180 out of 207 countries listed by the World Bank (see Table 1). For sustained growth of these economies, it is essential to reorient policy focus towards the growth of sectors having potential for sustainable growth and development both in the short and long span of time. One such smokeless sector is travel and tourism. In Southern African countries, the contribution of travel and tourism to Gross Domestic Product is noteworthy. It was 15.3% in Namibia, 13.4% in Lesotho, 9.6% in Botswana, 6.9% in South Africa and 5.5% in Eswatini in 2019 followed by the exceptional year 2020 due to the sudden outbreak of Coronavirus disease (COVID-19) pandemic and the recovery year 2021 (see Table 2). Similarly, travel and tourism have significant contributions to total employment in these nations. It was 15% in Namibia, 11.9% in Lesotho, 8.9% in South Africa, 8.4% in Botswana, and 5.9% in Eswatini followed by the exceptional year 2020 and the recovery year 2021 (see Table 2).

Table 1. Status of Economy, Financial and Tourism Sectors, 2019-2021

Country	International Tourism Receipts (current US$ million)		Financial Development Index		GDP Per Capita Growth (Annual %)		GDP (US$ million) (Country Rank)
	2019	2020	2019	2020	2020	2021	2021
Botswana	712.40	217.00	0.3511	0.3550	-10.40	9.56	17615 (122)
Eswatini	14.30	7.30	0.1514	0.1552	-2.48	6.83	4743 (164)
Lesotho	25.56	5.00	0.1452	0.1430	-9.51	0.13	2496 (180)
Namibia	451.00	155.00	0.4110	0.4142	-9.60	0.99	12311 (139)
South Africa	9064.00	2716.00	0.6400	0.6215	-7.48	3.87	419015 (31)

Source: Compiled from WDI of World Bank, 2023 & Financial Development Index Database of IMF, 2023

Table 2. Contribution of Travel & Tourism to GDP & Employment, 2020-2021

Country	Contribution to GDP		Contribution to Employment	
	2020	2021	2020	2021
Botswana	1229.60 (7.8%)	1412.80 (8.0%)	67.30 (7.5%)	69.90 (7.7%)
Eswatini	200.60 (4.4%)	221.30 (4.6%)	14.60 (5.5%)	15.50 (5.7%)
Lesotho	249.30 (10.6%)	276.80 (11.8%)	72.60 (10.0%)	75.80 (10.2%)
Namibia	1043.90 (8.6%)	1315.90 (11.0%)	87.40 (11.7%)	94.00 (12.6%)
South Africa	12200.00 (3.1%)	13200.00 (3.2%)	1060.00 (7.0%)	1080.00 (7.3%)

Note: *total contribution of travel and tourism to GDP in USD million; total contribution of travel and tourism to employment in thousands of jobs; Percentages are of total economy and total employment respectively*;
Source: Global Economic Impact and Trend 2022, WTTC

The contribution of the tourism sector in Botswana is due to the presence of incredible tourist attractions such as game reserves, wildlife and wilderness; in Eswatini due to a range of beautiful landscapes and wildlife; in Lesotho due to its natural beauty, rich flora and fauna, absorbing prehistoric and cultural heritage, sculpted mountains, cave houses, valleys, and rivers; in Namibia due to a unique mix of wildlife, spectacular scenery and diverse culture; in South Africa due to its picturesque natural landscape and game reserves, diverse cultural heritage and highly regarded wine. All of these showcases strong tourism potential in Southern African countries, and it has been reflected in the number of international tourist arrivals in 2019 as depicted in Table 3, albeit the availability of limited data for the years 2020 and 2021.

In 2019, Botswana hosted 34% of international tourists from Zimbabwe, 33% from South Africa, 9% from Zambia, 6% from Namibia, 3% from US, and 15% from the rest of the world. Second, Eswatini hosted 57% of international tourists from South Africa, 4% from Mozambique, 3% from Portugal, 3% from UK, 0.8% from Australia, and 31% from the rest of the world. Third, Lesotho hosted 85% of international tourists from South Africa, 3% from Zimbabwe, 1% from US, 1% from Germany, 1% from Botswana and 9% from the rest of the world. Fourth, Namibia hosted 35% of international tourists from Angola, 17% from South Africa, 15% from Zambia, 6% from Germany, 5% from Zimbabwe, and 21% from the rest of the world. Lastly, South Africa hosted 22% of international tourists from Zimbabwe, 15% from Lesotho, 13% from Mozambique, 9% from Eswatini, 7% from Botswana, and 34% from the rest of the world.

However, the above states of inbound arrivals were disturbed in 2020 due to the unprecedented outbreak of corona pandemic. In 2020, Botswana hosted 43% of international tourists from Zimbabwe, 37% from South Africa, 6% from Namibia, 4% from Zambia, 2% from Germany, and 8% from the rest of the world. Second, Eswatini hosted 60% of international tourists from South Africa, 6% from Mozambique, 3% from Portugal, 3% from UK, 0.5% from Australia, and 28% from the rest of the world. Third, Lesotho hosted 84% of international tourists from South Africa, 4% from Zimbabwe, 2% from Germany, 1% from China and 9% from the rest of the world. Fourth, Namibia hosted 38% of international tourists from Angola, 20% from South Africa, 12% from Zambia, 6% from Germany, 5% from Zimbabwe, and 18% from the rest of the world. Lastly, South Africa hosted 23% of international tourists from Zimbabwe, 19% from Lesotho, 16% from Mozambique, 9% from Eswatini, 7% from Botswana, and 27% from the rest of the world.

Similarly, the world's competitive strength in travel and tourism can be gauged from the ranking of these countries in terms of international tourism arrivals, international tourism expenditure and international tourism receipts (see Table 4).

Table 3. Brief Account of International Tourism, 2019 - 2021

Countries	International Tourist Arrivals (in Millions)	Inbound Arrivals: Source Nations
	2019, 2020, 2021	2021
Botswana	1.628 (2019), 0.40(2020)	Zimbabwe (43%), South Africa (32%), Zambia (5%), Namibia (5%), Germany (3%), Rest of the World (11%)
Eswatini	1.142 (2019), 0.20 (2020), 0.20 (2021)	South Africa (64%), Mozambique (7%), Portugal (5%), UK (2%), Australia (0.1%), Rest of the World (23%)
Lesotho	1.651 (2019)	South Africa (80%), Zimbabwe (3%), Germany (3%), US (2%), Netherlands (1%), Rest of the World (11%)
Namibia	1.226 (2019), 0.19 (2020) 0.2 (2021)	Angola (41%), South Africa (18%), Zambia (10%), Germany (7%), Botswana (4%), Rest of the World (19%)
South Africa	14.797 (2019), 2.8 (2020), 2.3 (2021)	Lesotho (20%), Zimbabwe (16%), Mozambique (16%), Eswatini (9%), Botswana (6%), Rest of the World (34%)

Source: Oxford Economics, UNWTO, WTTC Reports 2020, 2021, 2022

In terms of international tourist arrivals, South Africa occupied 36th, Botswana 95th, Namibia 96th, Lesotho 107th, and Eswatini 124th ranks among 189 countries in 2019 in the world. Furthermore, in terms of international tourism expenditure, South Africa occupied 43rd, Lesotho 124th, Botswana 129th, Namibia 156th, and Eswatini 163rd ranks among 181 countries in 2019 in the world. Also, in terms of international tourism receipts, South Africa occupied 36th, Botswana 124th, Namibia 136th, Lesotho 176th, and Eswatini 181st ranks among 186 countries in 2019 in the world. Thus, tourism can be the catalyst for rapid economic expansion and growth in Southern African countries.

Existing literature argues that the growth effects of tourism can be significantly realized when economic resources are effectively and efficiently mobilised for capital formation which in turn depends on the depth, access, efficiency and stability of the financial system (Al-Mulali *et al.* 2020). In this direction, the role of tourism can't be over-emphasized because tourism contributes to the expansion of economic activities (reflected in the increase in Gross Domestic Product per capita) thereby creating demand for financial services (Levine 2003; Shahbaz 2009; Cannonier & Burke 2017; Shahbaz *et al.* 2018). Therefore, it is imperative to examine whether the development of tourism effectively and significantly contributes to financial development via its effect on economic growth and country's openness in the Southern African nations in the long-run. The compliance to this objective can reorient the policy directions for achieving sustained development in less developed economies such as Botswana, Eswatini, Lesotho, Namibia and South Africa.

Table 4. World Ranking Based on International Tourism Indicators, 2019

Country	International Tourism Expenditure	International Tourism Receipts	International Tourism Arrivals
Botswana	181	186	189
Eswatini	163	181	124
Lesotho	124	176	107
Namibia	156	136	96
South Africa	43	36	36

Source: Compiled from NationMaster Online Country Statistics on International Tourism

In this perspective, contribution to the literature has been made in four directions – first, it is a study of the first kind in the context of Southern African countries; second, it measures the tourism sector development in Southern African countries by constructing a tourism development index based on principal component analysis; third, it measures depth, access, efficiency and stability of financial markets and institutions using financial development index of International Monetary Fund; and fourth, it provides the evidence of the statistically significant positive impact of tourism sector development on financial development when economic growth and openness of Southern African countries are controlled. In the rest of the study, section 2 reviews the relevant literature, section 3 elaborates on the data sources and methods of analyses, section 4 presents and discusses the findings, and section 5 concludes.

1. Literature Review

The extant literature has accorded travel and tourism a significant contributor to the economic growth and development of a nation via its role in increasing foreign exchange reserves, creating new infrastructure and tourist attractions, enhancing the quality of human resources, creating new employment opportunities, increasing

earnings, productivity improvements, industrial development, poverty reduction, balanced regional development, and in ensuring sustainable development (McKinnon 1964; Croes 2006; Lee & Chang 2008; Lemmetyinen & Go 2009; Cernat & Gourdon 2012; Li *et al.* 2018; OECD 2018; Khan *et al.* 2020; Mishra *et al.* 2020, 2021, 2022). In other words, travel and tourism have been observed to spread positive economic externalities in economies by increasing the extent of financial deepening, and real economic growth (Tsaurai 2018; Shahbaz *et al.* 2018). Thus, significant growth effects of travel and tourism can be realized when economic resources are efficiently mobilised for capital formation through a financial system that has good depth, easy access, utmost efficiency and robust stability (Al-Mulali *et al.* 2020).

In this direction, the role of tourism can't be over-emphasized because tourism contributes to the expansion of economic activities – productivity, investment, employment, output, and welfare – thereby creating demand for financial services (Lee & Kwon 1995; Levine 2003; Chao *et al.* 2006, 2009; Shahbaz 2009; Shahbaz *et al.* 2018). Such an increase in demand for financial services can positively affect financial development in a nation (Cannonier & Burke 2017). In simple words, the theoretical as well as the empirical argument, is that tourism sector development contributes to the real economic growth of a country which in turn increases the demand for financial services thereby contributing to financial development (*i.e.*, tourism-led financial development hypothesis). The existing literature is scanty in addressing this issue except for a few studies including Kumar (2014) for Vietnam, Shabaz *et al.* (2017, 2018) for Malaysia, Katircioglu *et al.* (2018) for Turkey, Cannonier & Burke (2017) for Caribbean countries, Musakwa & Odhiambo (2020) for South Africa, Khanna and Sharma (2021) for 207 countries Khanal *et al.* (2022) for Australia, Tsaurai (2022) for emerging markets, and Kumar *et al.* (2023) for Fiji. And, in the context of Southern African countries, no study has yet been taken up to examine the impact of tourism sector development on financial development via its effect on real economic growth in the long-run. Hence, this study is an attempt to bridge this knowledge gap in the literature, especially in the context of Southern African countries.

2. Materials and Methods

The study aims is to examine the impact of tourism sector development on financial development in Southern African Countries when their economic growth and openness are controlled. For this purpose, a panel of five countries – Botswana, Eswatini, Lesotho, Namibia and South Africa – and four variables – financial development, tourism sector development, economic growth and country's openness – have been considered over 25 years from 1995 to 2019 chosen based on the availability of data. In this study, the proposed theoretical or functional form of the empirical framework is:

$$FD_{it} = f\left(TD_{it}, EG_{it}, OPN_{it}\right) \quad 2.1$$

Here, *FD* is the financial development, *EG* is the economic growth, and *OPN* is the openness of an economy under consideration. In this study, the variable financial development has been measured by the Financial Development Index (*FDIX*) of the International Monetary Fund which reflects the depth, access, efficiency and stability of financial markets and institutions in a country in a year. Besides, we have constructed a composite index, called Tourism Sector Development Index (*TDIX*) employing Principal Component Analysis (PCA) based on annual data on three key indicators of tourism development, viz., International Tourist Arrivals (*ITA*), International Tourism Expenditure (*ITE*) and International Tourism Receipts (*ITR*). Also, we measured economic growth in a country in terms of the natural logarithm of the gross domestic per capita (*GDPC*) in a year. Finally, the openness of an economy has been measured in terms of net inflows of foreign direct investment (*FDI*) in a year. The time series data on the underlying variables have been obtained from the online database of the World Bank and the International Monetary Fund. Then all these variables have been expressed in their natural logarithms to get rid of the possible issues of heteroskedasticity (Gujarati *et al.* 2017). Thus, the log-linear form of the functional form 2.1 is stated in specification 2.2:

$$LnFDIX_{it} = \psi_1 + \psi_2 LnTDIX_{it} + \psi_3 LnGDPC_{it} + \psi_4 LnFDI_{it} + \omega_{it} \quad 2.2$$

Construction of Tourism Development Index (TDIX): One strand of the extant literature lends support to the use of the number of international tourist arrivals to measure tourism sector development (Kim *et al.* 2006; Katircioglu, 2009; Tang & Abosedra, 2016) while others use international tourism expenditure (Song *et al.* 2010; Cardenas-Garci *et al.* 2015; Aslan, 2016), and international tourism receipts (Chen & Chiou-Wei, 2009; Arslanturk *et al.* 2011; Ridderstaat *et al.* 2014). There are shreds of evidence where either one of these indicators, some of these or all of these indicators have been used in measuring tourism sector development (Shahzad *et al.* 2017). Such a methodology has certain shortcomings – first, each of these indicators reflects only a partial linkage with

the macroeconomic growth of an economy; and second, these indicators depict a strong correlation among themselves as the larger the flow of international tourists, the greater is the volume of expenditure and hence, bigger is the number of receipts thereby posing the problems of multicollinearity (Shahzad *et al.* 2017). All these justify why a composite indicator of tourism sector development is required. The existing literature supports the construction of a composite index of tourism sector development in a country by combining international tourist arrivals, international tourism expenditure, and international tourism receipts through Principal Component Analysis (Shahzad *et al.* 2017; Shahbaz *et al.* 2018; Al-Mulali *et al.* 2020). The process of the construction of this composite index is stated below:

If the set of values of the 3-selected tourism indicators for the i^{th} country are T_{i1}, T_{i2}, T_{i3}, then the composite indices obtained for each country through the first principal component is given by the linear combination of the variables: $CTD_i = w_{11}T_{i1} + w_{12}T_{i2} + w_{13}T_{i3}$, where w_{11}, w_{12}, w_{13} are weights of each indicator such that their sum of squares is one, and CTD is the composite tourism sector development index. The first principal component is calculated such that it accounts for the greatest possible variance in the dataset. Finally, the obtained composite index is normalized by the Max-Min method to obtain the Tourism development index which is given by $TDIX = \frac{CTD_i - Min\{CTD_i\}}{Max\{CTD_i\} - Min\{CTD_i\}}$.

Description of Data Characteristics: The basic statistical features of each variable have been examined by calculating mean, standard deviation, skewness and kurtosis, and by testing the normality of the dataset using the Jarque-Bera (JB) goodness-of-fit test where the null hypothesis is the normal distribution of the data. The JB test statistic is given by: $JB = \frac{n}{64}\left(S^2 + \frac{1}{4}(K-3)^2\right)$ where S is the sample skewness, K is the sample kurtosis and n are the sample size.

Estimation of Parameters: Since cross-sectional dependence is an important issue in a panel dataset due to the strong macroeconomic interdependence of economies in the Southern African region, it is essential to check the likely presence of the cross-sectional dependence. For this purpose, we have used the CD statistic of Pesaran (2004) which can be stated as: $CD = \sqrt{\frac{2T}{N(N-1)}}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}$. In this test statistic, $\hat{\rho}_{ij}$ is the average value of the pair-wise correlation coefficients of OLS residuals regressions under the fixed/random effect model. As will be seen in the next section, the panel datasets under consideration exhibit cross-sectional independence. Thus, IPS unit root test Im, Pesaran & Shin (2003), a variant of the first generation stationarity test has been considered adequate to examine the stationary properties and determine the order of integration of the variables used in the heterogeneous cross-sections. By considering the autoregressive properties of each cross-section, IPS test uses the following t-bar statistic to analyse the stationary properties of the underlying dataset: $\bar{t} = \frac{1}{N}\sum_{i=1}^{N} t_{\rho_i}$ where t_{ρ_i} is the individual t-statistic for $H_0 : \rho_i = 1 vs. H_a : |\rho_i| < 1$, given the regression model: $y_{it} = \rho_i y_{i,t-1} + \sum_{j=1}^{p_i}\phi_{ij}\Delta y_{it-j} + Z_{it}^{'}\gamma + \varepsilon_{it}$. As will be seen in Section 4, the variables of interest are a mix of I(0) and I(1).

Therefore, specification (2) can be estimated in the Autoregressive Distributive Lag (ARDL) framework based on the appropriate estimator robustly chosen by using the Hausman test (Hausman, 1978) from a set of three different dynamic estimators – the Mean Group (MG) estimator as proposed by Pesaran & Smith (1995), the Pooled Mean Group (PMG) estimator as developed by (Pesaran *et al.* 1999), and the Dynamic Fixed Effects (DFE) estimator as put forward by Weinhold (1999). These estimators by assuming long-run equilibrium and the heterogeneity of the dynamic adjustment process (Demetriades & Law, 2006), are computed by the maximum likelihood method.

The MG estimator is obtained by estimating a separate regression for each cross-section, and then helps estimating both the short-run and long-run parameters by averaging the individual parameters from each cross-section. In this way, the MG estimator ensures the coefficients are heterogeneous both in the short-run and long-run. Second, the PMG approach estimates the short-run and long-run parameters from the panel error correction specification (3) in the ARDL framework. It allows short-run coefficients, intercepts, the error correction coefficients (the speed of adjustment of short-run disequilibrium towards the long-run equilibrium values) and error variances to be heterogeneous across cross-sections. However, it maintains homogeneity of the long-run slope coefficient across cross-sections. Lastly, the DFE estimator allows heterogeneity of intercepts across cross-

sections while maintaining the homogeneity of the error correction coefficients, and short- and long-run coefficients across cross-sections.

$$\Delta LnFDIX_{it} = \varphi_i ECT_{it} + \sum_{j=1}^{p-1} \lambda_{ij} \Delta LnFDIX_{i,t-j} + \sum_{i=1}^{q-1} \eta_{1ij} \Delta LnTDIX_{i,t-j} + \sum_{i=1}^{r-1} \eta_{2ij} \Delta LnGDPC_{i,t-j} + \sum_{i=1}^{u-1} \eta_{3ij} \Delta LnFDI_{i,t-j} + \varepsilon_{it} \quad 2.3$$

In this ARDL framework, the lag structure of the variables has been determined by the Akaike Information Criterion (AIC) of lag selection. It will be seen from the next section that the optimal lag structure of the proposed econometric model is ARDL (1,1,1,1,1).

Model Selection: We have used the Hausman test as suggested by Hausman (1978) to identify the best estimator from among the MG, PMG and DFE estimators. The null hypothesis of this test is that the difference between PMG and MG, or PMG and DFE estimation is not significant. If the null hypothesis is not rejected (*i.e.*, p-value is greater than 0.05), then the PMG estimator is suggested to be the efficient estimator.

In specification (2), the coefficient ψ_2 is expected to have a positive sign, if tourism development promotes financial development, otherwise negative; the coefficient ψ_3 is expected to have a positive sign, if economic growth enhances financial development, otherwise negative; the coefficient ψ_4 is expected to have a positive sign, if country's openness improves financial development, otherwise negative.

4. Results and Discussion

At the outset, the tourism development index, TDIX, has been constructed based on the annual observations on international tourist arrivals, international tourism expenditure and international tourism receipts deploying the Principal Component Analysis (see Table 5). It is observed from the Table 5 that the eigen value for the first principal component (PC-01) is not only greater than one but explains 97% of the total variability which justifies its relevancy in index construction. The factor loadings of PC-01 as reported under eigen vectors are all positive and thus, indicate that these are the weights of the three tourism indicators respectively. Then, the weighted tourism development index has been constructed following the methodology explained in the previous section.

Table 5. Results of Principal Component Analysis

Eigen Values			
Component	**Eigen Values**	**Proportion**	
PC-01	2.9379	0.9793	
PC-02	0.0516	0.0172	
PC-03	0.0105	0.0035	
Eigen Vectors			
Variables	PC-01	PC-02	PC-03
ITE	0.578	0.492	0.650
ITA	0.573	-0.813	0.105
ITR	0.580	0.312	-0.752

Source: Authors' Calculation

In the next step, we have examined the nature of the tourism development index, financial development index, economic growth variable and the indicator of country's openness by analysing the descriptive statistics presented in Table 6. The mean growth of GDP per capita is above 8 per cent for South Africa followed by Botswana, Namibia, and Eswatini which indicates booming economies of Southern African countries over the last 25 years. The mean growth of GDP is the lowest for Lesotho over the sample period. The mean growth of financial development and tourism development indicators are negative for all the countries over the sample period. The GDP per capita growth is positively skewed for Botswana and Lesotho, but negative for Namibia, Eswatini and South Africa. The growth of financial development indicator is positively skewed for Namibia and Eswatini, but negative for Botswana, Lesotho and South Africa. The growth of tourism development indicator is negative for all the countries thereby indicating the probability of the presence of larges decreases than increases in this series. The kurtosis is less than three for the growth of GDP per capita, financial development and tourism

development in all the Southern African countries except that for tourism development in Lesotho where it is greater than three. This indicates that these three series are either platykurtic or leptokurtic. However, the Jarque-Bera normality test indicates that the growth of the GDP per capita series is normal as there is a lack of sufficient statistical evidence to reject the null hypothesis of normal distribution for all the countries. The growth of financial development indicator is normally distributed for all countries except for Botswana. The growth of tourism development indicator is normally distributed for all countries except for Botswana and Lesotho.

Table 6. Descriptive Statistics of Variables, 1996-2019

Country/Statistics	LnTDIX	LnGDPC	LnFDIX	LnFDI
Botswana				
Mean	-3.520	8.726	-1.168	19.055
Std. Dev.	0.483	0.189	0.129	0.884
Skewness	-1.393	0.043	-1.255	-0.616
Kurtosis	0.915	-1.374	1.108	-0.878
Jarque-Bera Stat.	8.957**	1.974	7.841**	2.384
p-val.	0.011	0.372	0.019	0.303
Observations	25	25	25	25
Lesotho				
Mean	-4.896	6.943	-1.978	17.653
Std. Dev.	1.867	0.226	0.104	0.800
Skewness	-0.799	0.005	-0.205	0.018
Kurtosis	4.031	-1.619	-0.754	-0.531
Jarque-Bera Stat.	19.580*	2.730	0.767	0.295
p-val.	0.000	0.255	0.681	0.863
Observations	25	25	25	25
Namibia				
Mean	-3.776	8.492	-0.930	19.489
Std. Dev.	0.273	0.182	0.281	0.872
Skewness	-0.525	-0.175	0.113	-0.312
Kurtosis	-0.668	-1.545	-1.925	-0.904
Jarque-Bera Stat.	1.613	2.614	3.913	1.256
p-val.	0.446	0.271	0.141	0.533
Observations	25	25	25	25
Eswatini				
Mean	-6.323	8.244	-1.906	17.845
Std. Dev.	0.875	0.176	0.306	0.658
Skewness	-0.647	-0.139	0.693	-0.242
Kurtosis	-0.726	-1.616	0.409	-1.132
Jarque-Bera Stat.	2.293	2.800	2.175	1.578
p-val.	0.317	0.246	0.337	0.454
Observations	25	25	25	25
South Africa				
Mean	-0.536	8.818	-0.648	21.676
Std. Dev.	0.486	0.112	0.171	0.932
Skewness	-0.628	-0.485	-0.874	-0.254
Kurtosis	-1.461	-1.574	0.326	-1.419
Jarque-Bera Stat.	3.866	3.561	3.293	2.366
p-val.	0.144	0.168	0.192	0.306
Observations	25	25	25	25

*Note: LnFDI: Natural Logarithm of Net Inflows of Foreign Direct Investment; LnFDIX: Natural Logarithm of Financial Development Index; LnGDPC: Natural Logarithm of GDP per Capita; LnINF: Natural Logarithm of Inflation; LnTDIX: Natural Logarithm of Tourism Development Index; *significant at 0.01 level; **significant at 0.05 level.*

Source: Authors' Calculation

Then the possibility of the existence of cross-sectional dependency among the variables has been tested by deploying Pesaran's CD test (see Table 7). It is observed from the Table 7 that the proposed model (specification (2)) does not exhibit any cross-sectional dependency. So, the first-generation unit root test, IPS, has been used to check the stationary properties of the variables and select the appropriate estimation method.

The results are reported in Table 8 which infer that the variables are a mix of I(0) and I(1) thereby justifying the use of ARDL regression to understand the short- and long-run dynamics as specified in (3) in the previous section.

Table 7. Pesaran's Cross-sectional Dependence Test

Panel Data Model	CD test stat.	p-value
Fixed Effect	-0.460	0.645
Random Effect	-0.248	0.804

*H0: No Cross-Sectional Dependence; * sig. at 0.01 level*
Source: Authors' Estimation

Table 8. Results of IPS Panel Unit Root Test

Variables	At Level with Intercept	At 1st Difference with Intercept	Order of Integration
LnFDIX	-1.9613** (0.0249)	-	I(0)
LnTDIX	-1.4303*** (0.0763)	-	I(0)
LnGDPC	1.1282 (0.8704)	-4.4804* (0.0000)	I(1)
LnFDI	-3.3192* (0.0005)	-	I(0)

*Note: Values within parentheses are p-values; *, **, *** significant at 0.01, 0.05 and 0.10 levels respectively*
Source: Authors' Estimation

Table 9. Results of Short-Run Long-Run Relationships

Variables	Mean Group (MG)	Pooled Mean Group (PMG)	Dynamic Fixed Effects (DFE)
Long-Run Coefficients			
LnTDIX	0.1731 (0.212)	0.1127** (0.044)	0.0878 (0.379)
LnGDPC	0.4963* (0.001)	0.2413** (0.039)	0.4837*** (0.060)
LnFDI	-0.0927 (0.382)	0.0005 (0.983)	-0.0491 (0.428)
Error Correction Term			
ECT	-0.5161* (0.000)	-0.3208* (0.001)	-0.3865* (0.000)
Short-Run Coefficients			
ΔLnTDIX	-0.0823 (0.179)	-0.0345 (0.419)	0.0035 (0.944)
ΔLnGDPC	-1.1561 (0.262)	-0.8282 (0.299)	-0.5765 (0.265)
ΔLnFDI	0.0450 (0.314)	-0.0019 (0.262)	0.0031 (0.867)
C	-2.3954* (0.000)	-1.7688* (0.002)	-2.3291* (0.003)
Obs.	125	125	125
#Hausman Test: χ2 Stat. (PMG or MG): 4.78 (0.1889) => PMG is Efficient			
@Hausman χ2 Stat. (PMG or DFE): 0.070 (0.9952) => PMG is Efficient			

*Note: p-val. in parentheses; *, **, *** sig. at 0.01, 0.05 and 0.10 levels respectively; Dependent Variable: Δ(LnFDIX); Dependent & Dynamic Regressors Lag Structure: ARDL (1,1,1,1); #Null Hypothesis: PMG is efficient estimation than MG @Null Hypothesis: PMG is efficient estimation than DFE;* ECT: Speed of Adjustment or Error Correction Term
Source: Authors' Estimation

The ARDL specification (3) has been estimated using MG, PMG and DFE estimators (see Table 9) of which the best estimator has been chosen by resorting to the Hausman test. The Hausman test suggests that PMG based estimation of ARDL specification (3) is more efficient than MG and DFE estimators. While interpreting the PMG based estimation, it is inferred from Table 9 that in the long-run, the coefficient of the tourism development index is positive and statistically significant at 0.05 levels. It means, in Southern African countries, tourism sector expansion can contribute to financial development in the long-run by 0.11 percent when the rate of real economic growth and the degree of country's openness has been controlled (as the coefficients of economic growth and openness variables are both positive, the former being significant at 0.05 levels while the latter is not). In other words, tourism sector development has the potential to promote financial development via its positive effects on real economic growth and the country's openness in the long-run. This finding validates the 'tourism-led financial development hypothesis' in the context of Southern African countries.

However, no short-run relationship between tourism sector development and financial development in Southern African countries has been observed. Nonetheless, the coefficient of error correction term, ECT, is negative and statistically significant at 0.01 levels. It means the short-run deviations from the long-run equilibrium relationship can subsequently be restored through an annual adjustment rate of 0.516 percent. Thus, the policy implication is that the Southern African countries can achieve more depth, accessible, efficient and stable financial sector by catalyzing travel and tourism in the long-run.

This finding corroborates the findings of Kumar (2014) for Vietnam, Shabaz *et al.* (2017, 2018) for Malaysia, Cannonier & Burke (2017) for Caribbean countries, and Musakwa & Odhiambo (2020) for South Africa and contradicts the findings of Ohlan (2017) for India. In addition, it brings into the limelight another dimension of the tourism-finance nexus, *i.e.*, tourism development can lead to the financial development of a country in the Southern African region, contrary to the existing empirical evidence in support of the 'finance-led tourism development hypothesis' by Tsaurai (2018) for Southern African Countries, and Musakwa & Odhiambo (2021) for Kenya. Thus, the bottom line is that the tourism sector development can stimulate productive economic activities and strengthen the tourism-growth nexus thereby leading to the financial sector development in Southern African countries.

Conclusions and Further Research

In this study, the long-run impact of tourism development on financial development via its effects on economic growth and country's openness in Southern African countries for the period 1995 to 2019 is positive and statistically significant. Thus, tourism sector development can be considered a crucial policy objective for attaining higher economic growth as well as enhanced financial development in the region. Precisely, increasing budgetary allocations for building tourism destinations and infrastructure and introducing innovative tourism projects would certainly enhance international tourist arrivals and consequential international tourism spending and receipts. On the one hand, this would spur investment, employment, income and output in Southern African countries, and on the other hand, would create demand for improved and efficient financial services thereby contributing to enhanced financial development. Despite such novelties, the study is delimited for not examining country-specific dynamics which can be considered as a direction for future work.

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The Impact of Increasing Performance and Productivity in the Management of Human Resources in Albanian Enterprises

Fioralba VELA
Department of Business, University of "Ismail Qemali" Vlore, Albania
fioralba.vela@univlora.edu.al

Zamira SINAJ
Department of Business, University of "Ismail Qemali" Vlore, Albania
sinaj.zamira@yahoo.it, zamira.sinaj@univlora.edu.al

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Abstract: The importance of improving the efficiency of enterprises in Albania and, consequently, the role of personnel management in the implementation of this task has increased especially in recent years when the number of workers has decreased significantly due to the increase in emigration. The purpose of the study is to determine the most effective system of motivation and planning for them, considering the characteristics and national mentality of agricultural workers, and to form recommendations for the most acceptable management style for this group. The Holfstede typology of cultural dimensions was used as a primary method to identify the cultural and behavioral characteristics of the target audience. As a result of the survey conducted among 1514 staff representatives and the processing of its results, the average indicators for cultural dimensions were calculated and the evaluations of these indicators were given. According to the data obtained for the typology of cultural dimensions, it was found that the values in the examined social group are mainly determined by traditions and customs, which means that a management model is required that will not impose the existing principles of Western management but uses the tools own based on relatively democratic principles. Based on the obtained characteristics, recommendations were formed for such main management tools as the principles of subordination, the system of defining tasks and monitoring their implementation, as well as for effective motivation of personnel. The practical importance of the study lies in the development of recommendations for improving personnel management and, as a result, increasing efficiency in agricultural enterprises in Albania.

Keywords: management; performance; agrocomplex; enterprises; Hofstede method.

JEL Classification: J50; L25; L29; Z10; R11.

Introduction

Albania as a country in the stage of development, to one degree or another, is characterized by the barriers mentioned for the creation and management of new business. However, along with a few difficulties for development, the country also has considerable advantages. One of the most important is the presence in Albania of a large part of the young population, which adapts best to rapid changes, is ready to accept innovations and has the potential to produce and implement new ideas, especially in the field of entrepreneurship (Krujë & Kadiasi 2020). Most of the new businesses in Albania have been created in the field of ICT, education, and e-commerce. Such more traditional fields of operation as the agro-industrial sector are less popular among young entrepreneurs (Boshnjaku & Caro 2020). At the same time, Albania's agro-industrial complex in general has a high potential: it provides a significant part of the GDP and creates jobs for almost half of the working population (Kosta *et al.* 2022), plays an important role in the export of certain types of products, its development is facilitated by climatic and geographical conditions. However, at the end of the 20th century, after the transition of the state economy to market relations and the intensive development of technologies.

Albania as a country at the stage of development, to one degree or another is characterised by the mentioned barriers to establishing and managing new business. However, along with several difficulties for development, the country also has significant advantages. One of the most important ones is the presence in

Albania of a large part of the young population that is best adapted to rapid changes, ready to accept innovations and has the potential to produce and implement new ideas, in particular in the entrepreneurship area (Kruja & Kadiasi 2020). Most start-ups in Albania are created in the area of ICT, education, as well as e-commerce. Such more traditional areas of operation as the agro-industrial sector are less popular among young entrepreneurs (Boshnjaku & Caro 2020). At the same time, the agro-industrial complex of Albania in general has a high potential: it provides a significant part of GDP and creates jobs for almost half of the working population (Kosta *et al.* 2022), plays an important role in the export of certain product types, its development is facilitated by climatic and geographical conditions.

Considering the importance of Albania's agro-industrial sector for the growth of the country's economy and the great potential of start-ups in economic development, the study that combines these two aspects is important and modern. Albanian start-ups in the agriculture area have both great potential due to the large part of youth in the country and the industry's prospects, as well as a few difficulties, mostly connected with insufficiently effective state policies. Therefore, it is important and relevant to study the content and causes of such problems, as well as to determine ways to reduce or eliminate them.

Most researchers focus on the problems of the imperfect legal framework (Kacollja *et al.* 2021), as well as limited access to financing from investors and bank credits (Konomi 2022). However, the list of real problems is much wider (Gjoka & Duka 2021), and their solution is not only in changes in state policy, but also may depend on the founders of the business themselves, because the success of start-ups largely depends on the availability of ideas and talent among its managers. It follows from this that the solution to existing problems is among other things, in the correct choice and justification of promising directions for the development of start-ups in the agricultural sector. A successful choice of direction can not only be a key success factor of the start-up idea itself, but also solve the financing problem by getting potential investors interested in a detailed disclosure of the developed strategy.

Thus, the purpose of the study is to outline the problems of start-ups in the agricultural sector of Albania and to suggest ways to solve these problems at the level of the state and at the level of individual businesses in terms of determining the most promising development directions. Therewith, one of the key factors in increasing the effectiveness of almost any process is the systematisation and improvement of its management. Regarding the situation under study, this refers to better management of personnel who are accustomed to existing in the traditional paradigm and avoid substantial changes – both in everyday life and in labour relations. Filling the gap in the studies of new management solutions in enterprises in Albania, in this paper, the task was set to examine the specific features of the target audience and to identify the psychological and cultural characteristics of its representatives.

1. Literature Review

Albania as a country at the stage of development, to one degree or another is characterised by the mentioned barriers to establishing and managing new business. However, along with a number of difficulties for development, the country also has significant advantages. While culture and livestock without proper support is declining. Therefore, according to the conclusions drawn in her study, a qualitatively different approach is needed in the management of personnel of the agro-industrial complex for the formation of the country's food security potential. With this, without fundamentally new approaches in the management and implementation of measures planned for the reclamation of territories and the achievement of sustainable development goals, there is a risk of repeating the same mistakes that led to the current situation.

An important contribution to the examination of farmers' psychology and their management approach was made by Shang and Xiong (2021), who surveyed representatives of 169 farms to determine their willingness to insure crops and crop prices. next. As a result, it was identified that farmers have a low assessment of their ability to predict crop prices, but, nevertheless, they do not trust such assessment by specialists and, in most cases, refuse to give insurance. This contradiction leads to the conclusion that in order to gain the trust of farmers, it is necessary to convey to them the essence of innovations (in this case, insurance products) in an accessible form.

Janz (2007) noted an important shift in mindset.

In particular, almost all authors, researching the ways of introducing innovations in the agro-industrial complex of Albania, did so in the context of the existing western management paradigm. With this, as can be seen from a series of studies mentioned above, the specific features of Albanian farm personnel are such that any management system must adapt to the existing generational mentality and traditions.

Considering the above, the purpose of this study is to identify the main cultural codes and social characteristics of personnel and to form a specialized set of recommendations for their management.

2. Materials and Methods

Due to the evident specific features - geographical remoteness from settlements, closed communities, constant challenges, regular movements, and the absence of a stationary home in its conventional sense - this social group has been formed for many generations in a relative cultural and social vacuum.

Therefore, when it comes to managing such personnel, the existing experience of Western management is not applicable. It was decided to conduct a study according to the typology of cultural dimensions developed by Geert Hofstede to form a new approach and understand the logic, motivation, and values of Albanian agricultural workers. Within the framework of these measurements, the attitude of a person to work, the service hierarchy, life orientation, and ethnic cultural characteristics are determined.

The survey was conducted in six key categories listed below.

The PDI Power Distance index is the degree to which people who do not have power or have little power agree that power is distributed unevenly in society, *i.e.* the higher this indicator, the more society agrees that the leader has indisputable authority.

Individualism IDV – assessment of the dominance of individual interests. The higher this indicator, the less collective goals and collective responsibility are inherent in such a society.

Masculinity MAS is a focus on achieving results at any cost. The lower this indicator, the higher the value of intangible benefits, relationships in the team, quality of life.

Avoiding uncertainty UAI index is the need to have specific plans and understand how to achieve them. Consequently, the lower this indicator, the higher the willingness of this society to take risks.

The long-term orientation LTO is a kind of persistence coefficient, a willingness to endure hardships and failures here and now in the expectation of future well-being.

The IVR assumption is the degree of satisfaction with life, and readiness to fulfil one's own desires independently.

During the study, 1,514 employees of agricultural facilities in Albania were interviewed, representing different groups – by age, gender, and labour specialisation. The studies were conducted in the field on the territory. Respondents were asked to assess the degree of their agreement with the statements in six categories on a scale from "completely disagree" to "completely agree". The survey was conducted under the legend of a general sociological study to avoid distrust of the interviewer group.

For the convenience of respondents, the response scale assumed a five-point system, which was already translated into a generally accepted one-hundred-point system by the formula at the analysis stage

$$X_{100} = (X_5 - 3) * 25 + 50 \quad 2.1$$

where,

X_{100} – evaluation of the indicator according to the hundred-point system,

X_5 is an assessment of the indicator on a five-point system.

The assessments of each respondent were recorded, after which average indicators were formed for each of the six categories of measurement, which, in turn, formed the basis of recommendations on personnel management.

Results

A survey of 1,514 representatives of this social group was conducted to identify the cultural characteristics of employees of the agro-industrial complex of Albania. The respondents were randomly selected in three aimags in the centre and east of the country. Their structure in the context of the main social characteristics is presented in Table 1.

Table 1. Structure of the respondent group

Groups	Indicator	Number, persons	Specific weight in the group, %
Gender	Male	1105	73
	Female	409	27
Age	Under 20	91	6
	20–40	954	63
	40–60	424	28
	Over 60	45	3
Specialisation	Cattle breeding	1019	67
	Agriculture	495	33

Source: survey data (2022)

Since the sample was random, these proportions of indicators in social groups can be considered representative.

All cultural features measured using the Hofstede methodology were formed under the influence of society throughout the respondents' lives – "cultural programming" was created by people around them, first of all, by family, and then by work colleagues. The uniqueness of the target audience of this study, that is, employees of small family farms, lies in the fact that often in relatively isolated sums, family members, neighbours, and colleagues are practically the same team, which means that in the absence of outside opinions, the "cultural programming" of the environment produces the maximum effect.

For better contact with the respondents and the formation of confidence in the questionnaire, the interviewers d of the global social survey, because in this case, those taking part in the survey became the "majority" in their own eyes and reduced the number of psychological barriers.

First of all, it was necessary to identify the power distance index. The answers of all respondents were collected, the average score of the indicator was calculated and the index was determined according to the one-hundred-point system according to the formula (1). As a result, the PDI was 15 points out of a hundred. This means a low degree of power distance, characteristic of countries and communities where equality is valued, and the leader is perceived as a colleague and a reliable friend. This indicator also indicates the cultural traditions of decentralised management, which is evidently characteristic of life and scattered isolated farms.

The next indicator to be calculated was the individualism index. According to the results of the survey of the target audience, the average IDV was calculated – 18 points. A low indicator of this index indicates the presence of collective goals in society. Unlike individualistic cultures and companies, where employees overprotect their own personal space and rely only on themselves, the staff of Albanian agro-industrial enterprises embraces working in groups and the absence of pronounced internal competition. Historically, this is explained by the Albanian tradition for making important decisions. Therefore, the leader should avoid accepting authoritarian expressions of will without consulting the team.

The so-called MAS masculinity index demonstrates which of the two value models the collective tends to – work (conditionally male role) or take care (conditionally female). Named according to conventional family stereotypes, the roles identify the true need of team members – to receive maximum income no matter what, or to maintain human and trusting relationships among employees. This index, according to surveys conducted in selected collectives, amounted to 42 points. This means that, despite a certain balance of interests, there is a certain bias towards the "female" team, when it is necessary to concentrate efforts on taking care of the staff. It is characteristic that this index in other cultures is much higher and definitely dominates the "male" indicator. The peculiarity of the Albanian culture in the value of the MAS index can easily be explained by the substantial isolation of albanian – in the wild and depending on natural disasters, good relations within the collective can be literally life-saving.

An important cultural feature is also the readiness for uncertainty. Harsh natural conditions and difficult life are already quite unpredictable factors, which means that the target audience of the study is trying to minimise at least those risks that they can affect. Thus, the UAI score was a substantial 83 points out of 100. From the standpoint of management and personnel management, this refers to people's need for clear algorithms, formalised rules, conditions, and instructions. In addition, such a pattern of behaviour presupposes the willingness of employees to regularly interfere with management in the process as a momentary "pointing finger".

The next indicator of cultural dimensions – long-term orientation – was also examined using surveys. The resulting LTO index of 50 points indicates a predominantly neutral attitude to the idea of high goals pushed back in time. On the one hand, farmers are used to the fact that the result of their work is not immediately evident and it takes months and, sometimes, years to make sure of the successful implementation of the project. On the other hand, long hard work without visible confirmation of the correctness of the chosen path is also not for them. Evidently, in matters of long-term planning, a similar balance should be observed, and when forming global plans, intermediate control points and rewards should not be disregarded.

The final parameter is the assumption. The summed and analysed responses of the respondents eventually gave an indicator of this index of 35 points. Since communities with high IVR assumption rates are characterised as declaring relatively free satisfaction of desires, it should be stated that the target audience of this study does not perceive personal happiness as an unambiguous value. Difficult working conditions and limited resources have formed in generations of Albanian farmers the need to control the satisfaction of momentary desires and needs and introduced regulation of these impulses through a system of social prohibitions and norms. In general, the indicators of cultural dimensions of the examined community are as follows (Table 2).

Table 2. Average indicators of respondents' cultural measurements

PDI	IDV	MAS	UAI	LTO	IVR
15	18	42	83	50	35

Source: survey data (2022)

Summarising the results of surveys on all indicators, it can be stated that from the standpoint of management, the audience does not tolerate an authoritarian style and is used to taking part in decision-making. Such decisions should be made together, while the absence of conflicts and mutual trust are important in the team. The staff should understand the purpose of management changes and have the tools for intermediate control of achieving this goal. In the process of management, it is necessary to remember the presence of certain self-restrictions and taboos among employees, which should not conflict with management decisions.

Based on the generalised portrait of the employee obtained, democratic principles of leadership should be adopted to improve the efficiency and productivity of labour in agricultural enterprises in Albania.

With a democratic approach to management, all decisions are made by the manager together with the team that is involved in the planning process. Therewith, it is important to maintain a balance and avoid unnecessary initiatives of the staff, since their lack of the necessary managerial qualifications can neutralise the whole essence of managerial reforms.

Among the positive aspects of the democratic style is the prevalence of a high degree of satisfaction with their work among team members and, consequently, increased productivity. Therewith, such an approach may be ineffective in the event of critical and time-pressure situations, when a decision is needed immediately.

Considering such specific features of AIC personnel as remoteness, isolation, lack of constant monitoring, and operational feedback, some aspects of socially oriented management should also be adopted. Despite the inevitable loss of efficiency, in some cases it is the approach in which human relations in the team and a friendly environment come first, that is able to provide results in the long term.

Setting tasks to staff in the context of the measurements results can be initially visionary – *i.e.* it is quite possible that employees can clearly and in detail describe the goal set, provide tools, and they will be able to choose the methods of achieving the result themselves based on their own experience. It is proposed to conduct such an experiment on a separate focus group under conditions of increased control, and if it is successful, introduce such an innovation in other areas.

In any case, the recommended democratic leadership style is also good because it allows using the knowledge and skills of individual team members in the common interests. The life experience, practical skills, and actual qualifications of experienced shepherds and farmers are valuable resources and the task of the manager is to direct these qualities in the right area, eliminate unnecessary prejudices and thereby increase the overall efficiency of the project.

The issue of productivity growth is key in this context. The economy of Albania, which has experienced explosive growth in mining, is still in a vulnerable state, and the level of poverty of citizens is one of the highest in the region. Consequently, the growth of labour productivity in the agro-industrial complex can be an impetus to the withdrawal from the economic crisis. Conversely, low labour productivity is a key element of a self-sustaining negative feedback system known as the poverty trap or development trap. Under this system, low productivity leads to a decrease in economic indicators; a budget suffering from a deficit is forced to limit investments in education; as a consequence, the decline of the vocational training system leads to a decrease in the number of qualified personnel, which ultimately leads to an even more critical decrease in labour productivity. Therewith, it is important to understand that this refers not to the abstract productivity of some administrative or economic enterprise, but to specific people, individual labour indicators, whose effective work should form the basis of the economic revival of the country.

A qualitative growth of management in the agricultural sector is necessary to break this vicious circle.

The management principles proposed above, formed considering the special mentality of Albanian farmers, are designed to normalise productivity indicators in the medium term. In addition, it is necessary to move away from the legacy of the period of a rigidly planned economy in Albania and introduce into the study such value concepts demanded by respondents as friendly patronage from the head, decentralisation of management sources, regular industry khurals for consultations and exchange of experience, and an effective motivation system.

The motivation here can be values that are also unique and unusual for other economies and societies. In particular, the overwhelming majority of respondents noted that the best reward for effective work for them would not be money or premium household items, but young cattle, the value of which grows as they grow older. In

addition, such "alive bonuses" do not require a separate transport resource, especially valuable for a cattleman lifestyle.

Within the framework of increasing overall efficiency, the recommendation of mutual rotation of employees of the agricultural sector deserves special attention – mentally being part of the albanian culture, employees of settled agricultural farms demonstrate greater efficiency after a temporary change of situation and work in other fields. In addition, such rotations also contribute to the exchange of experience between farms.

It is important to emphasise that the growth of labour productivity as such is not an end goal in itself – even with a certain increase in indicators, the focus on primary production with a low added value substantially limits the development of farms, making them dependent on circumstances. Consequently, the increased resources obtained as a result of increasing the productivity of enterprises, yields, and livestock, it is necessary to invest in agro-processing – even the simplest points of processing of raw materials substantially increase the income of both pastoralists and farmers.

It is the adapted control system that will help to make this qualitative leap in the foreseeable future. Farmers who have established primary processing points on the territory of their farms will be able to increase income by supplying higher-grade products to the market.

3. Discussion

The problems of personnel management have been examined quite extensively before, but there has not been a narrow focus on the Albanian specific features. Nevertheless, a number of issues and solutions examined in this study resonate the conclusions of other authors.

In particular, Berber and Slavić (2022) investigated the nature and specific features of human resource management in the agro-industrial field, described the practice of the main and most important personnel management measures on the example of 12 operating enterprises in the agricultural sector. In the process of investigating motivational mechanisms in the personnel management structure of specific enterprises, the authors analysed the main management models that showed practical positive experience and proposed the most effective scheme. Such a motivational model includes in its structure a number of constituent elements – goals, objectives, principles, methods, and tools – and priority areas that allow the management of the company to increase the effectiveness of employees' work.

Adeel (2017) also examined the problem of systematisation of human resource management in agriculture. The author calculated that human capital is a more important and valuable resource than technological developments and financial sources since the time to train a qualified specialist is measured in years. In addition, he suggested that finding a person in the hierarchical structure of the company is in itself a satisfaction of internal ambitions and needs for socialisation, which serves as a certain motivation for productive work.

Zhai *et al.* (2020) examined the agricultural sector of the economy in the context of the global challenges of the growing world population and the fourth evolution of technology, reviewed thirteen different representative decision support systems and concluded that the importance of systematic development of skills and technological savvy of agro-enterprise personnel is critically high.

Since the neighboring regions of Albania have geographical problems similar to the Albanian one, the experience of the researchers of these countries in the integration of agriculture and tourism is interesting. Liu, Zhang *et al.* (2023) examined the development of remote territories in the context of green tourism gaining popularity worldwide. The results of their study show that the attraction of tourists who want to experience significant positive impact on the development of rural areas. In the context of the national and cultural characteristics of the Albanian villagers identified during the study, it can be concluded that this innovation will take root in their environment, which means that it is necessary to immediately develop the appropriate personnel management and logistics systems processes.

Its mountainous regions, due to objective geographical reasons, have a relatively low economic potential, which leads their inhabitants to lag behind in the social field. Despite the general increase in prosperity, which began in 1991, the transition to a market economy has increased the property stratification of residents of different regions of the country. Insufficiently developed regional policy has led to such negative consequences as unemployment, increased social tension, an increase in the volume of the shadow economy, and, as a result, the state budget deficit. The heterogeneity of indicators for the economic and social development of the population requires intervention. Consequently, a precise regional policy with clear algorithms for the individual development of separate districts should be the basis for the updated management concept at all levels.

Guliyeva *et al.* (2021), investigating a similar subject of the effectiveness of a personality-oriented approach in working with agricultural workers, identified that the development of employee value is directly proportional to labour productivity in the agro-industrial sector. According to the results of the analysis of the econometric model, the most stimulating factors influencing labour productivity in the agro-industrial complex were such values as the moral qualities of employees, a democratic approach in relations with subordinates, self-development, assistance in self-realisation, tolerance, and dedication to the common cause. In other words, the desire for improvement and development, the achievement of goals (both personal and corporate), freedom of expression, and the absence of total control by management with a high level of development of moral values, and tolerance in the team, leads to a substantial increase in labour productivity. All this, in a certain sense, echoes the above-mentioned results of the study and the recommendations of a democratic style in management.

Evidently, a long-term increase in labour productivity is impossible without the personal positivity experienced by employees from the work done. Bodescu *et al.* (2022) examined the relationship between productivity and satisfaction of food industry workers by conducting surveys of 254 employees and 17 managers from 60 companies. As a result, it was determined that a low level of staff satisfaction requires higher remuneration for their work. All other things being equal, it is more financially costly for employers than the services of employees with a high level of satisfaction.

Cock *et al.* (2022) analysed labour productivity in global agriculture through the prism of a choice between two concepts – nominal quantitative yield growth and efficiency of return from a conditional unit of labour expended. The authors of the study recommend further development of labour productivity according to the second concept, which assumes an increase in farm income from the transition to higher-value agricultural crops to avoid impoverishment of small farms and relocation of their employees to cities in search of more profitable work.

Colnago and Dogliotti (2020) also conducted their study on the subject of labour productivity in agriculture. As a result of their work, it was confirmed that labour productivity is a key factor in increasing the sustainability of family farm systems, income, and quality of life. The main factors shaping labour productivity were the difference in crop yields, the distribution of the labour force across various types of production activities, and their efficiency and profitability.

The essence of the study by Hogan *et al.* (2022) on the subject of efficiency growth in the field of agriculture was to identify productive techniques and technologies of work when performing specific tasks, and an assessment of the time savings that could be obtained by performing them during the peak labour intensity on dairy farms of spring calving. Labour savings were assessed for 12 substantial individual work methods and technologies, of which 5 were related to milking, 4 to calf care, 2 to cow care, and one to pasture management.

Another aspect of the problem of personnel management in agriculture is the age of employees. Urbancová and Vrabcová (2020), using the example of agricultural enterprises in the neighboring countries, examined demographic trends and the resulting problems of workforce shortage. Based on a quantitative study of 136 companies operating in the raw materials sector, the authors identified organisational advantages and effective human resource management strategies designed to ensure a generational change in farms. The surveyed respondents see the main advantages in keeping key employees, increasing motivation and productivity, and improving the organisational climate. Drawing parallels with the survey data obtained as a result of the current study, the absence of an age problem and, accordingly, the need to manage demographics can be stated.

In the process of investigating the role of personnel management, it is important to consider the information received in the context of sustainable human resource management (HRM), a trend that has been dynamically developing over the past 15 years. Kramar (2022) notes that HRM strategies are designed to define goals, methods, and types of management that personnel management specialists will be able to apply in the medium term in the context of the global sustainable development movement, involving concern for the environment and the well-being of present and future generations. The author formulates the six defining characteristics of HRM as readiness for contradictions, concern for the development of abilities, the need to recognise negative results, attention to the practical implementation of knowledge, a clear statement of values, and the development of a system of unified measurable indicators.

Thus, the results of the work done and its comparison with the experience of other studies indicate that the approach to assessing labour productivity indicators was correct. The role of management in increasing these indicators is also confirmed by the experience of a number of authors. Therewith, the unique situation that has

developed in remote pastures and agricultural enterprises in Albania requires substantial amendments when trying to transfer this experience to local realities.

Conclusions

The data obtained as a result of the study confirm the initial hypothesis that quality management has a positive effect on labour productivity and performance growth in enterprises in Albania. Therewith, any innovations in management should be evaluated in advance from the standpoint of cultural characteristics and national traditions of the farm and pastures staff.

The results of a survey conducted in the field among the target audience of interest showed that according to Hofstede's typology of cultural change, the most effective management style is democratic when leadership takes place in a relatively mild manner and the boss is an understanding friend and attentive supervisor, not a soulless commander. Therewith, it is important to maintain good relations within the team and to involve the collective council in making key decisions.

Thus, the goal of forming recommendations for effective management, which was originally set, was successfully completed. In subsequent studies, it will be necessary to analyse the results of the factual implementation of the proposed management style.

In addition, among the innovations recommended by the results of the study are:

- state control over the areas,
- introduction of the simplest relatively inexpensive technical means in farms on the level of a reconnaissance drone, sensors of humidity, acidity, temperature, lighting, etc.;
- the unification of the control system by technical means by developing an Android programme for remote monitoring of sensors in the national language;
- the creation of local places for the primary processing of raw materials;
- development of conditions for the launch of the so-called green tourism programme, which should include the development of routes, the preparation of a cultural programme, the regulation of medical insurance, and the development of logistics infrastructure.

From a practical standpoint, following these recommendations will improve the quality of management and labour productivity in the agro-industrial complex of Albania, which will provide an important impetus for the development of the economy.

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The Study on Socio-Economic Impacts of Tourism in the Golden Triangle of Odisha

Rojalin MOHANTY
Faculty of Hospitality and Tourism Management
Siksha O Anusandhan Deemed to be University, Odisha, India
mohantyrojalin789@gmail.com

Ansuman SAMAL
Faculty of Hospitality and Tourism Management
Siksha O Anusandhan Deemed to be University, Odisha, India
ansumansamal@soa.ac.in

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Abstract: The Puri-Konark-Bhubaneswar "Golden Triangle" is not only Odisha's main draw but also has enormous potential as a tourist destination. Odisha, on India's eastern coast, is an auspicious Indian state with numerous opportunities and a wealth of sights to see. The state has many natural and cultural resources, such as its beaches, arts and crafts, temples and monuments, lakes, forests, and wildlife. Millions of worshippers from all over the world visit the temple of Lord Jagannath in Puribecause it is considered one of the holiest of holy dhams in India, alongside the Sun Temple at Konark, the sole World Heritage Monument in all of India. Bhubaneswar, the state capital, is home to a wide variety of well-known tourist attractions, such as the Lingaraj temple, the Rajarani temple "widely regarded as the crowning achievement of Kalingan architecture", the Jain caves at Khandagiri and Udaygiri, the white tiger breeding grounds at Nandankanan, the site of the Kalingan war at Dhauligiri, and many others besides. Odisha has a lot of potential as a tourist destination, and there are many exciting things to see and do there, but the state has not seen a significant uptick in visitor numbers to match its product. This study mostly focused on a popular travel destination for the "Golden Triangle". Many people travel to Puri each year to pay their respects to Lord Jagannath because it is considered to be one of the four Dhams. The group travels to Puri, the Sun Temple at Konark, and the Shiva Temple in Bhubaneswar. Since so many people flock to Odisha, the area around Bhubaneswar, Puri, and Konarkhas become known as the "Golden Triangle".

Keywords: tourism; Golden Triangle; socio-economic impact; sustainability.

JEL Classification: Q01; Z32; F43; R11.

Introduction

Tourism is seen as a means of socio-economic growth in countries like India. The tourism industry is vital to the economic development and growth of many nations. Despite the worldwide economic downturn, tourism has remained among the world's most successful. Tourism's positive effects on a community extend beyond the immediate benefits it provides to the economy and the lives of its residents, however, as greater mutual understanding and harmony among the populace is one final result, peace and brotherhood are also fostered by tourism's ripple effect. India is a huge country with a rich history and a wide variety of traditions. They were one of the world's greatest civilizations. Today, India is recognised as a world heritage site alongside other major cultural destinations. Travellers to India will encounter a wide variety of monuments, buildings, religious sites, animals, plants, musical performances, and handicrafts. Odisha has a history and culture that are unparalleled. Economic and cultural growth in tourist destinations is increasingly being entrusted to festivals.

To travel to a new place to immerse oneself in a new culture, one must first define cultural tourism as a specific type of travel. Travelling away from home allows cultural tourists to immerse themselves in the traditions of their destinations. The real reason for going is to check out the historical sites and museums. Festivals and

fairs are integral to society. It helps people calm down and enjoy themselves more. All through the year, people in India celebrate a wide variety of holidays. Cultural events in Odisha are very well-known among visitors. Celebrations and traditional practices are what make Odisha famous. Odisha's many cultural celebrations serve to boost the state's tourist industry.

Odisha is unlike any other state as a tourist destination. Odisha's Golden Triangle, which includes Puri, Konark Temple, and Bhubaneswar, should not be missed on any trip to the state. To complement its status as one of the four holiest sites in Hinduism, Puri also features a long stretch of beach. Puri is the perfect place to go if you are on a spiritual quest or just looking for a relaxing beach vacation away from the hustle and bustle of the city. Visit Puri during the annual Rathyatra of Shree Jagannath if you want to take part in one of India's most spectacular celebrations. The opportunity to travel 10 kilometres outside of Puri to visit Raghurajpur. Odia artisans who practisePattachitra, Ganjapa, and palm-leaf painting call this place home. Notable Odissi dancer and teacher Guru Kelucharan Mohapatra was born there as well. From Puri, you can reach Konark, a UNESCO World Heritage Site, in about an hour by taking the Marine Drive. This Sun Temple, also called Black Pagoda, dates back to the 13th century, and its ruins still have the power to enchant visitors. This enormous building takes the shape of a chariot and is equipped with 12 enormous wheels on both sides and 7 labouring horses at the front. The statues of war stallions and angry elephants, along with the intricately carved walls, fill visitors with awe. The beaches of Balighai, Ramchandi, and Chandrabhaga are a bonus. Adventure sports fans will adore the water sports complex located close to Ramchandi beach.

The capital city, Bhubaneswar, captures the essence of Odisha. It has a long and storied history, but it is also quickly becoming India's leading centre for information technology. The Lingaraj Temple complex was constructed in the 11th century and is a stunning example of classical Odia architecture. It's known as a "Temple City" due to the abundance of historic temples located there. Parshurameswara, built in the 7th century, Mukteswara, constructed in the 10th century, Rajarani, constructed in the 11th century, and Brahmeswar are all well-known temples in Bhubaneswar. The Nandankanan Zoological Park and the rock-cut caves of Udaygiri and Khandagiri, both of which date back to the second century, are two attractions that visitors to Bhubaneswar should not miss.

1. Literature Review

Festivalgoers are a boon to the economy. Among the many ways in which community festivals contribute to the local economy is by serving as a venue for local artists to sell their wares (Jauhari & Munjal 2015). Festivals are important to a nation's economy, which is why Nagy and Nagy (2013) advocated for a year-round festival calendar to equalise demand and revenue. Increases in tax revenue and employment opportunities, new businesses moving into the area, soaring hotel occupancy rates, and positive press coverage are just some of the economic benefits of festival tourism, as noted by Nurse (2001).

The community and culture are enriched by festivals (Molina-Go´mez *et al.* 2021). They provide opportunities for the communities that host tourists to demonstrate their culture, history, religion, art, cuisine, and identity (Walker 2019). They are wonderful for strengthening community ties and fostering a deeper social economy (Richards & King 2022). They help keep traditions and values alive and help people feel more connected to their past (Jauhari & Munjal 2015). Community pride can be boosted through participation in festivals that honour local history and traditions (Ferdinand & Williams 2013, Zargar & Farmanesh 2021). Regional economic growth is aided by events and festivals, too (Getz, 1993, Gursoy *et al.* 2004). Festivals are increasingly being used as a source of both employment and revenue, capitalising on the attention and interest they attract from tourists (Shipman & Vogel 2022). The economic planning and tourism development trajectories of many regions, communities, and countries have begun to include festivals in recent years (Davies *et al.* 2010, Getz & Page 2016, Tichaawa 2016). Because of the international scope of the festival, Durgamohan (2015) found that the economic benefits for artists were not limited to the local context. This network of artists has opened doors for regional performers to appear at international festivals. According to Gaur and Chapnerkar (2015), festival tourism contributes to rampant consumerism, but they also point out that there are two poles to this phenomenon: on the one hand, people's strong religious convictions drive them to spend lavishly on religious festivals, which boosts the economy and causes price inflation in advance of the holidays.

The honest truth about Farm/agricultural tourism, cultural tourism, nature tourism, adventure tourism, and ecotourism are all examples of rural tourism. Tourism showcasing rural life, art, culture, and heritage in rural locations, which benefits the local community economically and socially, and allows tourists to interact with the locals for a more enriching tourism experience, can be categorised as rural tourism. Recently have festivals and events become practical means of improving community livelihoods and decreasing poverty (Wu & Pearce,

2013). Festival and event tourism is becoming increasingly popular around the world, particularly in emerging economies that are looking to diversify their economies, as reported by Steinbrink *et al.* (2011) & Thao & Dong (2023). Festivals can help stimulate the growth of other SMMEs, which play a significant role in creating jobs because of their size.

Direct economic gains, such as job creation and income generation, are favoured (Dwyer *et al.* 2005, Sharpley 2002) however; the benefits of festivals are many and varied, providing a holistic platform from which to approach the challenge of community livelihoods. Subsidiary industries such as agriculture, fishing, forestry, handicrafts, and food processing often receive an indirect boost from festivals beyond the direct benefits to those industries (Muresan *et al.* 2016). Cultural and community celebration events are vitally important to the residents of the state (Gaur & Chapnerkar 2015). Religious celebrations in Hinduism are not comparable. Different states, cities, and temples all have their unique customs and stories. When compared to festivals held in other parts of India (Yadukrishna 2020). Utilizing factor analysis and the Social Impact Perception (SIP) Scale, Small (2007) categorised social costs as follows: inconvenience, behavioural consequences, and personal frustration.

3. Methodological Frameworks of the Study

The research will focus on the positive and negative effects of growing tourism in the Golden Triangle region, so a project profile and an analysis of these effects are part of the research's mandate. This research suggests several steps that can be taken to improve the tourism industry in Bhubaneswar, Puri, and Konark Circuit. The study also considers the monetary and cultural concerns that have arisen as a result of the tourism development initiatives in the area under investigation. The primary goals of the research are to improve the positive impacts of tourism and to minimise the negative impacts of tourism in the Golden Triangle, as well as to assess the current state of tourism infrastructure and facilities in the study area. As a result, the local community in the Golden Triangle will receive social benefits, protect cultural traditions, and enjoy economic benefits from tourism.

The study's goals were to describe the demographics of the respondents in terms of age, gender, civil status, religion, income, and level of education to evaluate the perceived socio-cultural and economic effects of festivals in the province of "Golden Triangle" to determine whether or not there is a statistically significant difference in these perceptions when respondents were sorted into groups based on these variables and to suggest a strategy for bolstering and promoting the province's cultural tourism industry.

3.1 Objectives

- ✓ To study Odisha's potential as a tourist destination is being investigated.
- ✓ To identify the purpose of the analysis is to learn how tourism affects the economy and society.
- ✓ To explore how crucial Puri, Konark, and Bhubaneswar are as tourist destinations and to burgeoning tourism industries that have altered the local economies and communities.
- ✓ To demonstrate the purpose of examining the efforts made by the Odisha State Government and the Department of Tourism to promote the state's "Golden Triangle".

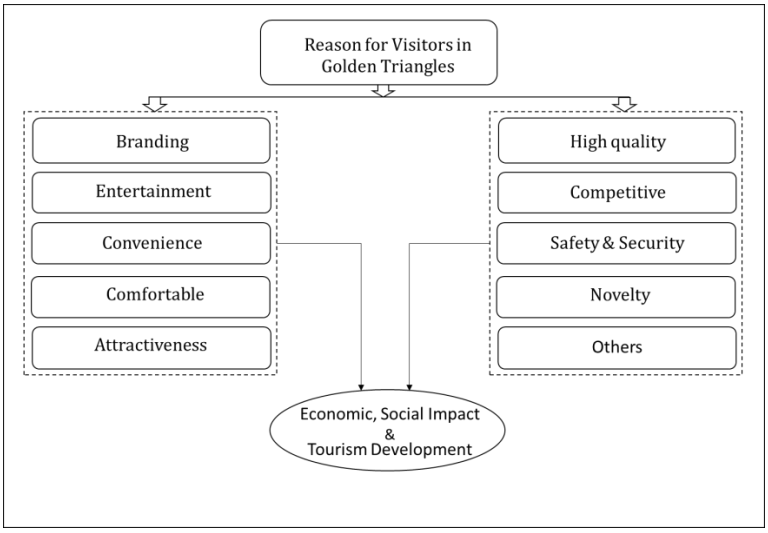
3.2 Hypotheses

H_0: There is no significant various economic and social impact due to the tourism development of the "Golden Triangle" of Odisha.

H_a: There is a significant various economic and social impact due to the tourism development of the "Golden Triangle" of Odisha.

All the information used in the proposed study has come from both primary and secondary resources. A questionnaire was used to collect the bulk of the primary data. We have collected our sample size of 1280 visitors including international and domestic visitors to the Golden Triangle and 812 residents of Puri, Konark, and Bhubaneswar so that our findings would be more easily understood by the public. All category's sample sizes were randomly determined. When surveying multiple types of respondents, we used a stratified random sampling strategy. Data collection from the communities was conducted using an observational approach as well.

Figure 1. Conceptual Framework of the Study



Taking the aims of the research into account, two sets of questionnaires were developed to collect primary data from vacationers and residents. The first round of questionnaires was created to collect data from both local and international visitors. A pilot study allowed the researcher to gauge the reliability. The questionnaires were revised based on the results of the pilot study, and they were distributed manually to ensure accurate data collection.

4. Growth of Tourism Industry

The government of Odisha has prepared a tourism development plan, focusing on a handful of strategically important areas with the highest intrinsic potential and significance. Bhubaneswar, Puri, and Konark form a triangle known as the Golden Triangle of Odisha, and they are just three of the many tourist circuits in the state that have been identified as having significant potential for growth. The Bhubaneswar-Puri-Konark route showcases the state's natural beauty and cultural heritage. Two of the most well-known are the Sun Temple in Konark and the Jagannath Temple in Puri. In addition, Puri and Konark'sneighbouring regions are home to numerous tourist hotspots, such as historical monuments, beautiful beaches, and quaint villages known for their artisanal wares. However, there is a pressing need to investigate and resolve the many problems that threaten the success of the circuit's tourism industry. This will allow the circuit's tourism goals to be met and its tourism potential to be fully realised. The tourism potential should be expanded through concerted planning and action. Therefore, it is crucial to formulate a strategy that will incorporate the efforts of all relevant organisations.

The Jagannath temple and the city's beaches are Puri's most popular tourist destinations. This temple, as one of India's most sacred sites, draws visitors from all walks of life and economic strata. Very few non-Hindus are interested in visiting this temple because they cannot enter the temple premises. Thus, more pilgrims than tourists visit this temple. However, the Konark Sun Temple is both a Dead Temple (where no worship takes place) and a marvel of architecture. As a result, it draws in people who have a keen interest in culture. Having the status of a UNESCO World Heritage Site means that it is visited by many people from other countries. Scholars conducting studies in the fields of architecture, history, and culture also frequent the site. With its position as both the state capital and the state's primary entry point, Bhubaneswar is visited by many people from all over the world.

5. Golden Triangle

Bhubaneswar, Puri, and Konarka, the three major cities in Odisha, together make up a tourist hotspot known as the Golden Triangle. It is the most visited area in the state and is home to many significant temples and monuments. The distance from Bhubaneswar to Puri is 69 Km, and from Puri to Konarak is 36 Km. Bhubaneswar is the capital city of Odisha, and it is the third pole of the "Golden Triangle" which also includes the ancient cities of Puri and Konark. Many famous landmarks can be found in these areas. At the very least, we should see the Konark Sun Temple, Chandrabhaga Beach, Puri Jagannath Temple, Puri Sea beach, Lingaraj Temple, Mukteswar Temple, Dhauligiri, Udayagiri, Khandagiri, and RajaRani Temple in Bhubaneswar. Coconut water is available on the road, and the food, includes Abhada, Khaja, and Dalma at Puri. the dal to Fish fry,

Shrimp fry, and other seafood near the sea beach, are delicious. Odisha is a state in India with a rich history and many fascinating attractions.

The Department of Tourism works to promote and position Odisha as one of the preferred destinations among domestic and international tourist markets to increase the number of tourists who visit the state and the average length of their stay. The Tourism Department has adopted a multi-pronged strategy to aggressively promote tourism in source markets to accomplish the aforementioned goals.

Figure 2. State of Odisha

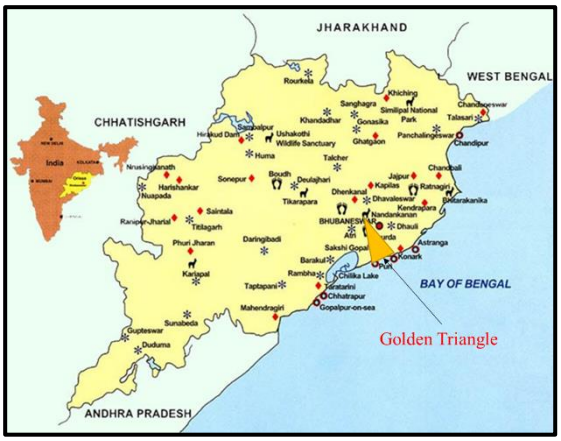
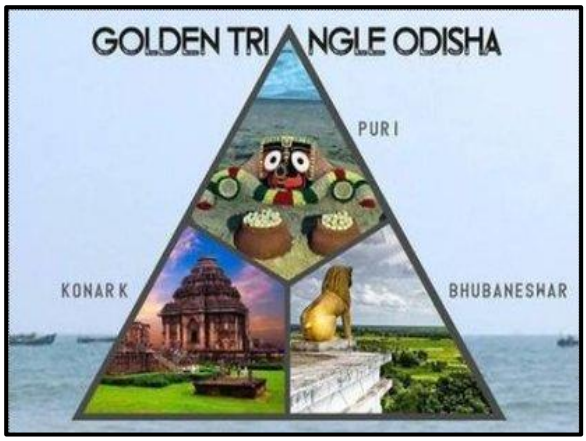


Figure 3. Golden Triangle of Odisha



On September 2021, the Department of Tourism and FICCI held a virtual celebration of World Tourism Day. This year's World Tourism Day focused on the role of tourism in fostering inclusive economic growth.As a result of Cyclone Jawad's impact on the coasts of Odisha, the annual mega-cultural extravaganza known as the "Konark Festival" set against the magnificent Sun Temple at Konarkhad to be shortened to just two days. This programme featured internationally renowned classical dance artists.Timed to coincide with the world-famous Konark Festival, the International Sand Art Festival takes place on the beach of Chandrabhaga (3 km from Konark). The festival's theme-based sand art is intended to draw visitors from all over the world.

The Rajarani Music Festival took place in Bhubaneswar's Rajarani Temple complex and was hosted by Odisha Tourism and the Odisha SangeetNatakAkademi. However, theRajarani Music Festival was called off because of the heavy downpour. From March 2022, the foothills of Dhauli played host to the Dhauli-KalingaMahotsav, an event co-organized by the Department of Tourism, Government of Odisha and the Orissa Dance Academy. The festival's organisers say their goal is to "preserve, promote, and popularize" heritage on a global scale. Near Bhubaneswar, on the banks of the River Daya, the historically significant Dhauli hills host an annual festival.

The Department of Tourism, together with the Vrindaban Gurukul Trust in Bhubaneswar (which was established by Padma Bhushan Hariprasad Chaurasia), hosted the premier Indian classical music concert, Vrindaban Mahotsav-2022, at UtkalMandap on March 2022.The event was held for the third time this year. Every year, Mahotsav is held on the evening before Holi, the festival of colours. DD Bharati and Odisha Tourism's social media channels broadcasted the concert live.

5.1 Tourists Visited Odisha

The Government of Odisha has established a Local Tourism Promotion Council (LTPC) in each destination to facilitate local involvement in destination planning, management, and maintenance.

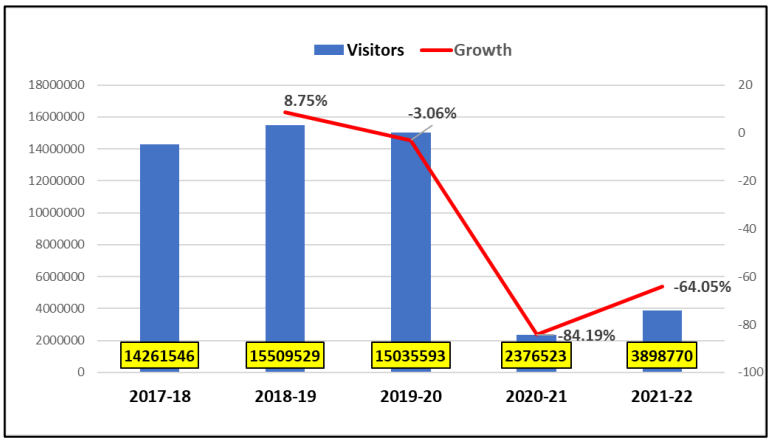
Table 1. Domestic Tourists visited Golden Triangle

Year	Tourist	Growth
2017-18	14261546	
2018-19	15509529	8.75
2019-20	15035593	-3.06
2020-21	2376523	-84.19
2021-22 (March)	3898770	-64.05

Dhauli, Khandagiri and Udayagiri, Chilika (Barkul), and Konark are just some of the popular tourist destinations where LTPCs are formed. Domestic and Foreign tourists have visited Odisha as well as Golden Triangle, which is

Bhubaneswar, Puri, and Konarka, the three major cities in Odisha, together make up a tourist hotspot known as the Golden Triangle. Being home to the state's most revered temples and landmarks, it attracts many visitors every year. The following table shows Domestic and Foreign tourists visiting Odisha as well as the Golden Triangle.

Figure 4. Domestic Tourists visited Golden Triangle

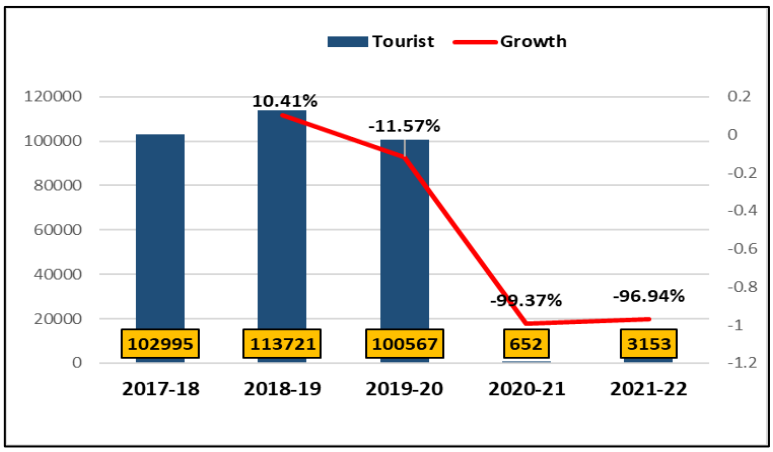


Here we are considering the domestic visitors from the year 2017 to 2022 (five years). As per the above figure, we can observe that the number of tourists visited in the year 2017-18 was around 1,42,61,546 and in the year 2018-2019 the number of tourists slightly increased and it was highest within said five years around 1,55,09,529. The growth of tourists is 8.75%, whereas in the year 2019-20 the number of tourists slightly decreased, it was around 1,50,35,593. The growth decreased by 3.06%. After that in the year 2020-21 the tourist growth rate tremendously fell due to the COVID-19 pandemic, but in 2021-22 again the tourist growth rate increased slowly and up to march the growth rate was -64.05%.

Table 2. Foreign Tourists visited Golden Triangle

Year	Tourist	Growth
2017-18	102995	
2018-19	113721	10.41%
2019-20	100567	-11.57%
2020-21	652	-99.37%
2021-22 (March)	3153	-96.94%

Figure 5. Foreign Tourists visited Golden Triangle



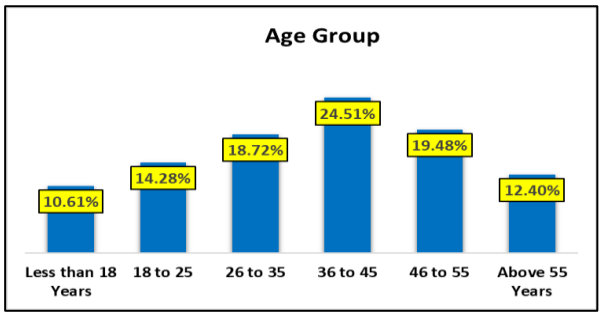
As per above table 2 and figure 5, we can observe that the number of tourists visited in the year 2017-18 was around 1,02,995 and in the year 2018-2019 the number of tourists slightly increased and it was highest within said five years around 1,13,721. The growth of foreign tourists is 10.41%, whereas in the year 2019-20 the number of tourists slightly decreased, it was around 1,00,567. The growth decreased by 11.57%. After that in the year, 2020-21 the tourist growth rate tremendously fell, it was (-) 99.37% due to the COVID-19 pandemic, but in 2021-22 again the tourist growth rate increased slowly and up to march the growth rate was (-) 96.94%.

Tourist Age Group

Table 3. The tourists age group visited Golden Triangle

Age in Years	Tourist
Less than 18 Years	10.61%
18 to 25	14.28%
26 to 35	18.72%
36 to 45	24.51%
46 to 55	19.48%
Above 55 Years	12.40%

Figure 6. Tourists age group visited Golden Triangle

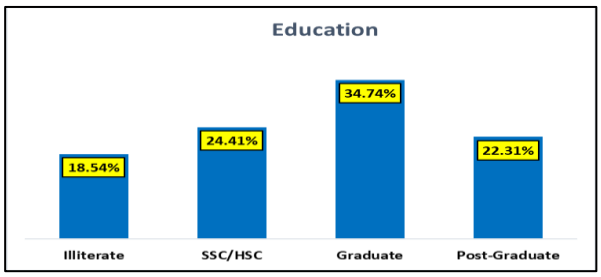


Tourist Education

Table 4. Tourists' education visited Golden Triangle

Education	Percentage
Illiterate	18.54%
SSC/HSC	24.41%
Graduate	34.74%
Post-Graduate	22.31%

Figure 7. Tourists' education visited Golden Triangle

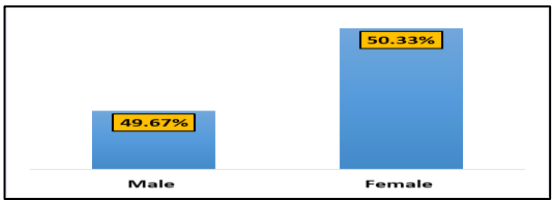


Tourist Gender Status

Table 5. Tourists gender visited Golden Triangle

Male	49.67%
Female	50.33%

Figure 8. Tourists gender visited Golden Triangle



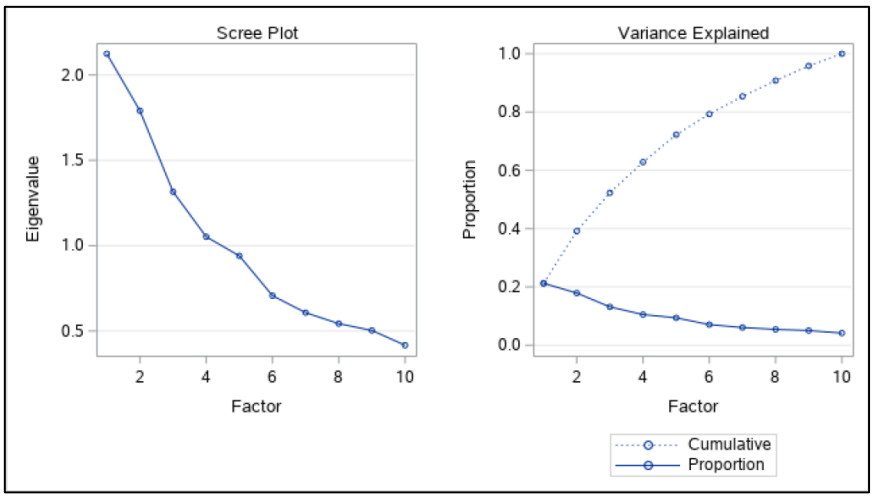
We also observe the above tourist gender status Table 5 and Figure 8 that more female visitors have mostly visited Golden Triangle in Odisha than male visitors.

6. Data Analysis and Findings

Table 6. Data Validation

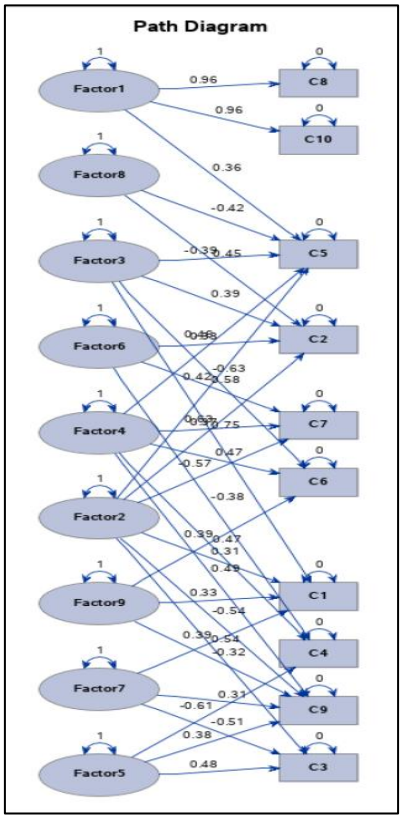
Descriptive Statistics			Eigenvalue			
Criteria	Mean	StdDev	Eigenvalue	Difference	Proportion	Cumulative
1	4.326	1.518	2.124	0.333	0.212	0.212
2	4.118	1.678	1.79	0.474	0.179	0.391
3	4.215	1.622	1.315	0.263	0.131	0.523
4	2.256	1.187	1.052	0.111	0.105	0.628
5	2.611	1.051	0.94	0.233	0.94	0.722
6	3.326	1.858	0.706	0.995	0.71	0.792
7	2.02	1.27	0.774	0.644	0.621	0.853
8	4.465	1.463	0.784	0.864	0.503	0.958
9	3.319	1.615	0.73	0.401	0.543	0.908
10	1.604	0.886	0.745	0.812	0.417	0.921

Figure 9. Tourists gender visited Golden Triangle



After Principle Component Analysis (PCA) we can observe the data validation (Table 6) of statistics and we can observe the reliability of the Eigenvalue, which is very important for data validation. Here we can see all tencriteriaof eigenvalues are greater than 0.7, which is significant in reliability. So, we can say our data is very good reliability for analysis. The Scree plot of PCA (Figure 9) is also shown very well.

Figure 10. Path Diagram of Criteria



In the above path diagram, we can observe the mostly strong correlation factors are Destination Attractiveness (C8) and the Novelty (C10) of the tourists, visit for the Golden Triangle of Odisha, which is 0.96. The second strong correlation factor is Safety & Security (C7), which is 0.75. The rest of the factors are average, which means the other criteria are also important for the tourist to visit the Golden Triangle.

6.1 Demonstrated Hypothesis

Table 7. ANOVA Table

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	1042.381041	115.820116	82.60	<.0001
Error	1431	2006.525274	1.402184		
Corrected Total	1440	3048.906315			

R-Square	Coeff Var	Root MSE	Criteria Mean
0.341887	35.21865	1.184138	3.362248

Figure 11. Fit Statistics

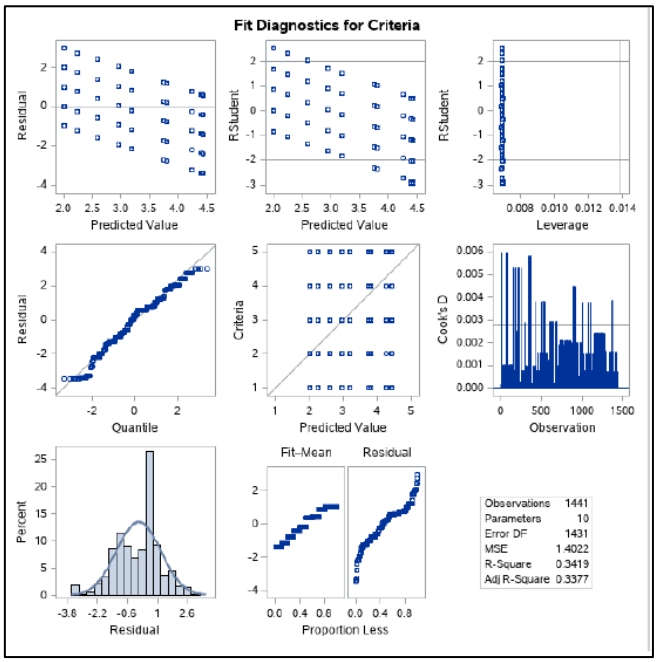
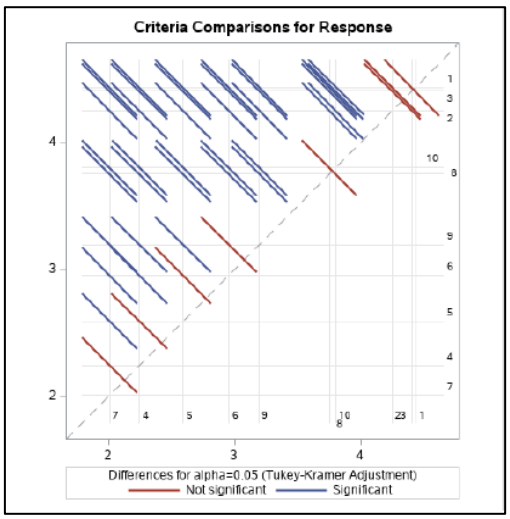


Figure 12. Comparison of Response



As per the above ANOVA Table 7, the "F" value is 82.60, which is quite good and the "P" value is less than 0.0001, which is also less than 0.05 significance. The fit diagnostic (Figure 11) shows the Mean Square Error (MSE) is 1.4022, R-Square is 0.3419, and the Adjusted RSquare is 0.3377 these values are also pretty good and acceptable. The comparison of the responsetable (Figure 12) difference in alfa is significant.

So, we can prove our hypothesis. The null hypothesis "*Ho: There is no significant various economic and social impact due to the tourism development of the "Golden Triangle" of Odisha.*" is rejected, whereas the alternative hypothesis *"Ha: There is a significant various economic and social impact due to the tourism development of the "Golden Triangle" of Odisha."* is accepted.

It is inferred that there is a significant impact, and it also means that there is a sign of the overall satisfaction of tourists based on their demographic profiles, various economic conditions, and social activities are most important for tourism development and Golden Triangle of Odisha.

Conclusion

It encourages cultural exchanges between visitors and locals by drawing them to community events. Spending by event tourists on local goods and amenities has a direct economic effect on local productions and spreads the benefit more widely across the economy and the community, and these tourist hotspots have a significant impact on the local economy both directly and indirectly. There must be something in it for both the host and the guest. Empirical studies have revealed that tourism has many positive effects on the local economy, culture, and society; however, more work needs to be done to better showcase local culture to visitors. This article has highlighted the Golden Triangle in Odisha and discussed the many positive social and economic effects that tourism has there. There's no denying that the social impact of tourism is a hot topic right now. A lot has been written on the subject, but unfortunately, the vast majority of it consists of the researcher's opinions rather than hard data. However, in recent years, interest in visiting Odisha's Golden Triangle has skyrocketed.

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Agrarian Governance – Who, What, Why, How, Where, When, Price, Level?

Hrabrin BACHEV
Institute of Agricultural Economics, Agricultural Academy, Bulgaria
hbachev@yahoo.com

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Abstract: The problem of understanding and evaluation of agrarian governance is among the most topical academic and practical tasks. However, there are huge differences in understandings of the governance among scholars, practitioners, official and business documents. Sometimes it is associated with the top management (country, organization); sometimes it is related to government agencies (public administration); sometimes it encompasses the management outside government entities; sometimes it is synonym of Management or a part of Management of organization, while in some case it is more general than Management including a variety of modes. This article adapts the New Institutional Economics methodology and proposes an adequate definition and framework for analyzing the system of agrarian governance. Based on a critical review of publications and experiences, the agrarian governance is understood as a complex system including: agrarian and related agents involved in making management decisions; rules, forms and mechanisms that govern behavior, activities and relationships of agrarian agents; processes and activities related to making governing decisions; a specific social order resulting from functioning of the system. Analysis includes individual elements for the system, different levels and main functional areas, for which adequate methods of institutional approach are suggested. Personal characteristics of participating agents, institutional environment, transaction costs and benefits, comparative efficiency of alternative governing structures, and "time factor" are considered. First holistic assessment found that Governance of Bulgarian agriculture is at moderate level having in mind EU perspective. Highest performance is attained for principles Equity and Solidarity and Good Working Public Sector while in terms of Working Private Sector and Stakeholders Involvements it is lowest.

Keywords: governance; agriculture; definition; assessment; Bulgaria.
JEL Classification: Q12; Q14; Q15; Q18; Q56; R11.

Introduction

The term Agrarian Governance are widely used in official documents, management practice, and in numerous academic publications around the globe and Bulgaria (Backer 2011; Bevir 2012; Bloor 2022; Boevski 2020; Braun and Birner 2017; Carbone 2017; Chakrabarti 2021; Chhotray and Stoker 2009; Darjaven Vestnik 2020; DFID 2010; Frija *et al.* 2021; Freidberg 2019; Ganev *et al.* 2020; Georgiev 2013; German 2018; Herrfahrdth 2006; Katsamunska 2016; Kumar and Sharma 2020; Ledger, 2016; Levi-Four 2012; Muluneh 2021; Morfi 2020; Schwindenhammer 2018; Shand 2018; Tleubayev *et al.* 2021; Torres-Salcido and Sanz-Cañada 2018; Weiss 2000). The significant academic, public, and private interest in the study of the governance system is dictated by the fact that the effectiveness of the specific governance system ultimately (pre)determines the degree of achievement of the diverse goals and the type of socio-economic development of a given country, industry, region, community, ecosystem, economic organization, etc. The relevance of the problem is also strengthened by the numerous examples of "failure" of the existing governance system on a sectoral, national, and international scale, the major socio-economic and ecological challenges and "crises" of various types, and the strong social "pressure" towards and drive by government, professional and business organizations to "reform" and "modernize" the existing governing system. The experience of Bulgaria and other countries shows that this academic and social problem is far from being solved. One of the main reasons for this is that an adequate holistic approach to understanding, analysing and evaluating the governance system in general and in the agrarian sphere in particular is not yet applied. The aim of the article is to adapt the interdisciplinary methodology

of the New Institutional Economics and to propose an adequate definition and approach to analyse of the system of agrarian governance in Bulgaria.

1. Content and Evolution of the Understanding of Agrarian Governance

The content of the Governance category is constantly expanding and enriching, which is determined both by the development of theory and the evolution of the forms used in practice, and the needs for evaluation and improvement. In view of its significance, Governance represents a growing interest for independent study by scholars in multiple disciplines - political scientists, legal scholars, sociologists, historians, economists, etc. In parallel, many new (specialized) areas of scientific research and governance practices are being identified and developed depending on the subject, functional area, level or type of management: program governance, contract governance, supply chain governance, environmental governance, agricultural sustainability governance, water, land and landscape governance, e-commerce governance, global governance, etc. Individual researchers and disciplines typically apply their own definitions of this key concept. Recent decades have seen borrowing and mutual enrichment, and interdisciplinarity of approaches to understanding and analyzing Governance from scientific disciplines and social practices.

The term Governance is derived from the Greek word kubernaein ("to steer") and is believed to be used as far back as Plato (Malapi-Nelson 2017). The term was later adopted from Latin, then from Old French, and from there into Medieval English, from where it gained worldwide distribution (Vymětal 2007). In more recent history, this term was used in the sense of "the specific activity of governing the country" (Tyndale and Frith 1831), and as distinguished from individual governance and in relation to institutional structure, originally used by Charles Plummer in The Governance of England (Wikipedia 2023). After the modernization of the late 18th century, when the state became decisive for solving complex socio-economic problems, the term Governance acquired "political significance" (Vymětal 2007). It becomes an expression of government and state policy, reflecting its form and/or the effectiveness of the intervention measures taken. This approach to understanding the category associates it solely associated with power and force, and with the government's activity of direct care, command and control "from above" through public bureaucracy.

As a result of the complexity of socio-economic processes and challenges, the development of globalization, economic integration and democratization, and the numerous "failures of the state" and the fundamental reformation of the public sector, a new understanding of governance has been developing. In this connection, the term New Governance arose, which refers to the changes in the state that began in the 1980s (BRITANICA 2023; Higgins and Lawrence 2005 Planas *et al.* 2022; Trubek and Trubek 2007). This "broader" understanding is related to the transformation of "services" from public administration to market, private, non-governmental and network structures, increasing the role of outside and above state organizations and civil society, and (the need for) cooperation and interaction of numerous public and private institutions and organizations.

It is generally accepted that Governance is a general, complex, multifaceted concept that is difficult to define in a precise way (Ali 2015; Fukuyama 2016; Higgins and Lawrence 2005; Scmitter 2018; Vymětal 2007). Attempts to define Governance can be grouped into several directions:

First, the traditional understanding of governance as agents (individuals, agencies, organizations, etc.) who govern and/or participate in governance – President, Parliament, etc. (Fukuyama 2016). In a narrower understanding, Governance is seen as a synonym for public administration, and in a broader sense it includes non-sovereign and informal agents outside the state system - international and non-governmental organizations, supra-national institutions such as the European Union, etc. For example, in the popular New Governance paradigm, the question of "Governance without Government" is posed, which means the transfer of many traditional functions from the state to private and non-governmental organizations - provision of public goods, services, regulations, control, (self) organization, etc. In this connection, the various agents are also identified, defined as governing units that can govern - government, formal organization, socio-political, or other informal group of people. In traditional economics, for example, the main governing units that optimize the allocation of resources in accordance with their interests are households and firms.

Second, defining Governance as a process of governing. Many authors accept that governance is the decision-making process and the process by which decisions are implemented (or not implemented) in society or in an organization (Ali 2015; IoG 2003; Planas *et al.* 2022; UNDP 1997; Wolman *et al.* 2008). This "processual" understanding of Governance makes a connection with traditional Management, which is essentially a purposeful process of making managerial decisions at different levels of governance. Many international organizations also define governance in this way, mostly in relation to a given country, a certain industry, etc. – "governance

consists of traditions and institutions through which power in a given country is exercised" (World Bank 1992, 2022).

Similarly, economic governance is defined as the processes that support economic activity and economic transactions by protecting property rights, sanctioning contracts, and taking collective action to provide appropriate physical and organizational infrastructure (Dixit 2016). In the traditional economy, the market equilibrium is reached namely through a process of decentralized actions of the economic agents (individuals, firms, households) governed by the "invisible hand of the market". In the New Institutional Economics, in addition to the "public" level Public Ordering) and market management (Market ordering), an important component of the governing process is also private ordering (Williamson 2005).

Third, defining Governance as a means (precondition) and a set of rules, means, methods, structures and mechanisms that govern people's behavior, activity and relationships (Furubotn and Richter 2005; Scmitter 2018; Vymětal 2007; Williamson 1996; 2005). "Governance has become a buzzword today describing the whole set of approaches and techniques for improving coordination between different levels of society" (Vymětal 2007). Similarly, economic governance refers to the policies and regulations that are put in place by governments to manage the economy, including macroeconomic management and microeconomic management (AAID 2008). Economics is a science that explains the "miracle" of how an order of maximization of private and aggregate product (welfare) is achieved by the actions of millions of individuals who specialize and exchange the products of one or other operations. The answers in Neoclassical Economics are that this is done (directed, coordinated, incentivized, sanctioned) by the "invisible hand of the market" and/or the "visible hand of the manager". Rare cases of "market failure" are found, but all of them are easily overcome with "state intervention".

The Old Institutionalism puts on the agenda the important role of institutions (introduced "from above" or evolved "from below") to "correct" market failures and govern the behavior of individuals. The classics of the New Institutional Economics also consider Governance in this sense: "Governance is the means by which to introduce order, thus mitigating conflicts and realizing mutual benefits" (Williamson 2005, 2009). What is new here is that the "strange world" without transaction costs is left, and the market, hybrids, firms, and bureaus are considered as alternative structures and forms of governance of transactions (Coase 1939, 1991, 1998; Williamson 1996, 1999, 2005, 2009). Although they do not always mention this term, Coase, North, and Ostrom also analyze certain rules, mechanisms, and forms (institutions, structures, social arrangements, etc.) that govern the activities of individual agents and ultimately predetermine economic development (Coase 1937, 1960, 1991; North 1990, 1991; Ostrom 1990, 1999).

Fourth, Governance is seen as a specific social order and the result of process of managment - "the state of being governed" and "getting work done by mobilizing collective resources" (Dixitr 2016; Fukuyama 2016; Scmitter 2018; Vymětal 2007). Here it is presented rather as a general order and framework that determines the conditions, harmony, and overall effect of decentralized efforts - the management of the activities and relations of agents pursuing their interests. Accordingly, in a given country, regions, industry, etc. different types or models of governance may dominate - "Rule of Law", "Rule of Money", "Rule of Force", etc.

This understanding makes it possible to better distinguish specific governance systems in different countries, industries, eco-systems, organizations, stages of development, etc. The same governance structures and models are known to have unequal results in different countries. Some researchers limit governance only to the social and political order other than that of the state in view of the "new" role of the market, network structures, non-state agents and the informal sector (BRITANICA 2023). The New Institutional Economics analyzes a different kind of principled order – market, private, public, international, etc.

This understanding is largely related to the study of the "quality of management" and the effort to improve the governance system, as "desired" states such as "good", "efficient", "honest", "sustainable", "transparent", "democratic" etc. becomes a criterion for its evaluation and a goal of development (EC 2018; UN 2015). Much of the Good Governance literature focuses on 'Governance as Implementation', namely the government's capacity to provide basic public goods and services (Fukuyama 2016; Osabohien *et al.* 2020; Ronaghi *et al.* 2020). Increasingly, these characteristics are also applied to assess governance in the private (corporate, agribusiness, etc.) and non-governmental sectors (Dimitrov *et al.* 2014; Aguilera and Cuervo-Cazurra 2009; Benz and Frey 2005; OECD 2015; Rodorff *et al.* 2019; Sacconi 2012; Skerman 2016).

In that "normative" direction, the definitions of international, state, non-governmental and business organizations are also supplemented - for example, the current definition of governance of the World Bank also includes "the process by which governments are elected, controlled and replaced; the government's capacity to effectively formulate and implement rational policies; and respect for citizens and the state of the institutions that govern their economic and social relationships (World Bank 2022). Governance Economics is precisely an

attempt to apply "the study of good order and working arrangements", which includes both - the spontaneous order of the market and the deliberate order of a conscious, deliberate, and purposeful kind (Williamson 2005).

There are also many definitions that combine some of the characteristics of governance described above (EC 2018; WB, 2023). It is rightly noted that "Governance is not only a characteristic, but very often a system, with some subjects, some processes, some prerequisites, causality and results" (Vymětal 2007).

Approaches to defining Agrarian Governance, in the ever-growing literature in this field, are similar to those of Governance in general, following the common logic of development in this dynamic field. Some of the most in-depth analyzes of the agrarian governance system do not even attempt to define this category, which is taken for granted and widely known (James, Klein and Sykuta 2011; Sykuta 2010; Cook 1995; Sykuta and Cook 2001; Sykuta and Parcell 2003).

Agrarian Governance is the governance related to agricultural production. Therefore, it is "easy" to define the object of this "sectoral", along with industry, transport, health care, etc., governance. It order to understand the essence of the Governance category, it is necessary to answer the following questions: Who, Whom, What, Why, How, Where, When, How Much and How Good?

It is obvious that Governance is related to people and human society, for without them there is only "natural governance" according to the laws of physics, biology, etc. In a hypothetical example of an individual farmer living alone on a remote island in the ocean, there is no governance, but simply "agronomic and technological" management or Management of "(mutual) relations" with nature. In modern agriculture, however, there are no such examples. Even for a self-subsistent farmer, far from populated areas (a mountain, an island, a desert oasis), there is some "external" control of activity and behavior[14] For example, there are "vested" and sanctioned property rights (for private possession, usage, management, etc.) over agricultural land by the state, local government, or community.

In modern conditions, there are also a variety of mandatory states, European Union, local community, etc. regulations on the manner of cultivation and use of the land, standards for the protection of biodiversity and the environment, etc. For example, the use of certain chemicals in agricultural production and the production of cannabis in Bulgaria are prohibited and punishable; changing the use of agricultural land for non-agricultural purposes is inadmissible and strictly regulated, etc. In addition, there are also informal obligations and restrictions for the farmer to respect comfort of the population and guests of the area, protection of air and water, joint use of private resources (for example, free access to the territory for tourists, hunters, scientists, etc.), order for use of municipal lands, etc. With all these formal and informal rules and restrictions (social governance system) the farmer (must) complies in order not to be sanctioned by law enforcement or society.

The farmer, however, is not a passive "participant" in (object of) governance. He lobbies or engages in collective action with other agents in the political process to get new rights, regulations, norms, government support and subsidies, etc. that suit his beliefs or interests. In this way, he becomes an active participant in the governance system of a given ecosystem, region, subsector, or the country as a whole. This simple example already answers the question Who and Whom?

In another example, with a typical market-oriented farmer in a lowland area, the presence and need for (a system of) governing relationships with other agents is much more obvious. For example, the farmer-entrepreneur must manage his relationships with landowners, labor, suppliers of inputs and services, credit, buyers of produce, etc. in order to effectively organize the production and sale of produce. For the coordination of a large part of these relations, various types of private contracts are used for supplying the necessary resources and marketing the product - contracts for purchase, hiring, borrowing, selling, provision of a loan, etc. In the conditions of developed markets, much of the farmer's activity and his relations with other agents is coordinated and "managed by the invisible hand of the market" - the "movement" of (free) market prices and market competition.

Along with this, there are also a variety of formal, informal and business rules, regulations, norms, and standards that the farmer observes or complies with - for product and service quality, specifics of technological operations, labor and product safety rules, norms for the protection of natural environment and biodiversity, animal welfare standards, etc. In addition, the farmer creates and/or joins different types of collective actions and organizations to coordinate and govern more effectively his relationships with other agents or authorities - registered agricultural holdings, companies, cooperatives, associations, lobbying and interests groups. He also

[14] The activity and behaviour of even the solitary Robinson Crusoe is "governed" by the native (English) ideology, beliefs, traditions and other "institutions" that he brought to the island and subsequently spread - Christianity, slavery, rights, etc.

has his own or accepts other beliefs, ideologies, views, norms, etc. – for example, for an ecologically sustainable farm, which also (self-) manage its behavior, actions and relationships.

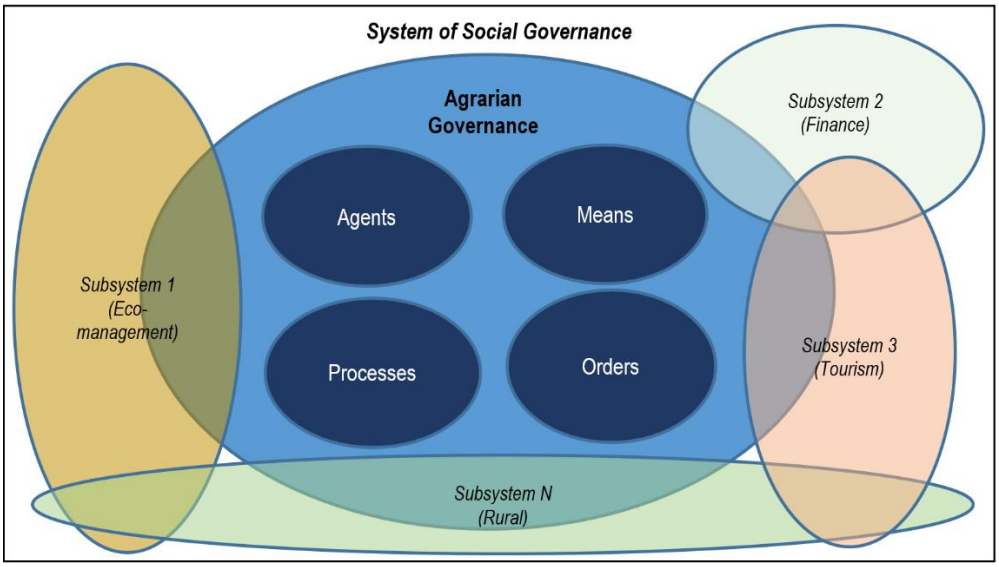
All these (management) structures, forms and mechanisms are an integral part of the governance system of agrarian production at the modern stage of development and should be analyzed. Moreover, the governance system in a given country, sub-sector, region, supply chain, ecosystem or organization is highly specific and dependent on multiple socio-economic, personal, natural, etc. factors. It is well known that the Common (agricultural, economic, environmental, etc.) policies of the European Union are applied in specific "Bulgarian way" in the conditions of Bulgaria. Identifying and evaluating these specific structures, forms, and mechanisms answers the What, Why, and How?

The process of agrarian governance takes place in different time periods and spatial-territorial, organizational and hierarchical boundaries. Governance analysis should always specify these dimensions and answer the Where and When questions to be precise. In addition, the Economists ask another question related to the analysis of agrarian governance, namely How much? Different forms and structures of governance have different advantages, disadvantages and costs for individual agents, the latter known as “transaction costs” (Coase 1937, 1960; Williamson 1996). Agrarian agents optimize not only production costs (related to production technology), but also transaction costs related to governing relationships with other agents. Governing structures have an important economic role - to rationalize, structure, and minimize the costs of human relations (North 1990; Williamson 2000). The "discovery" of transaction costs does not change, but only adds to the Economic science subject of optimal allocation of limited resources.

Last but not least important is the question of the quality of the system of governance - there is a good governance and there is a bad governance, and multiple Levels between these two extremes.

Therefore, agrarian governance is to be studied as a complex system that includes four principle components (Figure 1): (1) agrarian and related agents involved in the governance decision-making; (2) rules, forms, and mechanisms that govern the behavior, activities, and relationships of agrarian agents; (3) processes and activities related to making managerial decisions; and (4) a specific social order resulting from the governing process and functioning of the system.

Figure 1. Components and Relations of the System of Agrarian Governance



Source: author.

The agrarian governance system is a part (subsystem) of the social governance system and other important governance subsystems such as economy, primary industry, food, rural or urban areas, agro-ecosystem, tourism, energy, etc. The impact of and relationships with other systems of society largely (pre) determine the type of dominant system of agrarian governance and the "logic" of its development. For its part, agrarian governance is a set of different governance subsystems, differentiated depending on the type of production (plant breeding, animal breeding, fruit growing, agro-ecosystem services, etc.), the type of resources (land, water, technology, lab The agrarian management system is a part (subsystem) of the social management system and other important management subsystems such as economy, primary industry, food, rural or urban areas, agro-ecosystem, tourism, energy, etc. The impact of and relationships with other systems of society largely

(pre) determine the type of dominant system of agrarian governance and the "logic" of its development. For its part, agrarian management is a set of different management subsystems, differentiated depending on the type of production (plant breeding, animal breeding, fruit growing, agro-ecosystem services, etc.), the type of resources (land, water, technology, labor, finance, etc.), the functional area (inputs supply, innovation, marketing, risk management) etc. All of them should be studied in order to identify their specificity and role for the development of agrarian governance in general. Agrarian governance consists of (carried out at) different levels (farm, collective organization, ecosystem, subsector, national, transnational, European, global), which are to be analyzed to understand the functioning and development of agrarian governance in Bulgaria.

2. Framework for Analyzing and Assessing Agrarian Governance in Bulgaria

In a traditional closed subsistence economy, transaction costs do not exist because there is (almost) no division and specialization of labor, and therefore no need for exchange (transactions) between agents. In modern agriculture, however, agrarian agents specialize in certain productions and/or activities and trade products or services, thereby increasing productivity many times over (economies of scale and scope, and production costs, improving quality, increasing production volume, etc.).

In an unrealistic world of "zero transaction costs", the optimization of the allocation and use of agrarian resources is achieved quickly and costlessly according to the "marginal rule". Here, there is only one mechanism (the market and market competition) that effectively governs the individual and overall activities of agents. The farm, firm and household are studied as a "black box" that adapts instantly and costlessly to market price dynamics. With zero transaction costs, the form of governance has no economic significance, since agricultural activity is equally well (most efficiently) coordinated through the market (adaptation to changes in free market prices), and through mutual private bargaining between agents (special contract), and through cooperation (collective decision-making), and in an internal organization (direction by a manager), and in a single national private or state hierarchy/company (Bachev 2012).

In a real agrarian economy, however, there are significant costs associated with transactions between agents: for finding the best prices and markets, paying commissions and fees, finding a reliable partner, negotiating terms of exchange, writing and registering contracts, controlling of opportunism before signing and in the process of implementing agreements, adapting contracts to changes in production and exchange conditions, dispute resolutions, including by hiring lawyers, arbitration, court, etc., failed deals, fraud, etc. Agrarian agents also pay significant (transactional) costs for studying and implementing formal regulations related to resource use, production, technology, trade, nature conservation, etc. Farmers also have significant costs for formal registrations, certifications, licenses, applying for public support, paying fines, bribes, etc. Many agrarian agents also have coalition costs (partnership, cooperative, firm, corporation) related to the need for more efficient joint supply and use of resources, marketing, protection from monopoly, lobbying for government intervention in their favor, etc. The creation and development of these formal and informal organizations is associated with significant costs of initiation, negotiation, formation, organizational enhancement, information, management decision-making, controlling the opportunism of coalition members, reorganization and closure, etc.

The positive transaction costs often limit efficient farm expansion to a size that allow exploitation of possible technological economies of scale and scope. In other cases, high "external" transaction costs necessitate excessive intra-firm integration to overcome serious transactional difficulties and/or extract additional transactional benefits. Very often, high transaction costs even block an otherwise mutually beneficial exchange of resources, products and services, and lead to low productivity and under-utilization of resources on an enterprise and societal scale. Therefore, instead of "the first best", in practice we usually have "second best", "third best", etc. allocation of resources and governance of aggregate agrarian activity.

Agrarian economy is a Transaction costs economy, and the question is to optimize the total production AND transaction costs of the farm. This is a trade-off between transactional and production costs and benefits. Following the logic of Coase, the farm integrates additional transactions, increases its size and profits from internal integration of resources and activity, while the transaction costs of this are less than or equal to the costs of organizing these same transactions in the market or by another organization (Bachev 2012). Governance “matters” and “rational” agents select the most efficient form of governance for each transaction among practically possible alternatives (Williamson 2005). In the New Institutional Economy, the transaction and related costs are the "basic unit of economic analysis", and the criterion for choosing the most effective form of governance of

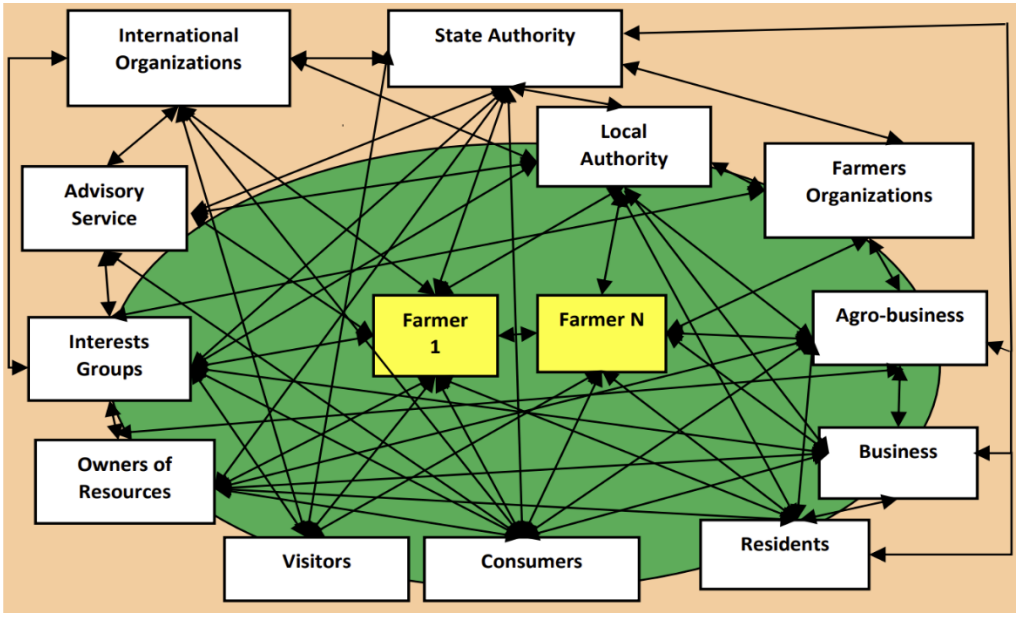
agrarian transactions and activity is the minimization of transaction costs and the maximization of transaction benefits.[15]

Moreover, the “problem of social costs” that has troubled traditional economists does not exist in a setting of zero transaction costs and well-defined private property rights (Coase 1960). The state of maximum efficiency is always achieved regardless of the initial distribution of rights between individuals through cost-free private negotiations - "internalization of externalities" without the need for state intervention. In a world of zero transaction costs, the definition (redistribution) of new rights and rules by individuals, interest groups, and society, and the effective sanctioning of these rights and rules, would be also easy (costless). However, when transaction costs are significant, the initial distribution of property rights among individuals and groups, and their well-defined and sanctioned nature, are critical to overall efficiency (Coase 1960). For example, if the "right to a clean and preserved natural environment" is not well defined and enforced, it creates great difficulties for effective eco-management - costly disputes between polluters and affected agents; significant environmental issues and challenges; disregarding the interests of certain groups or generations, etc. (Bachev 2020).

Imperfect institutional arrangement (undefined and/or poorly defined and enforced by the state authority rights and obligations), creates additional transaction costs for individuals and society, and leads to inefficient agrarian development. In Bulgaria, for example, the restoration of private rights to agricultural land after 1989 lasted more than 10 years, which greatly deformed the development of agriculture during this period - lack of incentives, destruction of assets, dominance of short-term leases, preference for annual crops, primitive and unsustainable structures (farms for self-sufficiency or in the process of privatization), degradation of agro-ecosystems, etc. There are numerous examples of private rights not protected by the state even now, which lower the efficiency and hinder the development of the sector - non-compliance with the laws, ineffective legal protection, direct encroachment (theft) of agrarian property, etc.

Therefore, institutions are an important means of (agrarian) governance by creating a certain social order, structuring human relationships, increasing predictability, reducing uncertainty, predetermining (increasing or decreasing) the amount of transaction costs, and ultimately determining the possibilities, type and extent of socio-economic development (North 1990; Williamson 2000). Given a certain institutional environment, the market often "fails" to effectively govern agrarian activity and resources. However, this does not necessarily mean "state intervention", as is the rule in Neoclassical Economics. Agrarian agents develop a variety of private forms, mechanisms and “institutions” to overcome market imperfections and to effectively govern their behavior, activities and relationships. The correct approach in the New Institutional Economics is to make effective choices between various alternative modes of (market, private, and public) governance, all of which have their own disadvantages and costs.

Figure 2. Agents of Agrarian Governance in Bulgaria



Source: author.

[15] Eventually, the choice of governance form is predetermined by the logic of minimizing not technological but transactional costs (Williamson, 2005).

The analysis of the country's agrarian governance system is to include several stages. First, it is necessary to identify the various agents of agrarian governance and the specific nature of their relationships, interests, goals, opportunities, power positions, dependencies, effects, conflicts, etc. The farm entrepreneur or farmer is the main figure in agriculture who manages resources, technology and activity, and therefore the "first" component in the analysis of agrarian governance (Figure 2).

Other agents also directly or "indirectly" participate in the governance of the agrarian sphere by negotiating and/or imposing relevant conditions, standards, norms, demand, etc. These are the owners of land, labor, material, financial, intellectual, etc. resources that are interested in their effective agricultural use and preservation. Often, they participate in various coalitions with the farmer entrepreneurs (informal partnership associations, formal firms, cooperatives, etc.) to realize more benefits. In turn, individual farmers form a variety of professional (business, not-for-profit, etc.) organizations and collective actions (initiatives, professional standards, lobbying, etc.) to better realize their goals and profit from joint activity.

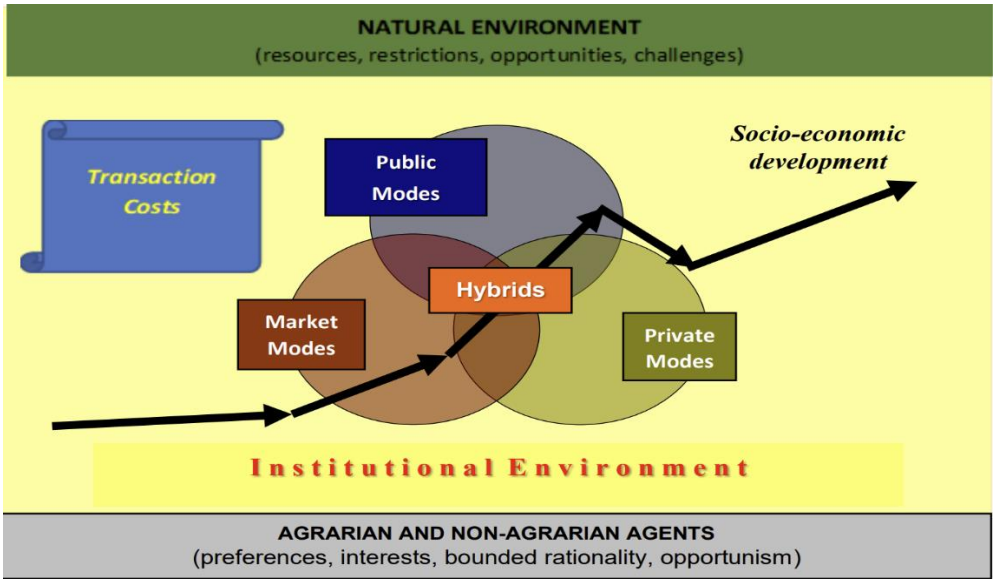
This is the agriculture-related business (suppliers of materials, equipment, finance and technology and/or buyers of agrarian products) and end users. These agents impose socio-economic and environmental standards, specific support and demand for farming activities and services. For example, a large number of large processors and food chains implement (voluntary and/or mandatory) standards for "quality", "eco-friendliness", "fairness", etc., which are their initiatives, generally accepted industry "codes of conduct" or the result of consumer pressure to "contribute" to socio-economic and environmental sustainability.

Next, it is the residents, visitors to rural areas, and the various interest groups that "set" the conditions (pressure, demand) for environmentally friendly, socially responsible and economically viable agrarian activity and areas. Finally, it is the state and local government, international organizations, etc. that support the agrarian sustainability initiatives of the various agents and/or impose mandatory (social, economic, environmental, etc.) production and consumption standards.

At this level of analysis, special attention is to be paid to the "personal" characteristics of individual agents involved in governance, since transaction costs have two "behavioral" origins - the bounded rationality and tendency of individuals for opportunism (Williamson, 2005). Agrarian agents do not have all the information about the economic system (price differentiation, demand, trade opportunities, development trends) because collecting and processing such information is very expensive or impossible (multiple markets, future events, partner's intention to cheat etc.). In order to optimize decision-making, they incur costs to "increase their imperfect rationality" - data collection, analysis, forecasting, training, consulting, etc.

Besides, agents are also "opportunistic", and if there is an opportunity to obtain additional benefit with impunity from using institutions, contracted or market exchange, they are likely to take advantage. Agrarian agents are to protect rights, investments and transactions from the risk of opportunism by: ex-ante efforts to find a secure partner and design a form of effective partner cooperation; and ex-post investments to prevent (by monitoring, controlling, incentivizing cooperation) possible opportunism at the contract implementation stage (Williamson 2005).

Figure 3. System of Agrarian Governance



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It is also necessary to analyze other significant factors of individual agents such as personal preferences, "discipline", ideology, knowledge, capabilities, propensity to take risks, reputation, trust, "contracting" power, etc.

Second, it is necessary to identify, distinguish, characterize and evaluate the principal mechanisms and forms that govern the behavior and activities of individual agents. These include (Figure 3):

- The analysis has to distinguish the all possible types of opportunism: pre-contract (Adverse Selection), when a partner takes advantage of the "information asymmetry" and negotiates better terms of exchange; post-contractual (Moral Hazard), when a partner takes advantage of the impossibility of fully controlling his activity (by the other partner, a third party) or receives a "legitimate benefit" from unexpected changes in the terms of exchange (costs, prices, regulations); and "free riding" type inherent in the evolution of larger organizations – since individual benefits are not proportional to individual costs, there is a tendency for each to expect others to invest in organizational development and to benefit in case it is successful.

The institutional environment or the "rules of the game" - this is the distribution of rights and obligations between individuals, groups and generations and the system for enforcement of these rights and rules (North 1990; Furubotn and Richter 2005). The spectrum of rights may include tangible and intangible assets, natural resources, activities, working conditions and wages, social protection, clean nature, food and eco-security, intra- and inter-generational justice, etc. Sanctioning of rights and rules is carried out by the state (administration, police, court, etc.), public pressure, trust, reputation, private forms, or is self-sanctioned by the agents themselves.

Part of the rights and obligations are determined by formal laws, normative documents, standards, court decisions, etc. There is usually strict government regulation of ownership, use, trade, etc. of agricultural lands and other natural resources, mandatory standards for product safety and quality, working conditions, protection of the natural environment, animal welfare, etc. There are also important informal rules and rights established by tradition, culture, religion, ideology, ethical and moral norms, etc., which are to be analyzed. In Bulgaria, many of the formal rights and rules "do not work" well and the informal "rules of the game" predetermine ("govern") the behavior of agents in society, and there is also a huge informal ("gray", "black") sector.

Institutional development is initiated by public (state, community) authorities, international politics (agreements, assistance, pressure) and private and collective actions of individuals. Bulgaria's membership in the European Union is related to the adaptation of modern European legislation (Acquis Communautaire) and better enforcement (external monitoring and sanctions in case of non-compliance by the Union). In the modern stage, many of the institutional innovations are also the result of the pressure or initiatives of certain interest groups – eco-associations, consumer organizations, etc. In the analysis, a qualitative characterization of the formal and informal institutional arrangement in agriculture is to be made, the effectiveness of the system for its sanctioning is to be assessed, and the incentives, limitations, costs and impact for a certain type of behavior and actions of the various agents is to be specified.

Institutional "modernization" is a long historical process, and individual components of the institutional environment have their own "logic" of development and life cycle lasting decades and centuries. In short periods of "normal" development, however, the institutional environment is usually "stable" because individuals can have little influence on institutions and institutional change. This is a major advantage because there is stable order and predictability, and therefore low transaction costs for agents. On the other hand, it is a significant drawback in the case of poor institutional arrangements, when the situation does not improve as "quickly" as the majority expects.

It is necessary to highlight and analyze the main elements of the institutional framework and their compliance with the European ones, take into account informal rules and restrictions important for the sector, assess the aggregate or (if possible) particular influence on the behavior, actions and relations of the agents, and effect in terms of transaction costs, and highlight the driving factors of institutional modernization (such as the Green Deal of European Union, reforming CAP, etc.) during the period.

- Market forms or the "invisible hand of the market" - these are the various decentralized initiatives governed by the movement of "free" market prices and market competition: spotlight exchange of resources, products and services, classic contract for purchase, rental or sale, trade with special high-quality, organic, etc. products and origins, agrarian and ecosystem services, etc. Individual agents use (adapt to) markets, profiting from labor specialization and mutually beneficial exchange (trade), while their voluntary decentralized actions "direct" and "correct" the overall distribution of resources among different activities, sectors, regions, ecosystems, countries etc.

However, there are many examples of lack of individual incentives, choice and/or unwanted exchange, and unsustainable development in the agrarian sector - missing markets, monopolistic or power relationships,

positive or negative externalities, disparity in income and working and living conditions in rural and urban areas, etc. Therefore, the free market "fails" to effectively govern the overall activity, exchange and investment in the agrarian sphere and leads to low socio-economic and environmental sustainability. The analysis is to establish whether markets for agrarian resources and products work "well" (many sellers and buyers), ascertain the costs and benefits associated with market forms for different agents, and identify cases of "market failure" in contemporary conditions.

- Private and collective forms or "private or collective order" - these are various private initiatives and special contractual and organizational forms: long-term supply and marketing contracts, voluntary eco-actions, voluntary or mandatory codes of conduct, coalition (family, company, corporate, etc.) farms, partnerships, cooperatives and associations, trademarks, labels, etc. Individual agents take advantage of economic, market, institutional, and other opportunities, and overcome institutional and market imperfections by choosing or designing new (mutually) beneficial private forms and rules for governing behavior, activity, and relationships. Private forms negotiate their own rules or accept (enforce) an existing private or collective order, transfer existing or grant new rights to the partner, and protect the absolute (provided by the institutional environment) and contracted (given or exchanged by the participants) rights of agents.

At the modern stage, much of the agrarian activity is governed by voluntary initiatives, through private negotiations, the "visible hand of the manager", collective decision-making, or complex hierarchical internal management structures. However, there are many examples of the "failure" of the private sector to govern socially desirable activities - for example, preferred eco-conservation, preservation of traditional family farms and productions, preservation and renewal of rural areas, etc.

Figure 4. Principal forms for governing agrarian transactions

<table>
<tr><td></td><td colspan="9">THE MOST EFFECTIVE MODE</td><td></td></tr>
<tr><td>Free Market</td><td>✓</td><td>✓</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td rowspan="8">CRITICAL DIMENSION OF TRANSATION</td></tr>
<tr><td>Special contract</td><td></td><td></td><td>✓</td><td></td><td></td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>Internal Organisation</td><td></td><td></td><td></td><td></td><td>✓</td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>Third-party intervention</td><td></td><td></td><td></td><td>🚑</td><td></td><td></td><td></td><td>🚑</td><td></td></tr>
<tr><td>Public intervention</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>🚑</td></tr>
<tr><td rowspan="8">GENERIC MODE OF GOVERNANCE</td><td>High</td><td>Low</td><td>High</td><td>Low</td><td>High</td><td>Low</td><td>High</td><td>Low</td><td></td></tr>
<tr><td colspan="9">Frequency</td></tr>
<tr><td colspan="2">Low</td><td colspan="2">High</td><td colspan="2">Low</td><td colspan="2">High</td><td></td></tr>
<tr><td colspan="9">Uncertainty</td></tr>
<tr><td colspan="4">Low</td><td colspan="4">High</td><td></td></tr>
<tr><td colspan="9">Asset Specificity</td></tr>
<tr><td colspan="8">High</td><td>Low</td></tr>
<tr><td colspan="9">Appropriability</td></tr>
<tr><td></td><td colspan="9">AGRARIAN TRANSACTION</td><td></td></tr>
</table>

🚑 - *a need for a third-party intervention*

Source: author.

The analysis is to identify and evaluate the advantages and disadvantages of the various private forms of governance dominant in Bulgarian agriculture - main types of farms (individual, family, cooperative, firm, company, etc.), special contractual forms (purchase, hiring of assets, borrowing, insurance, sale, interlinked transactions, etc.), collective organizations outside the farm gates, etc. For some of the transaction costs of these forms, there is available (statistical, reporting, etc.) or it is possible to collect reliable information from farm managers.

However, for much of the transaction costs lack the necessary information and it is necessary to apply qualitative Discrete Structural Analysis (Williamson 2005) to determine the comparative efficiency of alternative governance forms. This is done on the basis of determining the "critical dimensions" of transactions[16] - these are the factors that determine the changes of transaction costs in the specific economic, institutional and natural environment. Since transactions have different critical characteristics and the governance forms have different

[16] frequency of transactions with the same partner, uncertainty associated with transactions, specificity of assets to support a particular transaction (Williamson, 2005), and appropriability of rights associated with transactions (Bachev, 2010) have been identified as four critical dimensions of (agrarian) transactions and activities.

comparative advantages it is to "align" transactions (which differ in their attributes) to governing structures (which differ in terms of costs and competence) in a discriminating (mainly transaction cost-saving) way" (Williamson 2005). Depending on the combination of the specific characteristics of each activity/transaction, different most effective modes of governance of this activity will be efficient – market, contract, internal, trilateral, etc. (Figure 4).

While examples of "good" institutional environment evolution are few (in a small number of highly developed democracies with prospering populations), examples of "successful" modernizations in "institutions of governance" are numerous (Williamson, 2000). In the specific institutional, market and natural environment, agents usually choose or design the most efficient private forms for governing their relationships and activities. Therefore, the identification of the dominant forms of private governance in the agrarian sphere or its individual areas gives a good idea of the (most) effective forms for the specific stage of development.

- Public forms or "public order" - these are diverse public (community, government, international) interventions in the market and private sector such as: public recommendations, public regulations, public assistance, public taxation, public financing, public provision, public modernization of the institutional environment (rights and rules), etc. The role of public (local, national, European, etc.) governance is growing along with the intensification of activity and the exchange, and mutual (inter)dependence of socio-economic and environmental protection activities.

In some cases, it is possible that the effective governance of individual activity and/or the organization of certain activities through market mechanisms and/or through private negotiation may take a long period of time, be very expensive, fail to reach the socially desired scale, or may not be possible to be accomplished at all. Then centralized public intervention could reach the desired state faster, with less cost and more efficiently. However, there are many cases of poor public involvement (inaction, improper intervention, excessive regulation, corruption), leading to significant problems for sustainable agrarian development in Bulgaria and around the world.

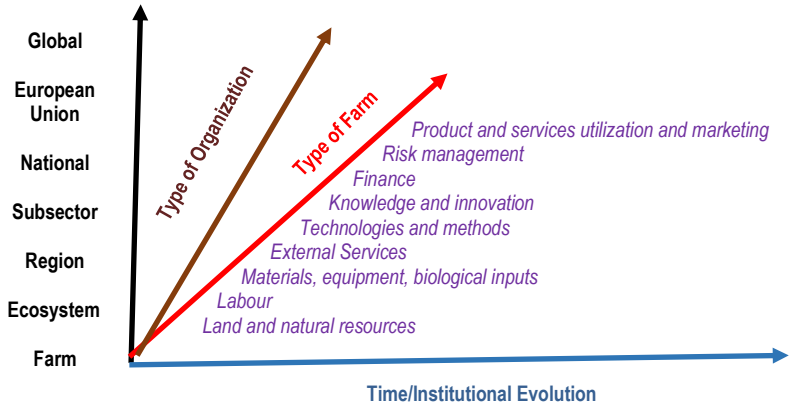
The analysis of the agrarian governance in the country is to establish whether the "needs" for public intervention (the identified cases of market, private and collective failure) are effectively filled with the necessary public interventions, whether the most effective form of public intervention has been chosen among (politically, administratively, financially, etc.) feasible alternatives, and also to identify the cases of dominant public failures at the modern stage of development of the sector.

- Hybrid forms – some combination of the above three, such as public-private partnership, public licensing and inspection of private bio-farms, etc.

In the long term, the specific system of governance of agrarian sector (pre)determines the type and nature of socio-economic development (Figure 3). Depending on the effectiveness of the established agrarian governance system, individual farms, sub-sectors, regions, agro-ecosystems, and countries achieve unequal results in socio-economic development, with various challenges in the economic, social and ecological sustainability of individual farms, sub-sectors, regions, ecosystems and agriculture in general.

Third, like any economic process, agrarian governance is a complex, multi-layered, polycentric and multi-dimensional process that takes place over time and involves numerous agents who develop and use diverse forms and mechanisms of governance. A detail analysis of this process is to be done in relatively distinct governance subsystems - different levels (from farm level to national and European), functional areas (supply of labor, land, capital, etc.), farm types and organizations etc., establishing their specificity, needs and efficiency (Figure 5).

Figure 4. Framework for Analysis of the Agrarian Governance System



Source: author

Particular attention is to be given to the identification and assessment of the dominant (most frequently used) forms of governance in the main functional areas of different types of farms, and which are related to: supply and use of labor, land and natural resources, services, material assets, equipment and biological inputs, knowledge and know-how, innovation, finance, insurance and risk management, and realization (utilization, processing, marketing, etc.) of agricultural products and services. In addition, the diverse "collective actions" (organizations) in which farmers participate to induce private and/or public intervention in the market and private sector in their own interest are to be analyzed. In this way, all forms of internal and external economic integration in the agrarian sphere will be identified, analyzed and evaluated. In addition, other organizations in agrarian governance are to be analyzed - state, international, non-governmental, etc.

It is necessary to take a snapshot (short video) in order to be able to thoroughly analyze the diverse structures and processes in agrarian governance at the current stage. Where reliable information is available, comparisons is to be also made with previous assessments of governance at the farm level to see the dynamics during the period of the country's integration into the European Union and implementation of the Union's Common Agricultural Policies.

The identification of applied and other realistically possible forms of governance of transactions in different types of farms is to be the subject of a special micro-economic study. For this purpose, primary information is to be collected from farm managers and farmer organizations (including through the official agro-statistics) about the employed or preferred governing modes, factors for managerial choice, costs related to the governance of the main types of transactions, and the efficiency of governance of farming enterprise.

Fourth, the analysis of the agrarian governance system is to end with an assessment of the (final) result of this process - the state of the system and the final efficiency of the functioning of the agrarian system. If the welfare of the farmers is growing and the shops are full, there is "agrarian governance", otherwise there is "no governance". At this stage, depending on the scope of the analysis, a variety of data characterizing various aspects of the state of the agricultural sector and its subsystems are to be used - farm competitiveness, product and productivity dynamics, quality of lands, agrarian ecosystems, etc.

However, this approach allows seeing only the aggregate "current" (static) effect of diverse (governance) mechanisms and forms, and long-term (governing) processes and activities of numerous agents. An important methodological issue is considering the "time factor", since many effects are the result(s) of old governance system(s), while many new and promising forms have not yet realized their potential effect(s).[17] One of the directions for overcoming this problem is an assessment of the level of agrarian sustainability, which by definition is "future-oriented" (Bachev, 2010). Another direction is an "immediate" assessment of the compliance of the country's agrarian governance system with the principles of "good governance" - for example, those in the European Union (Ivanov and Bachev, 2023). A third approach seeks a solution in extending the period of analysis – for example, the Programing Period for the implementation of the European Union Common Agricultural Policy. None of these approaches, however, solves the challenge arising from the time factor in the analysis of socio-economic processes. Agrarian governance is a multi-layered dynamic system, and any "one-sided" assessment in "short" periods of analysis cannot claim to be inclusive.

3. Assessing the Quality of Agrarian Governance in Bulgaria

A “new” and constantly evolving concept of “Good Governance” has been increasingly used in the last three decades by the international, public, non-governmental and business organizations (AAID 2008; ACML 2020; DFID 2010; Council of Europe 2022; IFAD, 1999; OECD 2015; World Bank 2022), and is been a topic of “hot” academic debates of scholars in politics, economics, organization, development studies, international politics, behavioral sciences, socio-legal studies, etc. (Aguilera and Cuervo-Cazurra 2019; Ali 2015; Andrews 2008; Bayyurt, Serin, Arıkan 2015; Cheshire, Higgins, and Lawrence 2007; Dasgupta and Roy, 2016; Fukuyama, 2016; Higgins and Lawrence 2005; Narzary 2015; Riegner 2012; Steffek and Wegmann 2021; Tripathi 2017; Weiss 2000). The critical role of the (good) governance in facing important (economic, social, environmental, etc.) challenges and achieving organizational, business, community, and social (including global) goals has been well recognized by the scientists, decision-makers, and public at large (Coase, 1991; Bayyurt, Serin, Arıkan 2015; Ostrom 2014; North 1990; Williamson 2005). Subsequently, attempts have been multiplying to specify and measure “how good or bad” that important factor of social development is. Furthermore, there is increasing acceptance that the good governance is a broader category than administration, business, economic, etc.

[17] Usually before any major crisis there is "normal governance", and conversely, a quick exit from the crisis requires "good governance".

efficiency, and (besides the Government) it is to include multiple agents and ("universal") social, environmental, etc. dimensions and goals. Thus, good governance is to be studied and assessed simultaneously as a means, a goal, and a result of "sustainable" socio-economic development (Bachev, Ivanov and Sarov 2020).

The major principles of "good" governance were initially introduced by the World Bank and become a benchmark related to "the manner in which power is exercised in the management of a country's economic and social resources for development". Since 1996 the Worldwide Governance Indicators have been reported annually including six governance dimensions: Voice and Accountability, Political Stability and Absence of Violence/Terrorism, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption (World Bank 2022). In addition, principles of "good" Corporate governance were introduced by OECD in 1999 including Discipline, Transparency, Independence, Accountability, Responsibility, Fairness, and Social Responsibility (OECD 2015). Since its introduction, the content and principles of good governance have been specified, enriched, and widely adopted by international, governmental, business, non-governmental, and other organizations. In the EU a larger set of principles for good "regional" governance have been formulated, monitored, and enforced including Fair Conduct of Elections, Representation and Participation, Responsiveness, Efficiency and Effectiveness, Openness and Transparency, Rule of Law, Ethical conduct, Competence and Capacity, Innovation and Openness to Change, Sustainability and Long-term Orientation, Sound Financial Management, Human rights, Cultural Diversity and Social Cohesion, Accountability (Council of Europe, 2022). Subsequently, many of these principles have been enshrined in national laws and regulations and/or accepted as voluntary (organizational, business etc.) standards for behavior in the Union and beyond.

Despite its widespread use still, there is no consensus about the content of the good governance and a unified approach to its "measurement". There have been suggested and applied multiple methods for assessing the compliance with the principles (standards, codes, characteristics, dimensions, best practices, etc.) of good governance at global, regional, national, corporate, NGO, sectoral scales, at different functional areas of activity (*e.g.* internet, R&D, environmental management, etc.), and management of major resources (land, water, etc.) and social challenges (*e.g.* climate change, biodiversity preservation, etc.). Applied approaches for understanding and evaluating the system of governance mostly depend on the objectives of involved organizations and/or incorporated "methodological" frameworks. For instance, the assessments of the World Bank and some international and national donor agencies focus predominately on the public economic governance (extent of services provision, efficiency, corruption, etc.) in beneficiary countries; the framework applied by the EU, OECD, UN, and other organizations prioritize democracy, human rights, etc. aspects as well; the corporate sector puts primary attention on the safeguarding the of shareholders and (increasingly) stakeholders and social interests, etc. Similarly, political scientists and political economists are mostly interested in the "model" of governance and power relations, low scholars' study mainly formal legal "order", economists primarily investigate the (program, investment, transaction, third-party, etc.) costs and benefits, etc. The variation in the chosen "principles" and employed indicators for evaluating the "goodness" of governance creates confusion among different users and brings up criticism (Fukuyama 2016). There is also a big criticism on applying a "Nirvana" approach which compares the real situation to some (Western, ideal, etc.) norms rather than to (an)other feasible "social arrangement(s)" (governance alternatives) in the specific conditions of a particular country, sector, region, agents, etc.

The holistic framework for assessing agrarian governance includes several steps: defining the components of the agrarian governance system; formulating the principles of good agrarian governance; specifying the assessment aspects for each principle; identifying the best indicators for each aspect; selecting the criteria and reference values for assessing the quality of agrarian governance for each indicators; and deriving the good governance assessment score (Ivanov and Bachev 2022; Bachev and Ivanov 2023).

The Good Governance Principles are "universal" and relate to the best (desirable) state of the individual components of the governance system and the system as a whole. They are based on the widely accepted universal principle of good governance formulated by the international organization (EU, UN, FAO, etc.) and adapted to the specific conditions of agriculture. For instance, for the "specific" contemporary conditions of European Union (and Bulgarian) agriculture 11 (good governance) principles related to the individual component of agrarian governance have been selected by a Panel of Experts – Good Legislation, Respectful Informal Rules, Good Working Public Sector, Good Working Private Sector, Good Working Markets, High Transparency, Good Involvement, High Efficiency, Good Leadership, Equity and Solidarity, and High Synergy.

The Aspects are precise standards ("measurement approaches") for each of the Principles representing a resulting state of the evaluated system when the relevant good governance Principle is realized. For contemporary Bulgarian conditions for every Principle 17 specific Aspects with their desired position have been

identified by Panel of Experts – Supportive administration, No administrative deadweight, Efficient private sector, Accessible market, Fair competition, Confident level of awareness, Participatory decision-making, High return, Low transaction costs, High competency, Recognized promotion model, Gender equity, Fair distribution, High GAV agriculture, Stable employment, Competitive trade, and Resilient environment (Table 1).

The Good Governance Indicators are quantitative and qualitative variables of different types which can be assessed in the specific conditions of the evaluated system allowing measurement of compliance with a particular Aspect. The set of Indicators provides a comprehensive picture of the state of individual components of agrarian governance and the system as a whole. For the selection of the Governance Indicators a number of criteria, broadly applied in the sustainability assessment literature and practices, were used: "Relevance", "Discriminatory power", "Analytical soundness", "Intelligibility and synonymity", "Measurability", "Governance and policy relevance", and "Practical applicability" (Bachev, Ivanov, Sarov 2020). For the specific conditions of Bulgarian agriculture 36 indicators have been selected by the Panel of Experts (Table 1).

For assessing the particular goodness level, a system of specific Good Governance Criteria (best norms, range, standards, practices, etc.) for each Indicator are used. They are based on modern scientific research, European Union practices and standards, existing social contracts, etc. in the Bulgarian agriculture or in the evaluated subsystem of country's agriculture. Good Governance Criteria are the practically possible desired levels for each Indicator for the specific conditions of the evaluated agro-system. They assist the assessment of agrarian governance by giving guidance for achieving (maintaining, improving) the best feasible standards for the particular components and the overall agrarian governance. Depending on the extent of the Criteria achievement the evaluated agro-system could be with a "good", "satisfactory" or "bad" governance. For instance, a higher or similar to the EU level corresponds to good governance for a particular indicator, and vice versa.

Assessment and analysis of compliance to the principles of good agrarian governance are done for each indicator. Very often individual Indicators for each Aspect and/or different Aspect and Principles of governance with unequal, and frequently with controversial levels. That requires a transformation into a "unitless" Governance Index and integration of estimates. Diverse quantitative and qualitative levels for each indicator are transformed into a Governance Index applying an appropriate scale for each Indicator.

Initial assessment of the governance of Bulgarian agriculture was done is the end of 2022 using data from statistical and other official sources as well as assessments of an 8-member Panel of Experts including leading scholars, and representatives of governmental and farmers organizations. The difference between used two types of indicators is the estimation modes, as the later ones are based on scores of Experts from a 5-level ranking scale (Very low, Low, Middle, High and Very high). The assessment score of each indicator is determined by the desired state derived from the principal aspects and indicator criteria interpretation, which means that in some cases, "Very low" is equivalent of 0, whereas in other cases might refer to 1. For the remaining indicators of governance, the Relative Comparison Assessment Method is employed (Ivanov, 2022). The statistically generated data are from different databases on macro and farm level, including Eurostat, FADN database averaging for 3-year period (2018-2020) whole experts' judgments is done having in mind the recent years.

Table 1. System of Principles, Aspects, Indicators, and Criteria for Assessing the Quality of Governance of Bulgarian Agriculture

Principles	Aspects	Indicators	Estimation mode	Units
Good Legislation	Comprehensive legislation	Completeness of the legislation (1)	Experts assessment	Ranking score
	Justified enforcement	Degree of implementation and abide with legislation (2)	Experts assessment	Ranking score
		Level of regulation costs for get acquainted and to be enforced (3)	Experts assessment	Ranking score
Respectful Informal Rules	Mutual Trust	Level of trust between subjects in the agriculture (4)	Experts assessment	Ranking score
	Good Manner	Conflict level and contradiction state within agriculture community (5)	Experts assessment	Ranking score
Good Working Public Sector	No administrative deadweight	Level of unlawful payments and embezzlement (6)	Experts assessment	Ranking score
	Supportive administration	Satisfaction degree from administrative services (7)	Experts assessment	Ranking score
		Level of governmental spending for agricultural public administrating (agri-governmental expenditure unto total governmental spending) (8)	RCA method	Percent

Principles	Aspects	Indicators	Estimation mode	Units
Good Working Private Sector	Efficient Private Sector	Effectiveness of contracting among agents in agriculture (9)	Experts assessment	Ranking score
		Equality in the opportunities for development of different organizations forms (10)	Experts assessment	Ranking score
		Propensity to external contracting (contractual work to total output) (11)	RCA method	Ranking score
Good Working Market	Accessible market	Level of entry and exit market costs (12)	Experts assessment	Ranking score
	Fair competition	Competition fairness and avoiding price rigging (13)	Experts assessment	Ranking score
		Degree of market orientation (farm use and farmhouse consumption unto total output (14)	RCA method	Share
High Transparency	Confident level of awareness	Information awareness of stakeholders and agents in agriculture (15)	Experts assessment	Ranking score
		Costs level for information access of stakeholders and agents (16)	Experts assessment	Ranking score
		Decision-making transparency extent (17)	Experts assessment	Ranking score
		Symmetric between decisions taken and public expectations in agriculture (18)	Experts assessment	Ranking score
Good Involvement	Participatory decision-making	Plurality level in decision –making process in agriculture (19)	Experts assessment	Ranking score
		Level of unacceptable lobbying impairing third parties (20)	Experts assessment	Ranking score
		Scope of farm access to public agricultural support (% farms with direct payment/all farms) (21)	RCA method	Percent
High Efficiency	High return	Total spending of means and efforts for dealing with other economic agents and administration in agriculture (22)	Experts assessment	Ranking score
		Price rewarding potential (price index outputs/price input index) (23)	RCA method	Index
	Low transaction costs	Level of transaction costs in the agriculture (total farm overhead costs/total input) (24)	RCA method	Share
Good Leadership	Recognized promotion model	Level of achieving own advantage on the expense of others through legal and illegal means (25)	Experts assessment	Ranking score
		Correctness and decency in the business relationships in agriculture (26)	Experts assessment	Ranking score
	High competency	Degree of competency and expertise of agents in agriculture (27)	Experts assessment	Ranking score
		Entrepreneurship abilities and level of self-improvement of agents (28)	Experts assessment	Ranking score
Equity and Solidarity	Ethnical, religious and bigotry equity	Level of discrimination on the ethnical, religious and bigotry causes (29)	Experts assessment	Ranking score
	Fair distribution	Fairness in the remuneration of employees in agriculture (compensation of employees/factor income) (30)	RCA method	Share
		Balance in the public support distribution in agriculture (Gini coefficient) (31)	RCA method	Coefficient
High Synergy	Stable employment	People engagement in agriculture (share of population employed in agriculture) (32)	RCA method	Percent
	High GAV agriculture	Significance of agriculture in the economy (GAV of agriculture per capita) (33)	RCA method	Euro
	Competitive trade	Importance of agriculture in the trade (agriculture export/agricultural import) (34)	RCA method	Index
	Resilient environment	Contribution of agriculture to climate change mitigation (% of greenhouse gases from agriculture in total GHG) (35)	RCA method	Percent
		Soil protection and control of nitrogen pollution (quantity of nitrogen fertilizers use) (36)	RCA method	Kg per ha

Source: Bachev and Ivanov, 2023.

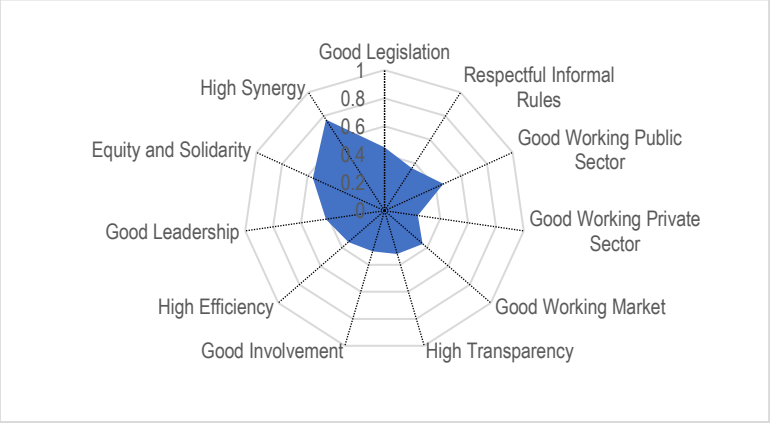
The common criteria used in this assessment is the average EU level and the medium EU situation. which is applied to provide the measurability and comparability of the assessment scores. The Good governance reference values are the practically observed indicators values on the counterpart EU average indicators. The

later assist the assessment of agrarian governance by giving guidance for achieving (maintaining, improving) the best feasible standards for the components and the overall agrarian governance.

The Integral Governance Index is computed through weighting Principal score assessment based on the principle number and component count. The Integral Governance Index of Bulgarian agriculture is represented by a qualitative score, which ranges from 0 to 1 that might be converted into qualitative assessment. For the purpose of this research are formulated five categories that Governance Index implies: "very good', "good", 'moderate", "satisfactory" and "bad" governance. These qualifications are linked to: Index range 0,81-1 for a "Very Good" governance; Index range 0.56-0,80 for a "Good" governance; Index range 0,46-0,55 for a "Moderate" governance; 0,21-0,45 for a "Satisfactory" governance and Index range less than 0,20 – referring to 'Bad or Unsatisfactory" agrarian governance. The governance assessment is oriented to the EU level, and therefore the Moderate rate is with a shorter range (plus or minus 0,05 deviation from the "average" EU value), while the extreme (Very Good or Bad) levels are kept in the normal 0.2 range in the 5 level Governance scale. Detailed explanation and justification of applied approach is done by Ivanov and Bachev (2023).

Initial approbation of the suggested framework has found out that the Integral Governance Index of Bulgarian agriculture is at moderate level having in mind the EU perspective. The highest performance is attained under the principles of Equity and Solidarity and the Good Working Public Sector while in terms of the Working Private Sector and the Stakeholders Involvements it is the lowest (Figure 6).

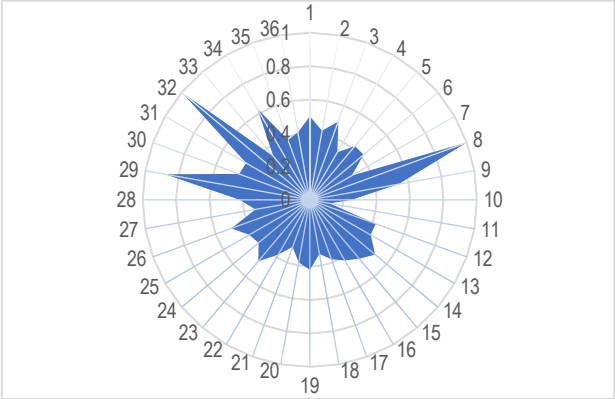
Figure 6. Quality Level of Agrarian Governance in Bulgaria for Major Principles of Good Governance



Source: author calculations.

Analysis of individual indicators demonstrates that the strongest points of agrarian governance system in the country at the present stage of development are: Level of governmental spending for agricultural public administrating (agri-governmental expenditure unto total governmental spending), People engagement in agriculture (share of population employed in agriculture), Level of discrimination on the ethnical, religious and bigotry causes, Effectiveness of contracting among agents in agriculture, Importance of agriculture in the trade (agriculture export unto agricultural import), Degree of market orientation (farm use and farmhouse consumption unto total output), Completeness of the legislation, Level of regulation costs for get acquainted and to be enforced, and Correctness and decency in the business relationships in agriculture (Figure 7).

Figure 7. Quality Level of Agrarian Governance in Bulgaria for Individual Indictors for Good Governance



Source: author calculations.

At the same time, the weakest point of the governance system of Bulgarian agriculture are identified as: Propensity to external contracting (contractual work to total output), Equality in the opportunities for development of different organizations forms, Satisfaction degree from administrative services, Scope of farm access to public agricultural support (percent of farms with direct payment unto all farms), Level of trust between subjects in the agriculture, Symmetric between decisions taken and public expectations in agriculture, and Degree of competency and expertise of agents in agriculture. In all these directions the efforts of responsible officials, farm and agribusiness managers, professional organizations, and other stakeholders have to be directed though policies instruments, administration reforms, improvement of private and collective management, international assistance, etc. in order to improve the governance of agrarian sector in the country.

Conclusions and Further Research

In this paper, we have tried to prove that agrarian governance is a complex system that includes agrarian and related agents involved in management decision-making; rules, forms and mechanisms that govern the behavior, activities and relationships of agrarian agents; processes and activities related to making governance decisions; a specific social order resulting from the governing process and functioning of the system. Adapting the methodology of the New Institutional Economics allows to better understand, analyze and evaluate this complex system and its individual components. The analysis is to include the individual elements for the system, different levels of governance and the main functional areas of the farming, for each of which appropriate quantitative or qualitative methods of the institutional approach are to be used.

This study also demonstrated that the (quantitative) assessment of the governance system of Bulgarian agriculture and the level of its compliance to the principles of “Good governance” is possible. The latter is a “work in progress” and further refinements are necessary in terms of perfection of the hierarchical system of governance principles, aspects and indicators, its broader application into analysis of the governance system in major subsectors of Bulgarian agriculture (crop, livestock, etc.) and international comparisons between EU countries, as well as in appropriate data collection, including through official agri-statistics system.

Systematic theoretical and empirical research in this "new" field should be expanded to better understand this complex category and refine approaches to its economic analysis. For a better distinction and a more complete definition, a wider use of the term Governance (гавърнанс) in languages like Bulgarian (where there is no specific term to distinguish it from Management) is necessary, as is already the practice both in scientific circles and in colloquial speech.

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Characterizing the Anchoring Effects of Official Forecasts on Private Expectations

Carlos R. BARRERA CHAUPIS
Research Division, Banco Central de Reserva del Perú
carlos.barrera@bcrp.gob.pe

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Abstract: The paper proposes a method for simultaneously estimating the treatment effects of a change in a policy variable on a numerable set of interrelated outcome variables (different moments from the same probability density function). Firstly, it defines a non-Gaussian probability density function as the outcome variable. Secondly, it uses a *functional regression* to explain the density in terms of a set of scalar variables. From both the observed and the fitted probability density functions, two sets of interrelated moments are then obtained by simulation. Finally, a set of difference-in-difference estimators can be defined from the available pairs of moments in the sample. A stylized application provides a 29-moment characterization of the direct treatment effects of the Peruvian Central Bank's forecasts on two sequences of Peruvian firms' probability densities of expectations (for inflation -π- and real growth -g-) during 2004-2015.

Keywords: statistical simulation methods; treatment effect models; central bank; forecasting; coordination.

JEL Classification: C15; C30; E37; E47; E58; G14.

Introduction

The literature on the official forecasts' anchoring effects has usually provided results considering the mean of expectations without justifying their tools as useful enough to fully characterize the anchoring effects (see Blinder *et al.* 2008; Dräger *et al.* 2016; Filacek and Saxa 2012; Gürkaynak *et al.* 2010; Hattori *et al.* 2016; Kozicki and Tinsley 2005; Kumar *et al.* 2015; Neuenkirch 2013; Pereira da Silva 2016; Pedersen 2015; Trabelsi 2016).

Filacek and Saxa (2012) and Barrera (2018) used two specific moments of the cross-sections of private expectations to gauge the **direct** effects of central banks' forecasts on those private expectations.[18]

In order to fully characterize the official forecasts' anchoring effects on private expectations, this paper proposes a method for simultaneously estimating the treatment effects of a change in a policy variable on a numerable set of interrelated outcome variables (different moments from the same probability density function).

Instead of using the temporal sequence of any specific moment (estimated from a sequence of large cross-sections), one moment at a time, the paper uses the temporal sequence of probability density functions (estimated from such a sequence of large cross-sections). By focusing on a general probability density function (not necessarily Gaussian) as a single outcome variable, the paper proposes a method for simultaneously estimating a numerable set of treatment effects (e.g., after a change in a policy variable) associated to the corresponding set of interrelated moments.

The proposal's key ingredient is a *functional-regression* stage allowing to control for many scalar confounding explanatory variables. This regression substitutes a set of numerable (possibly non-linear) regressions, each explaining one scalar outcome variable. Then, a *simulation* stage that converts our useful outcome variable, the probability density function, into a numerable set of interrelated outcome variables (a set of moments obtained by simulation from the same probability density function).

The proposal is conceived to fully characterize the anchoring effects of a benevolent central bank' forecasts/announcements on private expectations (firms' or households') whenever private expectations consist

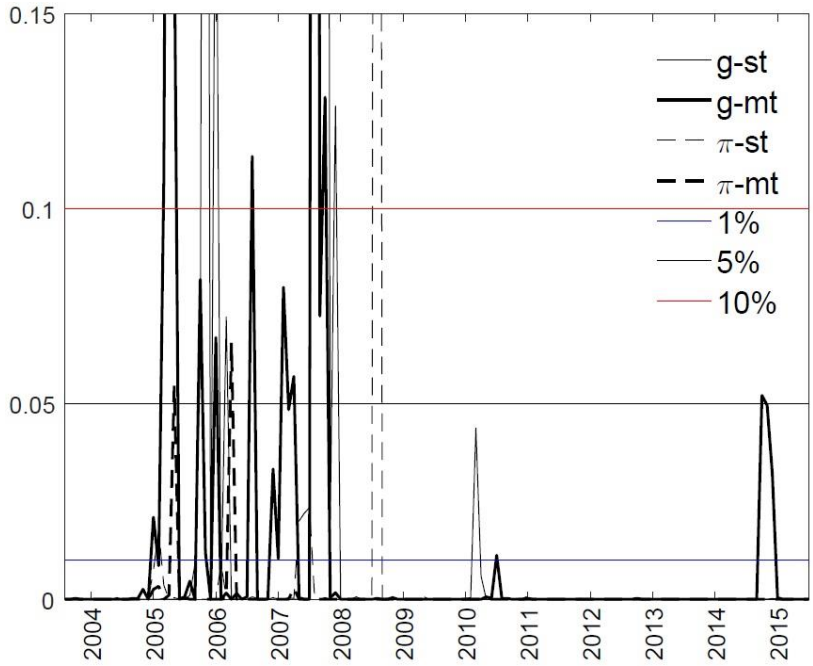
[18] The moments used by Filacek and Saxa (2012) and Barrera (2018) were dispersion and distance. Note these specific moments belong to different but related densities.

of a temporal sequence of large cross-sections from which a temporal sequence of probability density functions can be obtained by nonparametric methods. As a byproduct, the simulation stage solves a problem inherent in the functional-regression stage, that the functional coefficients resulting from any functional regression have reduced interpretability.

The availability of such a sequence of large cross-sections (*big data)* may not be the only justification for this inquiry. Characterizations in the anchoring expectations literature usually consider at most two moments of those cross-sections of expectations (non-robust mean and dispersion) under the unwarranted assumption of Gaussianity.

Figure 1 shows four temporal sequences of Jarque-Bera tests' p-values for the following monthly sequences of Peruvian firms' cross-sections of expectations during 2004-2015: short-term (st) and medium-term (mt) real growth (g) expectations as well as st and mt inflation (π) expectations. The cross-sections hardly comply with Gaussianity!

Figure 1. Jarque-Bera p-values (null: Gaussianity)



For non-Gaussian data, an improved characterization of the anchoring effects of Central Bank's forecasts is not only possible from the paper's proposal, but also needed out of the box. First, a benevolent central bank should care about the impact of its forecast (policy variable) on mainly robust versions of usual moments like the mean and the dispersion of firms' expectations. Second, a benevolent central bank should care about the impact of its inflation forecast on the probability mass of being in the target range, especially under the framework of inflation targeting. Interestingly, other moments can enhance the consistency of the aforementioned ones and thus should be included in a comprehensive set of moments to be simulated from the probability distribution of firms' forecasts.

To illustrate the usefulness of the proposal, a stylized application provides a moment characterization of the 'direct effects' of the Peruvian Central Bank's forecasts on two sequences of Peruvian firms' probability densities of expectations (of π and g) during 2004-2015. Main findings are: (i) Short-term π forecasts generate an *on-impact* increase in the probability that these expectations are in the target range of [1% 3%]. Short-term g forecasts generate an *on-impact* increase in the probability that these expectations are in the range of [4% 7%], but a *one-month-later* decrease in this probability. (ii) Medium-term π forecasts generate no significant changes in the probability that these expectations are in the target range of [1% 3%]. Medium-term g forecasts generate an *on-impact* decrease in the probability that these expectations are in the range of [4% 7%], but a *one-month-later* increase in this probability.[19]

[19] The range of 4% - 7% can be taken as containing the long-run growth rate. For the Peruvian economy, the probability mass of being inside such a range has highly varied over time.

Section 2 discusses the methodological issues associated to the functional regression models leading to the new complete-characterization tests. Section 3 describes the stylized application in terms of the Peruvian data (*i.e.*, the probability density functions as the outcome variable, the central bank's forecasts as the treatment variable, as well as the control/explanatory variables) and the estimation results. Section 4 concludes.

2. Materials and Methods

The proposal of this paper is closely tied to the difference-in-differences (DiD) approach and its limits: it is a generalization of DiD whenever important information is available as large cross-sections. After some preliminary requirements, the details of a recent piece of work in the literature are described to provide an appropriate context and notation for describing the paper's proposal.

2.1 Preliminaries

The difference-in-differences (DiD) approach usually uses ordinary least squares (OLS) in repeated cross-sections of some measure-y data of grouped individual units which are either treated or non-treated for several periods. For the sake of clarity, let's assume a complete set of T cross-sections is available (instead of just a subsequence of them) for each group $g \in \Xi \equiv \{1,2,\dots,G\}$. Every group g's temporal sequence of cross-sections is then indexed by $t \in \Upsilon \equiv \{1,2,\dots,T\}$. Let N_g be the number of individual units in each group g's sequence, so individual units are indexed by $i \in \Psi^g \equiv \{1,2,\dots,N_g\}$.

Two key assumptions are needed:

(1) The treatment is homogeneous, *i.e.*, the same treatment is simultaneously applied to all the treated individual units, groups and time periods.

(2) The homogeneous treatment takes place instantaneously at the beginning of many periods of time $\tau \in \Gamma \subset \Upsilon$, which are the 'intervention dates'.

These assumptions allow, for the whole sample across $\{i, g, t\}$, to label many periods as 'before' $(\tau - 1)$, 'after' (τ) and even 'another period after' $(\tau + 1)$ with respect to any specific 'intervention date'.[20] This setup leads to the equation that is usually estimated to obtain the DiD estimator:

$$y_{igt} = \beta_1 \text{treat}_{igt} + \beta_2 \text{post}_{igt} + \beta_3 \left(\text{treat}_{igt}\text{post}_{igt}\right) + \beta_4 X_{igt} + \alpha_0 + \alpha_g + \omega_t + \epsilon_{igt} \quad (2.1)$$

where $\text{treat}_{igt} = 1$ corresponds to treated individual units ($\text{treat}_{igt} = 0$, to non-treated individual units); $\text{post}_{igt} = 1$ corresponds to periods 'after' treatment ($\text{post}_{igt} = 0$, to periods 'before' treatment); X_{igt} are explanatory variables not related to the homogeneous treatment; α_0 is the intercept; α_g is the group g's fixed effect; ω_t is either the period t's fixed effect (if the available number of periods is small) or the product of a linear trend coefficient and t (if that is not the case); and ϵ_{igt} is the error term.

By defining

$$\tilde{y}_{igt} \equiv y_{igt} - \left(\beta_4 X_{igt} + \alpha_0 + \alpha_g + \omega_t\right) \quad (2.2)$$

equation 2.1 can be re-written,

$$\tilde{y}_{igt} = \beta_1 \text{treat}_{igt} + \beta_2 \text{post}_{igt} + \beta_3 \left(\text{treat}_{igt}\text{post}_{igt}\right) + \epsilon_{igt} \quad (2.3)$$

Thus, provided that $E\left[\epsilon_{igt} | \text{treat}_{igt}, \text{post}_{igt}\right] = 0$, the following expectations are obtained:

$$\begin{aligned} E\left[\tilde{y}_{igt} | \text{treat}_{igt} = 1, \text{post}_{igt} = 1\right] &= \beta_1 + \beta_2 + \beta_3 \\ E\left[\tilde{y}_{igt} | \text{treat}_{igt} = 1, \text{post}_{igt} = 0\right] &= \beta_1 \\ E\left[\tilde{y}_{igt} | \text{treat}_{igt} = 0, \text{post}_{igt} = 1\right] &= \beta_2 \\ E\left[\tilde{y}_{igt} | \text{treat}_{igt} = 0, \text{post}_{igt} = 0\right] &= 0 \end{aligned} \quad (2.4)$$

and by arranging them in the archetypical 2x2 matrix

[20] Set Γ is not just a subset of Υ: with just one period after treatment, its definition is $\Gamma \equiv \{\tau | \tau \in \Upsilon \wedge \tau - 1 \in \Upsilon\}$. With monthly data, having two periods after treatment allows the construction of 'experimental quarters', which imply an additional restriction in Γ's definition.

Table 1. DiD estimator

	Pre (B)	Post (A)	(A-B) diff.
Treatment (T)	β_1	$\beta_1 + \beta_2 + \beta_3$	$\beta_2 + \beta_3$
Control (C)	0	β_2	β_2
(T-C) diff.	β_1	$\beta_1 + \beta_3$	β_3

β_3, the causal effect, becomes the DiD's key parameter to be estimated. β_2 can be thought as the *placebo effect*. However, while a psychological effect is not negligible when investigating the effects of a drug treatment, it should be negligible whenever the 'patient' who receives the placebo (i) does not know he/she is receiving it, and (ii) does not care about what kind of drugs the 'patient next door' is receiving. Since this is the case in our non-experimental discipline, an economist may consider $\beta_2 + \beta_3$ as the *direct* effect (a key component of a causal effect) whenever there is no data about individuals ('patients') not receiving any 'treatment'. To see this, consider that equation 2.1 becomes $y_{igt} = (\beta_2 + \beta_3)\text{post}_{igt} + \beta_4 X_{igt} + \alpha_0 + \alpha_g + \omega_t + \epsilon_{igt}$ and equation 2.3 becomes $\tilde{y}_{igt} = (\beta_2 + \beta_3)\text{post}_{igt} + \epsilon_{igt}$: this equation foreshadows equation 2.10 in subsection 2.2.

In addition to estimating all the parameters in equation 2.1 by OLS, the researcher can also run the following OLS regression,

$$y_{igt} = \bar{\beta}_4 X_{igt} + \bar{\alpha}_0 + \bar{\alpha}_g + \bar{\omega}_t + \varepsilon_{igt} \qquad 2.5$$

and then use the estimated coefficients to get the estimated residuals, which can be interpreted as a corrected response (free of confounders), just like $\tilde{y}_{igt}$ in equation 2.2. Note that although $\tilde{y}_{igt}$ estimates include the true errors in equation 2.1, they correspond to the full sample and thus an appropriate division is required: divide all these 'residuals' in four sets: before-the-treatment $(\tau - 1)$ residuals for treated individual units, $\tau - 1$ residuals for non-treated individual units, after-the-treatment (τ) residuals for treated individual units, and τ residuals for non-treated individual units.[21] Then, by a direct application of the Frisch-Waugh-Lovell (FWL) theorem, there are two equivalent procedures to obtain both an estimate of the treatment effect and a test for its significance:

(i) run an OLS regression of the corresponding 4-type panel on the same explanatory dummies as in equation 2.3, and then use the estimate of β_3 and the corresponding standard error to buid the t-test.

(ii) compute the corresponding sample means (fill the table above) as well as the sample variances $E\left[\tilde{y}_{igt} | \text{treat}_{igt} = a, \text{post}_{igt} = b\right]$, $a, b \in \{0,1\}$, and then use all these sample moments to build the t-test for the significance of β_3. However, this solution assumes all treatments are made 'simultaneously' to all treated individual units, thus it is feasible to suppose a placebo treatment was simultaneously made to the non-treated individual units.

These details provide a framework for interpreting the literature. Bertrand *et al.* (2004) (BDM from now onwards) is a milestone in the literature on DiD approach for underlining severely biased standard errors because of neglected serial-correlation problems. These authors propose three techniques to solve such a problem for large sample sizes, from which the simplest one consists in *ignoring* the time series component in the estimation[22] when computing the standard errors. BDM show there are two versions of this specific technique bringing correct rejection rates and relatively high power:

(a) average the data 'before' and 'after' the treatment and then run equation 2.1 on the resulting averaged outcome variable as a two-period panel.[23]

(b) obtain the residuals from an auxiliary regression excluding all dummy variables associated to the treatment and divide the residuals of *the treated groups only* in two sets: before-the-treatment residuals and after-the-treatment residuals. Then proceed with an OLS regression of this two-period panel on and 'after' dummy.[24]

Note version (b) is similar to the procedure (ii) above because now it is *not* feasible to suppose a placebo treatment was simultaneously made to the non-treated individual units, thus it is not possible to use the

[21] Do not forget the 'experimental quarters' in the case of monthly data: there also exist $\tau + 1$ residuals for treated individual units and $\tau + 1$ residuals for non-treated individual units.

[22] As an example, not ignoring such a component would be equivalent to postulate a common AR(1) model for each group g in equation 2.1, which affects the estimation strategy for all the other parameters therein.

[23] BDM note this solution works well only for treatments that are 'simultaneously' applied to all the *treated groups*. If the treatment occurs at different times for some of those groups, 'before' and 'after' are not the same for all groups and a modification is needed.

[24] BDM note this solution works as well as (a) for treatments that are 'simultaneously' applied to all the *treated groups*. Moreover, it works well when the treatments occur at different times for some of the *treated groups*.

counterfactual information provided by non-treated individual units. Besides, there is their emphasis on *treated groups*, which will be clarified next.

2.2 Single-Group Tests and Single-Unit Tests

Even though DiD approach have been pervasive in the economics literature on policy evaluation, it is not quite immune to criticism when used with observational data. Wherever the experimental setup does not hold, some drastic adaptations should be made. In general, the internal validity of model in equation 2.1 depends on having the same treatment across different treated individual units. In the case of BDM, they explicitly take groups as states and treatment/intervention as passed laws (so that individual units may be thought as firms and the measure y, as their profits). If the law is passed in some states but not in others, then all firms in the former states will be treated and all firms in the latter states will be non-treated (by default). The model in equation 2.1 must then be modified as

$$y_{igt} = \beta_1 \text{treat}_{gt} + \beta_2 \text{post}_{gt} + \beta_3 \left(\text{treat}_{gt}\text{post}_{gt}\right) + \beta_4 X_{igt} + \alpha_0 + \alpha_g + \omega_t + \epsilon_{igt} \quad (2.6)$$

where the emphasis of the treatment has changed from individual unit i to groups g: the *treated groups* must be indexed by $g' \in \Psi \subset \Xi$. The internal validity of model in equation 2.6 now depends on having exactly the same passed law across different treated states/countries (groups). Otherwise, the model should be written as

$$y_{igt} = \sum_{g' \in \Psi} \beta_{1g'} \text{treat}_{g't} + \beta_2 \text{post}_{gt} + \sum_{g' \in \Psi} \beta_{3g'} \left(\text{treat}_{g't}\text{post}_{gt}\right) + \beta_4 X_{igt} + \alpha_0 + \alpha_g + \omega_t + \epsilon_{igt} \quad (2.7)$$

where the assumption of simultaneous treatments still holds! This possibility is surprisingly not covered by BDM, because in their setup the analysis of state-tailored laws passed inside different states (say) should also be a reference model.[25]

The case under scrutiny here is related to both the qualitative and quantitative resources used for **the diffusion of central banks' official forecasts**. Many central banks are interested on how to use these announced forecasts to benevolently affect the private sector's expectations inside their countries, especially those central banks being under the framework of *inflation targeting* or in the path towards passing the charter law with a clear mandate enforcing such a framework. Under these circumstances, no matter how large the sample of 'experimental quarters' is, the model in equation 2.7 is the right setup. However, it does preclude the whole DiD approach because there is no clear counterfactual for each *treated group* $g \in \Psi$.[26] This is why the researcher is better served **by** a 'specific' model for each *treated group* $g \in \Psi$,[27]

$$y_{it}^g = \beta_2^g \text{post}_t^g + \beta_4^g X_{it}^g + \alpha_0 + \omega_t + \epsilon_{it}^g, \qquad \forall g \in \Psi \quad (2.8)$$

from which the **single-group tests** for a singleton group[28] can be obtained by defining

$$\tilde{y}_{it}^g = y_{it}^g - \left(\beta_4^g X_{it}^g + \alpha_0 + \omega_t\right), \qquad \forall g \in \Psi \quad (2.9)$$

or by running the associated OLS regression with the whole sample for cleaning the data from the confounders' effects (an alternative analogous to the one described from equation 2.5 on). Then, two versions of the following equation

$$\tilde{y}_{it}^g = \beta_2^g \text{post}_t^g + \epsilon_{it}^g, \qquad \forall g \in \Psi \quad (2.10)$$

can be run for each *treated group* g: one for comparing the τ residuals with the $\tau - 1$ residuals and one for comparing the $\tau + 1$ residuals with the $\tau - 1$ residuals.

Thus, provided that $E\left[\epsilon_{it}^g | \text{post}_t^g\right] = 0$, the following expectations are obtained:

$$\begin{aligned} E\left[\tilde{y}_{it}^g | \text{post}_t^g = 1\right] &= \beta_2^g \\ E\left[\tilde{y}_{it}^g | \text{post}_t^g = 0\right] &= 0 \end{aligned} \quad (2.11)$$

and by arranging them in a 1x2 matrix

Table 2. Single-group estimator

	Pre (B)	Post (A)	(A-B) diff.
Treatment (T)	0	β_2^g	β_2^g

[25] BDM do make their reader note their two versions (a) and (b) of their most simple technique do poorly with a small number of groups. And it is important to mention this for our case is group $g = 1$! However, it will soon be shown that BDM's simulations are built with respect to both a model and a parameter which is different from the one this paper emphasizes.

[26] For the sake of a simplified notation, g' is abandoned from here on. The context will help to disentangle whether g is a group or just the real growth.

[27] Treated state in BDM or treated country in Barrera (2018).

[28] Since α^0 and α^g are the coefficients associated to the same column of ones, only α^0 remains.

β_2^g becomes the single-group parameter to be estimated.

There are few steps left for reaching either the procedure in Barrera (2018) or the proposal in this paper: first, without information specific to firm i allowing to explain y_{it}^g, its expectation for either real growth (g) or inflation (π), X_{it}^g should be replaced by aggregate information, X_t^g; by the same token, the y_{it}^g data can then be collapsed in terms of a particular moment of the cross-section indexed by i, say, the dispersion of the cross-section of firms' expectations in country g. The single-group tests become the *single-unit tests*.[29]

2.3 Proposal

The proposal here is to collapse the y_{it}^g cross-sectional data in terms of a functional response, a probability density function, which then will allow the researcher to obtain a comprehensive list of moments by means of simulations. Specifically, the proposal requires:

- to use the temporal sequence of available long-cross-sections to obtain f_t, the associated sequence of kernel-based densities;
- to use **functional regressions** to explain the evolution of the densities and to control for relevant 'confounders' (*e.g.*, a temporal trend);
- to simulate from both the observed (f_t) and estimated ($\hat{f}_t$) densities to obtain the difference in moment r at time t, $\Delta m_t^r \equiv m_t^r(f_t) - m_t^r(\hat{f}_t)$**;** all moments m^r are available for us to select!
- to calculate all available differences between any Δm_t^r after a policy intervention ('treatment') and its corresponding pre-treatment, $\Delta m_{t-\Delta t}^r$. Then, to build the corresponding t-tests.[30]

The literature about functional regressions provides two ways of modeling functions, that is, explaining a sequence of functions (a special variable) by means of two or more sequences of scalars (variables). The proposal uses the **fully-fledged functional approach** (Ramsay and Silverman 1997; Ramsay and Silverman 2005) and the reader is referred to these books. A little warning is due here: the (alternative) **longitudinal approach** is useful when modeling sequences of continuous **sections** of demand or supply (say) at the cost of not being possible to abandon the firms' dimension i.

For illustrating the proposal above, the stylized application belongs to the literature about anchoring expectations (see footnote 1). In fact, the proposal above has Barrera (2018)'s methodology as its ancestor. Motivated by Filacek and Saxa (2012), Barrera (2018) used few specific scalar criteria (two robust moments) of the small cross-sections of Consensus professional forecasters' expectations to gauge the **direct** effects of *Banco Central de Reserva del Peru* (*BCRP*) forecasts. The first stage of Barrera (2018)'s methodology was to explain these robust moments by a relevant set of explanatory variables not related to *BCRP* forecasts (a set of confounders) and then use the estimated *errors* from those non-linear (NL) regressions[31] as the outcome variables supposedly affected by *BCRP* forecasts. Its second stage considered the chronology of *BCRP* forecasts to define 'experimental quarters' made by pre-treatment months (s = 1), and post-treatment months of two types: on-impact months (s = 2) and more-than-1-month-later month (s = 3), so all estimated errors of type (s = 3) were compared with those of type (s = 1) to detect significant average changes of type ({s = 3|s = 1}) by means of t-tests (*Ha*); the analogous procedure was followed with estimated errors of type (s = 2) to detect significant average changes of type ({s = 2|s = 1}). Besides, from the discussion in sub-sections II.1 and II.2, a direct effect is a gross effect, while the causal effect provided by DiD approach is a net effect; in general, these two effects are different, but in a non-experimental discipline such as Economics, these two effects can be considered the same.

While gauging the **direct** effects of *BCRP* forecasts on private expectations, it is possible to consider a different setup: a survey with large cross-sections. In the case of Peru, this data is available from *EEM*. For this case, our proposal offers a complete characterization of the **direct** effects of the availability of Central Bank's forecasts, that is, in terms of a comprehensive set of moments. For them to be consistent with each other, they should be made available from the same probability density associated to each month's cross-section. This idea

[29] The nonlinear regressions in Barrera (2018) were proposed for modeling a non-zero response such as the dispersion of expectations.

[30] One can consider two cases: a-month-after intervention effect and an on-impact intervention effect (i.e., just on time to be considered 'post-treatment'). Therefore, some special care must be taken in terms of the chronology of events. See Appendix A.

[31] One NL regression for each expectational variable (g and π) or even for each family of forecasting horizons in the available data (short-term and medium-term horizons, say).

naturally leads to modeling the sequence of probability densities (obtained by kernel methods) by means of a functional regression, which by following the analogy with previous paragraph, should then consider a relevant set of (scalar) explanatory variables not related to Central Bank's forecasts, etc.

Thus, the sequence of *Epanechnikov*-kernel estimated densities $\{f_t(a)\}$ is considered as as sequence of data observed without measurement noise. $f_t(a)$ is the period-t density function with domain $a \in A \equiv \{\underline{a}, \bar{a}\} \subset \Re$, $\forall t \in \{1,2,\dots,T\}$ (e.g., $a \equiv \pi$). These densities are modeled as the functional responses of a set of (scalar) explanatory variables in matrix $\boldsymbol{Z}$, $f(a) = \boldsymbol{Z} * \beta(a) + \epsilon(a)$, $\forall a \in A$:

(i) the forecasting horizon;

(ii) the level & variability of the observed variable a;

(iii) (a lag of) the level & variability of the nominal exchange rate (FX);

(iv) the robust mean & robust standard deviation of the Consensus professional forecasters' (insiders') forecasts; and,

(v) a time trend.

Explanatory variable i) is mandatory: all π & g forecasts are **fixed-event forecasts** as they refer to the end of either the current year or the next year (specific dates only). Also note application of simplified DiD approach requires *not* including the *BCRP* forecasts. For the sake of comparability, Appendix C reports the results in Barrera (2018) for two scalar output variables obtained from EEM cross-sections, the robust dispersions S_n and Q_n.

However, the key problem is to escape from the obviously mistaken analogy of using the estimated errors from those *functional regressions* for obtaining interpretable treatment effects. The FWL theorem can be invoked for least-squares estimation procedures of *functional regressions*.[32] Its strict application will lead to treatment effects expressed in terms of functional regression coefficients, with reduced interpretability. The solution is to use the close relationship between a general probability density and all the set of moments that can be obtained from sampling from such a density: the needed estimated errors become the differences (deltas) between the simulated moments from the observed probability densities and the simulated moments from the estimated probability densities.[33] Appendix B provides detailed information about the comprehensive list of moments used in the paper.

3. Stylized Application

3.1 Data

To fully characterize the effects of Central Reserve Bank of Peru (*BCRP*)'s forecasts on Peruvian firms' expectations for real growth (g) and inflation (π), three different sources of forecasts are considered in the paper. Firstly, *BCRP* gauges private firms' expectations with a survey, the Macroeconomic Expectations Survey (*Encuesta de Expectativas Macroeconómicas* or EEM). It consists of an increasing sample of Peruvian firms who provide, on a monthly basis, their forecasts for $\{g, \pi, ...\}$ to the *BCRP*'s Department of Production Activity (EEM surveys' closing date is the end of the month). The EEM cross-sections of forecasts are large enough for the corresponding sequence of densities $\{f_t(a)\}$ to be non-parametrically estimated with the *Epanechnikov* kernel and immediately taken as observed data. Each element of this sequence, $f_t(a)$, is the density function of period t with domain $a \in A \equiv \{\underline{a}, \bar{a}\} \subset \Re$, $\forall t \in \{1,2,\dots,T\}$ (e.g., $a \equiv \pi$).

Secondly, *BCRP* forecasts for both variables are available from the *BCRP*'s *Inflation Reports* (IR), whose disclosure (publication and media diffusion) is made every three or four months. The IR publication defines the treatment (dichotomous) variable (the same for either π or g, one at a time) because IR publication dates define the 'experimental quarters' behind the quasi-experimental testing of the treatment effects (exact dates correspond to the press releases; see Appendix A). Single-unit t-tests for the treatment effects of *BCRP* forecasts on *EEM* probability density functions *(BCRP* → EEM) only use the observations inside 'experimental quarters', which are build after such an assignment of dates: 'experimental quarters' must begin with the month previous to the IR publication month (press release). Given that EEM surveys' closing dates follow Consensus surveys', assignment

[32] See Davidson and MacKinnon (1993). FWL theorem can only approximately hold for other estimation procedures (e.g., generalized least squares).

[33] By simulation, there usually exists a *functional relationship* between any moment and the probability density function from which it comes. By formulae, we require the existence of a probability density function, its moment-generating function and even the moments. Then, a simple example of such a relationship would be the (robust) mean: it would be the (weighted) integral of such a probability density function. This simple idea usually holds for any (existing) moment, so the FWL theorem holds for both the *functional regression* and those simulated moments.

of dates for *BCRP* → EEM single-unit t-tests is almost the same (differing only for a triad of months: August 2003, March 2010 and April 2014).[34]

Finally, other explanatory variables are the robust location (median) and robust dispersions (S_n and Q_n) calculated from *Consensus Forecasts*' small cross-sections of professional forecasters' expectations about π and g in Peru.[35] Consensus Economics, Inc. asks a small sample of professional forecasters or 'insiders' (as they will be called from now on) to provide forecasts for π and g on a monthly basis. Since the closing dates of *Consensus Forecasts*' surveys is every month's 3rd Monday, Appendix A defines the due precedence of *BCRP* forecasts with respect to *Consensus Forecasts*' explanatory variables (robust location and dispersions). Since EEM surveys' closing date is the end of the month, the due precedence of *BCRP* forecasts with respect to EEM *Epanechnikov* probability densities is also assured.

Besides the data and its chronology, four additional data issues need to be controlled for. Firstly, all forecasts under study are fixed-event forecasts because all of them consider two fixed events (with fixed dates): either the end of the current calendar year or the end of next calendar year. Since the maximum forecasting horizon is $H = 24$ months, the full sample of forecasts can be split into two separate sub-samples: the short-term forecasts ($h \leq 12$) and the medium-term forecasts ($12 < h \leq 24$).

The common sample of forecasts is January 2004 - December 2015. Given their fixed-event nature, this sample can only include the forecasts for the end of 2004 which were generated during the year 2004 (medium-term forecasts for the end of 2004 generated during the year 2003 are 'not available'). Similarly, this sample can only include the forecasts for the end of 2015 which were generated during the year 2015 (medium-term forecasts for the end of 2016 generated during the year 2015 are 'not available').

Secondly, there exists an important number of 'not available' data for each EEM individual firm along the monthly sample: firms can abandon the survey and then may reenter the survey. Then, all cross-section computations (for either the EEM *Epanechnikov* densities or the EEM sample moments) only consider the available numbers, provided that EEM cross-sections are large (a similar pattern occurs for the individual insiders who provide forecasts to Consensus Economics, Inc.). The list of firms surveyed at least once has been growing fast: in January 2004, it included 432 firms, which were kept without change by January 2006; in January 2009, the list included 917 firms; in January 2012, the list included 959 firms; in March 2012, it reached 1003 firms; finally, in December 2015, the list included 1278 firms. The number of firms' plausible answers used to estimate the *Epanechnikov* densities has then been increasing, belonging to an approximated range of [300 500], though.

Thirdly, the EEM data first received was pre-depurated and well organized, but barely covered the last two years (2014-2015). Since the study was supposed to go back as far as January 2002, the author had to deal with non-depurated data beginning in January 2004 and ending in December 2015. The advantages of such a trade are obvious: the outlier depuration was made conservatively and homogeneously, leading to the ranges [-10 15] and [-2 15] for short-term and medium-term π expectations, respectively, as well as to [-3 15] and [-1 15] for short-term and medium-term g expectations, respectively. In spite of this conservative and homogeneous data depuration, the *Epanechnikov* densities still have fat tails, so robust location (median) and dispersions (S_n and Q_n) must be considered since their means and variances may become not-well-defined in the population.

Figure 2 shows a sub-sequence of EEM densities, this time obtained from Peruvian financial entities' and analysts' short-term π (pre-depurated) expectations. This subsequence corresponds to an upsurge of the nominal exchange rate (FX) in Peru (beginning in August 2014). Clearly, π expectations react to nominal depreciation: the probability mass moves towards ranges of higher inflation expectations.[36] This kind of evolution does justify the inclusion of (lagged) FX variables into the set of explanatory variables for the EEM densities of Peruvian firms' π forecasts: the monthly average and the $\text{Ln}\big(1000(\text{standard deviation})\big)$ of end-of-period daily FX interbank quotations. Lagged FX variables are needed to avoid some conceptual problems related to having two proxies of central bank credibility, one on each side of any relationship. Particular moments of these EEM

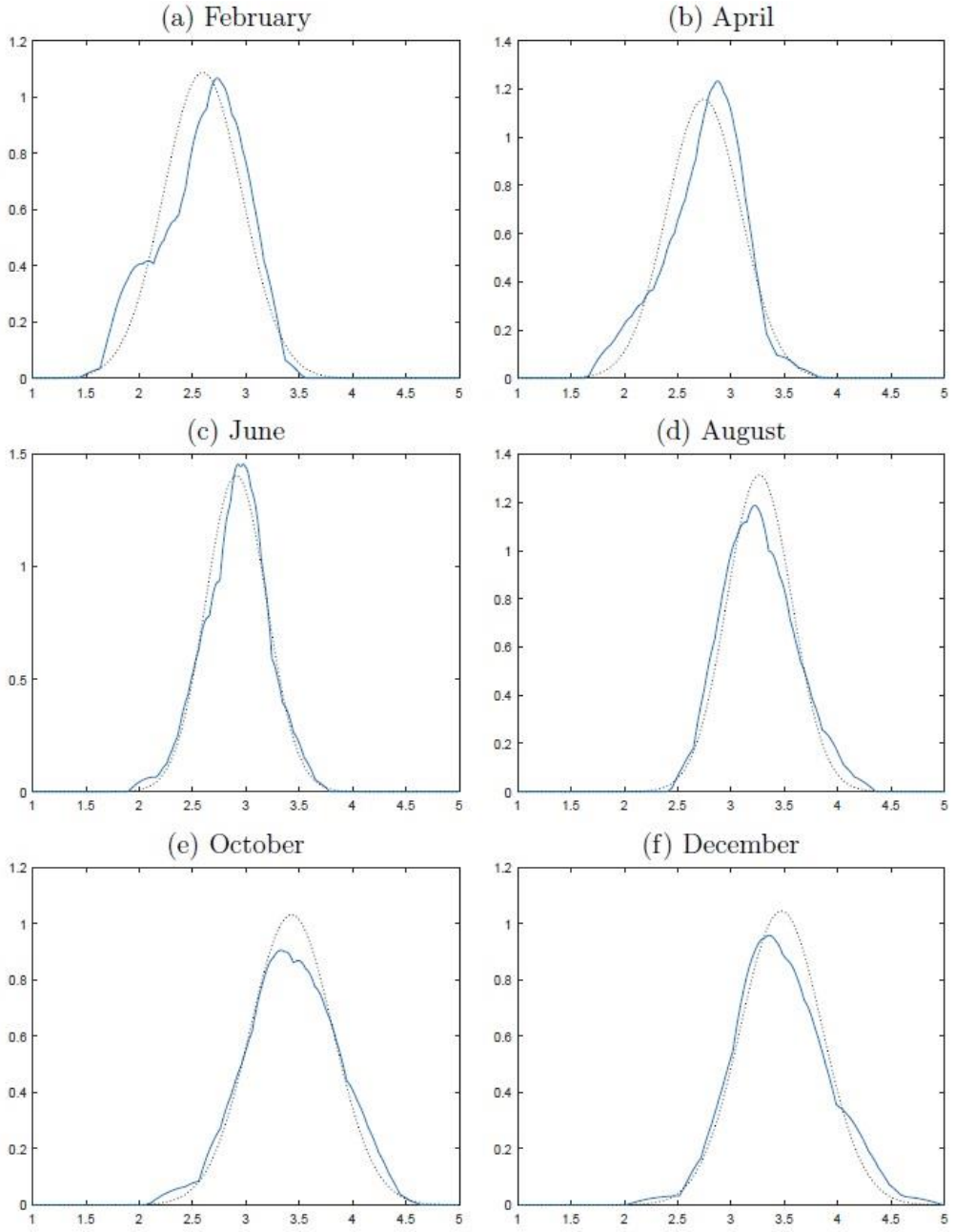
[34] Note that it is always possible to use a continuous monthly series of *BCRP* forecasts (one for π and another for g) by defining the *BCRP* forecasts as 'outstanding' (the most recently published *BCRP* forecast). This simple information-set-based strategy transforms a quarterly series into a monthly series and, in the case of the literature on mixed sampling frequencies, it provides a model which becomes a simple alternative to the Kalman filter model with missing observations in the low-frequency series (see Foroni 2012, and her references therein).

[35] See Appendix B for the definitions of the moments used in the paper.

[36] The range of these economists' expectations is narrower than the ranges of the firms' expectations, which may be related to the pre-depurations made.

densities (for instance, robust dispersions) are actually proxies of central bank credibility with respect to price stability (see Bordo and Siklos 2015), and so are those FX variables.

Figure 2. Peruvian economists' short-term π expectations during 2015



Note: Bi-monthly sequence of Epanechnikov kernel densities (continuous line) and Gaussian densities (dotted line). Besides, Epanechnikov densities are not close to their Gaussian peers (the latter densities used the sample mean and standard deviation of the same data used for obtaining the former densities).

3.2 Research Results

The results from short-term-horizon g expectations show that the publication of short-term g forecasts generate *on-impact* increases in the skewness, the two robust measures of kurtosis, and the probability that these expectations are in the long-run-growth-rate range of [4% 7%]. All these *on-impact* increases are consistent with *on-impact* decreases in the percentile 95, a measure of the left tail's probability mass and a measure of the right tail's probability mass. However, the *one-impact* change in the probability that these expectations are in the range has a sign opposite to the *one-month-later* change in this probability. This *one-month-later* change is consistent with a *one-month-later* decrease in the mode and the *one-month-later* increases in the kurtosis, the robust measure of skewness and a measure of the left tail's probability mass. See Table D1 in Appendix D.

The results from short-term-horizon π expectations show that the publication of short-term π forecasts generate *on-impact* increases in robust and non-robust measures of location (trimmed means and median), as well as in the two robust measures of dispersion, the percentiles 5, 10, 15, 20, 80 & 85, and the probability that these expectations are in the target range of [1% 3%]. All these *on-impact* increases are consistent with *on-impact* decreases in the two measures of the left tail's probability mass and the percentile 95. However, some of the *one-month-later* changes have signs opposite to those *on-impact* changes (e.g., trimmed means, median, percentile 85). All these *one-month-later* decreases are consistent with a *one-month-later* increase in the skewness and a *one-month-later* decrease in the mean. See Table D2 in Appendix D.

The results from medium-term-horizon g expectations show that the publication of medium-term g forecasts generate *on-impact* increases in the two robust measures of dispersion, the percentiles 90 & 95, and the robust measure of skewness. All these *on-impact* increases are consistent with *on-impact* decreases in the percentile 15 and the probability that these expectations are in the long-run-growth-rate range of [4% 7%]. However, the *on-impact* change in the probability that these expectations are in the target range has a sign opposite to the *one-month-later* change in this probability. This *one-month-later* change is consistent with a *one-month-later* decrease in the robust measure of skewness and a *one-month-later* increase in the non-robust measure of kurtosis. See Table E1 in Appendix E.

The results from medium-term-horizon π expectations show that the publication of medium-term π forecasts generates *on-impact* increases in robust and non-robust measures of location (mean, trimmed means, median and mode), as well as in the two robust measures of dispersion, the percentiles 5, 10, 15, 80 & 85, the robust measure of skewness and the two robust measures of kurtosis. All these *on-impact* increases are consistent with *on-impact* decreases in the two measures of the left tail's probability mass coupled with *on-impact* increases in a measure of the right tail's probability mass. However, some of the *one-month-later* changes have signs opposite to those *on-impact* changes (*e.g.*, some location measures, percentiles 5 & 80, and the robust measure of skewness). All these *one-month-later* decreases are consistent with *one-month-later* increases in one of the robust measures of kurtosis as well as in the measure of the right tail's probability mass. Surprisingly, there are no significant changes in the probability that these expectations are in the target range of [1% 3%]. See Table E2 in Appendix E.

All these results contrast with the non-significant results from updated single-moment NL-regression-based t-tests (the robust measures of dispersion, Q_n & S_n). See Tables C1 and C2 in Appendix C.

4. Discussions

The experimental setup and its requirements impose severe restrictions to applications where the researcher wants not only to discover whether a particular treated group g becomes significantly affected by some kind of treatment, but also to explore the treated group g's conditions under which such a treatment maximizes its benevolent impact, as well as to determine specific ways to manage the treatment in the most effective way. For this kind of questions, the conditions associated to the other treated groups can really bias the treatment effect because there does not exist a homogeneous treatment (including their specific conditions) across treated groups (countries in our desired application).

From these problems, we build on BDM's (implicit) solution of disregarding any counterfactual. The paper provides an extension to such a solution, which allows a complete and consistent characterization of the direct effects from treatment (on-impact changes & one-month-later changes). The stylized application takes advantage from the availability of large cross-sections in EEM surveys for Peruvian firms. Benevolent effects from Peruvian Central Bank's forecasts are found for EEM firms' π expectations.

The perspectives from the empirical side are related to considering (i) the *Ha* single-unit t-tests for the short-term sample, as well as to the hypothesis of useful effects coming from Consensus forecasts, (ii) the complementary convergence data considered in Barrera (2018), that is, the gap between the EEM expectations and the previous *BCRP* forecasts as a new probability density function to be affected by the current *BCRP* forecasts, and (iii) the non-linear functional regressions, which will be useful for addressing relevant questions about the different direct effects of *BCRP* forecasts being above (below) the maximum (minimum) inflation allowed by the target range, or just inside this range.

The perspectives from the methodological side are related to the possibility of a well-defined homogeneous and simultaneous treatment that would lead to a control set of densities (a counterfactual). In this case, a *fully-fledged DiD approach* will be feasible, and our proposal will provide *full characterization* of *causal* effects of a treatment (if and only if the specific application does not allow to consider a direct effect as being the

same as a causal effect). Such availability of data in terms of densities for many countries (say) would be named *huge data* instead of just *big data*.

Conclusions

The paper proposed a method for simultaneously estimating the treatment effects of a change in a policy variable on a numerable set of interrelated outcome variables (different moments from the same probability density function). The stylized application provided a 29-moment characterization of the direct treatment effects of the Peruvian Central Bank's forecasts on two sequences of Peruvian firms' probability densities of expectations (for inflation -π- and real growth -g-) during 2004-2015.

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Appendices

A Chronologies

Table A1: Assignment of BCRP forecasts to Consensus Economics Inc.'s surveys */
(From Section 3.1 or Subsection 2.3)

Dates associated with Peru's IRs					
Number	IR	Press Release	IR tentative assignment from LACF survey 1/	LACF Survey Date close to the Press Release 2/	IR final assignment from LACF survey 1/
	Aug03	29aug03	(Sep03)	18aug03	(Sep03)
1	Jan04	06feb04	Feb04	16feb04	Feb04
2	May04	04jun04	Jun04	21jun04	Jun04
3	Aug04	10sep04	Sep04	20sep04	Sep04
4	Jan05	04feb05	Feb05	21feb05	Feb05
5	May05	03jun05	Jun05	20jun05	Jun05
6	Aug05	02sep05	Sep05	19sep05	Sep05
7	Jan06	03feb06	Feb06	20feb06	Feb06
8	May06	02jun06	Jun06	19jun06	Jun06
9	Sep06	06oct06	Oct06	16oct06	Oct06
10	Jan07	09feb07	Feb07	19feb07	Feb07
11	May07	08jun07	Jun07	18jun07	Jun07
12	Sep07	05oct07	Oct07	15oct07	Oct07
13	Jan08	08feb08	Feb08	18feb08	Feb08
14	May08	13jun08	Jun08	16jun08	Jun08
15	Sep08	10oct08	Oct08	20oct08	Oct08
16	Mar09	13mar09	Mar09	16mar09	Mar09
17	Jun09	12jun09	Jun09	15jun09	Jun09
18	Sep09	18sep09	Oct09	21sep09	Sep09
19	Dec09	18dec09	Jan10	14dec09	Jan10
20	Mar10	26mar10	Apr10	15mar10	Apr10
21	Jun10	18jun10	Jul10	21jun10	Jun10
22	Sep10	17sep10	Oct10	20sep10	Sep10
23	Dec10	17dec10	Jan11	13dec10	Jan11
24	Mar11	18mar11	Apr11	21mar11	Mar11
25	Jun11	17jun11	Jul11	20jun11	Jun11
26	Sep11	16sep11	Oct11	19sep11	Sep11
27	Dec11	16dec11	Jan12	19dec11	Dec11
28	Mar12	23mar12	Apr12	19mar12	Apr12
29	Jun12	15jun12	Jun12	18jun12	Jun12
30	Sep12	14sep12	Sep12	17sep12	Sep12
31	Dec12	14dec12	Dec12	17dec12	Dec12
32	Mar13	22mar13	Apr13	18mar13	Apr13
33	Jun13	21jun13	Jul13	17jun13	Jul13
34	Sep13	20sep13	Oct13	16sep13	Oct13
35	Dec13	20dec13	Jan14	16dec13	Jan14
36	Apr14	25apr14	May14	22apr14	May14
37	Jul14	18jul14	Aug14	21jul14	Jul14
38	Oct14	17oct14	Nov14	20oct14	Oct14
39	Jan15	23jan15	Feb15	19jan15	Feb15
40	May15	22may15	Jun15	18may15	Jun15
41	Sep15	18sep15	Oct15	14sep15	Oct15
42	Dec15	18dec15	Jan16	14dec15	Jan16

∗/ Consensus survey's closing date is always before EEM's (the end of the month).

1/ Consensus Economics Inc. carries out the Latin-American-country survey every month's 3th Monday ([Consensus (2015)]). A tentative assignment of the central bank IR forecasts to the Consensus Economics Inc. surveys considers that these forecasts will surely affect the survey's forecasts from the very month of an IR publication (until they become affected by the following IR's forecasts) if the IR publication date falls before or at the 14th day of that month; otherwise, they will surely affect the survey from the following month to the publication month (until they become affected by the following IR's). The final assignment uses the closing date of the corresponding Consensus Economics Inc.'s survey.

2/ For the case of the effects upon the EEM's forecasts, both Consensus Economics Inc.'s dates and IR Press Releases' dates indicate that these two types of forecasts will contemporaneously affect the EEM's forecasts (except maybe for March 2010's IR). While the frequency of Consensus Economics Inc.'s forecasts is monthly (allowing a direct use of the auxiliary regression), Central Bank's IR forecasts still require a specially-tailored 'assignment' similar to the one used in the previous paper.

B Moments

The simulations are obtained from each estimated density corresponding to period $t \in \{1,2,\dots,T\}$, thus allowing to obtain a comprehensive set of scalar moments for each estimated density:

1. First-order moments: mean; 5%- and 10%-trimmed means;[37] median (percentile {50}); and mode.

2. Second-order moments: standard deviation; robust dispersion estimators Q_n and S_n proposed by Rousseeuw and Croux (1993).[38]

3. Higher-order moments: skewness, SK_2; kurtosis, KR, KR_2, KR_4;

4. Other moments: *Pr*(*range*),[39] its confidence interval and its variability coefficient; Percentiles {5, 10, 15, 20, 80, 85, 90, 95}; LQW_s and LQW_b left tails ($s = 0.125$ and $b = 0.250$); RQW_s and RQW_b right tails ($s = 0.875$ and $b = 0.750$).

Some clarifications are due regarding some 'other moments'. Traditional standardized moments, such as skewness (*SK*)[40] and kurtosis (*KR*),[41] actually depend upon other traditional moments like the mean or the variance, which may not exist in the population's distribution. Sample counterparts are always computable, but their values will then display an erratic behavior; see Bonato (2011). Corresponding robust measures SK_2, KR_2 and KR_4 are preferred,

$$SK_2 \equiv \frac{Q_3 + Q_1 - 2Q_2}{Q_3 - Q_1}$$

$$KR_2 \equiv \frac{(E_7 - E_5) + (E_3 - E_1)}{E_6 - E_2}$$

$$KR_4 \equiv \frac{F^{-1}(0.975) - F^{-1}(0.025)}{F^{-1}(0.750) - F^{-1}(0.250)}$$

where Q_i is the i-th quartile,[42] and E_i is the i-th octile, that is, $E_i \equiv F^{-1}(i/8)$ for $i \in \{1,2,\dots,7\}$; see Bonato (2011). Before continuing with the specificities of the simulations, note KR, KR_2 and KR_4 have two statistical disadvantages: (i) they are really measuring not only the tail heaviness but also the peakedness of a distribution, and (ii) their tail-heaviness interpretation is restricted to symmetric distributions. Brys *et al.* (2006) recommend the use of robust measures of left and right tails, the left quantile weight (LQW_p), and the right quantile weight (RQW_q) for $0 < p < 1/2$ and $\frac{1}{2} < q < 1$, respectively.

$$LQW_p \equiv \frac{F^{-1}\left(\frac{1-p}{2}\right) + F^{-1}\left(\frac{p}{2}\right) - 2F^{-1}(0.250)}{F^{-1}\left(\frac{1-p}{2}\right) - F^{-1}\left(\frac{p}{2}\right)}$$

$$RQW_q \equiv \frac{F^{-1}\left(\frac{1+q}{2}\right) + F^{-1}\left(1 - \frac{q}{2}\right) - 2F^{-1}(0.750)}{F^{-1}\left(\frac{1+q}{2}\right) - F^{-1}\left(1 - \frac{q}{2}\right)}$$

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[37] The p% trimmed mean of n sampled values $\{x_1, x_2, \dots, x_n\}$ is the mean of those values excluding the highest and lowest q data values, where $q \equiv n * \left(\frac{p}{100}\right)/2$.

[38] Given a sample of n points, $\{x_1, x_2, \dots, x_n\}$, $S_n \equiv s_{mp} s_{mg} med_i \left\{med_j\{|x_i - x_j|\}\right\}$ and $Q_n \equiv q_{mp} q_{mg} \{|x_i - x_j|;\ i < j\}_{(k)}$, $k \equiv \binom{h}{2}$, $h \equiv \lfloor n/2 \rfloor + 1$, where $\{y_i\}_{(k)}$ refers to the k-th order statistic obtained from the data set $\{y_i\}$; $\binom{a}{b}$, to the combinations of a elements taken in groups of b elements; and $\lfloor c \rfloor \equiv max\{d \in \mathbb{Z} | d \leq c\}$, to the maximum integer of c. s_{mg} and q_{mg} are the adjustment factors compensating for the (asymptotic) large-sample bias with respect to a normal distribution, and s_{mp} and q_{mp}, the adjustment factors compensating for the small-sample bias; see Croux and Rousseeuw (1992).

[39] The scalar criterion *Pr*(*range*) is the probability that the variable defining the support of the densities (functional responses in the functional regression model) happens to be inside the 'range'. This range is [4 7] for g forecasts and [1 3] for π forecasts.

[40] If SK is positive [negative], the long tail is to the right [left].

[41] If KR is regarded as a measure of tail heaviness, a positive [negative] KR means a symmetric distribution has heavier tails [lighter tails] than a normal distribution's tails.

[42] Given a process of n points, $\{x_1, x_2, \dots, x_n\}$, and assuming that the x_j's are independent and identically distributed with cumulative distribution function F, then $Q_1 \equiv F^{-1}(0.25)$, $Q_2 \equiv F^{-1}(0.50)$, and $Q_3 \equiv F^{-1}(0.75)$.

C Ha t-tests for BCRP →EEM

Table C1. Tests with Q_n dispersion of EEM forecasts
(From Section 3.2)

Variable	Model/d.f.	Current vs. Previous ({s = 2|s = 1})		Next vs. Previous ({s = 3|s = 1})	
		Tcal	p_1 (p-value)	Tcal	p_2 (p-value)
Short-term sample (h ≤ 12)					
GDP growth	Add.trend/32	-0.275	0.393	-0.262	0.398
CPI inflation	Add.trend/32	0.226	0.411	-0.692	0.247
Medium-term sample (h > 12)					
GDP growth	Add.trend/31	0.186	0.427	-0.052	0.479
CPI inflation	Add.trend/31	0.049	0.48	-0.023	0.491

See [Barrera (2018)]'s Online Appendix, Table E.1.

Table C2. Tests with S_n dispersion of EEM forecasts
(From Section 3.2)

Variable	Model/d.f.	Current vs. Previous ({s = 2|s = 1})		Next vs. Previous ({s = 3|s = 1})	
		Tcal	p_1 (p-value)	Tcal	p_2 (p-value)
Short-term sample (h ≤ 12)					
GDP growth	Add.trend/32	-1.193	0.121	-0.515	0.305
CPI inflation	Add.trend/32	-0.372	0.356	-0.792	0.217
Medium-term sample (h > 12)					
GDP growth	Add.trend/31	0.254	0.401	-0.045	0.482
CPI inflation	Add.trend/31	-0.26	0.398	-0.147	0.442

See [Barrera (2018)]'s Online Appendix, Table D.1.

D Ha t-tests for BCRP →EEM, short-term sample (moment-simulated deltas)

Table D1. BCRP → EEM (g)
(From Section 3.2)
Ha t-tests for EEM-moment-simulated deltas (m1, short-term sample, h ≤ 12)

Variable	**Simulated Scalar Criteria** (moments)	Current vs. Previous ({s = 2|s = 1})		Next vs. Previous ({s = 3|s = 1})	
		Tcal 34 d.f.	p_1 (p-value)	Tcal 34 d.f.	p_2 (p-value)
GDP growth	Mean	1.000	0.162	-1.000	0.162
	Trimmean5	-0.737	0.233	-0.520	0.303
	Prctile50	-0.431	0.335	-0.455	0.326
	Mode *	-0.406	0.344	-1.762	**0.044**
	Std.Dev.	-1.000	0.162	1.000	0.162
	Skewness	1.771	**0.043**	-0.381	0.353
	Kurtosis	-0.960	0.172	1.728	**0.047**
	Prctile5	0.928	0.180	-1.148	0.130
	Prctile10	0.563	0.289	-1.231	0.114
	Prctile15	-0.157	0.438	-1.267	0.107
	Prctile20	-0.430	0.335	-0.929	0.180
	Prctile80	0.019	0.492	0.840	0.204
	Prctile85	-0.645	0.262	0.855	0.199
	Prctile90	-1.165	0.126	0.971	0.169
	Prctile95	-1.347	**0.094**	0.994	0.164
	Trimmean10	-0.556	0.291	-0.659	0.257
	SK_2	0.740	0.232	1.319	**0.098**
	KR_2	1.909	**0.033**	1.300	0.101
	KR_4	1.379	**0.089**	0.820	0.209
	LQW_s	0.906	0.186	1.527	**0.068**
	LQW_b	-1.475	**0.075**	0.686	0.249
	RQW_s	0.656	0.258	-0.512	0.306
	RQW_b	-1.774	**0.043**	0.983	0.166
	Q_n	0.819	0.209	0.629	0.267
	S_n	0.951	0.174	0.595	0.278
	ub{Pr(.)} §	5.149	**0.000**	-1.769	**0.043**
	Pr(range) ♦	5.134	**0.000**	-1.753	**0.045**
	lb{Pr(.)} §	5.119	**0.000**	-1.737	**0.046**
	cv{Pr(.)}	-4.180	**0.000**	-1.781	**0.042**

* Not simulated. ♦g & π ranges: [4 7] & [1 3]. §Pr(range)'s 95% CI.

Table D2. BCRP → EEM (π)
(From Section 3.2)
Ha t-tests for EEM-moment-simulated deltas (m1, short-term sample, h ≤ 12)

Variable	**Simulated Scalar Criteria** (moments)	Current vs. Previous ({s = 2|s = 1}) Tcal 32 d.f.	p_1 (p-value)	Next vs. Previous ({s = 3|s = 1}) Tcal 31 d.f.	p_2 (p-value)
CPI inflation	Mean	1.067	0.147	-1.552	**0.065**
	Trimmean5	3.516	**0.001**	-2.436	**0.010**
	Prctile50	1.342	**0.095**	-1.815	**0.044**
	Mode *	-0.037	0.485	-1.179	0.124
	Std.Dev.	0.000	0.500	1.129	0.134
	Skewness	-1.253	0.110	1.661	**0.053**
	Kurtosis	0.976	0.168	-0.690	0.248
	Prctile5	2.338	**0.013**	-0.219	0.414
	Prctile10	3.608	**0.001**	-0.609	0.273
	Prctile15	2.097	**0.022**	-0.877	0.194
	Prctile20	1.699	**0.050**	-1.081	0.144
	Prctile80	4.085	**0.000**	-1.046	0.152
	Prctile85	2.858	**0.004**	-1.510	**0.071**
	Prctile90	0.566	0.288	-1.104	0.139
	Prctile95	-1.866	**0.036**	-1.127	0.134
	Trimmean10	3.832	**0.000**	-2.226	**0.017**
	SK_2	1.225	0.115	-0.394	0.348
	KR_2	-0.417	0.340	-0.065	0.474
	KR_4	-0.989	0.165	0.267	0.396
	LQW_s	-1.386	**0.088**	0.197	0.422
	LQW_b	-3.897	**0.000**	0.788	0.218
	RQW_s	0.381	0.353	-0.270	0.394
	RQW_b	1.006	0.161	-1.307	0.100
	Q_n	1.603	**0.059**	0.099	0.461
	S_n	2.672	**0.006**	0.174	0.431
	ub{Pr(.)} §	2.405	**0.011**	0.818	0.210
	Pr(range) ♦	2.419	**0.011**	0.819	0.210
	lb{Pr(.)} §	2.433	**0.010**	0.820	0.209
	cv{Pr(.)}	-0.600	0.276	-0.021	0.492

* Not simulated. ♦g & π ranges: [4 7] & [1 3]. §Pr(range)'s 95% CI.

E Ha t-tests for BCRP →EEM, medium-term sample (moment-simulated deltas)

Table E1. BCRP → EEM (g)
(From Section 3.2)
Ha t-tests for EEM-moment-simulated deltas (m2, medium-term sample, h > 12)

Variable	**Simulated Scalar Criteria** (moments)	Current vs. Previous ({s = 2|s = 1})		Next vs. Previous ({s = 3|s = 1})	
		Tcal 37 d.f.	p_1 (p-value)	Tcal 37 d.f.	p_2 (p-value)
GDP growth	Mean	0.583	0.282	0.753	0.228
	Trimmean5	0.381	0.353	0.274	0.393
	Prctile50	0.168	0.434	-0.276	0.392
	Mode *	0.427	0.336	-0.562	0.289
	Std.Dev.	-0.207	0.418	1.116	0.136
	Skewness	0.640	0.263	-0.632	0.266
	Kurtosis	-0.891	0.189	1.925	**0.031**
	Prctile5	-0.064	0.475	0.935	0.178
	Prctile10	-1.061	0.148	0.445	0.329
	Prctile15	-1.353	**0.092**	0.085	0.466
	Prctile20	-1.179	0.123	-0.295	0.385
	Prctile80	1.074	0.145	-0.241	0.405
	Prctile85	1.236	0.112	-0.154	0.439
	Prctile90	1.622	**0.057**	-0.775	0.222
	Prctile95	2.316	**0.013**	-1.153	0.128
	Trimmean10	0.241	0.406	0.055	0.478
	SK_2	-1.452	**0.077**	-1.664	**0.052**
	KR_2	0.048	0.481	-0.592	0.279
	KR_4	-0.948	0.175	0.135	0.447
	LQW_s	-1.010	0.160	0.982	0.166
	LQW_b	-0.950	0.174	-0.665	0.255
	RQW_s	1.153	0.128	-1.029	0.155
	RQW_b	1.119	0.135	0.495	0.312
	Q_n	2.164	**0.019**	0.717	0.239
	S_n	2.079	**0.022**	0.902	0.187
	ub{Pr(.)} §	-1.320	**0.097**	1.568	**0.063**
	Pr(range) ♦	-1.326	**0.096**	1.576	**0.062**
	lb{Pr(.)} §	-1.333	**0.095**	1.583	**0.061**
	cv{Pr(.)}	1.694	**0.049**	-1.752	**0.044**

* Not simulated. ♦g & π ranges: [4 7] & [1 3]. §Pr(range)'s 95% CI.

Table E2. BCRP → EEM (π)
(From Section 3.2)
Ha t-tests for EEM-moment-simulated deltas (m2, medium-term sample, h > 12)

Variable	**Simulated Scalar Criteria** (moments)	Current vs. Previous ({s = 2|s = 1})		Next vs. Previous ({s = 3|s = 1})	
		Tcal 35 d.f.	p_1 (p-value)	Tcal 34 d.f.	p_2 (p-value)
CPI inflation	Mean	3.907	**0.000**	0.959	0.172
	Trimmean5	3.750	**0.000**	-1.760	**0.044**
	Prctile50	2.268	**0.015**	-1.326	**0.097**
	Mode *	1.262	0.108	0.105	0.458
	Std.Dev.	0.346	0.366	-0.960	0.172
	Skewness	1.119	0.135	0.268	0.395
	Kurtosis	-0.114	0.455	-0.867	0.196
	Prctile5	1.783	**0.042**	-2.684	**0.006**
	Prctile10	1.906	**0.032**	-0.966	0.171
	Prctile15	1.686	**0.050**	-1.146	0.130
	Prctile20	1.115	0.136	-0.957	0.173
	Prctile80	4.276	**0.000**	-1.475	**0.075**
	Prctile85	2.595	**0.007**	-1.289	0.103
	Prctile90	-0.278	0.391	-1.434	**0.080**
	Prctile95	-0.869	0.195	-1.715	**0.048**
	Trimmean10	3.996	**0.000**	-1.571	**0.063**
	SK_2	1.738	**0.046**	-1.894	**0.033**
	KR_2	1.918	**0.032**	2.313	**0.013**
	KR_4	2.214	**0.017**	-0.114	0.455
	LQW_s	-2.344	**0.012**	0.098	0.461
	LQW_b	-1.706	**0.048**	-0.415	0.340
	RQW_s	1.000	0.162	0.376	0.355
	RQW_b	1.747	**0.045**	2.033	**0.025**
	Q_n	2.289	**0.014**	-0.850	0.201
	S_n	2.774	**0.004**	-0.868	0.196
	ub{Pr(.)} §	-1.012	0.159	1.090	0.142
	Pr(range) ♦	-1.016	0.158	1.084	0.143
	lb{Pr(.)} §	-1.020	0.157	1.079	0.144
	cv{Pr(.)}	-0.003	0.499	-0.283	0.390

* Not simulated. ♦g & π ranges: [4 7] & [1 3]. §Pr(range)'s 95% CI.

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The Impact of the Pandemic on the Economic Development about Small and Medium Sized Businesses

Altynbek ZHAKUPOV
L.N. Gumilyov, Eurasian National University, Kazakhstan
zhakupov.altynbek@bk.ru

Assylkhan YESSILOV
Kazakh University of Technology and Business, Kazakhstan
esilov@gmail.com

Alibek YELEMESSOV
Pavlodar Pedagogical University, Kazakhstan
alibek-ele@mail.ru

Nargiz ISMAILOVA
Abay Myrzakhmetov Kokshetau University, Kazakhstan
isaismailova6@gmail.com

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Abstract: The article substantiates the use of a systems approach to the processes about business model switching in small businesses, as this approach was not previously demanded before the pandemic. In this regard, it is concluded that the study of strategic shifts made by small businesses in different segments of the economy is an important new stage in the development of the systems approach.
This paper proposes adapting the matrix approach to distinguish crisis states for small businesses according to the properties of their business models: divergent to crisis; crisis-resistant; adaptive; temporarily limited; externally supported; true bankruptcy.
A standardized decision-making procedure for digitalization has been developed, and the challenges that small businesses need to address when choosing a digitalization scenario as the minimum necessary sequence of actions, each element of which is necessary to realize the digital transition, have been identified.
Keywords: pandemic; COVID-19; matrix; small and medium businesses; crisis; economics management.
JEL Classification: E21; E25; E27; E16; E44; E64; E65; F13.

Introduction

The world is unlikely to emerge from the COVID-19 crisis unscathed. The consequences of this crisis are likely to be nothing like what the world has seen so far, given the strength and speed with which the coronavirus has spread everywhere. Under these circumstances, businesses, especially small businesses, should consider possible forms of predicting the economic impact of the pandemic.

The first effects of the pandemic were a sharp drop in both aggregate demand and supply. The widespread closures of businesses to combat the pandemic led to a decline in aggregate supply, while the decline in consumption and investment led to a decline in demand. The search for forms of forecasting relies on selecting a model and approach in general that will predict the effects of the pandemic on small businesses. A common small business problem is that some small business owners are at risk of going out of business because of a failure to prepare for a crisis. Particular problems are that a number of entrepreneurs lack adequate crisis management strategies to survive unexpected constraints on operations.

Traditionally, all institutions related to business support have focused on crisis prevention rather than on providing crisis response strategies. Raising small business owners' awareness of the economic risks associated with the lack of crisis management strategies is a starting point for improving business practices.

Let us agree that uncertainty persists for a long time, and the full impact of a pandemic on business will not be definitively determined until after it is over[1].

Therefore, the first conclusion that is not in demand today is the requirement to study the dynamics in studies of the effects pandemic on small business: each new advance of the crisis must be accompanied by active studies of economic dynamics, and the findings must be accompanied by fairly private revisions and adjustments as a consequence of the findings.

It is intuitively obvious that the crisis not only forces many organizations to fight for survival, but also to look for alternative strategic paths. While, on the one hand, the pandemic posed enormous challenges to small businesses, on the other hand, it also required a new search, giving businesses the opportunity to identify new models that will allow them to survive the crisis. In general, the systemic crisis management model includes a crisis management model, crisis management planning, contingency planning, and business continuity planning, which enhances the survival of small businesses[2].

In connection with the above, the authors hypothesize that businesses need to form the ability to switch business models within a single enterprise (or group) without liquidation (in any form) within the framework of systemic views.

Such a "switch", according to the authors, can be justified only within the framework of the system approach, ensuring sustainable development in times of crisis (Fig.1). As part of the idea of implementing the "switch" two possibilities, based on different theoretical foundations, should be considered:

- crisis management theory,
- the theory of crisis intervention.

Figure 1. Crisis management stages

Figure 2. Crisis intervention models to help maximize mental stability during a crisis

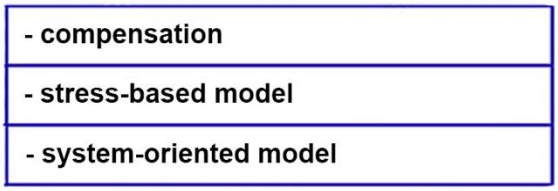
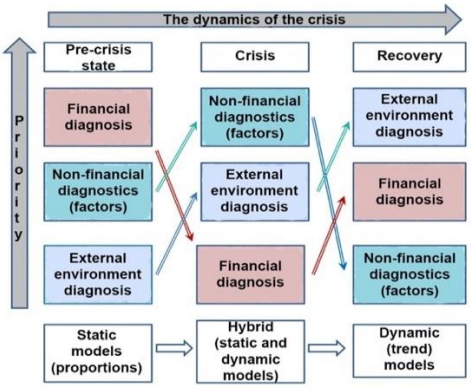


Figure 3. Matrix for the application of different SME diagnostic models during different periods of crisis



[1] Seetharaman P. Business models shifts: Impact of Covid-19 // International Journal of Information Management, 2020, vol. 54, no. 102173.

[2] Braun B. Preparedness, crisis management and policy change: The Euro area at the critical juncture of 2008-2013 // The British Journal of Politics & International Relations, 2015, vol. 17, pp. 419-441.

A system-oriented model can help identify social factors to predict people's reactions. Entrepreneurs can use compensation, stress-oriented, and systems-oriented models to establish a discernible onset of a crisis, figure out whether the crisis is situational or developmental, understand the perceptions of the people involved, minimize future vulnerabilities, and determine a time frame for response (Fig.2).

Such learning must consider internal factors: business boundaries, communications, processes, goals and values that change during a crisis as well (Fig 3.).

1. Research Methodology

The economy is considered from the position of system solutions as a set of socio-economic systems, *i.e.*, isolated in time and space relatively stable and holistic parts of the surrounding world, which are distinguished by the observer by spatial or functional features. Such a vision allows us to establish the possibility of identifying sustainable parts of the economy during a crisis in unity with the problematic ones and propose an algorithm based on structural shifts to increase the survival of small business.

However, from 2003 to 2013, developing crisis strategies for small business owners was not a priority, which led to significant losses when the pandemic struck. Without crisis management strategies in small firms, the risk of significant financial loss or business closure is higher when an external shock manifest itself.

A systematic approach to enhancing survivability in crisis situations manifests itself in the following:

- exploring one's own capabilities to examine the impact of standardized processes and practices in small businesses;
- exploring renewal opportunities to change or create processes, products, or services to increase the likelihood of survival;
- partnering to survive an operational crisis by providing expanded control over products, information, and cash, moving between suppliers, manufacturers, and retailers to customers;
- understanding the added value of small businesses to minimize risk when providing technology services.

An important role in crisis management during a pandemic is to understand the need for systemic (system-forming) resources. For example, platforms became such a resource in commerce, while, say, in tourism, restaurant business, hotel business such resources have not been established (despite an attempt to identify them - ring flights, cruise ship ring routes, delivery of ready-made lunches and dinners, including serving, provision of rooms and services by hotels for remote work). Confirming the hypothesis put forward about the need to create conditions for switching business models, it should be understood that system resources must have substitutability and replenish ability, and in this case in the pandemic there were few examples where system resources could be replenished, *i.e.*, the entire economic system worked for consumption, waiting for the end, not for replenishment. The only resource that was being replenished was the digital environment - everything related to data and its processing. And it was digital solutions that made it possible to put forward the thesis of switching business models instead of bankrupting enterprises. Information on auditing, organizational structure, team design, and training capabilities will undoubtedly be needed for such a switch.

2. Analysis

In strategic analysis, since the 60s of the last century, such tools as matrices have been widely developed to systematize management information. Widely known are the matrices BCG, GE, SWOT, SNW and many others. Matrices in management are a two-scale systematization, which makes it possible to distinguish certain quadrants on a graph, united by two properties. Attempts to make three-dimensional matrices (*i.e.*, consisting of cubes rather than quadrants) are known in the literature, but they have not become widespread due to perceptual complexity. Table 1 presents one of the successful classifications of matrix tools, which the authors supplemented with comments on the applicability of these matrices in small business, based on the universality and possibility to take into account the features of small business.

Table 1. Matrix toolkit in small business operations

№	Level	Matrix name	Description	Eligibility for small businesses
1	Vision of the organisation	SWOT matrix	Analysis of the company's strengths, opportunities and threats	YES
2		MCC matrix	Analysis of the relevance of the company's mission to its core capabilities	YES
3		Matrix of the economic development vector of a company	Analysis of static data	Limited
4	Market	BCG Matrix	Analysis of growth rates and market share	Limited
5		GE Matrix	Analysis of comparative market attractiveness and competitiveness	No
6		ADL Matrix	Industry life cycle and relative market position analysis	YES
7		Hofer/Schendel matrix	Analysis of industry position among competitors and stage of market development	YES
8		Ansoff Matrix ("market-product")	Market and product strategy analysis	YES
9		Porter matrix (five competitive forces)	Strategic business opportunities	Limited
10		Market elasticity matrix of competitive response	Analysis of firm action on product competitiveness factors depending on elasticity of priority competitor's product response	YES
11		Product grouping matrix	Product grouping analysis	No
12		Impact Uncertainty Matrix	Exposure and non-exposure analysis when entering a new market	Yes
13	**Industry**	Cooper matrix	Industry attractiveness and business strength analysis	Limited
14		Shell/DPM Matrix	Analysis of attractiveness of resource-intensive industry as a function of competitiveness	Yes
15		Matrix of strategies for businesses in decline	Analysis of competitive advantage in the industry environment	Yes
16		Matrix of the main forms of alliances	Industry environment alliance analysis	No
17	**Target segment**	Matrix of competitive position improvements	Analysis of market differentiation and penetration	Limited
18		Matrix "Relative Cost Efficiency Differential"	Analysis of differentiation and relative cost efficiency	Limited
19		Matrix "Productivity-Innovation/ Differentiation	Innovation / differentiation and productivity analysis	Limited
20	**Quality**	Price/Quality Matrix	Product positioning in terms of quality and price	Yes
21		Quality-Resource Intensity Matrix	Analysis of quality versus capacity	Yes
22	**Marketing**	Matrix for brand family expansion strategy	Analysis of distinctive advantage and market segmentation	Limited

23		Awareness - attitude towards the product brand" matrix	Analysis of the relationship between gross profit margin and sales response	Yes
24		Matrix of marketing channels	Analysis of the correlation between the rate of market development and the value added by the channel	Yes
25		Matrix "Contact - level of service adaptation	Analysis of the relationship between the level of customisation of services and the degree of customer contact	Yes
26		Marketing Diagnostic Matrix	Analysis of strategy implementation dependency	Limited
27	Management	Matrix of modes of strategic management	Analysis of dependency of strategy and planning impact	No
28		Matrix of the strategic management model	Analysis of dependency of management model on the type of change	No
29		Hersey-Blanchard matrix	Analysis of situational leadership model	Yes
30		Matrix "Ohio University Leadership Style Dimensionality Combinations"	Analyzing combinations of leadership style dimensions	Limited
31		Management grid matrix	Analysis of leadership types	Limited
32	Personnel	Change-Resistance Matrix	Analyzing the relationship and resilience to change within the organization	Limited
33		Matrix of Payment Influence on Group Relationships	Analyzing the relationship between group relations and pay differentials	Yes
34		Matrix of types of inclusion of the worker in the group	Analysis of the relationship between attitudes to organisational values and attitudes to organisational norms	Yes
35		Core Business Skills Matrix	Market and core business capability analysis	Yes
36		Job Importance Matrix	Job Importance Dependency Analysis	Limited
37		Matrix of existing formal systems of performance criteria	Analysis of existing formal quality performance criteria systems	Limited
38		Matrix of performance management results	Analysis of performance management results	Limited
39		Blake-Moughton Matrix	Analysis of job performance as a function of the number of people and the number of tasks	Yes
40		Mac-Donald Matrix	Performance analysis	Limited

Source: compiled by the author, based on Matrix Methods of Strategic Analysis/Classification and Implementation.

Having analyzed the above matrix, we concluded that structurally, the matrix should be presented in two coordinates - the stage of crisis and the state of the small enterprise (3x3), as shown in Figure 4.

Figure 4. 3x3 matrix format for strategy selection in a crisis situation

Stages of crisis/small business condition	Sustainable	Threatened	Close to bankruptcy
Pre-crisis	1	2	3
Acute crisis	4	5	6
Recovery	7	8	9

Accordingly, if after the diagnostics we can place the results of enterprise diagnostics in one of the quadrants, then we should also give some recommendations: what strategies to choose in each quadrant.

However, as it was repeatedly noted in the previous paragraphs of the thesis, small business depends to a large extent on the external environment. This allows us to make an addition in the form of a macroeconomic indicator - the GDP growth rate, dividing the growth rate also into three stages (it should be noted that this is done conditionally for this study, in a practical study this number of stages can be increased or decreased - for example, the fall or growth of GDP).

According to the authors, the study of the dynamics of cash flow makes it possible to establish the presence of problems in a small enterprise.

Undoubtedly, we should not refuse the traditional coefficient analysis either, revealing those coefficient ratios which adequately describe this or that type of activity (Fig. 5), supplemented with the state "no crisis". The adapted vertical part of the matrix during a pandemic is more appropriately presented in the following form (Fig. 6), although consciously assuming the error that it is applicable only to the business whose condition was stable before the crisis. Undoubtedly, if we strive for universality, we can increase the number of gradations by adding the state of small business before the pandemic (Fig. 7).

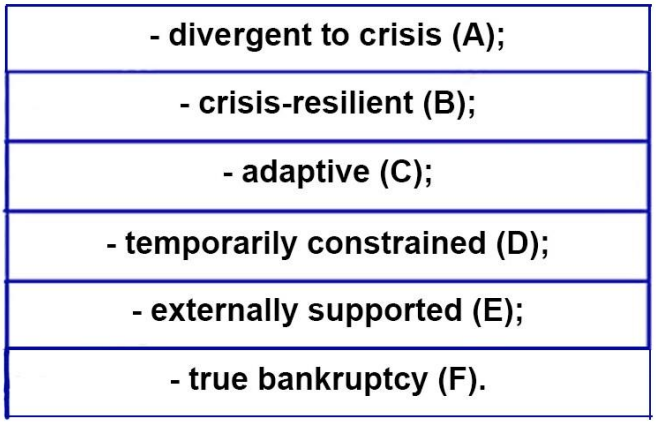
Figure 5. Ratios of coefficients for different crisis stages

Ratio of ratios	Stages of crisis
Return on equity (Net profit / Equity) ≥ 25%	No crisis (0)
Own working capital ratio (Own working capital / Working capital) ≥ 0.2	
Financial leverage (Borrowings / Equity) < 0.7	
Asset turnover (Revenue / Assets) ≥ 25%	
Return on equity (Net income / Equity) ≤ 5% or losses	Pre-crisis (1)
Own working capital ratio (Own working capital / Working capital) ≤ 0.1 or there is no own working capital	
Financial leverage (Borrowed capital / Own capital) ≥ 0.7	
Asset turnover (Revenue / Assets) ≤ 5%	
Return on equity (Net income / Equity) not available due to losses	Acute crisis (2)
Own working capital ratio (Own working capital / Working capital) < 0 or no own working capital	
Financial leverage (Borrowed capital / Equity) ≥ 0.7	
Asset turnover (Revenue / Assets) ≤ 2%	
Return on equity (Net income / Equity) > 0	Recovery (3)
Working capital adequacy ratio (Working capital / Working capital) > 0 and ≤ 0.1	
Financial leverage (Borrowings / Equity) ≥ 0.7	
Asset turnover (Revenue / Assets) ≤ 2%	

Figure 6. Types of small business condition before and after the crisis (pandemic conditions)

State before the external crisis	State during the crisis
Normal, functional	Regular
	Pre-crisis
Presence of problems	Pre-crisis
	Acute crisis
Threat of bankruptcy	Acute crisis
	Liquidation
Recovery	

Figure 7. Number of gradations on the horizontal axis [3]



Divergent to the Crisis. N. Taleb [4] used the concept of anti-fragility specifically for such business models. Such businesses grow returns (sales and profitability) on invested capital. Indeed, certain types of business improve under stress and realize their opportunities more effectively in an external crisis situation. For the current pandemic crisis, Internet commerce, shipping, non-pandemic drug manufacturers, Internet services, computer games, etc. proved to be anti-fragile. A number of business opportunities that had been criticized as difficult and unproductive turned out to be important after the onset. These opportunities turned out to include overstocking in warehouses, technological leadership, availability of alternative suppliers in global supply network, the presence of several channels to consumers, etc. Examples of the seemingly obvious divergent behavior, but did not take advantage of this opportunity, was the small private medical business, especially in the second wave of the pandemic.

Accordingly, the assignment of small businesses to this category can be carried out either only during the crisis as a fact, or by modeling threats and assessing the dynamics of the business model. It should be noted that this gradation does not stem entirely from the entrepreneur's internal decisions, but largely depends on the favorable environment and the business' choice of this environment before the crisis.

Crisis-resistant. Such models can be described as being able to remain in working order (without changing the business model) during external crisis problems in time of crisis. Such small enterprises include enterprises of food industry, housing and utilities sector. As a rule, in such situations the volume of sales changes (both in the direction of growth and decline), but the interaction itself remains unchanged. Among the "growing" areas we can include information technology (for example, the record revenue growth of Zoom, which provides video conferencing services), the sales volume of which is unlikely to grow during the recovery phase, logistics, for which the growth of the volume of supply, caused more problems than a significant increase in profitability.

Cab services have experienced a drop in sales, but by expanding functional solutions (delivery), most aggregators manage to maintain their business model.

Various stress tests could be recommended to assess the resilience of such businesses, allowing to assess the margin of resilience and the limits within which the business should not spend resources to change the business model.

Adaptable to crises. A number of businesses needed to adapt their business models. Adaptation may have involved switching to remote services, replacing sales of goods with services (for example, instead of selling a self-test, a service to administer the test and receive the results), reducing the product line, and changing the way services and production are provided due to viral safety and quarantine requirements. Such businesses include government services, education, production of protective equipment (production of masks, production of nitrile gloves). Adaptation of such business models turns out to be expensive and intensive, but the results of such adaptation lead to the possibility of faster recovery and growth of operational efficiency in the post-pandemic period, which, incidentally, was demonstrated by the recovery period after the first wave.

Temporarily limited. The choice between trying to maintain operations in a pandemic or temporarily suspending them with the intention of resuming a crisis is one of the most difficult. The decision to close is made under the pressure of external circumstances. These types of businesses find themselves in the most difficult

[3] Ritter T., Pedersen C.L. Analyzing the impact of the coronavirus crisis on business models // Industrial Marketing Management, 2020, vol. 88, pp. 214-224.
[4] Taleb N.N. Antifragility How to Profit from Chaos. M.: KoLibri, Azbuka-Atticus, 2014.

situation, especially if economic conditions are recovering on a "W" rather than a "V" basis. The second wave of the crisis can significantly reduce the resources of small businesses, not allowing a second recovery. Such types should include the tourist segment, the hotel sector, the theater arts, in part fitness clubs and similar activities. But the suspension also occurred in manufacturing: cars, home appliances, etc. The key argument for such businesses is the statement that it is better to suspend a business than to bring a business to bankruptcy and start a new one while trying to maintain operations. Given that the second wave is accompanied by an investment boom, it is advisable to invest the freed funds during the second wave. The argument against is uncertainty - no one can predict when the pandemic will end and the number of waves.

Externally Supported. Businesses are not able to meet the needs of external financing and depend on external support. In turn, external support largely depends on the social orientation of the business. Of course, there is a discussion in society about the choice between direct support of the population and support for businesses that provide necessary services to the population or do not lay off their employees. Governments offer support programs to reduce vulnerability, investors offer financing for their firms, and banks form various payment vacation programs. Like temporarily restricted businesses, the key assumption here is that the business will be successful after the crisis and that external assistance is justified relative to the alternatives (e.g., unemployment, social instability, unavailability of services, crisis, loss of investment, non-repayment of loans, etc.).

True bankruptcy. This type of business ceases to exist during a crisis because the cost of getting the business through the crisis exceeds the possible profitability after the crisis. In these situations, it makes more sense to go out of business. During the crisis the business idea may finally become obsolete after the crisis, or the chosen area may become uninteresting for entrepreneurship (for example, the elimination of small stores after the sale of pre-crisis inventory).

Figure 8. Summary matrix for management decisions in crisis management of small businesses

State before the external crisis	State in times of crisis	GDP fall (Gross Domestic Product)(1) / GDP growth (Gross Domestic Product)(2)					
		Divergent to crisis (A)	Crisis resilient (B)	Adaptive (C)	Temporarily constrained (D)	Externally supported (E)	True bankruptcy(F)
Normal, functional (N)	Regular (N)			1			
	Pre-crisis (P)			2			
Existence of problems (R)	Acute crisis (C)				3		
	Acute crisis second wave (V)				4	5	
Threat of bankruptcy (F)	Liquidation (L)					6	7
	Recovery (W)						

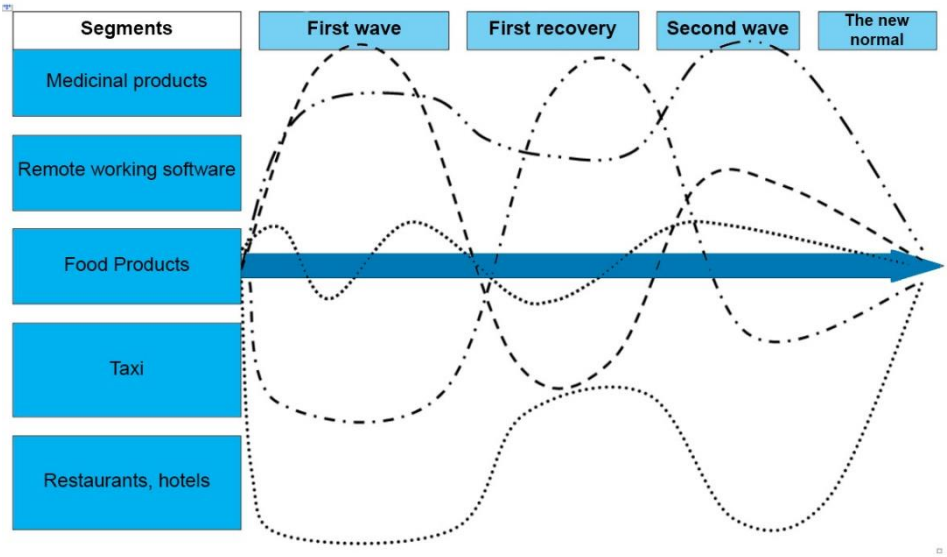
The final vision of the management decision matrix is shown in Fig. 8, which also demonstrates a possible scenario for an adaptive business (1,2,3,4,5,6,7 - results of periodic diagnostics). Possible scenarios and management recommendations will be discussed in the next paragraph.

Figure 9. Choice of actions by pandemic crisis stage

	First wave	First recovery	Second wave	A new normal
Target	Retention of staff, retention of operations	Return of profit	Downsizing	Follow the pre-crisis strategy
Consumers	Preservation of service	Retention of crisis clients	...	...
Value creation	Postpone projects, continue digitalisation	Develop new technologies	Stop innovative projects	Combine digitalisation and pre-crisis strategy
Value proposition	Focus on internal sales	...	Service contracts	Growth of virtual interaction
Opportunit	E-commerce	...	...	Factories of the future

But the selected actions are not enough to form scenarios. To do this, we need to look at the dynamics of the crisis, which is shown in Fig. 10.

Figure 10. Evolution of the crisis by segment



Further we systematize possible actions in scenarios of anti-crisis behavior according to Fig. 9 and in accordance with the assumptions adopted in S. Torgren and T.A. Williams:

1. Postponement of investments.
2. Fire some of the full-time employees.
3. Expect extra pay for work from the government.
4. Reduce payroll costs for full-time employees.
5. Stop paying freelance workers.
6. Reduce any costs.
7. Negotiate contracts already agreed upon.
8. Control stock reduction.
9. Continue revenue-oriented activities.
10. Continue survival-oriented activities.
11. Reduce innovation activities.
12. Attract loans.
13. Ask for deferral of loans.
14. Termination of activity.

Undoubtedly, for practical application, the above list should be specified and detailed, but attention should be paid to the refusal of excessive detailing, which will lead to the impossibility of choosing the scenario. In other words, a certain generalization should also be inherent in the practical formation of a set of actions.

In forming a scenario, it is quite common to give preference to the worst- and best-case scenarios, assembling the final scenario as something in between the two options.

The problem is that, in fact, one tends to see only one scenario and is more likely to choose the option closer to a favorable development of events and reject the worst-case scenario as too bad even to consider.

This approach will lead to the fact that the consideration of scenarios will be shifted in the direction of the optimistic option (more often) or pessimistic (less often). But the future is described not only by one uncertainty, and there is a high probability that there are several such uncertainties. Therefore, the dominant approach in scenario analysis is more effective - the use of a scenario cross, which with the help of two uncertainties forms four variants of events.

But the objection that there are more than two uncertainties is objective, and that such an approach would also have lacunas. Using more than four scenarios raises the possibility of failing to distinguish between different options. Therefore, it is suggested that in order to select the two most important uncertainties, a hierarchy of such uncertainties should be constructed, from which the two most significant uncertainties should be selected. To construct a hierarchy of uncertainties it is possible to use any of the known methods of constructing an objective tree.

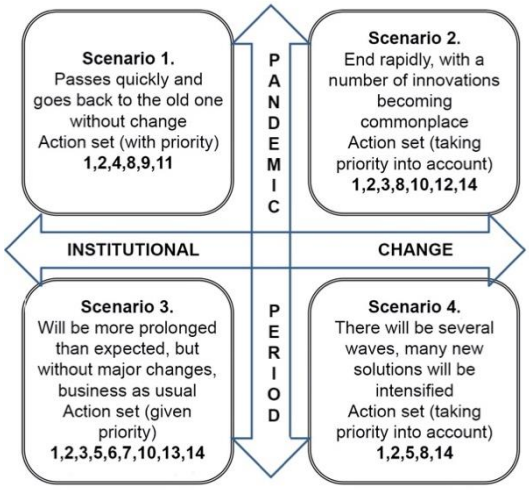
In our case, we chose two uncertainties to construct a scenario cross:

1) how long will the pandemic last? (Fast, within the expected output, or very long with seasonal flare-ups);

2) will changes in business models and state behavior be institutionalized? (Everything will return to its previous conditions, or many changes will become a habitual way of life).

It is necessary to pay attention to the fact that the scenario cross is also not a tool which fixes the logic of events one-step and for the whole period until the end of uncertainty. Obviously, the scenario cross of the first wave differs from the second wave. And the example below (Fig. 11) refers to the scenario cross of the second wave of the epidemic. For example, if the second wave in the scenario cross of the spring period was uncertainty, then already in the fall, the third and fourth waves, as well as seasonal outbreaks become a probabilistic event, which requires reflection within the scenario or scenarios, but not to form an independent scenario.

Figure 11. Scenario cross of a possible presentation for pandemic crisis



Thus, Fig. 11 shows two uncertainties - the first (vertical axis) is the pandemic continuation period (short or long), with the short one during the second wave defined just over a year - spring 2021, the long one was defined over 2 - years - spring 2022 with seasonal outbreaks up to 5 years - until 2025. The pessimism of the latter scenario is due to the speed of vaccine development and the beginning of mass production, as well as information about the mutation of the coronavirus.

The second uncertainty in Figure 11 (horizontal axis) is related to the uncertainty of society's perception of the results of the pandemic, from the fact that everything will return to claims that the world will never be the same. Such changes cannot be determined with the probability of events occurring, as what changes society will accept can only be reasoned at the level of futurism, especially since three other uncertainties are superimposed on the horizontal axis - digitalization and quantum research, globalization and regionalization, ecology and industrial production. Therefore, we retain this particular choice on the axis: the transformation of society and business in a coronavirus story. It should be noted that a possible alternative to this axis is state financial support for small business, but we believe that state financial support is just one of those solutions that may or may not be institutionalized.

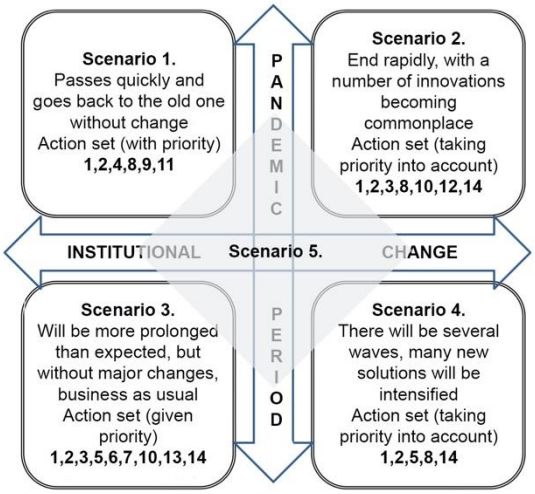
As a result, we can distinguish four segments, each of which will correspond to a scenario. Theoretically, there could be a fifth scenario - at the intersection of the axes, but it is usually not considered, considering it either a compromise or not reflecting the dynamics of the axes (Fig. 12).

Scenario 1 assumes that society will not perceive coronavirus constraints, and, after a fairly short period, the weight of social economic relations will return to the January 2020 period, except for digital solutions, which have simply been accelerated in their development (covariate development). Such a scenario would be in line with the strategy of "concentrating on what is available.

Scenario 2 also assumes a rapid end (at the time of the first wave 2-3 months, at the time of the second wave just over a year) of coronavirus pressure on business but considers that during the crisis there were progressive solutions that should provide new opportunities during the recovery and the formation of a new reality. These innovations are indeed related to progress rather than a consequence of coronavirus constraints, but because they have withstood pandemic testing, the range of resilience of businesses using such solutions is

expanding. Notwithstanding the above, this scenario already assumes decisions to go out of business, to cease operations. Such a scenario would be consistent with a "deferred growth" strategy.

Figure 12. Scenario cross, assuming a fifth scenario



Scenario 3, in fact, focuses on the threat of a lasting pandemic impact, but again counts on the fact that resistance to pandemic change will be built up in society. As a result, the threats will increase for those businesses that are heavily pandemic-oriented. This scenario would be consistent with an "asset reduction" strategy.

Scenario 4, the most pessimistic of the presented scenarios, believes that the duration of the pandemic will be long, that there will be several waves with their own characteristics, that society will endure new relations in almost all spheres, and its result will require significant renewal of many types of business, making the threat of bankruptcy of many small enterprises imminent. Such a scenario would be consistent with a "development or exit" strategy.

Scenario 5 assumes that it will be formed as compensations for deviations from pre-crisis business development, and will try to take into account the realities of each of the scenarios. This is the most complex version of the scenario and can only be formed after the first four scenarios have been worked out. Such a scenario would be consistent with the "increase in market share - growth" strategy.

A set of four (or five) alternative scenarios serves as a simple tool for small business to find a way out of the crisis and successfully interact.

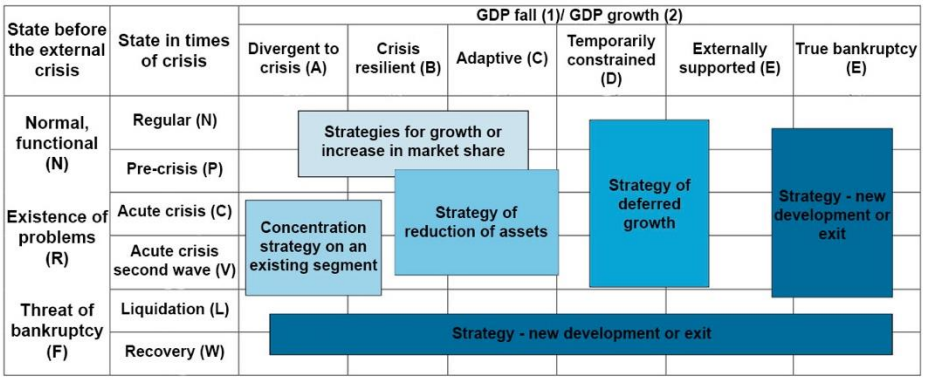
The formation of scenarios and corresponding strategies is aimed at renewing the business in the long term after the crisis, while maintaining control over the current situation, taking into account the requirements of rapid response.

Small enterprises, unfortunately, do not have sufficient resources for strategic development, especially in times of crisis, when it is a question of survival. Therefore, decisions about alternative ways out of the crisis or innovative solutions are quite risky and require time, which is often simply not available.

The strategies shown in Fig. 13 in practical activities require adaptation, and they determine the direction of development rather than specific actions.

The goal of a growth strategy is to maintain sustainability in fast-growing segments of markets. In the initial stages of the pandemic, these segments grew very rapidly, and to keep up requires significant resources and strengthening the position of a particular type of business before the displacement stage (recovery wave) occurs. One of the problems with this strategy is that the resources spent may not ensure a sustainable position (e.g., the development of additional mask manufacturing facilities). The situation is similar to increasing market share. The implementation of this strategy requires large investments: it is necessary to increase sales volume, at least according to the growth rate of the market. Significant increases in market share usually culminate in horizontal mergers (as observed in the first recovery in the restaurant business). In the displacement stage, growth in market share can be achieved through features of the product itself, market segmentation, pricing, improved service or improved distribution efficiency.

Figure 13. Matrix of strategies for small businesses during a pandemic



Strategies involve getting as much cash as possible in the process of leaving the business (gradual or rapid) the business, understanding that it is not profitable to try to maintain a weak position in an unattractive market. Even if leaving the business would benefit competitors, it is better to leave that market and focus resources on developing other opportunities, during the recovery period. Such strategies should be employed when the business in question still has some value and is somehow attractive. Unfortunately, the available strategies and scenarios do not answer the question of choosing a new one, which requires further research.

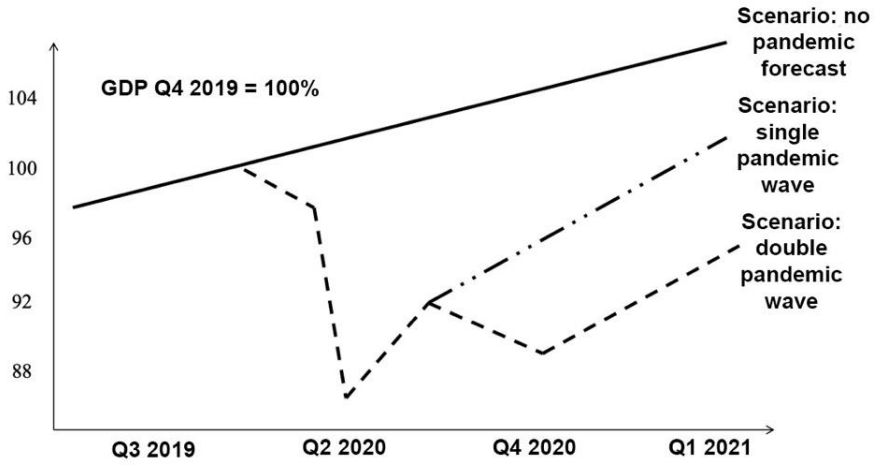
Long-term thinking and scenario development are really difficult in times of crisis. With the help of alternative scenarios and the choice of appropriate strategies with a perspective beyond the long term, entrepreneurs have received support and assistance on how to survive and emerge from the crisis, as well as benefit from the actions applied in times of acute crisis.

Scenarios are usually long-term tools for business development and creating flexibility and sustainability. In this case, we applied the scenario approach to short-term goals as well, to find a way out of a crisis situation. Scenarios are useful tools for innovation and business community anywhere, but in these difficult times, they open the mindset to positive and offensive action instead of defensive, threat-based behavior.

3. Implementing Crisis Management in the Aftermath of a Pandemic as a Shock and Re-Shock to Scarce Business

The pandemic, which continued throughout 2020, had a different impact on the socio-economic level of countries' development, putting negative dynamics of key macroeconomic indicators in front of everyone in approximately the same way. Moreover, like any crisis, the pandemic not only made a certain completed circle in its manifestation of crisis, but also with a new force began to move in a second wave, raising the obvious in this case predictions of a possible third wave and even the uninterrupted first wave, which only strengthened its effect These different positions are based on traditional ideas about the evolution of crises, so further we will not dwell on a specific point of view regarding the order number of the pandemic wave, but focus on the directions of

Figure 13. Forecast of global economic development and recovery in the post-pandemic period, %



But economic recovery takes place between the first and second waves of the pandemic, as noted by analysts at the World Bank, the OECD, and respected international agencies. This recovery can be represented in the shape

of the letter "V" (as opposed to a longer recovery in the shape of the letter "U"), so it is fair to say that the crisis is spontaneous[5], and states have mostly made the right decisions on anti-crisis regulation.

However, considering the fact that, according to the OECD forecasts, the world economy is unlikely to recover to pre-crisis levels before 2022.

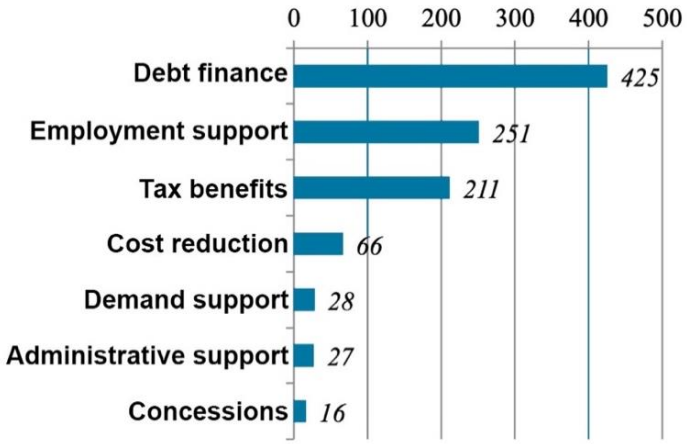
At present researchers unambiguously fix the end of the positive trend of development of the world economy, which lasted during the pre-pandemic period, and depending on the number and pandemic wave amplitudes predict different scenarios for economic recovery in terms of time and effect.

Undoubtedly, the crisis caused by the pandemic is unparalleled in recent history, but its effect on the economy is complex and consists of the interdependent influence of the determinants, which form the characteristics of the impact of the pandemic on the functioning of the economy as a whole and, accordingly, have an impact on small business.

If we go deeper into the determinants of demand, the main effect of the pandemic crisis should be considered a general decline in income and purchasing activity. Therefore, most of the decisions and measures taken by governments of the countries were discussed and taken regarding the so-called "helicopter money", *i.e.*, financing the expenditures of the population when the income fell due to the lockdown - thus a successful attempt to activate economic activity is made. In general, in this aspect, it should be noted that the International Monetary Fund recommends that all countries consider anti-crisis measures (in fact, this is government spending) precisely for the purpose of increasing aggregate demand[6].

In general, the governments of countries, considering the rate of spread of the disease and the negative effects on the economy, decide on some or other measures to support citizens and businesses in the pandemic.

Figure 14. Ranking of types of small business support by number of instruments used, units



In general, some typical, optimal and balanced package of anti-crisis measures (without regard to the economic capabilities of a particular state) to support business includes the following measures:

- state financial and non-financial support to business through the use of monetary and tax mechanisms (limitation - the capacity of the budget and fiscal policy of the state), while full compensation is unacceptable;
- support of employment, payment of wages through the mechanism of subsidizing the minimum wage
- restructuring of part of the fixed and variable costs of business in terms of tax, credit, rent, utility payments;
- issuing direct loans to SMEs through state institutions, providing grants and subsidies to SMEs;
- development of the public procurement system to support the entrepreneurial sector, including through increased participation of small businesses, continued implementation of national development projects and important investment projects aimed at creating conditions for business development;
- introduction, expansion or simplification of credit guarantees to increase the ability of commercial banks to lend to SMEs;
- correct selection of the most affected sectors and development of non-typical measures to facilitate or restore business, considering the problems of organizing sales, increasing employment, and changing business processes

[5] Buklemishev O. Coronavirus crisis and its effects on the economy // Population and Economics, 2020, vol. 4, no. 2, pp. 13-17.

[6] IMF. Economic Policies for the COVID-19. War. URL: https://blogs.imf.org/2020/04/01/economic-policies-for-the-covid-19-war/.

- reduction of administrative barriers and consulting support for business adaptation to the new economic realities.

If we rank the most common anti-crisis measures of support to small businesses in the world as a whole, the leading one is debt financing (Fig. 14, 15).

4. Implementation of Digital and Cognitive Technologies in a Crisis Management Model

Analyzing the conclusions of these authors, we believe that new methods, including digital transformation and new techniques of cognitive management, should be introduced into the practice of anti-crisis survival.

Nevertheless, it should be understood that digital transformation is still not an ideal process, and in its implementation in the activities of the enterprise (including small businesses) it overcomes significant difficulties.

Figure 15. Main challenges in the impact of the digital economy on small businesses

- threats of cyber-attacks. Information not only provides opportunities for communication and credible decision-making, but also creates opportunities for the manipulation of the information consumer
- financial and business risks. The decision to change business processes in favour of digital solutions requires additional costs. In addition, the decisions made may not lead to the expected results, which already entails entrepreneurial risks
- job losses. Digital solutions often lead to a higher risk of employee layoffs
- barriers in the digitalisation of business prevent small businesses from being aware of business support and from being heard and supported

The four main problems stated above in the area of the impact of digitalization on small businesses can be reasonably reduced to two, in the context of this study: 1) financial relationships and 2) a high degree of uncertainty, which is determined by the low (insufficient) level of digital competence of employees engaged in small business.

One of the obstacles to the transformation of the business model (Fig. 16) is the lack of convergent perception of environmental change by managers. However, the COVID-19 pandemic has led almost everyone to believe that dramatic and significant changes have indeed occurred in the business environment, with most researchers confident that these changes will not only occur during the pandemic, but will also persist into the post-pandemic period.

Figure 16. Opportunities for digitalization of different groups of business processes in small businesses

Business process groups	Digital tools (systems, products, software solutions)
Objective №1. Establish closer relationships with suppli ers and customers	
Interaction with suppliers	SCM (Supply Chain Management) systems
Interaction with customers	CRM (Customer Relationships management) systems
Task №2. Increase the level of your own operational efficiency	
Resource management	ERP (Enterprise Resources Planning)
Business process management	BPM (Business Process Management) systems
Analytical component management (data analysis)	Big Data, Data mining, OLAP-cube, cloud computing, Google Analytics, etc.
Providing company's employees with up-to-date technology to effectively execute daily tasks.	Office 365 Google doc, use of CRM system, dashboards to evaluate key metrics
Task №3. Improving the competitiveness of manufactured products	
Product management (control, storage and provision of necessary information)	Marketing activities, including: digital internet marketing tools
PLM (Product Lifecycle Management) and PDM (Product Data Management) systems, digital sensors, GIS-technologies, etc.	Use of google Analytics, Google Adwords tools; SEO and SMM

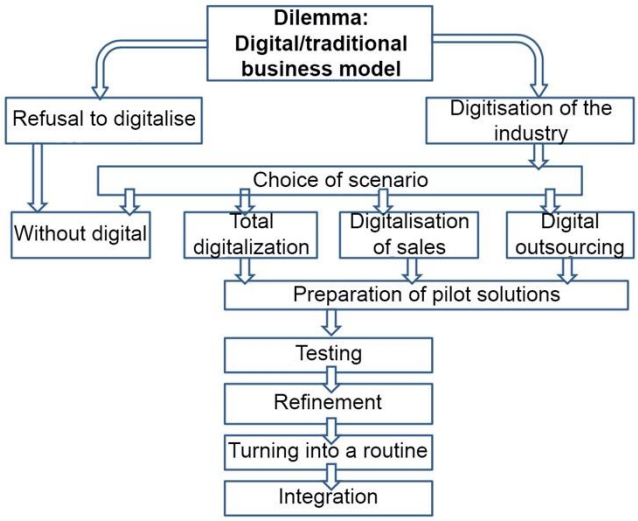
Requirements for speed of change rest on the hope that the long-term impact of pandemic

COVID-19 is still small and the post-pandemic opportunities will be even greater if firms can use digital technology during a pandemic.

Figure 17. Implementation of a four-phase model for digitalization activities for a small enterprise[7]

Phase 1: Experimentation as an understanding of the digitalisation opportunity; development of basic skills; setting up a pilot project; shaping the workspace;
Phase 2. Implementation, as development of the first product/service; resource mobilisation; fundraising; development of a release plan;
Phase 3. Expansion as more cases; release planning; building structure and teams; growth plan;
Phase 4: Optimisation as business practices as the new normal; setting financial targets and outcomes; normalising the data environment.

Figure 18. Decision-making about digitalization and standard stages given the choice of scenario



To meet the challenges of this article, the authors have developed a standardized decision-making procedure for digitalization and proposed recommended steps. This shows the challenges that small businesses need to address when choosing a digitalization scenario as the minimum necessary sequence of actions, each element of which is necessary to implement the digital transition.

Consequently, according to the authors, the sequence of tasks for small businesses to transition to digital solutions in a crisis situation contains:

- clarifying the ways and means of diffusion of digital innovation in the firm and the choice of a strategic scenario of digitalization;
- the search for available knowledge and the organization of training of specialists, including self-learning;
- changing the organizational structure and functions (auxiliary processes) that create the opportunity for subsequent digital projects;
- organizing sales in the digital environment (independently or on the basis of industry or universal integrators);
- managing access to various data sources, platforms, financial technologies and ecosystems, and managing resources;
- building a set of different digital technologies necessary for operations, taking into account their obsolescence and need for updating, as well as testing new available technologies;
- Increasing operational efficiency (in times of crisis, avoiding payment gaps);
- transition to a bespoke organization of activities (precisely in the crisis period), in the recovery period the development of the concept of everything as a service.

Let us further elaborate on these tasks more specifically.

To clarify the ways and means of diffusion of digital innovations in the firm and the choice of a strategic scenario of digitalization. First of all, it is necessary to form a digital vision of your own business in a digital format. The digital image of business does not allow for inviting outside consultants to form it, so to form it, it is necessary

[7] Demarest G., Scott J. Architect's Guide to Implementing a Digital Transformation. Springer, 2016.

to collect data on best practices. Once the vision of the digital future of the business has been established, a strategy for transition to such a state must be developed, based on consideration of the digitalization of functions (all or selected ones). This phase is considered complete when a project team is established to implement pilot solutions.

Search for available knowledge and organize training of specialists, including self-study. The project team must generate a list of available knowledge sources for digital transformation solutions and create a sense of urgency for the entire business for digital solutions. At the same time, an important task of this stage is to organize self-learning to reduce the time it takes to obtain digital solutions. Despite the common recommendation to bring in external specialists, the crisis requirements of rapid digital results require the use of internal resources.

Change the organizational structure and functions (supporting processes) that create the opportunity for subsequent digital projects. It is necessary to conduct a functional analysis of business processes, to consider the introduction of new functions in order to catch up with emerging digital technologies in business. This should exclude the creation of functions on the principles of "it should be" or "will be needed in the future", which will lead to unnecessary costs. The organizational structure should be changed (adjusted) according to the new set of functions. If the number of personnel is small, this part of the reform should be performed by the owner himself.

Organization of sales in the digital environment (independently or on the basis of industry or universal integrators). First of all, a selective implementation of digital technologies must be carried out: individual tasks, services, payments, etc. The next step is to redesign sales channels, combining these solutions with possible digital promotion in market segments. When selecting products or services for random testing, prioritize products/services suitable for digital marketing, which is established by analyzing best practices (and taking into account the region).

Managing access and necessary resources. In the digital economy, consumers are becoming the main resource, so it is necessary to understand exactly where customer data will be stored and who will have access to it. In addition, the simplification of sales processes leads to the possibility of the growth of spontaneous purchases that do not require complex actions or complex choices for the consumer, as very often the digital shopper is deterred by non-standard procedures. Great opportunities are contained in collaborations with partners that also promote small business sales, so affiliate networks become a powerful tool for digital promotion. Such solutions should also involve: building a portfolio of different digital and financial technologies; implementing your own online commerce platforms, engaging digital analytics data, and engaging consumers through social media.

Growth of operational efficiency (in the crisis period - avoiding gaps in payments). In order to achieve operational efficiency during the crisis, functional business models should be abandoned as much as possible and reoriented exclusively to product business models, including final services. The development of partnerships should be preserved only in promising value chains, taking into account the growth at the stage of economic recovery. A special place in this block is occupied by mastering new skills that lead to productivity growth.

The transition to a bespoke organization of activities (precisely in the crisis period), in the period of recovery the development of the concept of everything as a service. Fulfillment of large individual orders from industrial enterprises or state customer will provide financial stability. Therefore, the search for orders from a large customer becomes one of the tools for redesigning business processes, but it should be understood that such opportunities are limited. An important role here is played by sales managers in such segments, which allows to formulate ideas from partners, expanding the product portfolio. Thus, because of the increasing amount of customization of end products, it is advisable to use digital twins, developing a scalable solution for the use of resources, when the replacement of costly physical testing by the use of digital technology is everywhere, which makes this study practical significance.

Conclusion

Analysis of examples interconnectedness environmental indicators and threats to small businesses demonstrates that a holistic view of the situation, rather than individual private solutions, must be formed to adapt models of anti-crisis behavior. In general, to overcome uncertainty there is no possibility to make a single optimal choice, and multivariant strategies with the possibility of least-cost switching becomes a necessity - this justifies the relevance of this study.

The study highlighted a set of uncertainties affecting small businesses in the current pandemic (resource availability (including anti-globalization sentiment and actions); short-term needs and timing (including the uncertainty of ending the pandemic or establishing a new reality); lessons learned (or lack thereof in shaping the

new reality); patterns of competition (including the dominance of technology leaders); communication and digitalization (quality of communication and digital transition); and groups of factors, with:

- oil price shock factors;
- targeted government regulation and support;
- digital transformation, including ecosystem uptake;
- changing patterns of consumption of goods and services created by small businesses.

An important conclusion of the study is that the crisis implies a dual understanding: it can be a global crisis, which affects all aspects of economic development, and it can be a private local crisis, which concerns a specific organization. If for large companies these different meanings can be considered independently, then for small business they quite often coincide: a general crisis and a local crisis, and further we consider those manifestations of the general crisis which created (or can create) problems for small business.

Given the analysis of factors affecting small businesses, the definition crisis management for small businesses should be supplemented by a reference to the external environment, as small businesses, do not have the ability to form their own crisis management, sustainability potential and largely depend on the environment.

The authors proposed to adapt the matrix approach to distinguish crisis states for small businesses according to the properties of their business models: divergent to crisis; crisis-resistant; adaptive; temporarily limited; externally supported; true bankruptcy.

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*** Order No. 2 of the Minister of Health of the Republic of Kazakhstan dated 8 January 2018 "On Amendments to Order No. 450 of the Minister of Health of the Republic of Kazakhstan dated 3 July 2017 "On Approval of the Rules of Emergency Medical Care in the Republic of Kazakhstan";

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Rethinking Epistemology: Narratives in Economics as a Social Science

Emerson Abraham JACKSON
Centre of West African Studies, University of Birmingham, United Kingdom
Economic Modelling and Forecasting Division, Research and Statistics Department
Bank of Sierra Leone, Freetown, Sierra Leone
EAJ392@bham.ac.uk, Emersonjackson69@gmail.com

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Abstract: This research explores the incorporation of narrative perspectives in economics as a social science and its implications for rethinking epistemology. By examining the role of narratives in economic analysis, the study highlights the advantages of narratives in providing contextualized accounts of human experiences, connecting economic concepts to real-world phenomena, and exploring diverse perspectives. It emphasizes the importance of interdisciplinary collaboration between philosophers, economists, and social scientists to gain a comprehensive understanding of narratives' influence on economic decision-making, market dynamics, and consumer behavior. The research suggests that narratives offer a means to challenge the notion of a single, objective truth and contribute to a more inclusive and robust framework for analyzing economic phenomena. The implications extend beyond economics, urging a broader perspective on epistemology by embracing narrative perspectives and engaging in interdisciplinary collaboration across disciplines. Overall, this research calls for a rethinking of epistemology, recognising the significance of narratives and their role in knowledge production.

Keywords: narratives, epistemology, economics, social science, interdisciplinary collaboration.

JEL Classification: B41; B50; A12.

Introduction

Epistemology, as a branch of philosophy, concerns the study of knowledge and its acquisition, justification, and validation (Lemos 2007). It delves into the nature of knowledge, the sources from which knowledge arises, and the criteria by which its validity is assessed (Klein 2015). Throughout history, philosophers have engaged in debates regarding nature and means of obtaining knowledge. Various theories and perspectives, including foundationalism, coherentism, and pragmatism, have emerged to comprehend the epistemological foundations of different fields of inquiry (BonJour 2010).

In the context of the philosophy of science, epistemology assumes a vital role in comprehending how knowledge is constructed within scientific disciplines (Stanford Encyclopedia of Philosophy 2018). Within the social sciences, such as economics, the nature of knowledge and the methods employed for its acquisition become particularly intriguing (Mäki 2018). Epistemological inquiries emerge concerning the reliability of economic theories, the role of empirical evidence, and the relationship between economic models and real-world phenomena (Hausman 2017). Understanding the epistemological underpinnings of economics is crucial for a critical evaluation of its theories and methodologies.

The significance of this study lies in its exploration of the role of narratives in economics as a social science. Narratives, or stories, serve as fundamental tools for human communication and sense-making (Bruner 2004). In recent years, a growing recognition of the importance of narratives in shaping economic discourse, policy-making, and public perceptions has emerged (Fourcade 2019). Economic narratives possess the capacity to influence people's beliefs, attitudes, and behavior, playing a pivotal role in shaping economic policies and outcomes (McCloskey 2016).

By examining the role of narratives in economics, this study seeks to shed light on how narratives influence economic knowledge production, dissemination, and reception. The study aims to analyze the

construction and dissemination of economic narratives, the impact of narratives on economic decision-making, and the implications for the epistemology of economics as a social science. Through understanding the role of narratives in economics, a more nuanced comprehension of economic knowledge and its societal implications can be achieved (Roos & Matthias 2021).

From a philosophical perspective, this study endeavours to address several research questions and objectives. Firstly, it aims to investigate how narratives are constructed in the field of economics. This entails examining the underlying assumptions, ideologies, and value systems that shape economic narratives (Davis 2016). By analysing the construction of narratives, the study intends to uncover the epistemic foundations of economic knowledge and elucidate how narratives contribute to its production (Shiller 2019). Secondly, the study seeks to explore the relationship between economic narratives and knowledge dissemination. It aims to understand how narratives are disseminated through various channels, such as academic publications, media, and policy debates (Fourcade 2019). By scrutinising the dissemination of economic narratives, the study aims to uncover the power dynamics involved in shaping economic knowledge and the potential biases that may arise (Fourcade-Gourinchas & Babb 2018).

Lastly, the study aims to evaluate the implications of narratives for the epistemology of economics. It seeks to critically assess the role of narratives in shaping economic theories, methodologies, and policy prescriptions (McCloskey 2019). Through an examination of the epistemological implications, the study endeavors to contribute to a rethinking of the foundations of economics as a social science and provide insights into the broader debates about the nature of knowledge in the social sciences (Roos & Matthias 2021).

The paper is structured as follows: Section 2 presents an analysis of Epistemological Frameworks in Philosophy, while Section 3 focuses on the Nature and Power of Narratives. Section 4 analyzes Narratives in Economic Research, while Section 5 explores Challenges and Critiques. In Section 6, a Rethink of Epistemology is provided, and finally, Section 7 concludes by explaining the Implications for Philosophy and Interdisciplinary Collaboration.

1. Epistemological Frameworks in Philosophy

1.1. Overview of Traditional Epistemological Theories and Approaches

Traditional epistemological theories and approaches have played a significant role in shaping our understanding of knowledge acquisition and justification. Foundationalism, one of the classical theories, posits that knowledge is built upon a secure foundation of indubitable beliefs or self-evident truths (Pollock 2007). According to foundationalism, knowledge is attained through a process of deductive reasoning from these foundational beliefs. However, foundationalism has faced critiques, such as the problem of the criterion, which challenges the possibility of establishing a definitive foundation for knowledge (BonJour 2002).

Coherentism, another influential theory, asserts that knowledge is a coherent network of beliefs that mutually support and justify each other (Haack 2009). Unlike foundationalism, coherentism does not require a foundational basis for knowledge. Instead, it focuses on the internal consistency and coherence of beliefs within a system. However, coherentism has been criticized for its susceptibility to circular reasoning and the challenge of determining which beliefs are relevant to the coherence of the system (Kvanvig 2003).

Pragmatism, a philosophical approach developed by Peirce, James, and Dewey, emphasizes the practical consequences of beliefs in determining their truth and validity (Misak 2013). Pragmatism highlights the importance of experimentation, empirical inquiry, and the usefulness of beliefs in guiding action and solving problems. It challenges the notion of absolute certainty and instead focuses on the pragmatic value of knowledge in achieving practical goals. However, pragmatism has faced criticisms for potentially prioritizing instrumentalism over truth and neglecting the objective correspondence between beliefs and reality (Putnam 2002).

1.2. Critiques of Traditional Epistemology and the Need for Rethinking

Critiques of traditional epistemology have emerged, leading to a call for rethinking epistemological frameworks. One key critique is the problem of skepticism, which challenges the possibility of knowledge and raises doubts about the reliability of our cognitive faculties (Stroud 2004). Skepticism questions whether we can ever have justified true beliefs and highlights the limitations of traditional epistemological theories in addressing this challenge.

Another critique focuses on the situatedness of knowledge and the influence of social, cultural, and historical contexts on the construction of knowledge (Hacking 2002). This perspective emphasizes that knowledge is not solely derived from individual reasoning but is shaped by social processes, power relations, and

historical contingencies. The social dimension of knowledge raises questions about objectivity, bias, and the role of social narratives in the formation and validation of knowledge.

Furthermore, the recognition of the fallibility and revisability of knowledge has led to the development of non-foundationalist epistemologies (Goldman 2009). These approaches acknowledge that knowledge is provisional and subject to revision based on new evidence, changing paradigms, and the evolution of understanding. This perspective challenges the static and rigid nature of traditional epistemology and encourages a more dynamic and open-minded approach to knowledge acquisition and evaluation.

1.3. Epistemological Perspectives Relevant to Narratives in Economics

In the context of narratives in economics, several epistemological perspectives are relevant and offer insights into the role of narratives in knowledge construction. Social constructivism, a prominent perspective, posits that knowledge is socially constructed through shared meanings, language, and cultural practices (Berger & Luckmann 1966). From a social constructivist standpoint, economic knowledge is shaped by the narratives and discourses prevalent within a society, reflecting the values, interests, and power dynamics of different social groups.

Hermeneutics, another relevant epistemological approach, emphasizes the interpretive nature of knowledge and the role of subjectivity in understanding and interpreting narratives. Hermeneutics emphasizes the context-dependent nature of knowledge and recognizes the active role of the interpreter in making sense of narratives (Gadamer 2004). In the context of economics, hermeneutics highlights the importance of understanding the cultural, historical, and linguistic contexts within which economic narratives emerge and are interpreted. It underscores the role of interpretation in uncovering the underlying assumptions, values, and meanings embedded in economic narratives.

Postmodernism, influenced by the works of Foucault, Derrida, and Lyotard, challenges the notion of a unified and objective knowledge by emphasizing the plurality of perspectives and the absence of a single grand narrative (Lyotard 1984). Postmodernism suggests that knowledge is fragmented, contingent, and shaped by power relations. In the field of economics, postmodern perspectives highlight the existence of diverse economic narratives, contestation of dominant economic discourses, and the potential for alternative economic narratives that challenge conventional wisdom and power structures (Jackson 2018).

Feminist epistemology also offers relevant insights into the role of narratives in knowledge production. Feminist epistemologists argue that traditional epistemological frameworks have been shaped by masculine perspectives, marginalizing women's experiences, and knowledge (Harding 2004). They emphasise the importance of incorporating diverse voices, narratives, and experiences in the construction of knowledge. In the context of economics, feminist epistemology sheds light on the gendered nature of economic narratives, their implications for women's economic agency, and the need for inclusive and gender-sensitive economic narratives.

2. The Nature and Power of Narratives

2.1. Defining Narratives and their Characteristics

Narratives are powerful tools used to convey stories, ideas, and information, and they play a significant role in human communication and understanding. Narratives can be defined as structured accounts of events or experiences that have a beginning, middle, and end, and they often involve characters, settings, conflicts, and resolutions (Ricoeur 1984). They provide a framework for organizing and interpreting information, allowing individuals to make sense of the world around them.

Narratives possess several key characteristics that contribute to their effectiveness (Barthes 1977). Firstly, narratives have a temporal dimension, unfolding over time and presenting events in a chronological order. This sequential structure allows individuals to follow and comprehend the narrative's plot. Secondly, narratives often involve a protagonist or central character who experiences a journey or transformation. This character-driven element helps to engage the audience emotionally and facilitates identification and empathy. Thirdly, narratives incorporate conflict or tension, creating a sense of suspense or anticipation that keeps the audience engaged. This conflict may be internal (within the protagonist) or external (between characters or forces).

2.2. Philosophical Theories on the Nature and Function of Narratives

Numerous philosophical theories have emerged to explain the nature and functions of narratives. One prominent perspective is the narrative theory proposed by literary critic Roland Barthes, which argues that narratives are fundamental to human cognition and meaning making (Kahneman & Tversky 1982). Barthes suggests that

narratives provide a structure for organizing experience, enabling individuals to impose order and significance onto their lives.

Another influential philosophical theory is the hermeneutic approach, championed by philosopher Hans-Georg Gadamer. According to Gadamer (2004), narratives play a crucial role in the interpretive process by providing a framework through which individuals can understand and interpret the world. He emphasizes that narratives are not merely passive conveyors of information but active agents in shaping our understanding and interpretation of reality.

Furthermore, philosopher Paul Ricoeur's work on narrative identity highlights the role of narratives in constructing and maintaining our sense of self. Ricoeur argues that narratives allow individuals to create a coherent and meaningful self-identity by weaving together various events and experiences into a unified life story. Narratives thus serve as a crucial tool for personal identity formation and self-understanding.

2.3. Role of Narratives in Shaping Economic Knowledge and Understanding

Narratives have a significant impact on the shaping of economic knowledge and understanding. They play a crucial role in how economic concepts and ideas are communicated, interpreted, and accepted by individuals and societies. Economic narratives can shape public opinion, policy decisions, and even market behaviour.

One way in which narratives influence economic knowledge is through their ability to simplify complex economic concepts and make them more accessible to the public (Ariely & Norton 2011). Economic stories and metaphors, such as the "invisible hand" or the "tragedy of the commons," help to distill complex economic theories into more relatable and understandable narratives. These simplified narratives can shape public understanding and beliefs about economic principles and guide decision-making.

Narratives also play a significant role in shaping economic ideologies and policy debates (Ariely & Norton 2011). Different narratives can frame economic issues in contrasting ways, influencing how individuals perceive and interpret economic phenomena. For example, narratives that emphasize the importance of individual initiative and free markets may promote laissez-faire economic policies, while narratives that highlight social justice and income inequality may advocate for more interventionist approaches.

Furthermore, narratives can impact market behaviour and investor decision-making. Economic narratives, such as narratives about stock market trends or financial crises, can shape market sentiment, influencing investor confidence and behaviour. Behavioural economists have shown that narratives can affect investment choices and market outcomes, as individuals often rely on stories and narratives to make sense of complex financial information.

3. Analysing Narratives in Economic Research

3.1. Methodological Considerations for Studying Narratives in Economics from a Philosophical Standpoint

When analysing narratives in economic research, it is important to consider methodological approaches from a philosophical standpoint. Narratives play a significant role in shaping economic beliefs, policy decisions, and market behavior (Davidson 2004). Therefore, understanding the philosophical foundations of studying narratives is crucial for conducting comprehensive and rigorous economic research.

One methodological consideration is the ontological perspective, which examines the nature of narratives and their ontological status. Narratives can be seen as social constructs that shape economic phenomena, but they can also be analyzed as linguistic expressions of individuals' beliefs and experiences (Hacking 2002). Researchers must navigate between these perspectives and determine whether narratives are objective phenomena or subjective interpretations.

Another consideration is the epistemological dimension, which explores how narratives contribute to knowledge acquisition and understanding in economics. Narratives can provide contextual information, interpret data, and offer explanatory frameworks (Earl 2005). However, they can also introduce biases and subjective interpretations. Philosophical examination helps researchers critically evaluate the epistemic value of narratives and distinguish between reliable and unreliable sources of economic knowledge.

Furthermore, methodological considerations should include hermeneutical approaches. Hermeneutics focuses on interpretation and understanding, recognizing that narratives are often open to multiple interpretations (Davidson 2004). Researchers need to adopt a reflective stance, acknowledging their own biases and preconceptions, while engaging in an ongoing dialogue with narratives to uncover hidden meanings and implications.

3.2. Deconstructing Narratives: Examining their Understanding Assumptions and Implications through a Philosophical Lens

Deconstructing narratives in economic research involves critically examining their underlying assumptions and implications. Narratives often contain implicit or explicit assumptions about economic agents, institutions, causality, and values. By deconstructing narratives, researchers can expose these assumptions and evaluate their impact on economic analysis.

From a philosophical perspective, narratives can be seen as discursive formations that reflect power dynamics, ideological positions, and social norms (Hirschman 2002). By uncovering the hidden assumptions and ideologies embedded within narratives, researchers can better understand how they shape economic discourse and influence policy decisions.

Furthermore, deconstructing narratives involves questioning their implications for economic theory and practice. Narratives can reinforce or challenge prevailing economic paradigms, influence policy choices, and impact market behavior (Hirschman 2002). Philosophical analysis allows researchers to evaluate the coherence, plausibility, and normative implications of narratives, shedding light on their potential consequences.

Additionally, examining narratives through a philosophical lens helps researchers recognize the limitations and biases that narratives may introduce into economic research. By critically engaging with narratives, researchers can identify potential blind spots, alternative interpretations, and areas where narratives may overlook or simplify complex economic phenomena.

3.3. Evaluating the Impacts of Narratives on Epistemic Justifications and Belief Formation

The impact of narratives on epistemic justifications and belief formation is a crucial area of analysis in economic research. Narratives have the power to shape individual beliefs, influence collective decision-making processes, and affect economic outcomes (Matravers, 2014). Evaluating this impact requires a philosophical examination of the relationship between narratives, knowledge acquisition, and belief formation.

From an epistemological standpoint, narratives can serve as heuristics or cognitive shortcuts that simplify complex economic information. They provide a sense of coherence and meaning, helping individuals make sense of economic phenomena (Earl 2005). However, this simplification can also lead to cognitive biases and distortions. Philosophical analysis helps researchers evaluate the trade-offs between narrative simplification and the accuracy of economic knowledge (Matravers 2014). By critically assessing the epistemic value of narratives, researchers can identify the strengths and limitations of relying on narratives as a basis for belief formation in economic research.

Moreover, narratives can influence the formation of economic beliefs by appealing to emotions, values, and cultural norms (Matravers 2014). They can shape public opinion, affect policy preferences, and impact market expectations. Philosophical scrutiny allows researchers to examine the ethical dimensions of narratives and assess their potential consequences for societal well-being. By analysing the ethical implications of narratives, researchers can evaluate the fairness, equity, and social justice aspects embedded within them.

Additionally, evaluating the impact of narratives on epistemic justifications and belief formation also involves examining the interaction between narratives and evidence in economic research. Narratives can influence the selection, interpretation, and weighting of evidence, potentially biasing the formation of beliefs (Earl 2005). Philosophical analysis helps researchers assess the reliability and validity of the evidence used to support narratives, ensuring that epistemic justifications are based on robust and credible empirical foundations.

Furthermore, philosophical examination allows for a critical assessment of the role of narratives in shaping economic paradigms and theoretical frameworks. Narratives can contribute to the construction of economic theories by providing explanatory frameworks and guiding the selection of variables and models (Earl 2005). Researchers can analyse how narratives interact with empirical data and theoretical frameworks, exploring their impact on the evolution of economic knowledge. By examining the relationship between narratives and theoretical constructs, researchers can identify the extent to which narratives shape economic theory and its applications.

4. Challenges and Critiques

4.1. Potential Biases and Limitations of Narratives in Economic Analysis from a Philosophical Perspective

While narratives have gained recognition as important tools in economic analysis, they also pose potential biases and limitations that need to be considered from a philosophical standpoint. One challenge is the subjective nature of narratives, as they are shaped by the perspectives, values, and biases of their creators and interpreters. This

subjectivity introduces the possibility of confirmation bias, where narratives may selectively emphasize evidence that supports pre-existing beliefs or ideological positions (Kahneman 2011). Philosophical analysis allows researchers to critically evaluate the potential biases inherent in narratives and consider alternative interpretations and counter-narratives.

Another limitation is the simplification of complex economic phenomena through narratives. Narratives often condense multifaceted issues into simplified storylines, which may overlook important nuances and complexities. This simplification can lead to oversights and distortions in economic analysis. Philosophical scrutiny helps researchers identify the limitations of narrative simplification and encourages a more nuanced understanding of economic phenomena.

Moreover, narratives can be influenced by power dynamics and social contexts. Dominant narratives can shape economic discourse and policy decisions, potentially marginalizing alternative perspectives, and voices. From a philosophical standpoint, it is crucial to examine the power relations embedded within narratives and consider the ethical implications of their construction and dissemination. This requires a critical analysis of the underlying power structures and the potential exclusion of marginalized groups (Fraser 2009).

4.2. Ethical Considerations in Narrative Construction and Dissemination

The construction and dissemination of narratives in economic analysis raise important ethical considerations. Narratives have the potential to shape public opinion, influence policy choices, and impact the lives of individuals and communities. From a philosophical perspective, it is essential to examine the ethical implications of narrative construction and dissemination.

One ethical concern is the potential for narratives to perpetuate stereotypes, reinforce biases, or perpetuate social inequalities. Narratives can inadvertently promote discriminatory or harmful narratives by presenting certain groups in a negative light or by failing to consider the diversity of experiences and perspectives. Philosophical analysis allows researchers to critically assess the ethical dimensions of narratives and ensure that they respect principles of fairness, justice, and inclusivity (Nussbaum 2010).

Furthermore, the ethical responsibility of narrative creators and disseminators must be considered. Researchers need to be transparent about their methods, disclose potential conflicts of interest, and acknowledge the limitations and uncertainties of their narratives. Philosophical examination helps highlight the ethical obligations to uphold intellectual integrity, honesty, and accountability in the construction and dissemination of narratives.

Additionally, the question of whose voices and experiences are included or excluded in narratives is of ethical importance. Ensuring diverse representation and avoiding the erasure of marginalized perspectives is crucial for ethical narrative construction. Philosophical analysis prompts researchers to critically reflect on their choices in narrative construction and dissemination, considering the potential consequences and ethical implications of privileging certain voices over others.

4.3. Resolving Conflicts between Narratives and Philosophical Concepts of Truth an Objectivity

The tension between narratives and philosophical concepts of truth and objectivity poses challenges in economic analysis. Narratives are inherently subjective and interpretive, while traditional notions of truth and objectivity emphasize neutrality and correspondence to an external reality. Philosophical examination is necessary to navigate these conflicts and foster a deeper understanding of the relationship between narratives and truth.

One approach is to view truth as a multidimensional concept that encompasses different dimensions of validity, coherence, and pragmatic effectiveness (Habermas 2009). From this perspective, narratives can contribute to truth in terms of their ability to provide meaningful interpretations and explanations of economic phenomena. Philosophical analysis helps researchers assess the ways in which narratives align with or deviate from traditional notions of truth, and how they can complement or challenge existing conceptions of objectivity in economic analysis.

Moreover, philosophical examination can help researchers explore alternative philosophical frameworks that accommodate the subjective nature of narratives while maintaining intellectual rigor. For example, hermeneutics, a philosophical approach to interpretation, recognizes the role of subjectivity and context in understanding and interpreting texts, including narratives (Gadamer 2004). By adopting a hermeneutical perspective, researchers can engage in a reflective dialogue with narratives, acknowledging their interpretive nature and uncovering deeper meanings and implications.

Resolving conflicts between narratives and philosophical concepts of truth and objectivity also requires a critical assessment of the limitations of traditional positivist approaches in economics. Positivism emphasizes the

objective measurement and quantification of economic phenomena, often excluding subjective experiences and qualitative data. Philosophical analysis can help challenge the dominance of positivist paradigms and encourage the integration of diverse epistemological approaches in economic research, including those that value narratives and qualitative methods (Lawson 2009).

Furthermore, researchers can explore the concept of situated knowledge, which recognizes that knowledge is influenced by the social and historical context in which it is produced (Haraway 2009). From this perspective, narratives can be seen as situated knowledge that reflects the experiences and perspectives of specific individuals or communities. Philosophical examination helps researchers appreciate the value of situated knowledge and its contribution to a more comprehensive understanding of economic phenomena.

5. Rethinking Epistemology: Narrative Perspectives

5.1. Reconceptualising Epistemology in Economics as a Social Science from a Philosophical Standpoint

Reconceptualising epistemology in economics as a social science from a philosophical standpoint involves recognizing the role of narratives in knowledge production and understanding. Traditionally, epistemology in economics has been influenced by positivist approaches that prioritize objective measurement and quantification of economic phenomena. However, embracing narrative perspectives challenges this paradigm by highlighting the subjective and interpretive nature of economic knowledge.

From a philosophical standpoint, reconceptualizing epistemology in economics involves acknowledging the social nature of knowledge production. Narratives are embedded in social contexts, shaped by social interactions, and influenced by power dynamics. By recognizing economics as a social science, researchers can appreciate the importance of narratives in capturing the complexity of economic phenomena and understanding the social and cultural dimensions that shape economic behavior.

Furthermore, reconceptualizing epistemology in economics encourages interdisciplinary approaches that incorporate insights from philosophy, sociology, anthropology, and other social sciences. Philosophical analysis helps researchers critically evaluate the epistemic value of narratives and their contribution to economic knowledge. By embracing the social nature of economic phenomena and the multiplicity of voices and perspectives, researchers can develop a more comprehensive and nuanced understanding of economic dynamics.

5.2. Integrating Narrative Perspectives with Philosophical Epistemological Frameworks

Integrating narrative perspectives with philosophical epistemological frameworks allows for a more nuanced understanding of nature and acquisition of economic knowledge. Philosophical epistemology provides a foundation for examining the criteria of knowledge, the relationship between evidence and belief, and the role of interpretation and narrative in knowledge acquisition.

One philosophical framework that can be integrated with narrative perspectives is hermeneutics. Hermeneutics emphasizes the interpretive nature of knowledge and recognizes that understanding is influenced by preconceptions, biases, and the context in which it occurs. By integrating hermeneutics with narrative perspectives, researchers can engage in a reflective dialogue with narratives, critically interpreting their meanings and uncovering hidden assumptions and implications.

Additionally, incorporating narrative perspectives into the philosophy of science can shed light on the process of theory-building and hypothesis formation in economics. Narratives can provide explanatory frameworks, guide the selection of variables and models, and shape the construction of economic theories. Integrating narrative perspectives with philosophical epistemological frameworks allows researchers to critically evaluate the relationship between narratives and theoretical frameworks, exploring how narratives contribute to the evolution of economic knowledge.

Moreover, incorporating narrative perspectives into the philosophy of language can enhance our understanding of the communicative aspect of economic knowledge. Narratives are linguistic expressions that convey meaning and understanding. By integrating narrative perspectives with theories of language and communication, researchers can explore how narratives facilitate the transmission of economic knowledge, the role of language in shaping narratives, and the dynamics of interpretation and meaning making.

5.3. Implications for the Nature and Methodology of Economic Knowledge

Integrating narrative perspectives into epistemology has significant implications for the nature and methodology of economic knowledge. Recognizing the importance of narratives challenges the notion of economics as a purely

objective and value-free discipline. Philosophical analysis prompts researchers to critically evaluate the role of values, subjectivity, and social context in the construction and interpretation of economic knowledge.

Moreover, incorporating narrative perspectives encourages a more pluralistic and inclusive approach to economic research (Jackson 2021). By embracing diverse narratives, researchers can capture a broader range of experiences, perspectives, and voices. This inclusive approach can lead to a more comprehensive understanding of economic phenomena and enable researchers to address previously overlooked issues and perspectives.

Additionally, integrating narrative perspectives in economic methodology expands the toolkit of research methods. While quantitative methods have traditionally dominated economic research, narrative perspectives encourage the use of qualitative methods such as interviews, case studies, and ethnographic research. These methods allow researchers to delve deeper into the lived experiences and narratives of individuals and communities, providing rich and contextualized insights into economic phenomena.

Furthermore, incorporating narrative perspectives in economic methodology challenges the linear and deterministic view of causality that is often employed in traditional economic analysis. Narratives recognize the complex interplay of multiple factors, contexts, and interpretations that shape economic outcomes (Jackson 2017). This recognition calls for a more holistic and multidimensional understanding of causality in economic research, where narratives can help identify the intricate webs of relationships and dynamics that influence economic phenomena.

In addition, narrative perspectives in economic epistemology encourage reflexivity and self-awareness among researchers. By acknowledging the role of narratives in shaping economic knowledge, researchers are prompted to reflect on their own biases, assumptions, and interpretations. This self-reflection can lead to a more critical and nuanced engagement with narratives, promoting intellectual humility and openness to alternative viewpoints.

Moreover, the integration of narrative perspectives with philosophical epistemological frameworks also has implications for policy making and the application of economic knowledge. Narratives play a significant role in shaping public opinion, policy choices, and societal values. By recognizing the power of narratives, policymakers can engage with a wider range of narratives to inform their decision-making processes, considering the diverse perspectives and experiences embedded within them.

By reconceptualizing epistemology in economics as a social science, integrating narrative perspectives with philosophical frameworks, and considering the implications for the nature and methodology of economic knowledge, researchers can embrace a more comprehensive and inclusive approach to understanding economic phenomena. This integration prompts researchers to critically evaluate the social context and subjective nature of economic knowledge, fostering a deeper understanding of the complex dynamics that shape economic behavior. Ultimately, incorporating narrative perspectives enriches economic research, policy making, and our overall understanding of the economic world.

6. Conclusion and Implications for Philosophy and Interdisciplinary Collaboration

6.1. Summary of Key Findings and Contributions to Philosophical Epistemology

Throughout this study, we have explored the role of narrative perspectives in philosophical analysis and its implications for epistemology. Our research has demonstrated that incorporating narrative perspectives enriches philosophical discourse by providing a deeper understanding of knowledge acquisition, justification, and the nature of truth. Through the examination of narratives, we have shed light on the complex interplay between subjective experiences, social contexts, and the construction of knowledge. This investigation has contributed to philosophical epistemology by emphasizing the significance of storytelling as a means of comprehending and communicating human experiences and knowledge.

By engaging with narratives, we have recognized the multifaceted nature of truth and the limitations of traditional analytic approaches in capturing the richness of human knowledge. Our findings underscore the importance of acknowledging diverse perspectives and lived experiences in philosophical analysis. We argue that narratives offer a unique lens through which philosophical questions can be explored, enabling a more holistic understanding of the complexities of knowledge and truth.

6.2. Advantages of Incorporating Narrative Perspectives in Philosophical Analysis

Incorporating narrative perspectives in philosophical analysis offers several advantages. First, narratives provide a rich and contextualized account of human experiences, enabling philosophers to grasp the intricacies of lived realities. Unlike traditional philosophical approaches that rely heavily on abstract reasoning and logical arguments, narratives offer concrete and relatable examples that connect philosophical concepts with real-world

phenomena. This connection to human experiences enhances the accessibility and relevance of philosophical inquiries, making them more relatable and engaging to a wider audience.

Second, narratives allow for the exploration of subjective perspectives and the diversity of human knowledge. By embracing narrative inquiry, philosophers can recognize the situated nature of knowledge and challenge the notion of a single, objective truth. This perspective acknowledges the plurality of narratives and their role in shaping individual and collective understandings of the world. By incorporating diverse narratives, philosophers can uncover hidden biases, challenge dominant paradigms, and foster a more inclusive and comprehensive philosophical discourse.

Moreover, narrative perspectives contribute to a more nuanced understanding of epistemic practices, such as the evaluation of evidence and the formation of beliefs. By analysing how narratives shape our epistemic processes, philosophers can identify the ways in which stories influence our knowledge acquisition, justification, and decision-making. This recognition can inform debates on the reliability of narrative-based reasoning, shedding light on the conditions under which narratives can be considered valid sources of knowledge.

6.3. Engaging in Interdisciplinary Collaboration with Economists and Social Scientists

To further enrich philosophical analysis and its implications, interdisciplinary collaboration with economists and social scientists is highly beneficial. By working together, philosophers, economists, and social scientists can bridge disciplinary boundaries and develop a more comprehensive understanding of human knowledge and social phenomena.

Collaborating with economists offers opportunities to explore the relationship between narrative perspectives and economic behaviour. Economists can provide valuable insights into how narratives shape individuals' economic decision-making, such as investment choices, consumer behaviour, and market dynamics. By integrating economic theories and empirical data, philosophers can gain a deeper understanding of the role narratives play in economic processes and develop more robust frameworks for analysing economic phenomena from a philosophical standpoint.

Similarly, engaging with social scientists, including sociologists and psychologists, can provide invaluable perspectives on the social and psychological dimensions of narrative-based reasoning. Social scientists can contribute their expertise in understanding how narratives are constructed, shared, and interpreted within different social and cultural contexts. This collaboration can shed light on the sociocultural factors that influence the formation and transmission of narratives, as well as the psychological mechanisms underlying their impact on human cognition and behaviour.

6.4. Recommendations for Future Research and Philosophical Discourse

Moving forward, we recommend several avenues for future research and philosophical discourse on narrative perspectives and epistemology. Firstly, further exploration is needed to investigate the role of narratives in different domains of knowledge, such as science, history, and ethics. By analysing how narratives shape these specific areas, philosophers can uncover the nuances of narrative-based reasoning within different epistemic contexts and shed light on the implications for knowledge production and evaluation.

Secondly, it is important to address the challenges and limitations of narrative-based epistemology. While narratives offer valuable insights, they are not without their flaws. Future research should critically examine the reliability and credibility of narratives as sources of knowledge, particularly in instances where they may be influenced by biases, misinformation, or subjective interpretations. Developing frameworks for assessing the epistemic quality of narratives will contribute to a more robust understanding of their role in knowledge acquisition and justification.

Additionally, interdisciplinary collaborations between philosophers, economists, and social scientists should be encouraged and fostered. By engaging in joint research projects and dialogues, scholars from different disciplines can contribute their unique perspectives and methodologies to unravel the complexities of narrative-based reasoning. This collaboration can also lead to the development of interdisciplinary frameworks that integrate philosophical, economic, and social scientific approaches, providing a more comprehensive understanding of the role of narratives in knowledge construction and societal dynamics.

Furthermore, the impact of narratives on social and political discourse deserves further investigation. Understanding how narratives shape public opinion, influence social movements, and contribute to the formation of collective identities is crucial in a society increasingly driven by media narratives and digital communication. Philosophers can contribute to these discussions by examining the ethical implications of narrative-based

persuasion and manipulation, as well as the potential for narratives to foster empathy, understanding, and social change.

In conclusion, incorporating narrative perspectives in philosophical analysis enriches our understanding of knowledge, truth, and the complexities of human experiences. By embracing diverse narratives and engaging in interdisciplinary collaborations, philosophers can advance epistemology and contribute to a more inclusive and comprehensive philosophical discourse. Future research should continue to explore the advantages and limitations of narrative-based epistemology, investigate its role in specific domains of knowledge, and critically examine the impact of narratives on social and political dynamics.

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A Conceptual Analysis of the Technology, Organisation, Environment, Readiness and Industry 4.0 Adoption in Malaysia Small and Medium Enterprises

Siti Nurul Aziah ISMAIL
Universiti Malaysia Terengganu, Malaysia
p4166@pps.umt.edu.my

Wan Norhayati MOHAMED
Universiti Malaysia Terengganu, Malaysia
Corresponding author: wannor@umt.edu.my

Khatijah OMAR
Universiti Malaysia Terengganu, Malaysia
khatijah@umt.edu.my

Nik Hazimah Nik MAT
Universiti Malaysia Terengganu, Malaysia
nikhazimah@umt.edu.my

Jumadil SAPUTRA
Universiti Malaysia Terengganu, Malaysia
jumadil.saputra@umt.edu.my

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Abstract: Technology advancement is a primary element in differentiating Industry Revolution 4.0 (IR 4.0) from previous Industrial Revolutions. This revolution changes the nature of workforces, and the way people work. As a result of rapid technological advancement through Industry 4.0, SMEs are finding it more difficult to innovate and adopt. SMEs have difficulty adopting Industry 4.0; hence they tend to remain inactive. They can, however, reap greater benefits if they are more active and open to this new revolution. The current paper aims to examine the potential for reviewing to investigate, in the context of Malaysian SMEs and the adoption of Industry 4.0, whether the relationships between technology, organisations, environment, and Industry 4.0 adoption are mediated by readiness. Also, the paper analysed the various issues and concepts related to the study through various literatures. The study's results are expected to demonstrate that the relationships between technology, organisations, and environmental aspects are mediated by a readiness to adopt Industry 4.0. This finding will provide information to SMEs on which aspects for the company to improve to be ready and adopt Industry 4.0. It will also be useful to policymakers who create strategies and support systems to encourage the growth of Malaysian SMEs.

Keywords: industry 4.0; small and medium enterprises; adoption, technology, organization, and environment framework; diffusion of innovation theory; Malaysia.

JEL Classification: M13; M31; M37; O32; R11.

Introduction

SMEs play a crucial role in Malaysia's economic landscape. Based on the Department of Statistics Malaysia report, SMEs' Gross Domestic Product (GDP) contribution shows a significant increase from 2015 with 36.3% to 2016 with 36.6%. It continues to increase to 37.1% in the year 2017 and year 2018 with an increment to 38.3% (Department of Statistics Malaysia Press Release Small and Medium Enterprises (SMEs) Performance 2018, 2018). The GDP contribution continued to increase in 2019 to 38.9%, with a nominal term recorded RM586.9 billion (Department of Statistics Malaysia, 2020). As a result, Malaysian SMEs are key players in the country's economic expansion and must meet the challenge of promoting and managing Industry 4.0 adoption. Since

Industry Revolution has systematically gone through different phases, the fast phase has brought us to Industry 4.0 today. Industry 4.0 introduced a smart manufacturing and production method involving various technologies, such as the Internet of Things (IoT) and the Internet of Services, also called IoS. The technologies implemented in Industry 4.0 have changed business operations and management.

Therefore, on October 31, 2018, Malaysia's Ministry of International Trade and Industry (MITI) announced the official Industry 4.0: Industry4WRD policy to keep pace with the technological revolution. This policy aims to develop a comprehensive transformation plan for Malaysia's manufacturing industry and related services towards Industry 4.0 adoption. However, after one year of launching the National Policy on Industry 4.0: Industry4WRD, Malaysia faces a slow adoption rate, with only 15 to 20% of companies migrating to Industry 4.0. The 15 to 20% of companies were tier-one companies obliged to adopt because they had no other choice. Industry 4.0 Malaysia Association President Raja Teagarajan said only 90 of the government's 500 target companies had gotten assistance with the transition to Industry 4.0 (Kaur, 2019). It was emphasised by Malaysia's position in the 'Leader' quadrant, according to the 2018 Readiness for the Future of Production Report issued by the World Economic Forum (WEF). Nonetheless, the leader quadrant countries have the most current economic value at stake for future disruptions if they fail to accelerate the transformation towards Industry 4.0 (World Economic Forum, 2018).

Nevertheless, the adoption decisions were influenced by various factors that businesses must consider. The most common contexts are technology, organisational and environmental. Technology, organisation, and environmental contexts influence company decisions on whether they need to initiate and adopt Industry 4.0 into their business. It has origins from the TOE Framework and has been integrated with the Diffusion of Innovation Theory (DOI) in numerous research works examining the adoption of technology and innovation (Paydar and Endut, 2013), (Amini and Bakri, 2015), (Bhattacharya and Wamba, 2015), (Al-Hujran et al., 2018), (Usman et al., 2019), (Skafi et al., 2020), (Kaminski, 2011).

1. Relationships between Technology, Organization, Environment, and Industry 4.0 in Malaysian SMEs

1.1 Relationship between Technology, Organization, Environment, and Industry 4.0 Readiness

Technology and readiness are common discussion topics among researchers. In one research work, technology readiness was referred to as being ready to enhance the standards of the currently used technology and to embark on the higher-level use of technology (Nugroho et al., 2017). Four traits of the human personality - optimism, innovativeness, discomfort, and insecurity are generally used to measure technology readiness. Optimism implies positivity towards technology and perceiving that technology offers benefits, such as making life more controllable, flexible, and efficient. Innovativeness is seen as eager to be a pioneer and front liner in trying new technology and a thought leader. Discomfort implies that a person perceives that technology will be problematic to control and that they are afraid of and concerned about new technology, which reduces their self-esteem. Meanwhile, insecurity involves doubt and wariness about the workability of the technology (Nugroho & Andryzal Fajar, 2017).

Readiness for Industry 4.0 is always highly related to the technology, which is the driving aspect of the adoption. The research found that the process's flexibility in production or services and stability is key to technological readiness as part of the industry 4.0 implementation (Samaranayake et al., 2017). According to (Vize et al., 2013), the technical readiness of a company impacts its ability to adopt new technology. Still, the technical complexities of dynamic web technologies necessitate both technical capabilities and knowledge of the technology. Where these are insufficient, managers may feel increasingly exposed to being exploited, heightening their risk perceptions and lowering their trust in adopting or employing technology. Therefore, readiness plays a pivotal role in fortifying the Industry 4.0 adoption. The readiness is mostly based on the company's digital preparedness for Industry 4.0 technologies. Research indicates that Industry 4.0 can be uniquely characterised by assessments of particular technologies, implying that the technology readiness of organisations is enhanced considerably to facilitate their readiness for Industry 4.0 (Hizam-Hanafiah et al., 2020).

Meanwhile, the organisation has a role in ensuring the business formation is well established. In the various roles accountable to the organisation, readiness is one element that must be administered. Knowing the Industry 4.0 readiness in the organisation is important to know how well to prepare the organisation to undergo a major change. It is to ensure that the organisation is aware of the efficiency based on their resources and to avoid any potential failure. Factors in the organisation, information intensity, top management support, organisational competency, and absorptive capability indicate the importance of elements in the organisation that can determine Industry 4.0 readiness and adoption. Industry 4.0 readiness in the organisation most likely rely on continuous support from top management. Numerous relationships will be changed due to Industry 4.0, such as

organisations with environmental aspects, the community, the value chain, and humanity. Therefore, organisations must design their strategy considering these changing relationships (Sony & Naik, 2019). Researchers have argued that a key dimension of readiness for Industry 4.0 is the appropriate degree of support from the senior managers (Stentoft et al., 2019), who are also the drivers of IT trend-related knowledge. Organisations only reach the point at which they can expand further and become ready for the inherent risk through the initiative of the leading managers (Nair et al., 2019). Hence, organisations must strategise and align the new technology's readiness and adoption.

Due to the rapid changes and great competition in the market, organisation transformations and strategies are crucial. It is because, with the transformation, organisations can develop sustainability and efficiency and adapt to the changes and challenges. Therefore, the commitment from the organisation to ensuring the readiness for adopting Industry 4.0 will enhance business sustainability. On the other hand, environment and Industry 4.0, readiness are closely related. Environments provide threats and opportunities that require the organisation to tackle them positively, adapt to the environmental requirements, and change operations accordingly. Interaction between the environment and business, internally or externally, will affect business sustainability and Industry 4.0. Organisations often thrive and become economically sustainable due to the influence of the elements of their external environment, such as the pressure from competitors, business partners, support from outside the business and governmental assistance. In contrast with external factors, organisations have great control over internal environmental factors. They can make business decisions based on their strategies and where they see fit. It indicated that the readiness to adopt Industry 4.0 is considerably influenced by the environmental factors that can be the source of either barriers or drivers.

Researchers have revealed that the readiness to face Industry 4.0 is positively and significantly affected by the external environment, the dynamic of which is at least as crucial as any other aspect, like technology (Maria et al., 2019). The government also need to foster and educate business, especially SMEs, in forms of guidance in the managerial aspect, technological aspect as well as organisational readiness in adapting the Industry 4.0 (Sari & Santoso, 2020). Since the external environmental factors are beyond the organisation's control, they must continuously study the environmental aspects and adapt to any possible changes. Therefore, a smooth adoption process can take place.

1.2 Relationship between Technology, Organization, Environment, and Industry 4.0 Adoption

Technology and Industry 4.0 is an intertwine phrase that is notable accompaniment. The evolution and advancement of technology itself have brought us to Industry 4.0. Today. The most common or based technologies applied in Industry 4.0, especially in manufacturing, are the Internet of Things (IoT), Cloud Computing, Big Data, Smart Manufacturing, Smart Products, et cetera. These technologies are the main adoption elements of Industry 4.0. Technological factors are linked to the firm's technological infrastructure and capabilities and those available on the market (Arcidiacono et al., 2019). The findings of the existing studies have generally demonstrated that technology and Industry 4.0 adoption are significantly and positively related. At the same time, this might not be universally applicable, but this relates in part to the technologies of Industry 4.0. For example, the results of one work illustrate that Industry 4.0 is connected to front-end technology being more widely adopted, in which a major role is played by Smart Manufacturing (Frank et al., 2019).

Besides that, a study in Indonesia found that technology's relative advantage is vital in determining the intention to adopt Industry 4.0 (Hidayatno et al., 2019). Research into the adoption of IIoT by manufacturers in Germany demonstrated that of all the factors of TOE affecting Industrial Internet of Things (IIoT) adoption. The greatest influence was found to come from technology relative advantage (Arnold & Voigt, 2019), which was also the case with Canadian SMEs regarding their Internet and e-business technologies (IEBT) adoption (Ifinedo, 2011). Other researchers have demonstrated that manufacturing professionals must adopt Industry 4.0 technologies. At the same time, companies must undertake technologies-related projects so their competitive edge can be maintained or strengthened (Chiarini et al., 2020). Additionally, Thong (1999) found that technology and organisations are significantly related to adoption. The adoption capability of an SME and a better-resourced company that has greater opportunities are not the same. Integrating IT, the IoT, and the general idea of Industry 4.0 is highly challenging for most SMEs. However, all enterprises require numerous technological developments and innovations through the adoption of Industry 4.0 to maintain market competitiveness (Sevinç et al., 2018).

In other aspects, Industry 4.0 will certainly affect how one organisation works, up and running, contrasting with the traditional practices, especially in most SMEs that are known with the conventional managerial system. During the Industry 4.0 adoption process, major transformations will be experienced due to substantial workforce skills changes, new business structures, new mechanisms of leadership, and new cultures of corporations. So

that an organisation can disseminate Industry 4.0 practices that focus on being sustainable, it must ensure that it is more capable regarding the expertise within its workforce, the strategic policies by which it organises itself, its instruments of leadership and its business culture of friendliness (Cevik Onar et al., 2017). An existing study examined how the technology of Industry 4.0 was associated with the processes used by businesses to create, maintain, and internally transfer knowledge. Their findings indicated that if a company systematically supports organisational-level learning and the exchange of knowledge, implementing the technology of Industry 4.0 will enhance its advantages (Tortorella et al., 2020).

Meanwhile, researchers exploring how SMEs had adopted Industry 4.0 discovered that those with internally and externally stronger forms of social capital were more likely to adopt the technologies of Industry 4.0. This association was strengthened with the managers' support and a greater capacity to absorb. Furthermore, social capital and the adoption of Industry 4.0 were positively and significantly related to higher levels of absorptive capacity and managerial support (Agostini & Nosella, 2019). Another study suggested that leadership must initiate organisational culture changes so that they do not cause internal conflicts, such as encouraging a learning and innovation culture, knowledge upgrades, and rewarding unconventional thinking (Sivathanu & Pillai, 2018). The more senior management backs innovative technology, the more likely these innovations will be adopted (Sevinç et al., 2018). Meanwhile, according to one study, when a company is undertaking the development process of adopting Industry 4.0, it must ensure the changes are generally understood and initiate innovative programs to train employees, so their competencies improve. Moreover, such companies must have leaders with open minds, creativity, and the capacity to think from the perspective of the organisation and the overall network (Horváth & Szabó, 2019).

Meanwhile, external and internal environmental factors undeniably influence the adoption decision. Organisations tend to be conscientiously aware of environmental conditions, especially in their respective industries. Internal environmental factors usually provide strengths and weaknesses within the organisation for them to grasp the whole business environment. In addition, external factors will mostly bring opportunities to seize and threats to the organisation to control. Competitive pressure, business partners, external support and government support, are among the environmental factors influencing the adoption of Industry 4.0. For example, researchers found RFID technology adoption intentions within companies were most significantly affected by competitive pressure; this had a positive association with adoption intention (Paydar et al., 2014). A study on the adoption of Blockchain among SMEs indicated that competitive pressure significantly impacts the adoption intention. It implies that SMEs are determined to stay relevant and competitive, and technological innovation, as in Industry 4.0, is the driving force (Wong et al., 2019).

Additionally, increasing numbers of consumers are anticipating business outcomes being delivered as Industry 4.0 advances, so organisations are coming to recognise that their services must be reinvented, their innovation accelerated and broadened, and their solutions delivered in a way that focuses on outcomes alongside their ecosystem partners. With substantial changes on the way, companies and partners will need to collaborate more closely. They may be left behind in the Industry 4.0 ecosystem if they fail to do so (Schroeck et al., 2020).On the other hand, government support and policies can help to create a favourable environment for businesses to adopt the technology. The reason is that a company is more likely to respond to this type of appeal and attempt to use new technologies when the authorities employ the media or introduce policies involving allocating additional social resources to an innovative tool. Therefore, all government initiatives contribute to beneficially adopting Industry 4.0 technology (Lin et al., 2018).

1.3 Relationship between Industry 4.0 Readiness and Industry 4.0 Adoption

The readiness and decision to adopt certain innovations or technologies greatly influence various factors. For instance, through the context of technology, companies will need to identify if they can acquire any advantages from the adoption of innovation of technologies in their business operation and processes. It is because neither a single event nor a limited number of discrete events constitute technological innovation. It entails a complex web of events involving numerous activities, decisions, and actions on the part of individuals and social units, most of whom are not even aware that they are part of such a process (Tornatzky & Fleischer, 1990). According to Hammer & Champy (2002), technology can manoeuvre business processes and organisational performance towards improvements with ongoing efforts. In order to succeed, companies need to explore the technological potential of one of their core competencies. Hence they will enjoy a continuing and growing advantage over their competitors. In this situation, technologies used internally and externally were involved, with the former referring to the organisation's existing technology it now uses and the latter referring to the available technologies offered in the market but not adopted or used by the business (Al-Hujran et al., 2018).

Past studies showed that influential factors derived from the aspects of technology, organisation and environment affect the adoption of innovation or technologies adoption, such as cloud ERP by SMEs (Usman et al., 2019), CRM adoption (Cruz-Jesus et al., 2019), Social commerce adoption (Abed, 2020), and SMEs' adoption of Cloud Computing Services (Skafi et al., 2020). In addition to this, readiness may influence the adoption decision through the technology, organisation, and environmental contexts. Readiness in this study refers to the causes and effects and links between technology, organisation and environment aspects towards the adoption and explains the relationships between them. It is because readiness often leads to adoption. Before the adoption, the whole implementation process was due to the readiness factors that drove the decision to adopt. To take the example of Denmark, despite being regarded as highly ICT-intensive compared to many other OECD countries, its readiness level is relatively low. The implication is that this low level applies in most OECD countries, so all organisations - not SMEs - require the allocation of resources so their preparation to adapt and change to accommodate the digital environment can be successful (Stentoft et al., 2019).

Moreover, countries with the ability and readiness at the forefront of digitalisation tend to be more advanced in adopting Industry 4.0. (Castelo-Branco et al., 2019). Therefore, according to the practitioners, the priority readiness aspects would allow for a smooth implementation of Industry 4.0 in SMEs. (Sriram & Vinodh, 2020). The readiness for adoption has been constantly studied and examined by researchers, hence the development of readiness models across various fields. In a review of this topic, Industry 4.0 readiness was evaluated using 158 model dimensions by various authors and businesses. From that, the six most important dimensions were identified: technology, people, strategy, leadership, process and innovation (Hizam-Hanafiah et al., 2020). For instance, a study on the different dimensions affecting Industry 4.0 readiness suggests it is positively and significantly affected by those elements related to the economy and the environment. Meanwhile, Industry 4.0 readiness is positively but insignificantly impacted by the dimensions of culture and technology but negatively and insignificantly by the social dimension (Maria et al., 2019). Besides that, the level and degree of readiness will also determine the company's adoption decision and lead to a higher degree of practising Industry 4.0 (Stentoft et al., 2019).

1.4 Readiness of Industry 4.0 Mediates Relationship between Technology, Organization, Environment and Industry 4.0 Adoption

Due to the limited research and findings on Industry 4.0 adoption, this study mostly relies on the previous literature related to IT adoption research. It is because Industry 4.0 is closely connected with IT and technology innovation. Those research and studies often relate adoptions with readiness. The author identified that adoption readiness had potential associations with the elements of technology examined: the relative advantage offered and how compatible, complex, available, and observable the technology was. Readiness is often seen as crucial in implementing and adopting any technology or innovation into the business operation. Most companies hesitate to adopt due to readiness issues. In addition, companies need to contemplate the risk should the adoption fail. For instance, one study found that one of the major causes of the failure of ERP implementation is a lack of readiness (Ali & Miller, 2017).

Additionally, adoption decisions are considerably influenced by readiness levels since higher readiness levels lead to technologies being regarded as of greater business relevance and hence more widely deployed (Stentoft et al., 2019). Other researchers proposed that the circumstances needed for readiness to be acquired wide international disparities. However, this demonstrates that a country's prominence in closing the digital gap should correspond to the likelihood of adopting Industry 4.0 (Castelo-Branco et al., 2019). Hence, the readiness can potentially mediate the technology towards adopting Industry 4.0. It is significant to note that adopting and transforming a company's technology does not solely rely on technology investment but also involves the whole organisation's commitment and business strategies. This gradual transformation requires well-prepared planning and readiness. Organisation elements in this study which involve information intensity, top management support, organisational competency, and absorptive capability, might be influenced by the readiness aspect towards the adoption.

For example, in order to employ Advanced Manufacturing Technology (AMT), the organisation's readiness must be well established throughout the implementation process (Rahardjo & Yahya, 2010). It is because the readiness and commitment from the organisation can enhance the advancement of Industry 4.0 (Jayashree et al., 2019). Besides that, a study indicated that readiness is considered a great assistance to the organisation in identifying the obstacles in the Industry 4.0 execution (Ślusarczyk, 2018). From these findings, it can be considered that readiness can mediate the organisation towards Industry 4.0 adoption. Besides technology and organisation, the environment has been acknowledged as one of the significant influences towards the adoption

decision. This study looks at elements of company pressure, business partners, external support, and government support within the environment factor. Since environmental elements are beyond the organisation's control, readiness plays an important role in the embarkment of Industry 4.0. Therefore, it is seen that Industry 4.0 readiness is positively and significantly affected by environmental factors (Maria et al., 2019). The company's readiness in preserving and improving the changes in environment towards the adoption of Industry 4.0 is indeed crucial. Moreover, the fast-changing and new dynamic environment presents huge challenges to companies. Thus, the readiness can mediate the environment towards Industry 4.0 adoption.

2. Underlying Theories

2.1 The DOI Theory and Technology, Organization, and Environment (TOE) Framework

The foundations for the current study are the DOI Theory, also called the Innovation Diffusion Theory (IDT), and the Technology, Organisation, and Environment (TOE) framework. These two prominent theories are widely used in technology adoption studies and research. DOI Theory consists of two aspects which are diffusion and innovations. The former can be defined as how particular routes and processes convey innovations to those belonging to social systems across time. Every message relates to a new idea, which makes this form of communication unique. Communication can be defined as a way of establishing a general understanding through the production and sharing of information by individuals. Since the messages focus on novel ideas, communication involving diffusion is unique. Its specific nature is the newness of ideas delivered through communication messages. Innovation can be defined as ideas, practices, or objects that individuals or other adoption units perceive as new. Whether or not an idea counts as an innovation is determined by its newness, which it is possible to express by knowing about it, persuading others to use it, and the decisions to adopt it. However, not all innovations are necessarily desirable since some innovations may be relevant to certain adopters, but in other situations, it is irrelevant to others (Rogers, 1983).

Tracing back to the beginning of the theory was created about a century ago. The theory was based on the three great foundations by the forefather of sociology and anthropology: the Frenchman Gabriel Tarde, the German Georg Simmel, and a group of anthropologists, the German-Austrian and British diffusionist. Since then, the theory has emerged and researched in different scientific disciplines. As the current research developed, the author identified eight principal forms of diffusion research: (1) How early innovations were known about, (2) The rate at which different innovations were adopted in social systems, (3) How innovative technology was, (4) The opinions of leaders, (5) Networks of diffusion, (6) The rate at which innovations were adopted in different social systems, (7) The use of communication channels, and (8) the outcomes of innovations (Rogers, 2003). Five categories of adopters are identified in the Innovation Diffusion Theory: the innovator, the early adopter, the early majority, the late majority, and the laggard. Each category has different characteristics and a different pace in adopting certain innovations. An innovator is someone wishing to be the original trialist of innovations. The early adopter is a thought leader. Rarely taking the initiative characterises those in the early majority. Those who are sceptical of adopting innovation are the late majority. Laggards are traditionalists bound by their beliefs (Diffusion of Innovation Theory, n.d.).

Rogers utilised the theory to propose five principle attributes explaining how innovations are adopted in organisations and how innovation-related uncertainty can be alleviated. Any innovation was deemed to comprise five characteristics. Firstly, relative advantage refers to its comparative improvement over previous generations. Second, compatibility refers to the relative ease of assimilating it into a business's current processes, methods, and value systems. Third, complexity refers to how difficult innovations are to use. Fourthly, observability means the degree to which others can see the innovation; fifthly, trialability refers to how easily the innovation can be experimented with (Oliveira et al., 2014). The attributes listed above describe how an organisation adopts innovation. At the time of writing, those researching IT and technology adoption have extensively used the DOI Theory and model, which have also been utilised by various types of social scientists, including educationalists, marketers, healthcare experts, and industrial engineers. Therefore, through this study, the above five attributes will be combined with the TOE Framework to explain the adoption of Industry 4.0. These attributes will be included in the context of technology under the TOE Framework.

Meanwhile, the TOE framework is a theory developed to delve into organisations' adoption decision through three perspectives or contexts: technology, the organisation, and the environment. In the 1990 work by Tornatzky and Fleischer, The Process of Technological Innovation, the authors proposed a key framework depicting the full process by which companies approached innovations. This included conception, adoption, and user implementation (Baker, 2012). The three contextual factors in TOE Framework influence a company's intention to adopt or not adopt the innovations. The concept of technology refers to the existing technologies used

internally by a company and externally available in the marketplace that may be relevant to particular organisations. The internal factors primarily comprise the organisational context, including the size of firms and their management, workforce, and formalisation structures. Meanwhile, the environmental context relates to the industry, suppliers, competitors, partners, and government (Tornatzky & Fleischer, 1990).

Since then, numerous researchers have utilised these ideas by testing the innovation adoption framework in their own fields, particularly regarding the adoption of technology. For example, this approach has been used to test EDI, KM, online business operations, RFID, online commerce, systems of the enterprise, and e-procurement (Awa et al., 2016). Furthermore, the adoption of online commerce by SMEs in developing nations could be explained by the TOE framework (Idris et al., 2017). Whether in the form in which it was created or its later IT adoption-related extensions, the TOE framework is highly useful for conducting analyses of how different IT innovations have been adopted and assimilated (Oliveira & Martins, 2010).

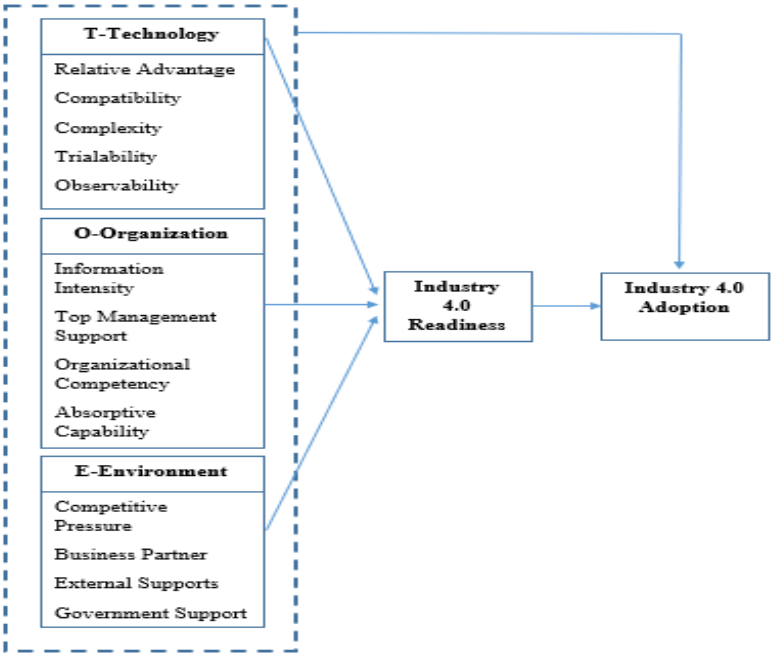
Previous researchers have employed integrated versions of the TOE framework and DOI theory when examining the adoption of different innovations and technologies. These include the internal and external elements involved in decisions to adopt Cloud Computing (Sayginer & Ercan, 2020), the retail industry's adoption of Radio Frequency Identification (RFID) technology (Paydar & Endut, 2013), the way that operations and supply chain management have adopted blockchain (Wong et al., 2019), as well as readiness factors identification for Industry 4.0 (Sari & Santoso, 2020). Instead of being one of the commonly used theories in innovation adoption study, DOI theory has its limitation: it does not include the environmental context, in contrast with TOE Framework, which also considers environmental aspects. Therefore, the combination of the TOE Framework and DOI theory will be able to explain innovation adoption at a firm level (Amini & Bakri, 2015). Hence, the TOE Framework and DOI theory integration complement each other (Puklavec et al., 2018).

In addition, TOE and DOI theories have been generally recognised to explore technological adoption as they have some parallels, such as both the theories include technology and organisation context. The TOE model typically aims to define appropriate categories for the determinants, while the DOI model helps to recognise a particular determinant within each category (Reza et al., 2021). Besides that, as compared to other technology acceptance and adoption models such as the Theory of Planned Behaviour (TPB) and Theory of Reason Action (TRA), DOI theory concentrates on the adoption decision through the organisational characteristic rather than individual roles (Taherdoost, 2018).

2.2 Framework

This conceptual paper seeks to ascertain the relationship between technology, organisation, environment, and adoption of Industry 4.0 as mediated by readiness.

Figure 1 - Research Framework



Source: adapted from Ramdani et al. (2009) and Meuter et al. (2005)

A study was conducted on several models developed by other authors. A study combination from Ramdani et al. (2009) and Meuter et al. (2005) was further explored. Ramdani et al. (2009) developed a model which determined

the relationship between technology, organisation, and environmental context towards the SMEs' adoption decisions. Meanwhile, Meuter et al. (2005) conceptual model consists of innovation characteristics, individual differences, consumer readiness and adoption. Thus, the conceptual model depicted in Figure 1 below results from a combination of those studies.

Therefore, the study proposed as below:

H1(a): There is a positive relationship between Technology and Industry 4.0 Readiness.
H1(b): There is a positive relationship between Organization and Industry 4.0 Readiness.
H1(c): There is a positive relationship between Environment and Industry 4.0 Readiness.
H2(a): There is a positive relationship between Technology and Industry 4.0 Adoption.
H2(b): There is a positive relationship between Organization and Industry 4.0 Adoption.
H2(c): There is a positive relationship between Environment and Industry 4.0 Adoption.
H3: There is a positive relationship between Industry 4.0 Readiness and Industry 4.0 Adoption.
H4: Industry 4.0 Readiness will positively mediate the relationship between Technology, Organization, Environment, and Industry 4.0 Adoption.

Conclusion

Industry 4.0 has become the talk of the town, and everyone races together and against each other to be part of it. Since the inception of Industry 4.0, it has emphasised the need for organisations to upgrade their whole business operation towards implementing and adopting technological advancement. In order to gain business sustainability, the business must keep pace with market trends and market pressures, especially SMEs. Thus, the current paper proposes to examine how technology, organisation, the environment, readiness for Industry 4.0, and the adoption of Industry 4.0 are related. The expectation is that the problems SMEs face in adopting Industry 4.0 will be addressed. In addition, this conceptual paper can contribute to supplementing literature for scholarly reference. However, a broader range of literature must be further examined with an astute assessment to gain more information to move forward with the empirical research. Once the current research is complete, the study results should impact policymakers and SMEs about Industry 4.0 adoption. Therefore, the current study proposes that readiness for Industry 4.0 has a mediating effect on technology, organisations, and environments concerning the adoption of Industry 4.0. Additional empirical studies are needed to conduct an assessment of the proposed framework about its efficacy.

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Autoregressive Distributed Lag Approach for Estimating the Nexus between Net Asset Value of Mutual Fund and Economic Determinants in India

Sathish PACHIYAPPAN
School of Business and Management, CHRIST (Deemed to be University), Bangalore, India
sathish.p@christuniversity.in

Ankita SHRIVASTAVA
School of Business and Management, CHRIST (Deemed to be University), Bangalore, India
ankita.shrivastava@bba.christuniversity.in

V John Paul RAJ
School of Business and Management, CHRIST (Deemed to be University), Bangalore, India
john.paulraj@christuniversity.in

Saravanan VELLAIYAN
School of Business and Management, CHRIST (Deemed to be University), Bangalore, India
saravanan.v@christuniversity.in

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Abstract: India has seen a phenomenal growth in cumulative mutual fund investment from Rs 7.93 trillion in 2012 to Rs 40.38 trillion in 2022, which is more than a five-fold increase since last 10 years. Retail investors are now realizing the power of savings and Systematic Investment Plans (SIP) to build long term wealth. A financial literacy wave which is sweeping across India has projected mutual funds as a significant contributor and beneficiary of this phenomenon. The evolving economic landscape of India provides investors with excellent opportunities to capitalize on these fluctuations through systematic investment in safe investment vehicles like mutual funds. The market associated with mutual funds is always subjected to economic risks. The erratic fluctuations in macroeconomic variables can largely explain the Volatility in Net Asset Value (NAV) of equity oriented mutual fund schemes. With this background, this paper examines the impact of select macroeconomic variables on mutual funds' performance in India. To analyse this, monthly observations of select macroeconomic variables, average NAV of large cap, mid cap, and small cap funds collected for a period of 10 years starting from January 2013 to November 2022. Descriptive statistics is used to probe the characteristics of the variable. In addition, correlation and ordinary least square method is applied to check the existing relationship and impact level of macroeconomic factors on NAV of select schemes. Lastly, short and long run relationship is analysed using Autoregressive Distributed Lag Model (ARDL).

Keywords: net asset value; macroeconomic factors; mutual fund; large cap; small cap and mid cap.

JEL Classification: E40; E22; C52; G10; G50; R11.

Introduction

Mutual Fund is a professionally managed investment fund that pools money from different investors to invest in different asset classes. Mutual funds are rapidly gaining importance in emerging markets especially in India. As of September 30, 2022, Assets Under Management (AUM) of Indian Mutual Fund Industry stood at ₹ 38,42,351 crore and the Indian Mutual Fund Industry is expected to hit the 90 trillion marks by 2030. The gross domestic savings rate has increased to 29.3% in 2021 from 28.1% in 2019. Professionally managed mutual funds not only have the advantages of diversification, increased liquidity, and rolling over earnings but also provide significantly better returns than bond markets, Fixed Deposits, and pension savings (Li *et al.* 2021).

In the last decade, Indian capital market had witnessed tremendous growth not only in number of folios but also the cumulative Mutual Fund investment, especially in the equity sector. Folio accretion has been spotted in

equity funds partly due to growing investment in Equity Linked Savings Scheme and partly due to the general economic upturn in the country (Ansari 2021). With the Government pushing savings and investment incentives onto the retail investors in the form of tax benefits, the sector is looking at a bright future with a CAGR of 21.7% in the next 4 years. Komleh (2018) agrees that investment companies and mutual funds are vital financial institutions in the capital markets that by providing numerous benefits to investors, sending resources into the capital market, has an important role on stability, balance, and development in capital markets. Thus, it is imperative to study factors that affect the Net Asset Value of equity fund schemes to help investors decide the mutual funds that best suit their risk appetite and investment objectives.

1. Behaviour of Economic Factors on Mutual Fund Performance

In spite of being a relatively safer investment compared to its counterparts, Mutual Funds exist in a volatile market attributed to volatility of their underlying assets, stocks. Diversification has on one hand mitigated unsystematic risk, but mutual funds are still subject to economic forces namely fluctuations arising in stock prices due to the ever-changing macro environment. Macroeconomic variables such as inflation, GDP, consumer price index impact the level of consumer spending and hence affects AUM as well as the performance of mutual funds as measured by the changing Net Asset Value. Thus, investors especially the retail investors should be aware of the impact of macroeconomic variables on the NAV to make informed investment decisions.

Studies which are related to the influence behavior of micro and macro-economic factors on the returns of mutual funds have been identified very less. In this regard, Pradhum and Joshi (2019) undertook a study to determine the impact of economic events on risk adjusted returns of Indian mutual funds and found that there is significant long run and short run impact of macroeconomic variables on the mutual fund performance. This study is built on the existing literature of Avramov and Wermers (2006) and Moskowitz (2000), where it is assumed that mutual fund returns may have a time-varying component. These returns can be expressed as a linear function of a set of macroeconomic variables (Ferson and Schadt1996).

With this backdrop, this study examines the select macroeconomic factors which determines the NAV performance of large cap, mid cap and small cap equity mutual funds in India. Also, to what extent these factors influence on NAV performance in short run as well as long run. As part of evolving the context for the present study, the next section presents about the base theories for testing as well as existing studies related to this context. Third and fourth sections deal with this econometric model and analysis to meet the objective. Finally, the last section discusses the conclusion and implications.

1.1 Problem Statement

In the absence of a well-developed, transparent, and responsive financial market, businesses would suffer and the spillover effects will also be borne by the people living in the economy. Despite the financial literacy wave increasing AUM, the consistent poor performance of mutual funds questions the play of external factors in determining the NAV of various funds. Stock prices reflect the market sentiments as well as the impact of economic cycles on the revenue generating capacity of the business. Stocks being the underlying assets for equity mutual funds necessitates the study of the impact of the economy on mutual funds. Macroeconomic variables are accurate indicators of the economy and therefore must be factored in the study of mutual funds.

Retail investors tend to invest in mutual funds more than any other asset class due to the safety blanket that they carry in the context of diversification and professional management of funds. Despite this, the majority of investors only invest in equity fund which exposes them to the risk attached with investing in the equity market that witnesses constant fluctuation and volatility in returns. Furthermore, retail investors with less accessibility to sensitive information often experience the shock factor that results from changing economic conditions which plunges the market into a downward trend.

It will also help the Asset management companies as well as fund managers to prepare for any economic downturn in advance as they will have a better understanding of how fluctuations in any macroeconomic variable will impact the performance of their fund. The study also aims to compare the extent of impact of the selected macroeconomic variables on three most popular equity fund categories in India- small cap funds, mid cap funds, and large cap funds.

1.2 Supporting Theories

The Capital Asset Pricing Model theory suggested by Sharpe (1964) and Lintner (1965) establish a relationship between systematic risk and expected returns. It proposed a linear relationship between required return on investment and risk. The unrealistic assumptions of CAPM made testing the validity of the model difficult and

determining the beta even more difficult as the model proposed a single factor risk. Moreover, betas do not remain constant and the prices of the securities are often affected by more than factor- macroeconomic variables, investor sentiments, etc. The failure of this theory led to the formation of Arbitrage pricing theory.

The Arbitrage pricing theory was evolved by Stephen Ross in 1976 who argued that in a market where different portfolios with multiple factors (betas) exists, CAPM with its one factor (one beta) may not be able to accurately determine the expected returns of a security. APT allows the actual returns to be influenced by a number of market variables especially macroeconomic variables. They affect the economy as a whole and their fluctuations result in fluctuations of various investment vehicles such as mutual funds. Economic variables have a systematic consequence on stock market returns because economic forces affect discount rates, the ability of the firm to generate cash and future dividend payments (Chen *et al*. 1986; Jecheche 2006; Essays 2018). Thus, APT forms the basis of this study as the multi-factor model allows consideration of macroeconomic variables on the NAV of mutual fund schemes.

2. Empirical Studies

Various number of studies have been conducted to determine the factors that affect the performance of mutual funds, which is a critical factor in selection of funds for investment. Several internal and external characteristics were explored that best explain the volatility and consistent poor performance of the mutual fund market despite being a safer investment vehicle among retail investors. Countless micro and macro-economic factors are also said to have a direct and significant impact on the risk adjusted returns of the capital market. The stock market is a large part of the capital market and are thus affected by the economic landscape of the country. Barakat *et al* Hanafy (2015) discovered a significant impact of inflation, stock market interest rate, money supply and exchange rate on the stock market returns of Tunisia and Egypt. Ouma and Muriu (2014) further concluded that money supply and inflation have a positive impact whereas exchange rate has a negative impact on returns of Kenya stock market.

The impact relationship between macroeconomic variables and stock market returns can be further contrasted in the short run and long run that can help the Government stabilize the volatile economic environment. A long run negative relationship exists between crude oil prices, inflation and stock prices and the relationship remains consistent in the short run as well. Finally short-run estimation confirms a positive and significant relationship for Gold, T-bill rates and Real Effective Exchange Rate (Joshi and Giri, 2015). Yu Hsing (2011) introduced two new variables- world stock market index and world interest rate to the field of study and further confirmed a positive and negative relationship with world stock market index and interest rate respectively.

Given the significant impact of macroeconomic variables on the stock market returns a similar phenomenon maybe observed in the performance of mutual funds. Thus, Kumar and Dash (2008) corroborated that oil prices had the greatest influence on the returns of mutual fund schemes whereas SENSEX returns explained the variance in returns. Equity mutual funds invest majority of the pooled money in stocks and are hence affected by the same factors (*i.e*., macroeconomic factors) that affect the performance of stock markets.

Kariuki (2014) and Pradhum and Joshi (2019) agree that economic indicators like interest rate and money supply have a positive impact on fund returns as these indicators reflect positively on the aggregate demand, consumer spending, and general economic health of the company. Yadav *et al* (2016) and Kariuki (2014) confirmed the existing literature by establishing a negative relationship between exchange rate and mutual fund returns as domestic currency depreciation makes investing in domestic country cheaper which brings an influx of foreign capital into the domestic market. Different schools of thought exist on the relationship between mutual fund returns and inflation. Krishnamurthy (2014) and Kariuki (2014) reported a positive impact of inflation whereas Ansari and Zaman (2021) concluded a negative impact on the Asset Under Management in Pakistan. Gyimah *et al.* (2021) documented a homogeneous long-run significant positive impacts of exchange rate, inflation, T-Bill, GDP whereas negative significant impact of monetary policy rate on the financial performance of mutual funds in Kenya.

Despite the apparent impact of macroeconomic variables on the financial performance of equity funds, microeconomic factors which are internal to an Asset Management Company can also have major impact on their performance. Singal and Manrai (2019) analyzed internal characteristics like fund size, managerial skill, inception date, loads, fees and expenses, diversification as potential determinants for the mutual fund performance in India. Gusni and Hamdani (2018) concluded that stock selection skill is a significant determinant of performance whereas market timing skill and fund size have no significant effect.

In spite the obvious popularity of equity mutual funds, debt funds are now gaining immense traction in the Indian market due to high liquidity and reasonable safety. Babu *et al* (2021) studied the impact of non-economic

factors on debt fund returns and concluded that investors with long term interests should invest in funds with a higher allocation in government securities and those looking for short term returns should invest in funds with higher allocation in Commercial papers and Certificates of Deposits. The rise and fall in NIFTY is equally significant in determining the performance of Indian debt funds as studied by Sharma (2020) who analyzed these funds on Sharpe ratio and Jenson's ratio.

Based on the above discussion, the studies which are related to the influence of economic factors on performance of NAV of equity schemes are still scanty in Indian context. Our contribution to the current literature is three-fold. First, the study adds to the ongoing debate about how macroeconomic variables affect the performance of equity mutual funds in India. Second, new macroeconomic variables have been introduced to the pool of existing variables like FPI, DII, IIP, US Interest rate, and stock market index (NSEI, Nifty MidCap 100, and Nifty SmallCap 100). Third, the degree of impact of select macroeconomic variables on the NAV of equity mutual fund schemes is differentiated and compared between small cap funds, mid cap funds, and large cap funds. Hence, the study has formulated the following research questions to fulfil the above-mentioned research gap.

1.Is there any relationship between the select macroeconomic variables and NAV of mutual fund schemes?

2.To what extent does the select macroeconomic variables impact on small cap, mid cap and large cap fund in short run as well as long run?

3. Research Objectives and Framework

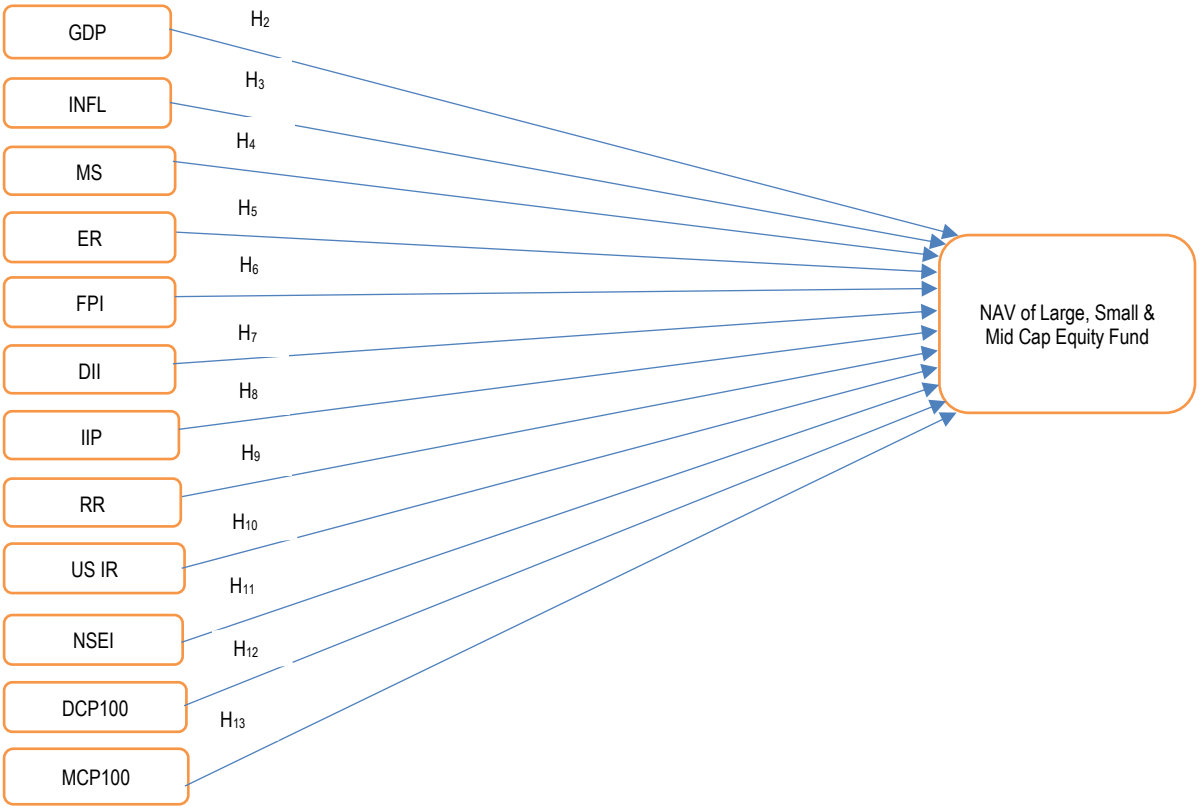
Research Objectives:

1.To understand the volatility of Net Asset Value of mutual fund schemes.

2.To find the relationship between the select macroeconomic variables and mutual funds' performance.

3.To examine the influence of select macroeconomic variables on small cap, mid cap, and large cap funds in short run as well as long run.

Graph 1. Research Framework



3.1 Hypothesis

H_1: There is a significant relationship between macroeconomic variables and Net Asset Value of mutual fund schemes.

H_2: There is a significant influence of Gross Domestic Product on the Net Asset value.

H_3: There is a significant influence of Inflation on the Net Asset value.
H_4: There is a significant influence of Money Supply on the Net Asset value.
H_5: There is a significant influence of Exchange Rate on the Net Asset value.
H_6: There is a significant influence of Foreign Portfolio Investment on the Net Asset value.
H_7: There is a significant influence of Domestic Institutional Investors on the Net Asset value.
H_8: There is a significant influence of Index of Industrial production in India on the Net Asset value.
H_9: There is a significant influence of Repo Rate on the Net Asset value.
H_{10}: There is a significant influence of US Interest Rate on the Net Asset value.
H_{11}: There is a significant influence of Nifty 50 index (NSEI) on the Net Asset value of mid cap funds.
H_{12}: There is a significant influence of Nifty MidCap 100 (DCP100) index on the Net Asset value of mid cap funds.
H_{13}: There is a significant influence of Nifty SmallCap 100 (MCP100) index on the Net Asset value of small cap funds.

3.2 Data and Model Specification

3.2.1 Data and Description of the Variables

The study is descriptive and analytical in nature. Also, used annual time series data on NAV of large cap, mid cap and small cap and the same considered as endogenous variable. Mean of Large Cap, Mid Cap and Small Cap fund NAV is computed from 10 different asset management companies such as ICICI Prudential Bluechip Fund, Franklin India Bluechip Fund, Mirae Asset Large Cap Fund, SBI Blue Chip Fund, Axis BlueChip Fund, HDFC Top 100 Fund, Nippon India Large Cap Fund, Aditya Birla Sunlife Frontline Equity Fund, Canara Robeco BlueChip Equity Fund, UTI Mastershare Unit Scheme. To see the prediction on this, the study has considered selecting macroeconomic variable as exogenous variables. All the exogeneous variables are selected after critical review from the existing studies as well as the reason for association between this. The select macroeconomic variables are Consumer Price Index (INFL) is the proxy of inflation, Exchange Rate (ER), Money Supply (MS), Gross Domestic Product (GDP), Index of Industrial Production (IIP), Effective Federal Funds Rate (USIR), Foreign Portfolio Investment (FPI), Domestic Institutional Investment (DII), Repo Rate (RR), Small Cap (MCP100), Mid Cap (DCP100) and Large Cap (NSEI) market index are considered. Monthly observations are taken above mentioned variables spanning from Jan 2013 to Nov 2022 over a period of 10 years. All the variable data is gathered from Bloomberg terminal source. Raw data of all the variables (except FPI and DII) were converted into natural logs for obtaining uniformity as well as minimizing the problem of heteroscedasticity (Bekhet and Mugableh 2012; Chen *et al.* 1986).

3.2.2 Econometric Model and Methodology

Stationarity checking of all the variables has been done with the help of Augmented Dickey Fuller Test. Further, the characteristic of each variable is described using descriptive statistics. Correlation analysis established in the study to find the relationship between the variables. In addition to this, the basic econometric model is formulated based on the objective of the study which is mentioned below.

$$Largecap = \alpha + \beta_1(INFL)_t + \beta_2(ER) + \beta_3(MS)_t + \beta_4(GDP)_t + \beta_5(IIP)_t + \beta_6(USIR)_t + \beta_7(FPI)_t + \beta_8(DII)_t + \beta_9(RR)_t + \beta_{10}(NSEI)_t + \mu t$$

$$Midcap = \alpha + \beta_1(INFL)_t + \beta_2(ER) + \beta_3(MS)_t + \beta_4(GDP)_t + \beta_5(IIP)_t + \beta_6(USIR)_t + \beta_7(FPI)_t + \beta_8(DII)_t + \beta_9(RR)_t + \beta_{10}(DCP100)_t + \mu t$$

$$Smallcap = \alpha + \beta_1(INFL)_t + \beta_2(ER) + \beta_3(M3)_t + \beta_4(GDP)_t + \beta_5(IIP)_t + \beta_6(USIR)_t + \beta_7(FPI)_t + \beta_8(DII)_t + \beta_9(RR)_t + \beta_{10}(MCP100)_t + \mu t$$

The study applied robust Autoregressive Distributed Lag (ARDL model) introduced by Pesaran and Shin (1999) and further it was extended by Pesaan, Shin, and Smith (2001) to probe the long run and short run impact among the variables. This model has several advantages over the other cointegration model such as Engle and Granger cointegration test and Johansen cointegration test. Also, this model can be applied if the variables are integrated at different level order *i.e* $I(0)$ or $I(1)$. This model is comparatively more efficient in small and limited observations, as is the case of this study.

According to the procedure, the study employed ARDL bound F test to check the presence of long run relationship among the variables. Hypothesis is framed and given below

H_0 – There is no presence of long run relationship ($H_0 = \gamma_1 = 0, \gamma_2 = 0, \gamma_3 = 0$)

H_1 – There is a presence of long run relationship ($H_1 = \gamma_1 \neq 0, \gamma_2 \neq 0, \gamma_3 \neq 0$)

The decision to accept or reject depends on the F statistics value. If the F statistics is greater than the lower 1(0) and upper bound 1(1), then there is a presence of long run relationship among variables and vice versa.

After estimating the co-integration with help of Bound F test, the study applied conditional ARDL to obtain the long run coefficients of each variable. It shows how far each regressor impacting more to determine the net of asset value of the large, mid and small cap fund. To estimate this, the study constructed the Unrestricted Error Correction Model (UECM) of ARDL approach and written as

$$LargeCap_t = \beta_0 + \Sigma\,\delta_1 INFL_{t-i} + \Sigma\,\delta_2\, lnER_{t-I} + \Sigma\,\delta_3 lnMS_{t-i} + \Sigma\,\delta_4 lnGDP_{t-i} + \Sigma\,\delta_5 \Delta lnIIP_{\ t-i} + \Sigma\,\delta_6 \Delta lnUSIR_{\ t-i} + \Sigma\,\delta_7 \Delta lnFPI_{\ t-i} + \Sigma\,\delta_8 \Delta lnDII_{\ t-i} + \Sigma\,\delta_9 \Delta lnRR_{\ t-i} + \Sigma\,\delta_{10} \Delta lnNSEI_{\ t-i} + \varepsilon_t$$

$$MidCap_t = \beta_0 + \Sigma\,\delta_1 INFL_{t-i} + \Sigma\,\delta_2\, lnER_{t-I} + \Sigma\,\delta_3 lnMS_{t-i} + \Sigma\,\delta_4 lnGDP_{t-i} + \Sigma\,\delta_5 \Delta lnIIP_{\ t-i} + \Sigma\,\delta_6 \Delta lnUSIR_{\ t-i} + \Sigma\,\delta_7 \Delta lnFPI_{\ t-i} + \Sigma\,\delta_8 \Delta lnDII_{\ t-i} + \Sigma\,\delta_9 \Delta lnRR_{\ t-i} + \Sigma\,\delta_{10} \Delta lnDCP100_{\ t-i} + \varepsilon_t$$

$$SmallCap_t = \beta_0 + \Sigma\,\delta_1 INFL_{t-i} + \Sigma\,\delta_2\, lnER_{t-I} + \Sigma\,\delta_3 lnMS_{t-i} + \Sigma\,\delta_4 lnGDP_{t-i} + \Sigma\,\delta_5 \Delta lnIIP_{\ t-i} + \Sigma\,\delta_6 \Delta lnUSIR_{\ t-i} + \Sigma\,\delta_7 \Delta lnFPI_{\ t-i} + \Sigma\,\delta_8 \Delta lnDII_{\ t-i} + \Sigma\,\delta_9 \Delta lnRR_{\ t-i} + \Sigma\,\delta_{10} \Delta lnMCP100_{\ t-i} + \varepsilon_t$$

Where, t = time series notation, Δ = First difference operator, β_0 = Intercept, δ= Beta Coefficient, ε_t = Residual or error term

Once the existence of long run equilibrium among the variables proved, the next process is to estimate the short run dynamic coefficients with the help of the error correction model associated with long run estimates obtained from ARDL-UECM approach. The ECM explains how long time it will take to get adjusted or speed of adjustments of dependent variable towards the long run equilibrium. The following equation is constructed for error correction mechanism.

$$LargeCap_t = \beta_0 + \Sigma\,\delta_1 INFL_{t-i} + \Sigma\,\delta_2\, lnER_{t-I} + \Sigma\,\delta_3 lnMS_{t-i} + \Sigma\,\delta_4 lnGDP_{t-i} + \Sigma\,\delta_5 \Delta lnIIP_{\ t-i} + \Sigma\,\delta_6 \Delta lnUSIR_{\ t-i} + \Sigma\,\delta_7 \Delta lnFPI_{\ t-i} + \Sigma\,\delta_8 \Delta lnDII_{\ t-i} + \Sigma\,\delta_9 \Delta lnRR_{\ t-i} + \Sigma\,\delta_{10} \Delta lnNSEI_{\ t-i} + \Phi ECM_{\ t-1} + \varepsilon_t$$

$$MidCap_t = \beta_0 + \Sigma\,\delta_1 INFL_{t-i} + \Sigma\,\delta_2\, lnER_{t-I} + \Sigma\,\delta_3 lnMS_{t-i} + \Sigma\,\delta_4 lnGDP_{t-i} + \Sigma\,\delta_5 \Delta lnIIP_{\ t-i} + \Sigma\,\delta_6 \Delta lnUSIR_{\ t-i} + \Sigma\,\delta_7 \Delta lnFPI_{\ t-i} + \Sigma\,\delta_8 \Delta lnDII_{\ t-i} + \Sigma\,\delta_9 \Delta lnRR_{\ t-i} + \Sigma\,\delta_{10} \Delta lnDCP100_{\ t-i} + \Phi ECM_{\ t-1} + \varepsilon_t$$

$$SmallCap_t = \beta_0 + \Sigma\,\delta_1 INFL_{t-i} + \Sigma\,\delta_2\, lnER_{t-I} + \Sigma\,\delta_3 lnMS_{t-i} + \Sigma\,\delta_4 lnGDP_{t-i} + \Sigma\,\delta_5 \Delta lnIIP_{\ t-i} + \Sigma\,\delta_6 \Delta lnUSIR_{\ t-i} + \Sigma\,\delta_7 \Delta lnFPI_{\ t-i} + \Sigma\,\delta_8 \Delta lnDII_{\ t-i} + \Sigma\,\delta_9 \Delta lnRR_{\ t-i} + \Sigma\,\delta_{10} \Delta lnMCP100_{\ t-i} + \Phi ECM_{\ t-1} + \varepsilon_t$$

where, ECM indicates error correction term, Φ is the speed of adjustment parameter to long run equlibrium and $\delta 1\ \delta_2\ \delta_3\ \delta_4\ \delta_5\ \delta_6\ \delta_7\ \delta_8\ \delta_9\ \delta_{10}\ \delta_{11}$ are short run coefficients.

Further, the stability of long run equilibrium needs the sign of ECT to be negative, but it should be significant. As stated earlier, the study applied residual diagnostics for ARDL model also to check the presence of autocorrelation and heteroscedasticity. In addition to this, study employed the Cumulative Sum of Recursive Residuals (CUSUM) test and Cumulative Sum of Squares of Recursive Residuals (CUSUMSQ) graph (Brown, Durbin and Evans 1975) to check the stability of the long run relationship associated with short run.

3.3 Empirical Results and Findings

3.3.1 Checking Unit Root Hypothesis

Testing of unit root problem with data on respective variables is always crucial before applying any econometric model. Hence, using of non-stationary time series data leads to the spurious results (Gujarati and Porter 2009). As per the time series assumptions, the absence of unit root which means presence of mean and variance constant over a period in a time series to make the series stationary (Hendry 1995). For checking the unit root test of each variable, the study used Augmented Dickey-Fuller (ADF) test proposed by Dickey and Fuller (1979). The following hypothesis is formulated to check the presence of unit root test of each variable.

3.3.2 Unit Root Test

H_0: Unit root problem in time series data (i.e., $\delta = 0$)
H_1: No unit root problem in time series data (i.e., $\delta < 0$)

The test requires calculation of the regression equation:

$$\Delta X_t = a + \gamma t + \beta X_{t-1} + \sum^{k-1}_{i=1} \Theta_i \Delta X_{t-1} + \varepsilon_t$$

where, a is the constant, and γ is the coefficient of time series. The variable X here represents all the variables under study *i.e.*, DII, ER, FPI, GDP, IIP, INFL, MS, USIR, NAV, and MCP100. In the equation, t is the trend of time, and ε_t is the residual or the error term. Coefficient expressed in the equation indicates that the test for checking unit root is carried out for X_{t-1}. If the coefficient differs significantly from directional bias (that is 0), we retain the alternate hypothesis ($\delta < 0$) and therefore reject the null hypothesis that variable X has a unit root

problem. The findings of the ADF test are summarized and presented in Table 1. From the table: ER, GDP, INFL, MS, USIR, S_NAV, M_NAV, L_NAV, MCP100, DCP100, and NSEI are stationary at first difference and only DII, FPI are stationary at level.

Table 1. Results of the ADF unit root test

Variables	At level		First level of difference		Inference
	t-statistics	Probability	t-statistics	Probability	
Domestic Institutional Investors	-5.3353	0.0000**			Stationary
Exchange Rate	-1.3774	0.5913	-11.0912	0.0000**	Stationary
Foreign Portfolio Investment	-7.0302	0.0000**			Stationary
Gross Domestic Product	-1.9297	0.3177	-12.4157	0.0000**	Stationary
Index of Industrial Production	-4.6109	0.0002**			Stationary
Inflation	0.4407	0.9839	-7.2092	0.0000**	Stationary
Money Supply	1.1364	0.9976	-11.4265	0.0000**	Stationary
Repo Rate (at level)	-1.2692	0.6421	-5.0137	0.0000**	Stationary
US Interest Rate (USIR)	-0.9455	0.7704	-4.0978	0.0014**	Stationary
SNAV	0.6111	0.9895	-9.5873	0.0000**	Stationary
MNAV	0.1751	0.9699	-10.1886	0.0000**	Stationary
LNAV	0.1428	0.9677	-10.9131	0.0000**	Stationary
Nifty Small Cap 100	-0.9834	0.7575	-10.01310	0.0000**	Stationary
Nifty Mid Cap 100	0.1255	0.9664	-10.6657	0.0000**	Stationary
National Stock Exchange India	0.3822	0.9814	-10.8991	0.0000**	Stationary

**5% significance

3.3.3 Descriptive Statistics

Table 2. Summary of Descriptive Statistics

Descriptive Statistics															
Frequencies /Variables	SNAV	GDP	INFL	MS	ER	FPI	DII	IIP	USIR	RR	MCP100	MNAV	LNAV	DCP100	NSEI
Mean	59.22	348.71	137.97	14039830	68.07	5255.90	4661.74	121.33	0.75	6.05	6412.14	312.92	144.48	17070.80	10561.58
Median	54.29	350.49	136.50	13208681	67.49	6582	4102.87	122.5	0.24	6.25	5934.3	310.28	142.91	16721.1	10077.1
Maximum	125.7	432.29	176.70	21051592	82.77	71046.00	55595.18	148.80	3.78	8.00	11289.0	605.09	254.58	32037.90	18758.35
Minimum	18.61	235.38	104.60	8115795	53.26	-118203	- 48319.17	54.00	0.05	4.00	2613.30	102.49	63.50	6589.80	5471.80
Std. Dev.	29.47	50.943	18.84	3835318	6.1626	25398.39	14801.31	12.89	0.87	1.34	2162.4	135.01	51.71	6675.39	3501.58
Skewness	0.93	-0.15	0.28	0.32	-0.07	-0.92	0.45	-1.18	1.13	-0.26	0.38	0.58	0.56	0.63	0.73
Kurtosis	3.07	1.75	2.17	1.91	2.66	6.96	5.80	7.79	3.21	1.93	2.47	2.68	2.54	2.72	2.61
Jarque Bera	17.50	8.17	4.96	7.93	0.54	94.73	43.24	141.61	25.5	7.07	4.27	7.16	7.28	8.30	11.33
Probability	0.01	0.01	0.08	0.01	0.76	0.00	0.00	0.00	0.00	0.02	0.11	0.0	0.02	0.01	0.00

Table 2 represents the summary of descriptive statistics of monthly net asset value and the macroeconomic variables under study.

The average monthly NAV of small cap equity fund schemes and that of all macroeconomic factors are positive. All variables other than FPI and DII have revealed positive minimum values during the study period. Volatility of the variables is identified by standard deviation. Money Supply and FPI have captured the highest volatility whereas US Interest rate and Inflation (as measured by CPI) displayed the lowest volatility. The direction and degree of deviation from the normal distribution curve is explained by skewness and kurtosis. All the variables are fairly symmetrical as these have recorded skewness values between -2 and +2 as per Hair *et al* (2010). The value of kurtosis for SNAV, FPI, DII, IIP, and USIR have leptokurtic distribution (*i.e*, Kurtosis > 3) whereas MNAV, LNAV, GDP, INFL, MS, ER, RR, MCP100, DCP100, and NSEI have a platykurtic distribution. Jarque-Bera value of the variables under study further substantiate the results. All variables except INFL, ER, and MCP100 are not normally distributed as their p value is less than 0.05.

3.4 Correlation Analysis

Table 3. Correlation Matrix

	DER	DGDP	DII	DINFL	DMS	DRR	DUSIR	FPI	IIP	DS_NAV	DM_NAV	DL_NAV	DMC P100	DDC P100	NSEI
DER	1														
DGDP	-0.0570	1													
DII	0.3559*	-0.0693	1												
DINFL	0.0895	-0.3180*	0.0528	1											
DMS	-0.1079	0.1278	-0.0207	-0.0577	1										
RR	-0.0267	-0.0004	-0.0259	0.0918	-0.1282	1									
DUSIR	-0.0894	0.3103*	0.0048	-0.0255	-0.1791	0.5441*	1								
FPI	-0.4444*	0.1805	-0.7863*	-0.0861	0.0312	0.1440	0.1963*	1							
IIP	-0.0700	0.4000*	0.2249*	-0.1943*	0.1351	0.1814*	0.3880*	-0.0350	1						
DS_NAV	-0.3390*	0.0589	-0.5033*	0.1607	0.1111	0.1794	0.1888*	0.5330*	-0.0060	1					
DM_NAV	-0.3775*	0.0269	-0.5616*	0.1684	0.0588	0.2145*	0.2271*	0.5942*	-0.0299	-	1				
DL_NAV	-0.4428*	-0.0426	-0.5974*	0.1817*	0.0051	0.1985*	0.2174*	0.5819*	-0.0452	-	-	1			
DMCP100	-0.4165*	-0.0457	-0.5242*	0.1845	0.0003	0.1146	0.2414	0.5431*	-0.0300	0.9336*	-	-	1		
DDCP100	-0.3894*	-0.0457	-0.5616*	0.1845	0.0003	0.1792	0.2347*	0.5732*	-0.0300	-	0.9680*	-	-	1	
NSEI	-0.4783*	-0.0457	-0.5779**	0.1845**	0.0003	0.1812*	0.2414*	0.5670*	-0.0300	-	-	0.9710*	-	-	1

*5% significance

Table 3 summarizes the results of correlation analysis. Correlation between the monthly net asset value and macroeconomic variables are studied through the correlation matrix. DII is positively correlated with DER (r = 0.3559, p<0.05) and IIP (r = 0.2249, p<0.05) whereas negatively correlated with DS_NAV (r = -0.5033, p<0.05), DMCP100 (r = -0.5242, p<0.05), and FPI (r = -0.7863, p<0.05). DINFL is negatively correlated with DGDP (r = -0.318, p<0.05) and IIP (r = -0.1943, p<0.05). DS_NAV exhibits a positive correlation with DMCP100 (r = 0.9336, p<0.05), DUSIR (r = 0.1888, p<0.05), and FPI (r = 0.533, p<0.05) but negative correlation with DER (r = -0.339, p<0.05). DMCP100 is negatively correlated with DER (r = -0.4165, p<0.05) but positively correlated with FPI (r = 0.5431, p<0.05). DUSIR revealed a positive correlation across DGDP (r = 0.3130, p<0.05), FPI (r = 0.1963, p>0.05), DRR (r = 0.5441, p<0.05) and IIP (r = 0.388, p<0.05). DM_NAV displayed a negative correlation with both DER (r = -0.3775, p<0.05) and DII (r = -0.5616, p<0.05) and a positive correlation with DDCP100 (r = 0.968, p<0.05), DUSIR (r = 0.2271, p<0.05), and FPI (r = 0.5942, p<0.05). DDCP100 is positively correlated with DUSIR (r = 0.2347, p<0.05) and FPI (r = 0.5732, p<0.05) and negatively correlated with DER (r = -0.3894, p<0.05) and DII (r = -0.5438, p<0.05). DL_NAV exhibited a positive correlation across INFL (r = 0.1817, p<0.05), DNSEI (r = 0.971, p<0.05), DUSIR (r = 0.2174, p<0.05), DRR (r = 0.1985, p<0.05) and FPI (r = 0.5819, p<0.05) while negative correlation across DER (r = -0.4428, p<0.05) and DII (r = -0.5974, p<0.05). DNSEI is additionally positively correlated with INFL (r = 0.1845, p<0.05), DRR (r = 0.1812, p<0.05), and FPI (r = 0.567, p<0.05) but negatively correlated with DER (r = -0.4783, p<0.05) and DII (r = -0.5779, p<0.05). Overall correlation coefficient results show moderate correlation across the macroeconomic factors. As a whole, the three types of funds show varying levels of correlation with almost the same variables such as market indices as the NAV reflects equity market sentiments captured by market indices. The NAV of all the three funds also show a positive and negative correlation with FPI and ER respectively. Inflation is additionally positively correlated to only the NAV of large cap funds.

3.5. Autoregressive Distributed Lag Model (ARDL)

3.5.1 Small cap funds

Table 4 summarizes the results of the Bound F test at three critical bounds- 90%, 95%, and 99%. The study of Narayan (2004) discusses two sets of critical bound values *i.e*., at upper limit and lower limit. The first set

assumes that all regressors are I (1) whereas the second set assumes they are I (0) which results in a set of three conditions.

Table 4. Bound F test Table

F-statistics	90%			95%			99%	
	I (0)	I (1)		I (0)	I (1)		I (0)	I (1)
62.2783	1.76	2.77		1.98	3.04		2.41	3.61

A F-test statistic value higher than the upper limit value *i.e.*, I (1) implies the mere presence of long-run co-integration whereas a value lesser than the lower limit *i.e.*, I (0) conforms absence of long-run co-integration. Finally, if the F test lies between the upper and the lower limit than it can be concluded that the data is inconcludable and inconsistent. Table 4 exhibits the value of F-statistic as 62.2783 which is much greater than the upper limit *i.e.*, 1.98 at a 5% significance. Hence, we can conclude that there is a long-run co-integration in the macroeconomic data. The following section substantiates the long run coefficients.

Table 5. Estimated Long run coefficients using the ARDL approach (Small Cap fund)

Dependent Variable: DS_NAV				
Regressor	Coefficient	Standard Error	t-Statistic	Prob (tstatistic)
Constant	-2.4320	1.6868	-1.4418	0.1525
DII	0.0012	0.0017	0.6908	0.4912
FPI	0.0008	0.0010	0.8565	0.3937
IIP	0.0191	0.0142	1.3459	0.1814
DER	0.7068	0.2114	3.3425**	0.0012**
DGDP	-0.0030	0.0097	-0.5055	0.6143
DINFL	-0.0067	0.1768	-0.0381	0.9696
DMS	0.0002	0.0001	2.3355**	0.0215**
DRR	1.4904	1.0371	1.4371	0.1538
DNIFSMCP100	0.0083	0.0007	11.6317**	0.0000**
DUSIR	-1.6071	1.2661	-1.2693	0.2073
F-statistic				62.2783

** denotes 5% significance level

Results obtained in the long run to determine the impact of macroeconomic variables on NAV of small cap funds are presented in Table 5. The estimated coefficients of the long run relationship show significant impact of few macroeconomic variables on the monthly NAV of small cap equity fund schemes. The coefficient of Exchange Rate (USD/INR) is positive and statistically significant in the determination of NAV. Similarly, Money supply has a very significant impact on the NAV of small cap equity funds. This is not surprising as increase in money circulating in the economy facilitates investment among retail investors and mutual funds being the top choice of investment among the retail investors experience a bullish trend in NAV. Lastly, NIFTY Smallcap 100 also has a positive coefficient and significant impact on NAV as the NIFTY index captures movement of stock prices of the top 100 small cap companies in India. Thus, the market index often mimics the movement of underlying stock prices and thus net asset value of equity fund schemes that contribute majority of their funds in small cap companies are significantly impacted by the market index.

The results of the short run dynamic coefficients associated with long run relationships obtained from ECM equation are given in table 6. The short run determinants vary from the long run determinants.

Table 6. Estimated Coefficients of the Short run Dynamic Error correction Model (Small Cap fund)

Dependent Variable: DS_NAV				
Regressor	Coefficient	Standard Error	t-Statistic	Prob (tstatistic)
D (DS_NAV (-1))	-0.0717	0.0260	-2.7578	0.0069**
D (DII)	-0.0024	0.0010	-2.2315	0.0279**
D (DER)	0.3554	0.0657	5.4059	0.0000**
D (DUSIR)	0.5462	0.7915	0.6901	0.4917
ECM	-0.8205	0.0284	-28.8018	0.0000
R-squared	0.9477	F-statistic		62.2783
Adjusted R-squared	0.9459	Akaike info criterion		3.1140
Durbin-Watson stat	1.8830			

** denotes 5% significance level

Serial Correlation Test: Breusch Godfrey LM 0.5779 (0.5630) Heteroskedasticity Test: Breusch-Pagan-Godfrey Test 1.2931 (0.6422)

Table 6 summarizes the estimated coefficients of the short run relationship. Out of the 10 select macroeconomic variables, only two variables have a significant impact on the determination of NAV in the short run. Domestic Institutional Investment has a negative coefficient and has a very significant impact. Exchange rate has a positive coefficient and is statistically significant in determining the movement of NAV of small cap schemes. However, coefficients of US Interest rate are not significant at 5% level though with a positive sign.

The equilibrium error correction term coefficient has a negative *i.e.*, -0.82 and significant value which clearly explains speed of adjustment towards long run equilibrium by 82 percent. This implies that the mutual fund market displays a high speed of adjustment to equilibrium after a shock. Thus, 82 percent of disequilibria from previous year's shock converge back to long run equilibrium in the current year. Stability and diagnostic tests are conducted to validate the performance and accuracy of model in predicting NAV of small cap schemes. The series association LM test displays a chi-square value of 0.5779 with a confidence value of 0.5630 thereby retaining the null hypothesis *i.e.*, there is no auto correlation. The tests of heteroscedasticity check reveals that the data does not exhibit any autoregressive conditional heteroscedasticity (1.2931) with a probability value of 0.6422.

Figure 1. CUSUM plots at 5% L.O.S

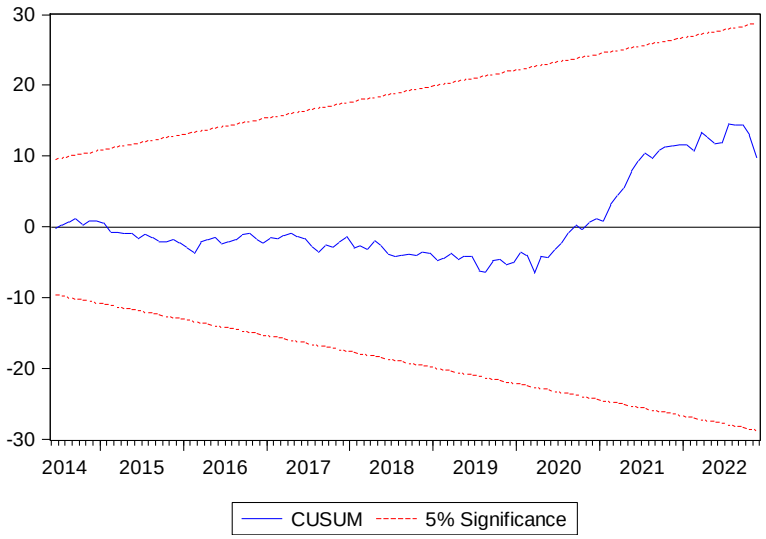


Figure 1 displays the CUSUM plot for long term stability tests of ARDL Error Corrections pattern. If the plot estimate lies within the critical 5 percent of the point of significance of crucial limits (*i.e.*, between the upper and lower limits), then the model is stable. Thus, estimates of CUSUSM lies far below the critical 5 percent that indicates robust coefficients in both long run and short run in the ARDL-ECM.

3.5.2 Mid cap funds

Table 7. Bound F test Table

F-statistics	90%			95%			99%	
	I (0)	I (1)		I (0)	I (1)		I (0)	I (1)
263.3544	1.76	2.77		1.98	3.04		2.41	3.61

Table 7 exhibits the value of F-statistic as 263.3544 which is greater than the upper limit *i.e.*, 1.98 at a 5% significance. Hence, it can be concluded that there is a long-run co-integration in the macroeconomic data. The following section substantiates the long run coefficients.

Results obtained in the long run to determine the impact of macroeconomic variables on NAV of mid cap funds are presented in table 8. The estimated coefficients of the long run relationship show significant impact of very few macroeconomic variables on the monthly NAV of mid cap equity fund schemes. The extent of impact is greater in small cap funds than mid cap funds. Only Nifty Midcap 100 shows a significant positive impact in the long run on the NAV of mid cap schemes. The market index often mimics the movement of underlying stock prices and thus net asset value of equity fund schemes that contribute majority of their funds in mid cap companies are significantly impacted by the market index.

Table 8. Estimated Long run coefficients using the ARDL approach (Mid Cap fund)

Dependent Variable: DM_NAV				
Regressor	Coefficient	Standard Error	t-Statistic	Prob (tstatistic)
Constant	-1.1351	4.8334	-0.2348	0.8148
DII	-0.0015	0.0048	-0.3221	0.7480
FPI	0.0040	0.0030	1.3221	0.1891
IIP	0.0166	0.0398	0.4183	0.6766
DER	-0.4365	0.7092	-0.6154	0.5396
DGDP	0.0030	0.0305	0.0999	0.9206
DINFL	0.4004	0.5086	0.7872	0.4330
DMS	-0.0008	0.0003	-0.2745	0.7842
DRR	6.4699	5.1052	1.2673	0.2080
DNIFMDCP100	0.0156	0.0008	19.1864**	0.0000*
DUSIR	-4.3085	3.7132	-1.1603	0.2487
F-statistic				263.3544

** denotes 5% significance level

Table 9. Estimated Coefficients of the Short run Dynamic Error correction Model (Mid Cap fund)

Dependent Variable: DM_NAV				
Regressor	Coefficient	Standard Error	t-Statistic	Prob (tstatistic)
D (DER)	0.0947	0.2479	0.3820	0.7032
D (DER (-1))	0.8730	0.2397	3.6298	0.0004**
D (DRR)	8.6042	2.2336	3.8521	0.0000**
D (DRR (-1))	6.2340	2.2667	2.7520	0.0071
ECM	-1.0011	0.0169	-59.2273	0.0000
R-squared	0.9739	F-statistic		263.3544
Adjusted R-squared	0.9730	Akaike info criterion		5.6435
Durbin-Watson stat	2.0704			

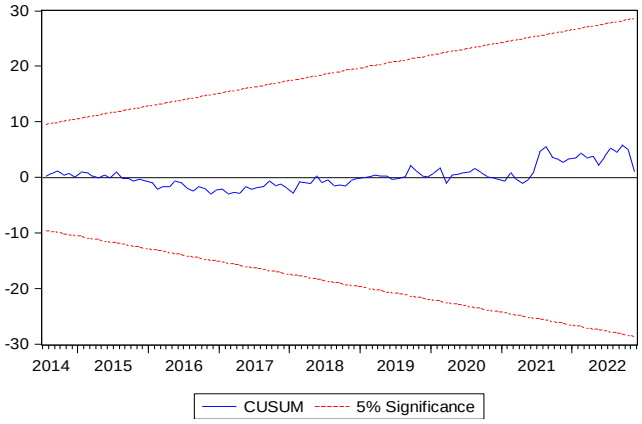
** denotes 5% significance level

Serial Correlation Test: Breusch Godfrey LM 0.9720 (0.3819) Heteroscedasticity Test: Breusch-Pagan-Godfrey Test 1.6829 (0.0708)

Table 9 summarizes the estimated coefficients of the short run relationship. Out of the 10 select macroeconomic variables, only two variables have a significant impact on the determination of NAV in the short run. Following the short run results of small cap schemes, exchange rate has a negative coefficient and has a very significant impact on the NAV of mid cap schemes too. Repo Rate has a positive coefficient and is statistically significant in determining the movement of NAV.

The equilibrium error correction term coefficient has a negative *i.e.*, -1.001 and significant value which clearly explains speed of adjustment towards long run equilibrium by 100 percent. This implies that the mutual fund market displays a high speed of adjustment to equilibrium after a shock.

Figure 2. CUSUM plots at 5% L.O.S



Stability and diagnostic tests are conducted to validate the performance and accuracy of the model in predicting NAV of small cap schemes. The series association LM test displays a chi-square value of 0.9720 with a

confidence value of 0.3819 thereby retaining the null hypothesis *i.e.*, there is no auto correlation. The tests of heteroscedasticity check reveals that the data does not exhibit any autoregressive conditional heteroscedasticity (1.6829) with a probability value of 0.0708.

Figure 2 displays the CUSUM plot for long term stability tests of ARDL Error Corrections pattern. If the plot estimate lies within the critical 5 percent of the point of significance of crucial limits (*i.e.*, between the upper and lower limits), then the model is stable. Thus, estimates of CUSUSM lies far below the critical 5 percent that indicates robust coefficients in both long run and short run in the ARDL-ECM.

3.5.3 Large Cap funds

Table 10 exhibits the value of F-statistic as 62.2783 which is greater than the upper limit *i.e.*, 1.98 at a 5% significance. Hence, we can conclude that there is a long-run co-integration in the macroeconomic data. The following section substantiates the long run coefficients.

Table 10. Bound F test Table

F-statistics	90%			95%			99%	
	I (0)	I (1)		I (0)	I (1)		I (0)	I (1)
12.0592	1.76	2.77		1.98	3.04		2.41	3.61

Results obtained in the long run to determine the impact of macroeconomic variables on NAV of small cap funds are presented in Table 11.

Table 11. Estimated Long run coefficients using the ARDL approach (Large Cap fund)

Dependent Variable: DL_NAV				
Regressor	Coefficient	Standard Error	t-Statistic	Prob (tstatistic)
Constant	-0.3454	1.7533	-0.1970	0.8442
DII	-0.0029	0.0017	-1.6268	0.1070
FPI	0.0002	0.0012	0.2477	0.8048
IIP	0.0031	0.0148	0.2124	0.8322
DER	-0.1292	0.1968	-0.6566	0.5129
DGDP	0.0030	0.0305	0.0999	0.9206
DINFL	0.0715	0.1759	0.4067	0.6851
DMS	0.0002	0.0001	1.8724	0.0641
DRR	1.5519	1.0308	1.5054	0.1354
DNSEI	0.0131	0.0008	16.3106**	0.0000**
DUSIR	-0.5893	1.1190	-0.5266	0.5956
F-statistic				12.0592

** denotes 5% significance level

The estimated coefficients of the long run relationship show significant impact of very few macroeconomic variables on the monthly NAV of large cap equity fund schemes. The extent of impact is greater in small cap funds than large cap funds. Only Nifty 50 shows a significant positive impact in the long run on the NAV of mid cap schemes. The market index often mimics the movement of underlying stock prices and thus net asset value of equity fund schemes that contribute majority of their funds in large cap companies are significantly impacted by the market index. None of the other macroeconomic variables are statistically significant in determining the NAV in the long run.

Table 12. Estimated Coefficients of the Short run Dynamic Error correction Model (Large Cap fund)

Dependent Variable: DL_NAV				
Regressor	Coefficient	Standard Error	t-Statistic	Prob (tstatistic)
D (DER)	0.0670	0.0924	0.7251	0.4701
D (DGDP)	-0.0013	0.0066	-0.2099	0.8341
D (DGDP (-1))	0.0152	0.0062	2.4390	0.0165**
D (DMS)	0.0001	0.0000	0.1375	0.8909
D (DNSEI)	0.0125	0.0002	50.5550	0.0000**
ECM	-1.1395	0.0898	-12.6867	0.0000
R-squared	0.9789	F-statistic		12.0592
Adjusted R-squared	0.9777	Akaike info criterion		3.7310
Durbin-Watson stat	1.8860			

** denotes 5% significance level

Serial Correlation Test: Breusch Godfrey LM 0.0703 (0.9321) Heteroscedasticity Test: Breusch-Pagan-Godfrey Test 1.2746 (0.2251)

Table 12 summarizes the estimated coefficients of the short run relationship. Out of the 10 select macroeconomic variables, only two variables have a significant impact on the determination of NAV in the short run. Unlike small cap and mid cap equity schemes, Gross Domestic Product has a positive coefficient and has a very significant impact on the NAV of mid cap schemes too. Nifty 50 has a positive coefficient too and is statistically significant in determining the movement of NAV.

The equilibrium error correction term coefficient has a negative *i.e.*, -1.1395 and significant value which clearly explains speed of adjustment towards long run equilibrium by 113 percent. This implies that the mutual fund market displays a high speed of adjustment to equilibrium after a shock. Stability and diagnostic tests are conducted to validate the performance and accuracy of model in predicting NAV of small cap schemes. The series association LM test displays a chi-square value of 0.0703 with a confidence value of 0.9321 thereby retaining the null hypothesis *i.e.*, there is no auto correlation. The tests of heteroscedasticity check reveals that the data does not exhibit any autoregressive conditional heteroscedasticity (1.2746) with a probability value of 0.2251.

Figure 3. CUSUM plots at 5% L.O.S

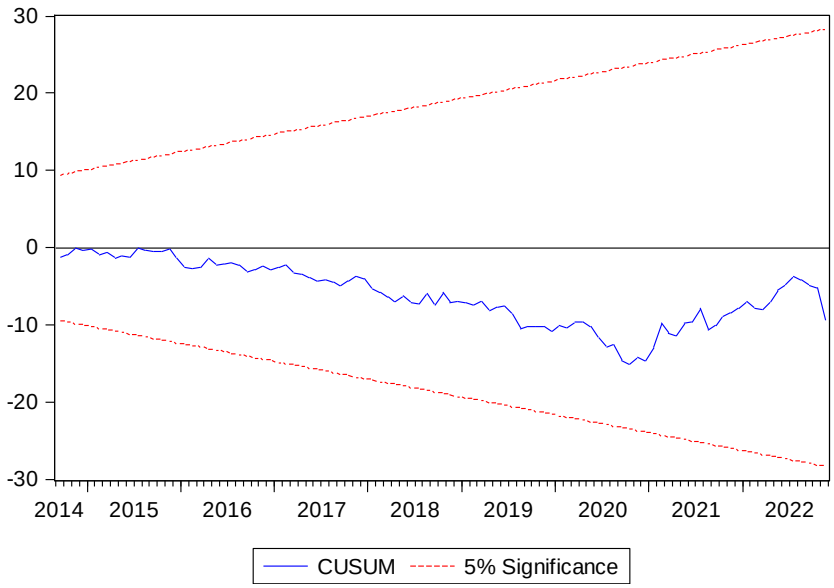


Figure 3 displays the CUSUM plot for long term stability tests of ARDL Error Corrections pattern. If the plot estimate lies within the critical 5 percent of the point of significance of crucial limits (*i.e.*, between the upper and lower limits), then the model is stable. Thus, estimates of CUSUSM lies far below the critical 5 percent that indicates robust coefficients in both long run and short run in the ARDL-ECM.

3.6. Scope and Limitation

The study is limited to a period of ten years, starting from 1st January 2013 to 31st October, 2022. Firstly, the duration of study can be increased to check the influence in the long run and enhance the accuracy of the model. Secondly, only twelve macroeconomic variables have been considered and there is a scope for including more variables such as unemployment rate and gross domestic savings rate. Thirdly, the study only includes equity mutual funds and there is future scope to study the impact of macroeconomic variables on debt funds, thematic funds, and passive funds to make the model more robust.

Implications and Conclusion

Policy Recommendations

The findings and conclusions of the study have substantiated the importance of macroeconomic variables in determining the Net Asset Value of mutual funds given their significance in the long run as well as the short run. These findings are of critical importance to the following stakeholders- Government, Fund Managers, and Investors as it helps each group make informed investment decisions. The Indian Government should take steps to regulate the significant macroeconomic variables such as Exchange rate, GDP, money supply to facilitate

economic development through increased investment in the capital markets- especially mutual funds. The fund managers can also use the study findings to either adopt an active management or passive management style based on the movement of the market indices. Retail investors can further track macroeconomic trends to absorb the shock factor better and decide their preferred mutual fund type- small cap, mid cap, and large cap fund based on their risk appetite.

Stimulating the economy when GDP is recording single digit or negative number through higher consumer spending is an excellent way of enhancing mutual funds returns- especially for large cap funds. Lenient fiscal policy through tax cuts and tax rebates during economic downturns, facilitating consumer spending by reducing interest rates, and stimulating the economy with deregulation in certain industries can help improve the economic environment of the country. Government spending on local infrastructure projects will not only increase GDP but also increase productivity which enables business to operate more efficiently.

Increasing exchange rate (USD/INR) *i.e*., depreciates Indian Rupee relative to the strong US Dollar, increases the performance of domestic mutual funds as it incentivizes local as well as foreign investors to invest in the local currency as it is cheaper than the home currency for foreign nationals. Thus, government often uses expansionary fiscal policies to weaken the INR against USD to increase FPI and FDI and invariably make a bullish move on the NAV. Finally, the significant positive impact of money supply implies that a general increase of money circulated in the economy enhances the performance of equity mutual funds. On one hand, Asset Under Management increases as households invest excess income in relatively less risky instruments like Fixed deposits, bonds, and Mutual funds. The Government can increase money circulating in the economy by injecting liquidity in the market by lowering reserve requirements of the banks that allows greater credit utilization.

Conclusion

Building on the Arbitrage Pricing Theory proposed by Stephen Ross in 1976 that market returns can be expressed as a function of macroeconomic variables; the study examines the most important impactful variables in determining the mutual fund returns. There are various studies that have examined the impact of macroeconomic variables on equity mutual funds in the Indian context but very few have compared the degree of impact between small cap, mid cap, and large cap funds. Our study further contributes to the present literature by introducing new investigatory variables such as- FPI, DII, Nifty SmallCap 100, Nifty MidCap100, NSEI, and US Interest Rate.

The results from the study have dual benefits as it allows the investors and fund managers to make informed investment decisions and facilitates rational economic policy making. In the paper, we investigated the impact of ten key macroeconomic variables on the monthly Net Asset Value of three most common equity funds in the Indian Capital Market- small cap funds, mid cap funds, and large cap funds over the period of 2013 to 2022 in India. The macroeconomic variables under study are- CPI as a proxy of inflation, Exchange Rate (ER), Money Supply (M3), Gross Domestic Product (GDP), Index of Industrial Production (IIP), EFFR, Foreign Portfolio Investment (FPI), Domestic Institutional Investment (DII), Repo Rate (RR), Nifty SmallCap 100, Nifty MidCap 100 and NSEI market index. We performed descriptive statistics to scrutinize the characteristics of data and correlation analysis to explore the co-movement of monthly Net Asset value of each fund category with the key macroeconomic variables. The results were further differentiated in the long run and short run using ARDL-UECM model to determine and compare the degree of impact between the three kinds of schemes.

Findings support the present literature that macroeconomic variables have a significant impact on the returns of mutual fund schemes in the Indian context. Exchange rate has a significant positive long run as well as short run impact on the returns of small cap funds whereas it only has a short run positive impact on mid cap funds and no impact on large cap funds. The market indices- Nifty SmallCap100, Nifty MidCap100, and NSEI have significant positive long run impact on the respective funds. Domestic Institutional Investors' trading activity and money supply has a significant negative and significant positive impact respectively on the returns of small cap funds. Repo rates have a significant short run negative impact on the returns of mid cap funds while GDP has a significant positive short run impact on the returns of large cap funds as corporate earnings increase which makes it bullish on NAV. Thus, our results add to the pool of literature that macroeconomic variables and especially market indices are significant determinants of Mutual fund NAV and their impact must thus be factored in by the fund managers to improve future fund performance.

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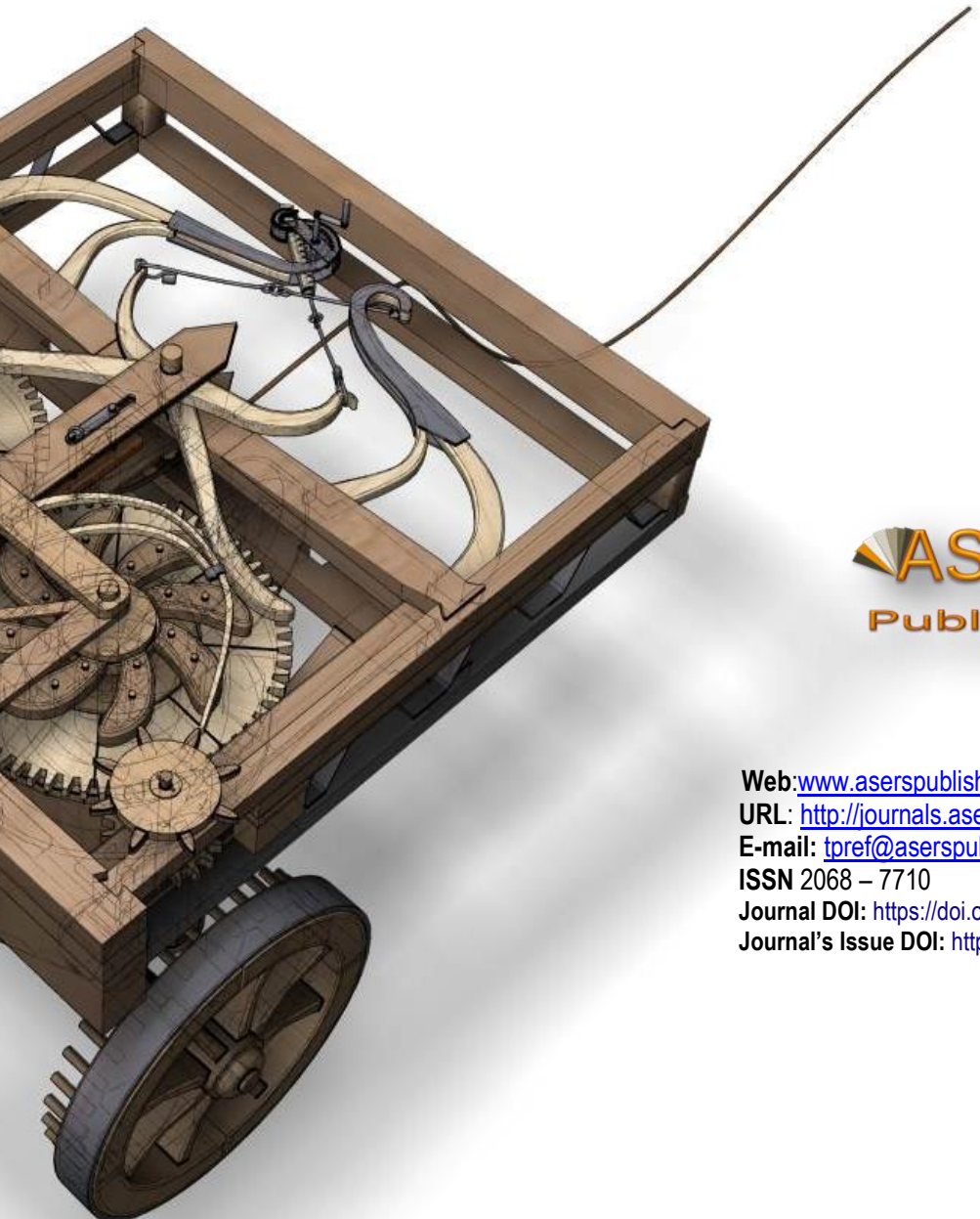

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