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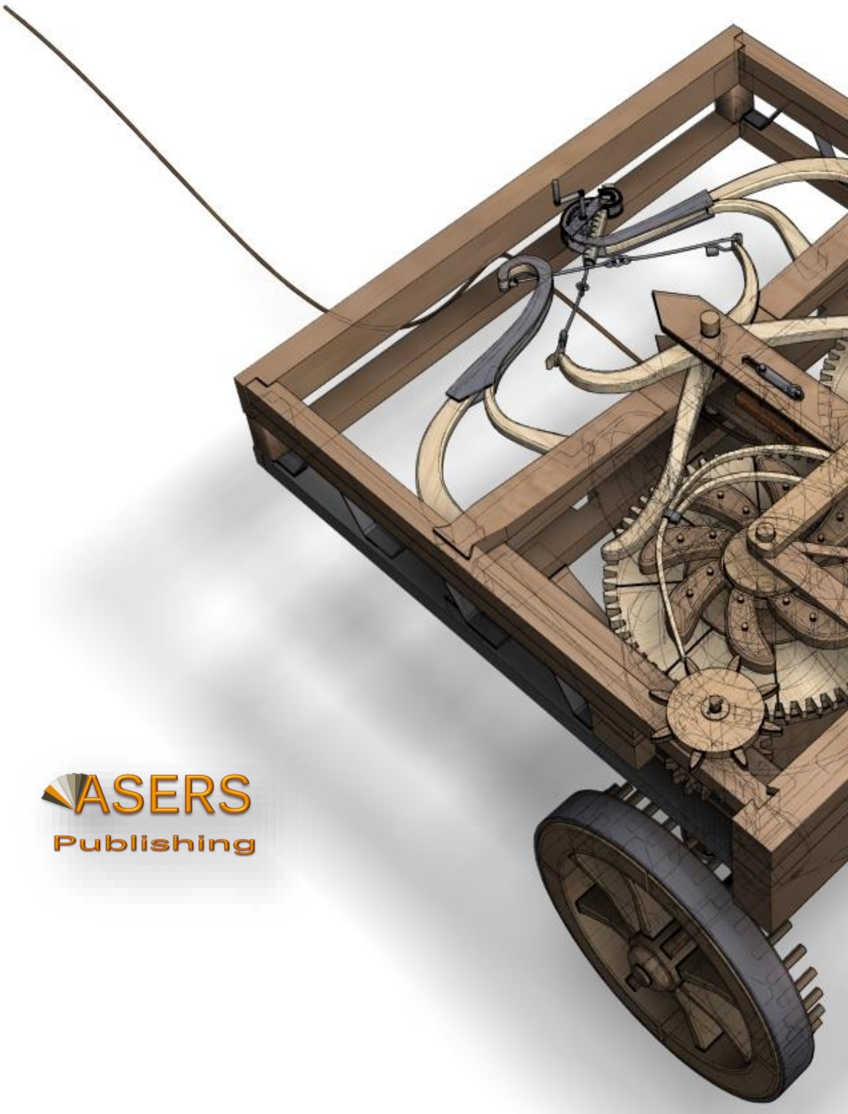

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# Call for Papers
## Volume VII, Issue 1(13), Summer 2016

# Theoretical and Practical Research in Economic Fields

Many economists today are concerned by the proliferation of journals and the concomitant labyrinth of research to be conquered in order to reach the specific information they require. To combat this tendency, **Theoretical and Practical Research in Economic Fields** has been conceived and designed outside the realm of the traditional economics journal. It consists of concise communications that provide a means of rapid and efficient dissemination of new results, models and methods in all fields of economic research.

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# A New Keynesian Framework for Monetary Policy Analysis in Iran's Economy. A Dynamic Stochastic General Equilibrium Approach

**Afshin HEIDARPOUR**
Economic Studies Department,
MAJLIS Research Center, **Iran**
afshinheidarpour@gmail.com

**Mosayeb PAHLAVANI**
Faculty of Economics,
University of Sistan and Baluchestan, **Iran**
pahlavani@hamoon.usb.ac.ir

**Mohamadnabi SHAHIKI TASH**
Faculty of Economics,
University of Sistan and Baluchestan, **Iran**
mohammad_tash@hamoon.usb.ac.ir

**Seyedkomail TAYEBI**
Faculty of Economics and Adminstrative Sciences,
University of Isfahan, **Iran**
sk.tayebi@ase.ui.ac.ir

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**Abstract**:

*This paper focuses on New Keynesian framework for monetary policy analysis of Iran. It considers a dynamic stochastic general equilibrium (DSGE) models. This article expands a sensitivity analysis of the optimal rules to deep structural parameters and investigating properties of an optimal simple rule with respect to prevailing type of shocks which is the main purpose of the article. Finally, the study highlights how an optimal policy rule depends on model structure, on the model calibration and nominal rigidities.*

*According to the research findings, based on the theoretical expectations, the effect of a positive shock inflicted on the government investment leads to an increase and gradual accumulation of fixed capital formation in the public sector. Among estimated parameters, consumption is the first affected and reduces, then employment increases consequently, finally production will also be affected. Also with the shock of oil revenues, increased oil revenues which results in public investment at first, because of the increase in oil revenues, the government enhances development expenditure. Though, increase in development expenditure is more than increase in current expenditure. Enhancing* *development expenditure and construction spending causes total spending increase. As a result of increased production of oil income, consumption and total investment will rise. This leads to inflation too.*

**Keywords:** monetary policy analysis, New Keynesian Approach, Bayesian estimation.

**JEL Classification**: E12, E52, E58, E61, O53.

## 1. Introduction

Accordingly, and with the development of the theoretical implications of this discussion, a large number of researchers' attempts to understand the connection between monetary policy, inflation and business cycles have led to the development of a framework which is Called New Keynesian (NK) model which widely used for the analysis of monetary policy. These new models, combine Keynesian principles (imperfect competition and lack of nominal flexibility) with a dynamic general equilibrium framework that was already largely dependent on real business cycle (RBC) model. These models can be used to analyze the relationship between money, inflation and business cycles and assessing the utility of alternative monetary policy (Benchimol 2011).

In this article I use the simple monetary rule. The main objective is to discover a set of regularities that describe the optimal properties or characteristics of a simple optimal rule in which the central bank faces data information uncertainty. For this purpose I use Calvo pricing with indexation to induce sticky domestic prices. With a domestic economy of this type and facing a number of domestic and external shocks and also the economy is assumed to have a welfare maximizing central bank.

## 2. Literature review

N.K school of thoughtdeveloped by economists like Tobin and Modigliani (Snowdon 2005). They tried to achieve Keynesian economics results by providing microeconomic foundations for Keynesian theories and applying classical assumptions. NK economics and original Keynesian economics are different in some cases.While Keynesian macroeconomic theory had been generally presented without microeconomic foundations. NK built their macroeconomic theories based on microeconomics foundations (Snowdon 2005).

Considering that the new classical general equilibrium models, with regard to the supposed neutrality of money in the economy, fiscal authority behavior and monetary policies in the model were not defined and the dynamics of the economy were examined only in the form of macroeconomic variables reactions to real shocks. Though these models were criticized by macroeconomists from this view (Christiano *et al.* 2005)

Following this criticisms, a group of economists tried to keep the positive aspects of these models, including the emphasis on rational expectations, microeconomic foundations and optimized behavior of economic agents and attempted to expand and to generalize new classical general equilibrium patterns by adding monopolistic competition structures and nominal and real bonds so that the impact of economic policies and demand-side shocks could be analyzed and explained. These patterns became well-known as patterns of dynamic stochastic general equilibrium (DSGE) and also are powerful tools for monetary policy (MP) analysis and practice forecasting. As Good friend and King (1997) mentioned major conclusions of monetary policy role in New Keynesian models: (i) MP action on the real economic activity may persist over several years, (ii) there is a long-run neutrality of money (iii) NK suggest significant gains from eliminating inflation which stem from increased transaction efficiency and reduced relative price distortions (iv) MP credibility plays an important role (Polansky 2013).

DSGE model is relatively new model including a special advantages compared to other competing models such as input-output models, social accounting matrix and applied general equilibrium. Among the most important features of this model the dynamics of the economy, considering the shocks and random effects, the expectations and the principles of individual optimization are remarkable. Although in these patterns different types of faults and adhesions in commodity markets and factors of production and finance, along with a wide range of random disturbances are explained and clarified but the new generation of DSGE models are applied successfully as possible in order to clarify the normal issues in optimal policymaking (Semko 2013).

Given the importance of the mentioned characteristics and limitations of competing models such as the input-output data, social accounting matrix, and vector auto regression and general equilibrium in using all of them, DSGE models have advantages compared to other models in the policy making.

Based on the above mentioned, the literature review suggests a different approach in monetary policy analysis through NK framework. For example Kalman (2002), has done a calibrated utility of the consumer and the percentage change in consumption as the effect on welfare.

Edge and others (2007) in their study entitled 'welfare maximization of monetary policy under uncertainty,' Using Dynamic Stochastic General Equilibrium (DSGE) has assessed the uncertainty situation that America's central bank (the Fed) is facing.

Moreover, the central bank loss function, interest rates and economic growth have been explained in a dynamic economic situation. At the same time the standards and rules performance of monetary policy replacement have been analyzed. In this studyusing known parameters have indicated that the optimal policy under uncertainty shows little reaction to normal rates situations such as price and wage inflation.

Malyzewfski research for the International Monetary Fund (2009) under the title of: 'monetary policy rules for oil- producing countries, welfare-based approach' considers a numerical simulation for different rules on fiscal a monetary policy (Malyzewfski, 2009).

The welfare implications are critical to the social welfare function in terms of wealth distribution in non-oil and non-oil-dependent landscape. In this section it is assumed that the Petroleum permanent income (oil and financial wealth-producing countries) are kept at a constant level and the private sector is not included in this study.

In addition, due to some specific features of Iran's economy, including lack of access to some statistical data or the lack of certainty to some statistics, insufficient studies to extract the exact amount some required structural parameters in macro modeling and high rate of shock accepting of Iran's economy due to exogenous oil dependence, dynamic stochastic general equilibrium models have unique advantages than other competitor models.

With this description, limited studies done in Iran's economy applying DSGE models confirm some of the above points and the results of those studies indicate the reliability of these models to assess the impact of policies and shocks on Iran's macroeconomic variables.

The relation is introduced in this study for explanation of monetary policy making in Iran's economy determines the growth rate of the monetary base in order to provide the raise of economic activities and the preservation of prices stability. In this regard, the monetary growth rate is determined in the way that the production deviation of potential production (output gap) and the deviation of inflation from the inflation target will be minimized. But the point that the inflation target in Iran's economy is not a specific amount and implicitly determined by monetary policy maker, is obvious.

In the macro-economic models and specifically the most dynamic stochastic general equilibrium models the preferences expressed by King, Plosser and Rebelo (1978) is used to clarify the utility function. In this method the economy is assumed to include many of the same subjects that have an infinite life and money in the family utility function as follows:

## 3. The research method

This research is done with a NK approach using DSGE model. In general, a simple NK monetary model focuses mainly on trade policy between inflation and the output gap reduction. One of the policy objectives of such an approach is to minimize the deviation from nominal sticky prices which leads to resources inefficiency. The major and important difference between the simplest version of the closed economy and macroeconomic models of the open economy is inconsistency (Engel 2013). As Walsh (2003) and others have argued, the standard Keynesian approach to monetary policy analysis prior to the early 1990s combined the assumption of nominal price with a simple structure for linking the quantity of money to aggregate spending. To address this issue a new type of model is developed and popularized by Good friend and King (1997), Rotemberg and Woodford(1997), McCallum and Nelson (2010), Clarida, Gali and Gertler (1999, 2001), Svensson (2009) etc. The new model is now constructed on the optimizing behavior of agents and is often referred to as NK models, which has become the workhorse of Keynesian MP Analysis. An extensive coverage of approximation techniques and solution method for DSGE models can be found in DeJong and Dave (2007), Canova and Luca (2009) and McCandless (2008).

The research model of the study comes as follows.

## 4. Description of Model

### Representative Household[1]

The model assumes that there is money in the utility function of households. Assuming that all households are similar, the representative sample of households seeks to maximize the expected of the discounted sum of time separable utilities subject to an inter temporal budget constraint. Suppose then that total expected utility can be denoted as:

$$u\left(c_t,\frac{M_t}{p_t},N_t,x_{1t},G_t,E_t\right)=\frac{x_{1t}}{1-\sigma}\left(C_tG_t^{\gamma}\right)^{1-\sigma}+\frac{1}{1-\varsigma}\left(\frac{M_t}{p_t}\right)^{1-\varsigma}-\frac{1}{1+\mu}\int_0^1 (N_t(i))^{1+\mu}di-\frac{1}{1+\xi}\int_0^1 (E_t(i))^{1+\xi}di \tag{1}$$

Where $C_t$ is the composite bundle of consumption goods, $\frac{M_t}{p_t}$ is the level of real money balances held by the household, and $I_t$ is investments, $N_t$ is proportion of household time devoted to the labor market (so that $1-N_t$ the proportion of time enjoyed as leisure by representative household). Following Woodford (2003) we assume that each of the differentiated good is produced with a specialized type of labor and that the representative household supplies each type of specialized labor, in this case, $N_t=\int_0^1 (N_t(i))di$ where $N_t$ is the quantity of labor of type i supplied by the household. And also $E_t$

Is the number of entrepreneurs, $B_t$ is bonds, as well as $\frac{1}{\sigma}\geq 0$, $\frac{1}{\varsigma}\geq 0$, $\frac{1}{\mu}\geq 0$, $\frac{1}{\xi}\geq 0$ in order are the elasticity inter temporal substitution for consumption, elasticity of real money holding, elasticity of Frisch labor supply, elasticity of entrepreneurship. Hence in real terms, the representative household's budget constraint can be written as,

$$C_t+I_t+\frac{M_t}{p_t}+\frac{B_t}{p_t}+\frac{T_t}{p_t}\leq\frac{W_t^N}{P}N_t+\frac{W_t^E}{P}E_t+\Pi_t+R_{t-1}K_{t-1}+(1+r_{t-1})\frac{B_{t-1}}{P}+\frac{M_{t-1}}{P} \tag{2}$$

Where $M_t$ is the level of money holdings chosen for the end of period t, $B_t$ is the level of bond at the end of period t, $W_t^N$ the representative is modeled as receiving a nominal wage rate for each unit of type *I* labor provided, the household is subject to a lump-sum tax levied by the government. $W_t^E$ is a nominal wage rate for each unit of type i entrepreneur provided, $R_{t-1}$ the real rate of rent chosen for the end of period t-1, $p_t$ Is the level of public prices, $\Pi_t$ is manufacturing enterprises distributed profit and $\sigma$ is private capital depreciation rate. Also we have law motion of investment as below:

$$K_t=(1-\sigma)K_{t-1}+I_t$$

Dynamic programming is used to solve the household's problem thus the maximization in (1) is subject to the budget constraint (2). So we have the first order condition for an internal optimum for $C_t, M_t, N_t, K_t, E_t, \frac{B_t}{p_t}$.

[1]Household behavior constructed based on Walsh 2003, Gali 2008 and Lou 2009, Turik 2009, Rohe 2012.

$$\max_{C_t,M_t,N_t,K_t,E_t,\frac{B_t}{p_t},\lambda_t} \Gamma_t = E_t\sum_{t=0}^{\infty}\beta^t \left\{ \begin{array}{l} \frac{x_{1t}}{1-\sigma}\left(C_tG_t^{\gamma}\right)^{1-\sigma} + \frac{\varpi}{1-\varsigma}\left(\frac{M_t}{p_t}\right)^{1-\varsigma} - \frac{1}{1+\mu}\int_0^1 (N_t(i))^{1+\mu}di - \frac{1}{1+\xi}\int_0^1 (e_t(i))^{1+\xi}di + \\ \lambda_t\left[W_t^N N_t + W_t^e e_t + \Pi_t + R_{t-1}K_{t-1} + (1+r_{t-1})\frac{B_{t-1}}{P} + \frac{M_{t-1}}{P} - C_t - I_t - \frac{M_t}{p_t} - \frac{B_t}{p_t} - \frac{T_t}{p_t} \le \right] \end{array} \right\} \quad (3)$$

$$\frac{\partial\Gamma_t}{\partial C_t} = G_t^{\gamma}(C_tG_t^{\gamma})^{-\sigma} - \lambda_t = 0 \quad (4)$$

$$\frac{\partial\Gamma_t}{\partial N_t} = -xN_t^{\mu} + \lambda_t w_t^N = 0 \quad (5)$$

$$\frac{\partial\Gamma_t}{\partial e_t} = -xe_t^{\xi} + \lambda_t w_t^e = 0 \quad (6)$$

$$\frac{\partial\Gamma_t}{\partial\left(\frac{M_t}{p_t}\right)} = \varpi\left(\frac{M_t}{p_t}\right)^{-\varsigma} - \lambda_t + \beta E_t\frac{\lambda_{t+1}}{\pi_{t+1}} = 0 \quad (7)$$

$$\frac{\partial\Gamma_t}{\partial K_t} = \beta E_t\lambda_{t+1}(R_t + 1 - \sigma)) - \lambda_t = 0 \quad (8)$$

$$\frac{\partial\Gamma_t}{\partial\left(\frac{B_t}{p_t}\right)_t} = \beta E_t\frac{\lambda_{t+1}(1+r_t)}{\pi_{t+1}} - \lambda_t = 0 \quad (9)$$

The combination of relation (5), (8), and (10) we have demand equation for real balance (11), a combination of relation (5) and (6) labor supply equation (12), a combination of relations (5) and (7) entrepreneur labor supply equation (13), a combination of relations (5) and (10) the relationship between the rate of return on bonds and capital lease rate, we will achieve.

$$\varpi\left(\frac{M_t}{p_t}\right)^{-\varsigma} = \left(\frac{r_t}{1+r_t}\right)G_t^{\gamma}(C_tG_t^{\gamma})^{-\sigma} \quad (10)$$

$$\chi\frac{N_t^{\mu}}{G_t^{\gamma}(C_tG_t^{\gamma})^{-\sigma}} = w_t^N \quad (11)$$

$$\chi\frac{e_t^{\xi}}{G_t^{\gamma}(C_tG_t^{\gamma})^{-\sigma}} = w_t^e \quad (12)$$

$$\beta E_t\frac{G_{t+1}^{\gamma}(C_{t+1}G_{t+1}^{\gamma})^{-\sigma}}{\pi_{t+1}} = \frac{G_t^{\gamma}(C_tG_t^{\gamma})^{-\sigma}}{1+r_t} \quad (13)$$

$$(R_t + 1 - \sigma) = E_t\frac{(1+r_t)}{\pi_{t+1}} \quad (14)$$

## Representative Final Goods Producing Firm

A large number of firms in the economy, which is the supplier of a combination of domestic and imported goods, final household consumption is the supply and under conditions of perfect competition in the market to sell. With this, the goal of every supply of the final products, maximizing the utility function as follows:

$$\Pi_t^D = p_t y_t^{Dp} - (p_t^F y_t^F + p_t^H y_t^H) \tag{15}$$

According to indicating the production of the elasticity of substitution and assuming constant elasticity of substitution are equal to 1

$$y_t^{Dp} = (y_t^H)^{\gamma} (y_t^F)^{1-\gamma} \tag{16}$$

Where in the profit function, $y_t^{Dp}$ represent a final product of the private sector, and $y_t^F$ aggregate demand for imported goods $y_t^H$ Household goods (domestic) $p_t^F$ price of imported goods and domestic goods prices. The share of domestic products in the total cost of the final products in the production process through $\gamma$ .

The equations of the optimal final product suppliers and summarized as follows:

$$y_t^F = (1-\gamma)(\frac{p_t^F}{p_t})^{-1} y_t^{Dp} \tag{17}$$

$$y_t^H = \gamma(\frac{p_t^H}{p_t})^{-1} y_t^{Dp} \tag{18}$$

$$P_t = (p_t^H)^{\gamma} (p_t^F)^{1-\gamma} \tag{19}$$

Equation (17) indicates the demand for imported goods, equation (18) demand for domestic goods and equation (19) equation to determine the price of the final product is a weighted average of the prices of imported goods and domestic.

### Final domestic supplier firms' behavior[2]

Suppose there is a myriad of final domestic supplier that combines a variety of intermediate goods, products from domestic final goods demand that the final product suppliers, producers and under conditions of perfect competition to sell and target each supplier maximizing the profit function.

$$\Pi_t^H = p_t^H y_t^H - \int_0^1 p_t^H(i) y_t^H(i) di \tag{20}$$

Note that the production function has constant elasticity of substitution.

$$y_t^H = \left[ \int_0^1 y_t^H(i)^{\frac{\theta h - 1}{\theta h}} di \right]^{\frac{\theta h - 1}{\theta h}} \tag{21}$$

In the profit function, $y_t^H$ denotes the total supply of domestic final goods, $y_t^H(i)$ is intermediate goods domestic demand and $p_t^H(i)$ domestic intermediate good price. $\theta h$ denotes elasticity of substitution between domestic intermediate good in the production process.

The equations of optimal domestic product suppliers in the following summary of the

$$y_t^H(i) = \left( \frac{p_t^H(i)}{p_t^H} \right)^{-\theta h} y_t^H \tag{22}$$

$$p_t^H = \left[ \int_0^1 p_t^H(i)^{1-\theta h} di \right]^{\frac{1}{1-\theta h}} \tag{23}$$

[2] Firm behaviour constructed based on Ireland 2000, Walsh 2003, Gali 2008 and Lou 2009.

Equation (22) is intermediate goods and inversely relative price of intermediate domestic goods and directly for final products supplied. Equation (23) also used to determine the price of the final home good and indicates the average weighted for domestic price of intermediate good.

### Supplier of imported foreign firm's behavior

Assumes many different countries are importer of the mix of goods, a basket of tradable goods imported final goods manufacturers demand under conditions of perfect competition and offers to sell. The goal of each importer to maximize the profit function is:

$$\Pi_t^F = p_t^F y_t^F - \int_0^1 p_t^F(j) y_t^F(j) dj \tag{24}$$

According to the same production function, we have constant elasticity of substitution

$$y_t^F = \left[ \int_0^1 y_t^F(j)^{\frac{\theta f - 1}{\theta f}} dj \right]^{\frac{\theta f - 1}{\theta f}} \tag{25}$$

In Profit function the $y_t^F$ denotes total supply of all goods imported, $y_t^F(j)$ is the import demand of $j$ country, my $p_t^F(j)$ is the price of imported goods in $j$ country. The production function $\theta f$ is elasticity of substitution between goods imported from different countries in the production process. The equations of optimization into the final after the summary are:

$$y_t^F(j) = \left( \frac{p_t^F(j)}{p_t^F} \right)^{-\theta f} y_t^F \tag{26}$$

$$p_t^F = \left[ \int_0^1 p_t^F(j)^{1-\theta f} dj \right]^{\frac{1}{1-\theta f}} \tag{27}$$

Equation (26) demand for imported commodities of the country *j* is inversely relative price of imported goods in the country j and he price of imported goods, is as well as a direct function of imports. Equation (27) represents the equation to determine the price of imported goods is a weighted average price of imported goods from countries considered. Meanwhile, the price of imported goods in the domestic currency $p_t^F$ to foreign currency $p_t^{FF}$ multiplied by the nominal exchange rate is the price of imported goods.

$$p_t^F = ER_t p_t^{FF} \tag{28}$$

The price of foreign goods has a single root autoregressive process.

$$p_t^{FF} = p_{t-1}^{FF\ 1+ppf} p_{t-2}^{FF\ -ppf} e^{GPF+epf} \tag{29}$$

### Representative Intermediate Goods Producing Firm

### The behavior of firms producing intermediate goods

Suppliers of product sale commodity to the final producers. In fact, domestic producers of intermediate goods have not perfect competition and under conditions of monopolistic competition have active.

$$\frac{\psi h}{2} \left( \frac{p_t^H(i)}{\pi^H p_{t-1}^H(i)} - 1 \right)^2 y_t^H \tag{30}$$

Which $p_t^H(i)$ represents the price of intermediate good $i$ and under steady state growth rate $\pi^H$ is the price of domestic goods. The production of non-tradable intermediate goods manufactured is

$$y_t^H(i) = a_t k_{t-1}^H(i)^\alpha N_t^H(i)^\mu E_t^H(i)^\xi (y_t^{pgs})^{1-\alpha-\mu-\xi} e^{aat} \tag{31}$$

Where $y_t^H(i)$ denotes he production of intermediate goods, $k^H$ is the use of capital in production, $N_t^H$ the use of labor in production, $E_t^H$ the use of force entrepreneurs in production, $a$ represents the level of technology and $aa$ represents a temporary productivity shock. Process $a$ technology is a process of unit root and determined exogenously.

The profit function of home intermediate goods is as below:

$$\Pi_t^H = p_t^H(i)\left(\left(\frac{p_t^H(i)}{p_t^H}\right)^{-\theta h} y_t^H\right) - W_t^N N_t^H(i) - W_t^E E_t^H(i) - R_{t-1}^k p_{t-1} k p_{t-1}^H(i) - \frac{\psi h}{2}\left(\frac{p_t^H(i)}{\pi^H p_{t-1}^H(i)} - 1\right)^2 y_t^H \quad (32)$$

Each firm plans to maximize the present value as below:

$$E_t \sum_t^{\infty} \beta^t \left( p_t^H(i)\left(y_t^H\right) - W_t^N N_t^H(i) - W_t^E E_t^H(i) - R_{t-1}^k p_{t-1} k p_{t-1}^H(i) - \frac{\psi h}{2}\left(\frac{p_t^H(i)}{\pi^H p_{t-1}^H(i)} - 1\right)^2 y_t^H \right) \quad (33)$$

Subject to:

$$y_t^H(i) = a_t k_{t-1}^H(i)^{\alpha} N_t^H(i)^{\mu} E_t^H(i)^{\xi} (y_t^{pgs})^{1-\alpha-\mu-\xi} e^{aat} \quad (34)$$

Then we have

$$\frac{W_t^N N_t^H}{W_t^E E_t^H} = \frac{\mu}{\xi} \quad (35)$$

$$\frac{W_t^N N_t^H}{R_{t-1}^k p_{t-1} k p_{t-1}^H} = \frac{\mu}{\alpha} \quad (36)$$

$$\frac{y_t^H}{N_t^H} = \frac{\left(\frac{W_t^N}{p_t^H}\right)}{(1--\theta h)\mu}\left[-\theta h + \psi_h\left(\beta E\left(\frac{W_{t+1}^N N_{t+1}^H}{W_t^N N_t^H}\left(\frac{p_{t+1}^H}{\pi^H p_t^H}\right)\right) - \left(\frac{p_t^H}{\pi^H p_{t-1}^H}\right)\left(\frac{p_t^H}{\pi^H p_{t-1}^H} - 1\right)\right)\right] \quad (37)$$

Equation (36) represents the ratio of labor costs at the expense of the entrepreneur. Equation (37) also represents the optimal ratio of labor costs to cost of capital and the equation (38) is a New Keynesian Phillips curve.

### Central Bank and Government Behavior

It is clear that because of the lack of independence of the monetary authorities in Iran, both the government and the central bank cannot be considered as two distinct models. The aim here is to provide theoretical arguments,functional model and the full name of the monetary authorities.

Also according to the central bank in terms of inflation targeting, price stability and economic growth, along with the implicit goal of the central bank's monetary policy tools to pursue the realization of two important. In addition, it provides care enough to balance the budget by the government, through three sources of tax income than households, the sale of bonds and net income from oil, the creation of money does not happen. However, if the occurred deficit, government borrows from the central bank and withdraw their deposits from Central Bank, to finance its budget deficit. In addition, the exchange sold of its oil revenues to the government for changes in the monetary base is considered. As a result, the so-called monetary base changes can be reflected in the budget constraint, oil revenues and withdrawal of government deposits with the central bank.

Hence we assume the nominal government spending rather than serve under a process of economic optimization, policy-based budgeting processes and act as exogenous, in addition to the oil the impact of the shocks of the transition. Accordingly, we have:

$$G_t = G_{t-1}{}^{1+\rho g} G_{t-2}{}^{-\rho g} e^{(GG+\rho^{go} e^{op_t+G_t})} \tag{38}$$

At the same time the government assumed part of the budget spent on current expenses ( $GC$ ) and spent the rest of the construction costs ( $GP$ ). It also assumes that the government's current cost of the state budget is spent on employment ( $N^g$ ) from the government to supply public services. If we define the government budget constraint:

$$G_t + (1+r_{t-1})\frac{B_{t-1}}{p_t} = T_t + \frac{B_t}{p_t} + \frac{M_t - M_{t-1}}{p_t} \tag{39}$$

Where $G$ is government spending and $M$ is the monetary base and expenditure for government progress expenditure is $GP$ and government consumer expenditure is $GC$ so we have as follows:

$$G_t = GC_t + GP_t \tag{40}$$

$$N_t^g = \frac{CG_t}{W_t^N} \tag{41}$$

$$GC = gc * G_t \tag{42}$$

Also here is assumed that public projects have time lag so public investment, and thus formed fixed capital formation in the public sector The delay in the implementation of projects approval, following the model Fukava (2012) will be modeling capabilities. $A_t^I$ shows the investment approved by the government in the budget at time t and the number of periods required to complete the project by $N$ . The capital law of motion for public progressive investment will be as follows:

$$K_{t+1}^G = I_t^G + (1-\delta^G)K_t^G \tag{43}$$

Where $\delta^G$ the rate of depreciation of public capital investments and government is $AR(1)$ the total public investment expenditure in the current resolution and progressive is visualized as follows:

$$\hat{C}_t^G = \rho_{CG}\hat{C}_{t-1}^g + \varepsilon_t^{CG} \tag{44}$$

$$\hat{I}_t^G = \rho_{IG}\hat{I}_{t-1}^G + \varepsilon_t^{IG} \tag{45}$$

As evidence of the state of the economy in terms of the volume of expenditure is apparent from oil revenues will follow.

In such a way that during the oil boom construction activities and consequently an increase in expenditure and vice versa during the recession, oil revenues are also seeing a decrease in government expenditure can be completed, so investment costs following written

$$\hat{I}_t^G = \sum_{n=0}^{N-1} \phi_n A_{t-N}^I \tag{46}$$

Where $\phi_n$ denotes the rate of investment during the show. When $N=1$ there is no delay between the time the decision to do with the operation of public investment projects there.

The monetary base is defined as follows:

$$M_t = DC_t + FR_t \tag{47}$$

Where $DC_t$ denotes currency and deposits also include current and overall domestic credit and $FR_t$ is foreign reserves (net foreign assets of the central bank). In this regard the assumption of foreign and domestic private banks is zero. Therefore net government debt to the central bank after deduction of net government deposits at the central bank and bank debt to the central bank as well. This is in fact the central bank balance sheet is as real as it can be written as follows:

$$m_t = dc_t + fr_t \tag{48}$$

The accumulation of foreign central banks will follow the following rule:

$$fr_t = \frac{fr_{t-1}}{\pi_t} + \zeta o_t \tag{49}$$

Where the accumulation of foreign assets of the central bank depends on the direct sale of oil revenues $o_t$. In other words, it is assumed that the percentage of oil revenues directly to the Central Bank sold $\zeta \in (0,1)$ and converted into riyals, and the percentage of it according to the law gives to the National Development Fund and to the requirements of harvest time and spend. The decision on how to spend oil revenues will be determined by the parameter $1-\zeta$. It is also assumed that in a closed economy of the National Development Fund to truly follow the following rule in which the percentage of oil revenues in each period the fund kept in the law of spent.

$$df_t = \frac{df_{t-1}}{\pi_t} + (1-\zeta)o_t \tag{50}$$

Also we assume the oil revenues follow as *AR(1)*

$$o_t = \rho_0 o_{t-1} + \varepsilon_t^0 \ \varepsilon_t^0 \sim i.i.d.N(0,\sigma^2) \tag{51}$$

In this regard, it is assumed that monetary policy instrument of the monetary authorities, the growth rate of the monetary base, although other assumptions may be considered, but this assumption is fairly explains the current situation of Iran's economy. It can conduct monetary policy in the economy of Iran explain. It can also be assumed that the monetary policy reaction function to be taken that the two aim to reduce the deviation of output from potential output and inflation deviations from the inflation target in the monetary growth rate, at least the. Obviously, the goal is not explicit and implicit monetary authorities with the description. In other words, the implicit inflation target in the form of a log-linear process complies with the following.

$$\hat{\hat{m}}_t = \rho_m \hat{\hat{m}}_{t-1} + \lambda_\pi(\hat{\pi}_t - \hat{\pi}_t^*) + \lambda_y \hat{y}_t + \upsilon_t \tag{52}$$

$$\varepsilon_t^{\pi^*} \sim i.i.d.N(0,\sigma_\pi{}^2) \text{ و } \pi_t^* = \rho_{\pi^*}\pi_{t-1}^* + \varepsilon_t^{\pi^*} \tag{53}$$

In equation (52), $\hat{\hat{m}}_t$ denotes percentage of deviation from the steady state of growth of the monetary base, $\hat{\pi}_t$ percentage of deviations of inflation from its stea $\hat{\pi}_t^*$ dy state value in the period $t$, the percentage of the target inflation deviation from the target value in the period $t$, $\hat{y}_t$ is the output gap and $\upsilon_t$ is monetary shocks. Here again, it is assumed that a process is followed as follows:

$$\upsilon_t = \rho_\upsilon \upsilon_{t-1} + \varepsilon_t^{mb}, \varepsilon_t^{mb} \sim iid.N(0,\sigma_{mb}{}^2) \tag{54}$$

$\varepsilon_t^{mb}$ is the shock from money base.

## 5. Equilibrium Determination

### 5.1 Markets clearing

If the consumer's budget constraint equation (2), the government budget constraint equation (40) are combined, market-clearing conditions for goods and services and the aggregate demand equation is obtained as follows:

$$Y_t = C_t + I_t + G_t \tag{55}$$

On the other hand the aggregate demand and aggregate supply that the sum of the total supply in the economy (private sector, public and import) must be equal to:

$$P_t y_t^D = P_t y_t^S = p_t^H y_t^H + p_t^F y_t^F + GC_t \tag{56}$$

Using variables which have become real money trading (11), the supply of labor (12), a pair of entrepreneurs (13), Euler equation (14) and the relationship between the rate of return on bonds and capital lease rate will be the following equations:

i. $$\varpi \left(\frac{\widehat{M}_t}{p_t}\right)^{-\varsigma} = \left(\frac{r_t}{1+r_t}\right) G_t^{\gamma} (\bar{C}_t \bar{G}_t^{\gamma})^{-\sigma}$$

ii. $$\chi \frac{N_t^{\mu}}{G_t^{\gamma} (C_t G_t^{\gamma})^{-\sigma}} = w_t^N$$

iii. $$\chi \frac{e_t^{\xi}}{G_t^{\gamma} (C_t G_t^{\gamma})^{-\sigma}} = w_t^e$$

iv. $$(R_t + 1 - \sigma) = E_t \frac{(1+r_t)}{\pi_{t+1}}$$

v. $$\beta E_t \frac{G_{t+1}^{\gamma} (C_{t+1} G_{t+1}^{\gamma})^{-\sigma}}{\pi_{t+1}} = \frac{G_t^{\gamma} (C_t G_t^{\gamma})^{-\sigma}}{1+r_t}$$

## 5.2 Log - linearing

In addition it should be noted that our model due to the presence of elements (such as static random process) is required log-linearing. On the other hand, assuming that the variable log deviations from steady state of using log-linear equations are as follows:

vi. $$\varpi \bar{m}^{-\varsigma}(1-\varsigma \hat{m}) = \left(\frac{r_t}{1+r_t}\right) \bar{G}_t^{\gamma} (\bar{C}_t \bar{G}_t^{\gamma})^{-\sigma} (1 - \hat{r}_t - \sigma \hat{c}_t + \gamma(1-\sigma)\hat{g}_t)$$

vii. $$\hat{m}_t = \frac{\sigma}{\varsigma}\hat{c}_t + \frac{\gamma(\sigma-1)}{\varsigma}\hat{g}_t - \frac{1}{\varsigma}\hat{r}_t$$

$$\chi \frac{N_t^{\mu}}{G_t^{\gamma} (C_t G_t^{\gamma})^{-\sigma}} (1 + \mu \hat{n}_t + \sigma \hat{c}_t + \gamma(1-\sigma)\hat{g}_t) = \bar{w}(1 + w_t^N)$$

viii. $$\hat{w}_t^N = \mu \hat{n}_t + \sigma \hat{c}_t + \gamma(1-\sigma)\hat{g}_t$$

$$\chi \frac{e_t^{\xi}}{G_t^{\gamma} (C_t G_t^{\gamma})^{-\sigma}} (1 + \xi \hat{e}_t + \sigma \hat{c}_t + \gamma(1-\sigma)\hat{g}_t) = \bar{w}(1 + w_t^e)$$

ix. $$\hat{w}_t^e = \xi \hat{e}_t + \sigma \hat{c}_t + \gamma(1-\sigma)\hat{g}_t$$

$$\beta \frac{\bar{G}^{\gamma} (\bar{C}\,\bar{G}^{\gamma})^{-\sigma}}{\bar{\pi}} E_t(1 - \sigma \hat{c}_{t+1} + \gamma(1-\sigma)\hat{g}_{t+1} - \hat{\pi}_{t+1}) = \frac{\bar{G}^{\gamma} (\bar{C}\bar{G}^{\gamma})^{-\sigma}}{\pi_{t+1}} = \frac{G_t^{\gamma} (C_t G_t^{\gamma})^{-\sigma}}{\bar{\pi}} (1 - \sigma \hat{c}_t + \gamma(1-\sigma)\hat{g}_t - \hat{r}_t$$

x. $$\hat{c}_t = \hat{c}_{t+1} - \frac{1}{\sigma}\left\{\hat{r}_t - \hat{\pi}_{t+1} - \gamma(\sigma-1)\left[\hat{g}_{t+1} - \hat{g}_t\right]\right\}$$

$$\bar{R}(1+r_t)+(1-\sigma)=\frac{1+\bar{r}}{\bar{\pi}}E_t(r_t-\pi_{t+1})$$

xi. $$\hat{R}_t=\frac{1+k}{\sigma+k}(\hat{r}_t-\hat{\pi}_{t+1}),k=\frac{1-\beta}{\beta}$$

The issue of maximizing profits by producing goods and final goods manufacturer in accordance with what was presented before, New Keynesian Phillips curve, the demand for labor and the cost per unit of output is obtained by the mobile production function, equation of motion and the technology shock capital move rule and equations were linearized equations now log in to see the following:

xii. $$\frac{\hat{W}_t^N\hat{N}_t^H}{\hat{W}_t^E\hat{E}_t^H}=\frac{\mu}{\xi}$$

xiii. $$\frac{\hat{W}_t^N\hat{N}_t^H}{\hat{R}_{t-1}^k p_{t-1}\hat{k}_{t-1}^H}=\frac{\mu}{\alpha}$$

xiv. $$\frac{\hat{y}_t^H}{\hat{N}_t^H}=\frac{\left(\frac{\hat{W}_t^N}{\hat{P}_t^H}\right)}{(1-\theta h)\mu}\left[-\theta h+\psi_h\left(\beta E\left(\frac{\hat{W}_{t+1}^N\hat{N}_{t+1}^H gm_{t+1}}{\hat{W}_t^N\hat{N}_t^H}\left(\frac{\hat{p}_{t+1}^H gm_{t+1}}{\pi^H\hat{p}_t^H ga_{t+1}}-1\right)-\left(\frac{\hat{p}_t^H gm_t}{\pi^H\hat{p}_{t-1}^H ga_t}\right)\left(\frac{\hat{p}_t^H gm_t}{\pi^H\hat{p}_{t-1}^H ga_t}-1\right)\right)\right)\right]$$

According to the Phillips curve, the marginal cost of production and it can be seen that the capital increase to reduce inflation and thus increase production final cost of a product unit and reduce inflation.

Log- linearing for government spending and monetary authorities would be as follows:

xv. $$C\hat{G}_t=\hat{G}_t$$

xvi. $$n_t^g=C\hat{G}_t-\hat{W}_t$$

xvii. $$\hat{g}_t=\frac{c\bar{g}}{\bar{g}}c\hat{g}_t+\frac{g\bar{i}}{\bar{i}}g\hat{i}_t$$

xviii. $$i\hat{t}=\frac{\bar{i}}{i\bar{t}}\hat{i}_t+\frac{g\bar{i}}{i\bar{t}}g\hat{i}_t$$

xix. $$g\hat{i}_t=\sum_{n=0}^{N-1}\phi_n A_{t-N}^I$$

xx. $$c\hat{g}_t=\rho_G c\hat{g}_{t-1}+\varepsilon_t^G\ , \qquad \varepsilon_t^G\ \square\ i.i.d.N(0,\sigma^2)$$

xxi. $$k\hat{g}_t=(1-\sigma_g)k\hat{g}_{t-1}+\sigma_g\hat{A}_{t-N+1}^i$$

xxii. $$\hat{A}_t^I=\rho^I\hat{A}_{t-1}^I+\varepsilon_t^I+\varepsilon_t^0\ \varepsilon_t^I\ \square\ i.i.d.N(0,\sigma^2)$$

xxiii. $$\hat{m}_t=\frac{dc}{m}d\hat{c}_t+\frac{fr}{m}\hat{fr}_t$$

xxiv. $$\hat{fr}_t=\hat{fr}_{t-1}-\hat{\pi}_t+\zeta\frac{o}{fr}\hat{o}_t$$

xxv. $$\hat{df}_t=\hat{df}_{t-1}-\hat{\pi}_t+(1-\zeta)\hat{o}_t$$

xxvi. $\varepsilon_t^o \sim i.i.d.N(0,\sigma^2)\ \hat{o}_t = \rho_0 \hat{o}_{t-1} + \varepsilon_t^0$

xxvii. $\hat{m}_t = m_t - m_{t-1} + \hat{\pi}_t$

## 6. Estimation and calibration

To estimate the parameters of Bayesian methods and algorithms used Metropolis- Hastings is also referred to. Using the algorithm, three parallel chains with a volume of 50 thousand to get super-dense Late obtained parameters. On the other hand due to structural shocks in the model to estimate the possibility of using variable is visible. Therefore, in this study the variables inflation, the monetary base growth rates, private consumption expenditure, output gap, government consumption spending and oil revenues are used. Private consumption expenditure variable, the output gap and inflation indicate that the overall economic situation, the growth rate of the monetary base index of monetary policy, fiscal policy and consumer spending represents oil revenues, the role of oil in the economy. The calibrated parameters and parameter estimation model based on experimental studies in Tables 1 and 2 have come.

**Table1.** Baseline model calibrated parameters

| $\bar{c}/\bar{y}$ | $\bar{i}/\bar{y}$ | $\bar{g}/\bar{y}$ | $\bar{i}/\bar{it}$ | $g\bar{i}/\bar{it}$ | $c\bar{g}/\bar{g}$ | $\bar{g}i/\bar{g}$ | $\bar{o}/\bar{df}$ | $\bar{o}/\bar{fr}$ | $d\bar{c}/\bar{m}$ | $f\bar{r}/\bar{m}$ | $\xi$ | $\xi_g$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.53 | 0.24 | 0.23 | 0.67 | 0.33 | 0.7 | 0.3 | 0.03 | 0.13 | 0.46 | 0.54 | 0.013 9 | 0.021 8 |

**Table 2.** Baseline model Bayesian estimation

| Estimation | Source | Prior estimation | Distribution | Definition | Parameter |
|---|---|---|---|---|---|
| 0.9648 (0.0125) | Kavand, 2011 | 0.97 (0.018) | beta | Rate of intertemporal preferences of consumers | $\beta$ |
| 0.6005 (0.0151) | - | 0.7 (0.02) | beta | Percent of firm cannot reduced their prices | $\xi$ |
| 0.4427 (0.02) | - | 0.42 (0.02) | beta | Share of private capital in production | $\alpha$ |
| 0.0953 (0.01) | - | 0.1 (0.01) | normal | Elasticity of substitution between private and public investment | $\psi$ |
| 1.1662 (0.05) | Tavakolian 2014 | 1.571 (0.05) | gamma | Inverse of the elasticity of intertemporal consumption | $\sigma$ |
| 0.1931 (0.001) | - | 0.2 (0.001) | beta | Elasticity of substitution between private and public consumption | $\gamma$ |
| 2.8938 (0.0499) | - | 2.175 (0.05) | gamma | Inverse elasticity of Frisch labor supply | $\eta$ |
| 1.0721 (0.0205) | - | 2.39 (0.05) | gamma | Inverse elasticity of real money balances | $b$ |
| 0.7836 (0.0015) | - | 0.8 (0.02) | beta | Percent of direct oil revenues selling to CB | $\omega$ |
| 0.8506 (0.01) | - | 0.85 (0.01) | beta | AR process multiplier for capital in budget bill | $\rho_A$ |
| 0.02603 (0.0102) | AR(1) Estimation | 0.27 (0.01) | beta | AR process multiplier for oil revenues shock | $\rho_o$ |
| 0.9268 (0.0458) | - | 0.9 (0.05) | beta | AR process multiplier for technology shock | $\rho_a$ |
| 0.31 (0.013) | - | 0.1 ($\infty$) | Inverse gamma | Standard errors for public investment shock | $\sigma_A$ |
| 1.01 (0.104) | - | 0.1 ($\infty$) | Inverse gamma | Standard errors for oil revenues shock | $\sigma_O$ |
| 0.06 (0.003) | - | 0.1 ($\infty$) | Inverse gamma | Standard errors for technology shock | $\sigma_a$ |

It should be noted that the previous distribution parameter for each parameter has been selected based on the characteristics and properties of the selected distribution. For example, beta distribution is a distribution known by three parameters: mean, standard deviation, the lower and upper limit. Therefore, in order to estimate and determine these parameters which are at specific intervals of the real figures, it is better use of the beta distribution. In addition, the gamma distribution is defined amplitudes of zero to infinity. Thus, the distribution range of the disposal has been positive.

In Figure 1 the prior and posterior estimated distribution model parameters are provided.

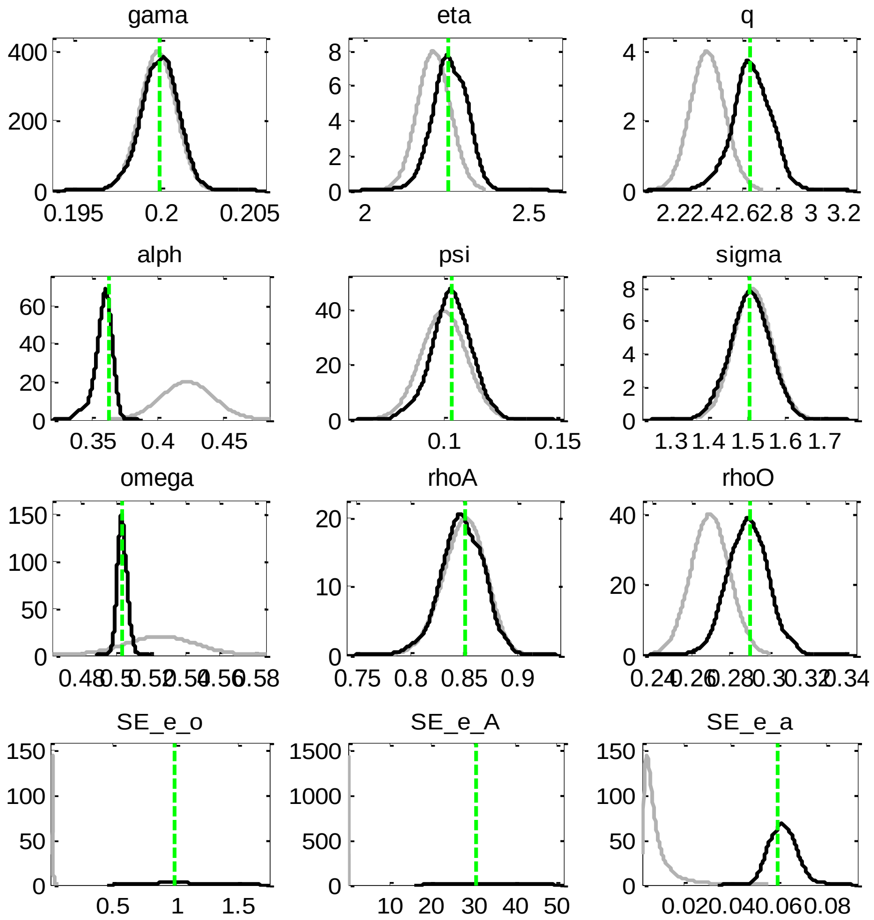



**Figure 1.** Prior and posterior distribution based on metro polis –Hastings algorithm

## 7. Impulse response functions

To examine the dynamics of economic variables associated with the research, response functions estimated based on the research model are obtained. It is necessary to note that among the multiple functions obtained from the reaction of monetary impulses aspects, technology, oil and construction budget is done more focus.

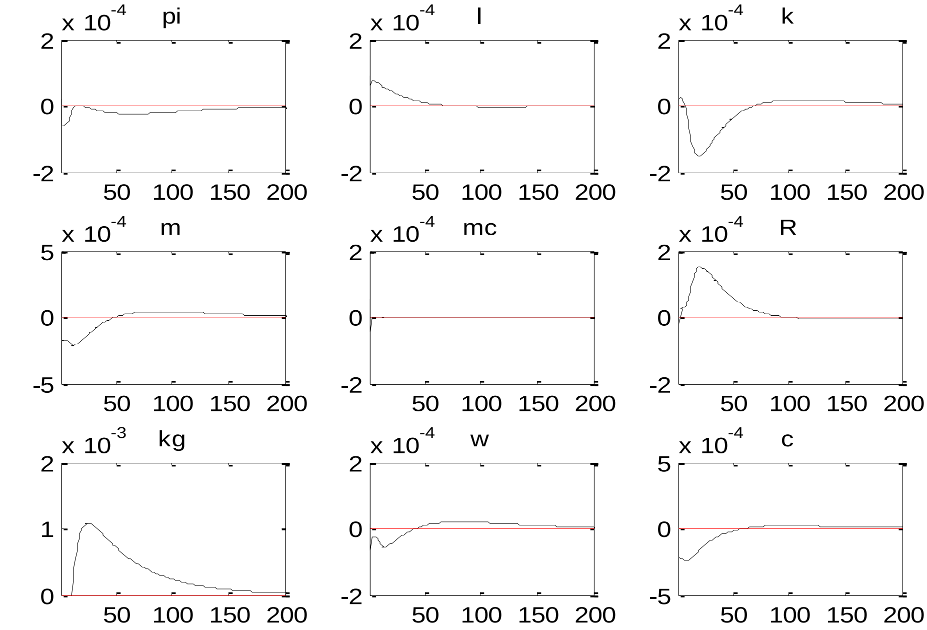
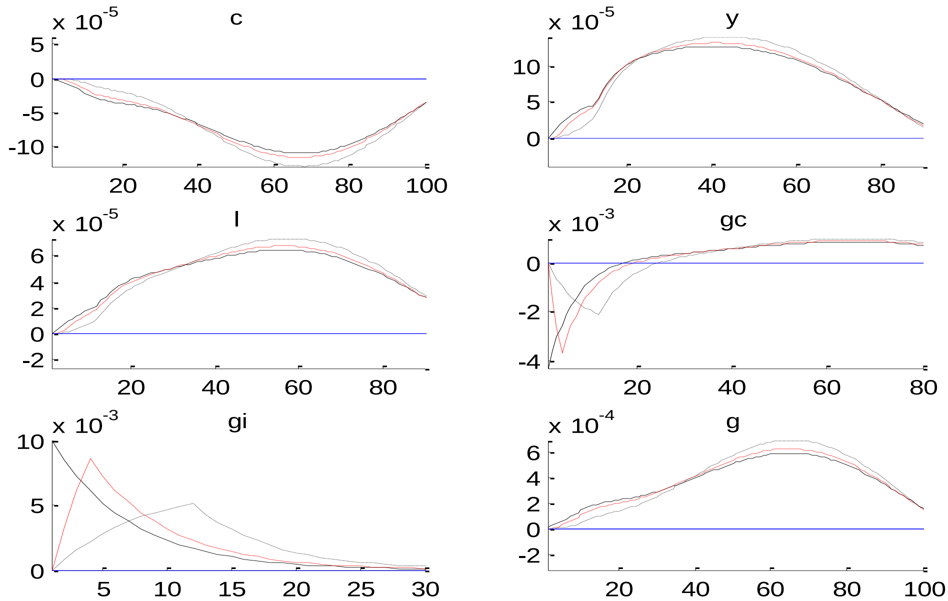



**Figure2.** Impulse response function for technology



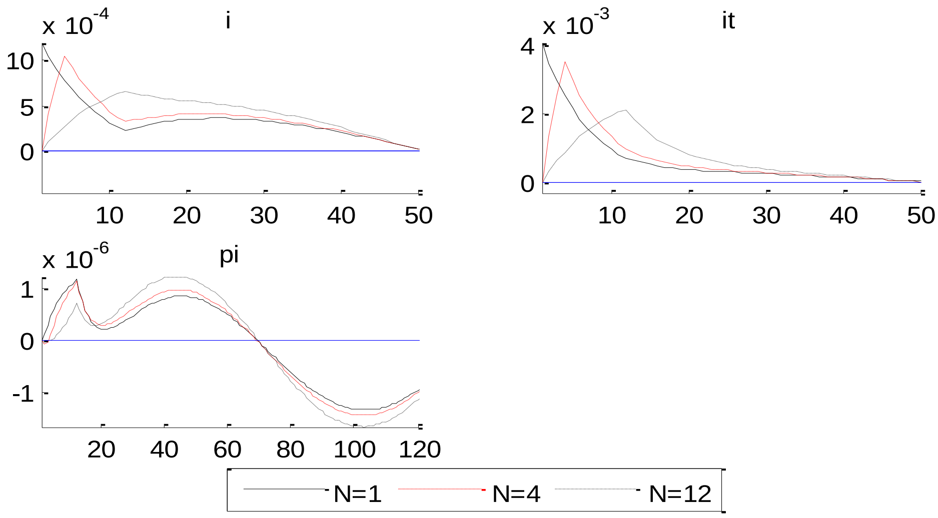



**Figure 3.** Impulse response function for progressive expenditures (N=12)

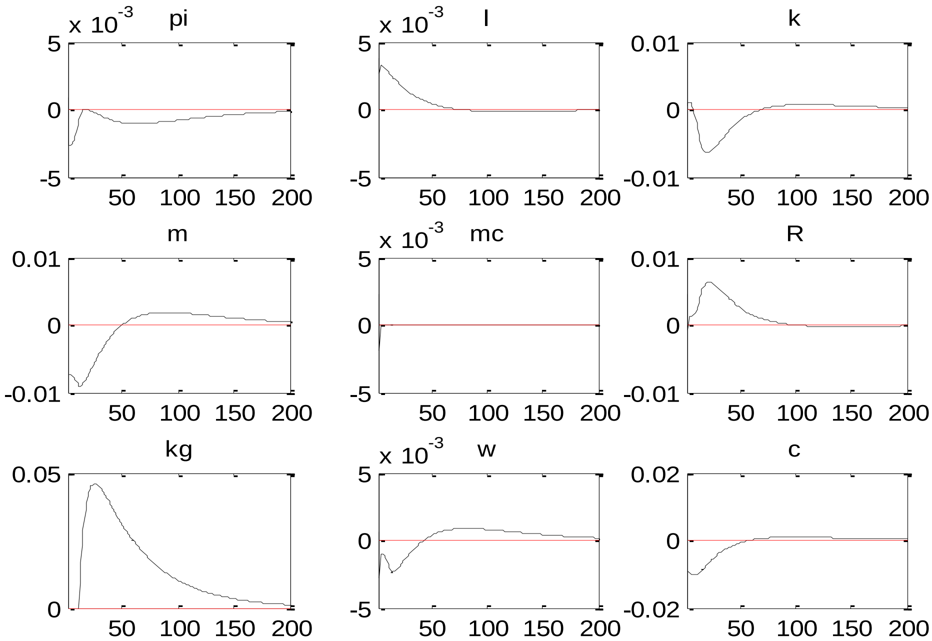



**Figure 4.** Impulse response function for oil revenues

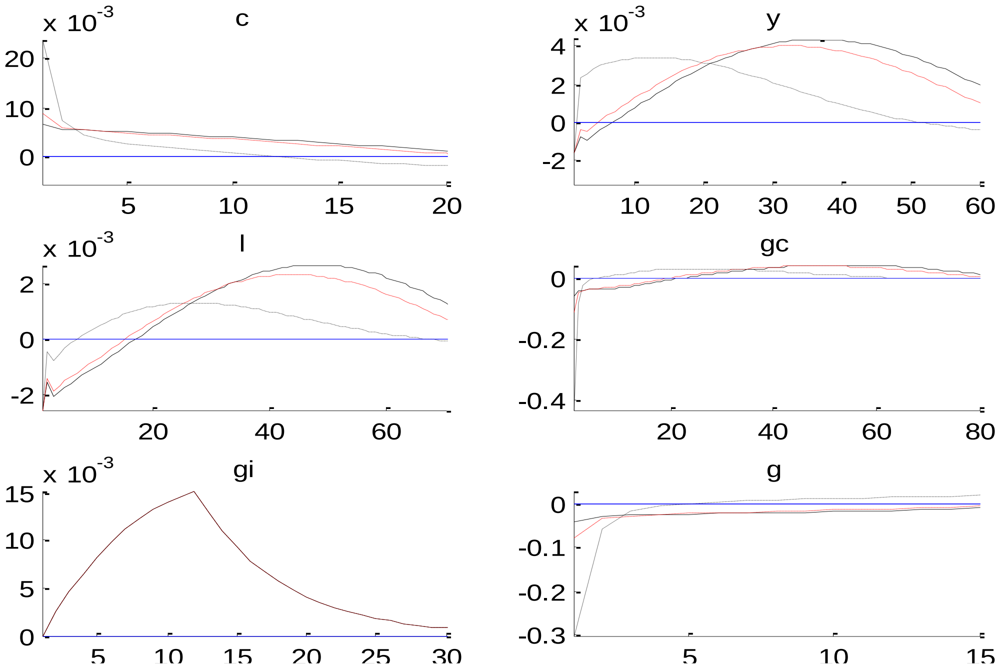



**Figure 4.** Impulse response function for oil revenues (N=12)

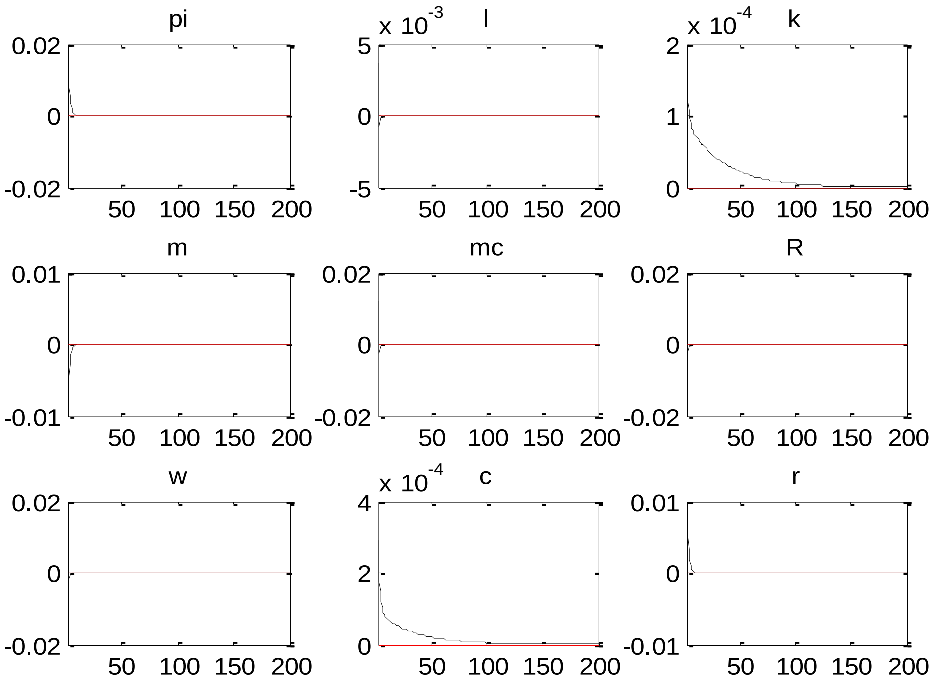



**Figure 5.** Impulse response functionfor money base (N=12)

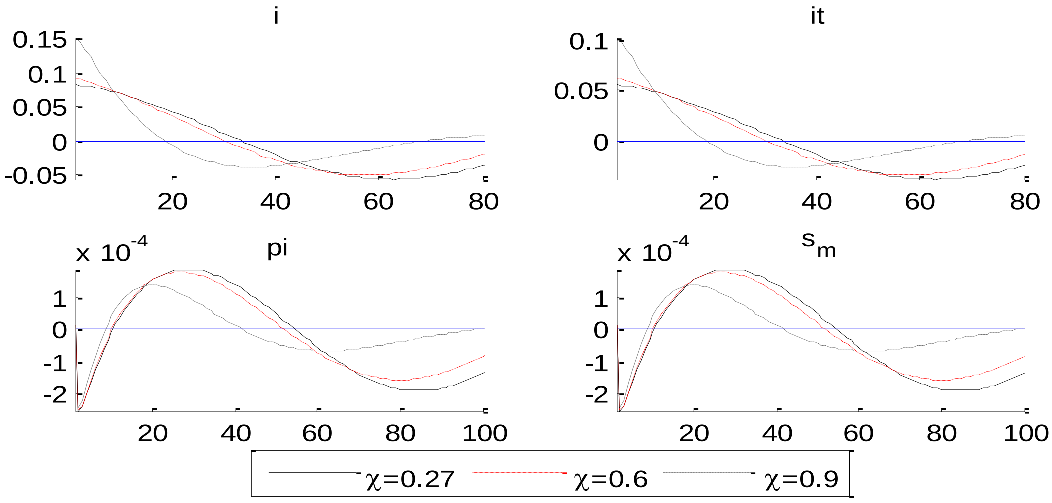



**Figure 6.** Impulse response function for money base (N=12)

## Conclusion

According to above mentioned in accordance with the theoretical expectations, following the effect of a positive shock inflicted on the government investment which leads to increase and gradual accumulation of fixed capital formation in the public sector, consumption is first affected and reduces, then employment increases Consequently, production will also be affected. This result is a little different with theoretical approach of Fukava (2012) research because with a neo-classical approach, the increase of public sector formation often funded through taxes and this tax increase from a welfare analysis approach has a negative effect on household wealth and general family well-being which results in consumption reduction and increase the supply of labor.

But what happens here is financing projects through oil revenues though the effective channel is different specifically this effect has different fluctuation for various times. So when development projects are carried out without interruption in terms of time, employment happens more. On the other hand due to the increased role of states in financing projects, reduction of the capital rent cost and inflation will also happen. Also it is notable that government expenditure Increase causes state capital increase which leads to the long-term effect of shock effect inflicted on government investment

Also with the shock of oil revenues, increased oil revenues results in public investment at first, because the increase in oil revenues, the government increases development expenditure. Though increase in development expenditure is more than Increase in current expenditure. Enhancing development expenditure and construction spending causes total spending increase and as a result of increased production of oil income, consumption and total investment will rise. This increase leads to inflation too. Though by increasing the inflation resulted from oil revenues, the monetary authority will react through reducing the growth rate of the monetary base.

However, the continuation of oil injection to the monetary base action to reduce inflation will be eroded and the government will be able to control inflation for a short time then the consumer welfare will reduces.

However, with entering a monetary shock to the economy, according to the figures, inflation increases, both real wages and real rent of capital decrease then consumer welfare reduces. With the emerged inflation emerged of a monetary shock, the government and the central bank react their anti-inflationary response in the form of monetary policy and reduction of money growth rate which result in production reduction, investment decrease and government spending cuts.

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## References:


[1] Benchimol, J. (2011). Base line new Keynesian DSGE model, PhD Doctoral theses, Pantheon Sorbonne University.

[2] Canova, F. and Luca, S. (2009). Back to square one: Identification issues in DSGE models, *Journal of Monetary Economics* 56(4), 431 – 449.

[3] Christiano, L.J., Eichenbaum, M., and Evans, C. (2005). Nominal Rigidities and the Dynamic Effects of a Shock

to Monetary Policy. *Journal of Political Economy* 113(1): 1–45. http://www.nber.org/papers/w8403.pdf

[4] Clarida, R., Gali,.J., and Gertler, M. (1999). The Science of Monetary Policy: A New Keynesian Perspective, *Journal of Economic Literature XXXVII (December 1999): 1661–1707*. http://dx.doi.org/10.1257/jel.37.4.1661

[5] Clarida, R., Gali, J., and Gertler, M. (2001). Optimal Monetary Policy in Closed Versus Open Economies, *American Economic Review* 91(2): 248 – 252. http://dx.doi.org/10.3386/w8604

[6] DeJong, D.N., Dave, C. (2007). Implementing Nonlinear Approximations Empirically, from Structural Macroeconometrics [Structural Macroeconometrics], Introductory Chapters, Princeton University Press. http://press.princeton.edu/chapters/s8436.pdf

[7] Fukava, K, (2012), Estimation of an Empirical FAVAR Model and DSGE Model for Evaluating Effects of Government Spending in Japan.

[8] Galí, Jordi (2002). New Perspectives on Monetary Policy, Inflation, and the Business Cycle. National Bureau of Economic Research Working Paper 8767. http://www.nber.org/papers/w8767.pdf

[9] Galí, J., (2008) Monetary Policy, Inflation, and the Business Cycle, Princeton University Press and copyrighted. http://www.press.princeton.edu/chapters/s8654.pdf

[10] Goodfriend, M and King, R. (1997). The New Neoclassical Synthesis and the Role of Monetary Policy, NBER Chapters, in: NBER Macroeconomics Annual, Volume 12, pages 231-296 National Bureau of Economic Research, Inc. http://www.nber.org/chapters/c11040

[11] Ireland Peter N., (2003), Implementing the Friedman Rule, Review of Economic Dynamics, PP. 120-134 http://dx.doi.org/10.1016/S1094-2025(02)00011-X

[12] Kavand, H., Ferris, S., (2011). The inflationary effects of stochastic resource revenues in resource-rich economies with less well-developed financial markets, Journal of Applied Economics, 44(29):1-10, http://dx.doi.org/10.1080/00036846.2011.581222

[13] Lou, D. (2008). Optimal Simple Money Rules in a Small Open economy, PhD Doctoral theses,

[14] Maliszewski, W. (2009). Fiscal Policy Rules for Oil Producing Countries: A Welfare-Based Assessment, IMF Working paper WP/09/126. https://www.imf.org/external/pubs/ft/wp/2009/wp09126.pdf

[15] McCallum, B. T. and Nelson, Edward, (2010). Money and Inflation: Some Critical Issues, Handbook of Monetary Economics, in: Benjamin M. Friedman and Michael Woodford (ed.), Handbook of Monetary Economics, edition 1, volume 3, chapter 3, pages 97-153 Elsevier. http://www.federalreserve.gov/pubs/feds/2010/201057/201057pap.pdf

[16] McCandless, G. (2008). The ABCs of RBCs: An Introduction to Dynamic Macroeconomic Models. Harvard University Press.

[17] Polanský, J.(2013). DSGE Models with Financial Frictions: A Theory and Applications to the Czech Economy

[18] Rotemberg, J. and Woodford, M. (1997), An optimization-based econometric framework for the evaluation of monetary policy. Cambridge, MA: National Bureau of Economic Research. NBER Working Paper,

[19] Semko, R. (2013). Optimal Economic Policy and Oil Price Shocks in Russia, Economic Research, ISSN 1331-677X , Volume 26(2): 69-82

[20] Svensson, Lars, E.O. (2009). Evaluating Monetary Policy, CEPR Discussion Papers 7481, C.E.P.R. Discussion Papers. http://ssrn.com/abstract=1507478

[21] Snowdon, B.(2005). Modern Macroeconomics: Its Origins, Development and current state, Northampton, MA: E.Elgar.

[22] Tavakolian, H. (2014). Estimating the Degree of Fiscal Dominance and its Welfare Costs in a Dynamic Stochastic General Equilibrium, Journal of Monetary and Banking Research, vol 7, number 21.

[23] Walsh, Carl E, (2010). Monetary Theory and policy'. 3rd ed. Cambridge, MA: MIT Press.

[24] Woodford, M. (1996). Control of the Public Debt: A Requirement for Price Stability?, NBER Working Paper,

Number 5684.http://www.nber.org/papers/w5684.pdf

[25] Woodford, M. (1998). Public Debt and the Price Level, Manuscript, Princeton University.

[26] Woodford, M. (2003). Interest and Prices. Foundations of a Theory of Monetary Policy. Princeton University Press.

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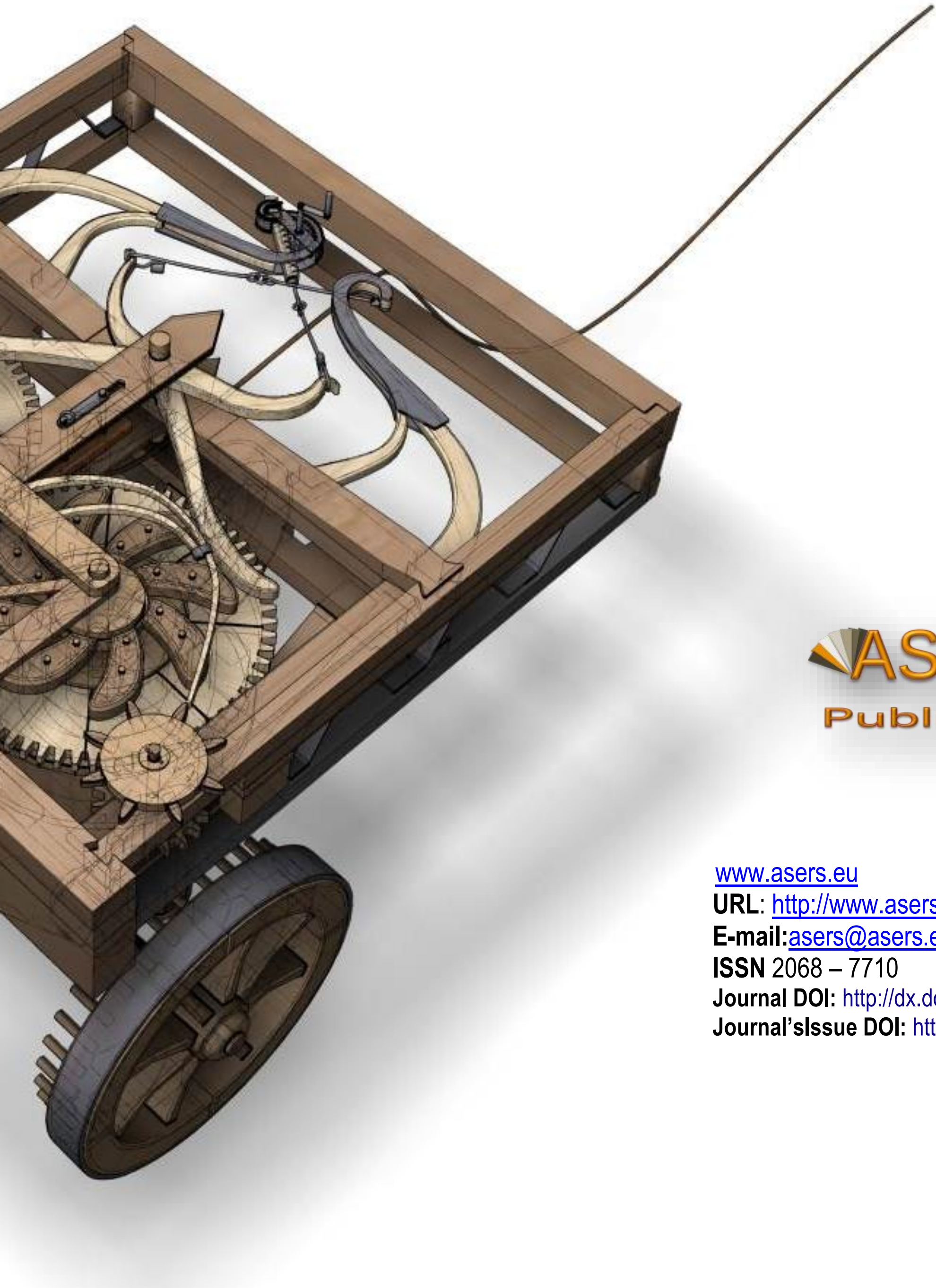

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