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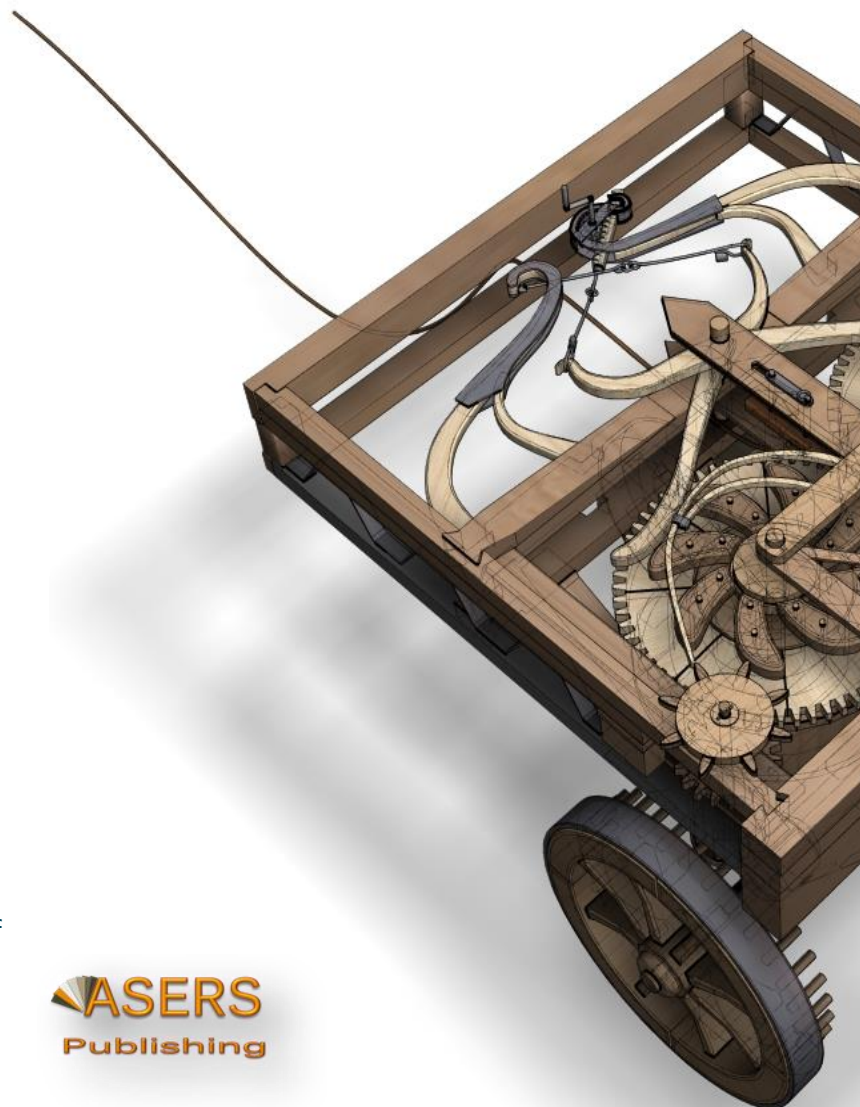
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Contents:

- 1 Is Foreign Portfolio Investment Beneficial to India's Balance of Payments? An Exploratory Analysis**
Justine GEORGE
St Paul's College, Kalamassery, Kerala, India ...5
- A
S
Friedman, Monetarism and Quantitative Easing**
Victor Olivio ROMERO
University of Connecticut,
Metropolitan University, Caracas, Venezuela ...11
- 3 Policy Rate Divergence in the ASEAN-4: Impact of Global Risk Perception and Financial Market Characteristics**
Laura B. FERMO
Central Bank of the Philippines, Philippines ...30
- 4 Drivers of Low Inflation in Malta after the Crisis**
Brian MICALLEF
Modelling and Research Department, Central Bank of Malta, Malta ...53
- 5 Lessons from Enterprise Reforms in China and Vietnam Can Stylized Necessary Conditions for the Sustainability of Socialist-Oriented Economic Strategies Be Identified?**
Alberto GABRIELE
Independent Researcher, Italy ...63
- 6 Straight-Time And Overtime: A Sequential-Lottery Approach**
Aleksandar VASILEV,
American University in Bulgaria, Bulgaria ...81

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Drivers of Low Inflation in Malta after the Crisis

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Abstract

Despite robust growth, inflation in Malta has been subdued after the crisis and lower than what a Phillips curve would imply. This study examines the determinants of low inflation by comparing inflation forecasts conditioning on three groups of variables – real activity, external and financial – to see which one of these categories best explains post-crisis inflation. The analysis is conducted within a Bayesian VAR (BVAR) framework over two different disinflation periods, the first one starting in mid-2008 and the other one in 2012. For Malta, forecasts conditional on the path of the external variables are the closest to the actual path of inflation in both periods. On the contrary, in the euro area, the first episode was driven by external factors but domestic factors played a more important role in the second one. This point to the significant cross-country heterogeneity among euro area countries even in the face of apparently similar patterns in headline inflation.

Keywords: Inflation, Conditional forecasts, Bayesian Vector Autoregression, Cross-country comparison, Malta.

JEL classification: E31, E32, E37

Introduction

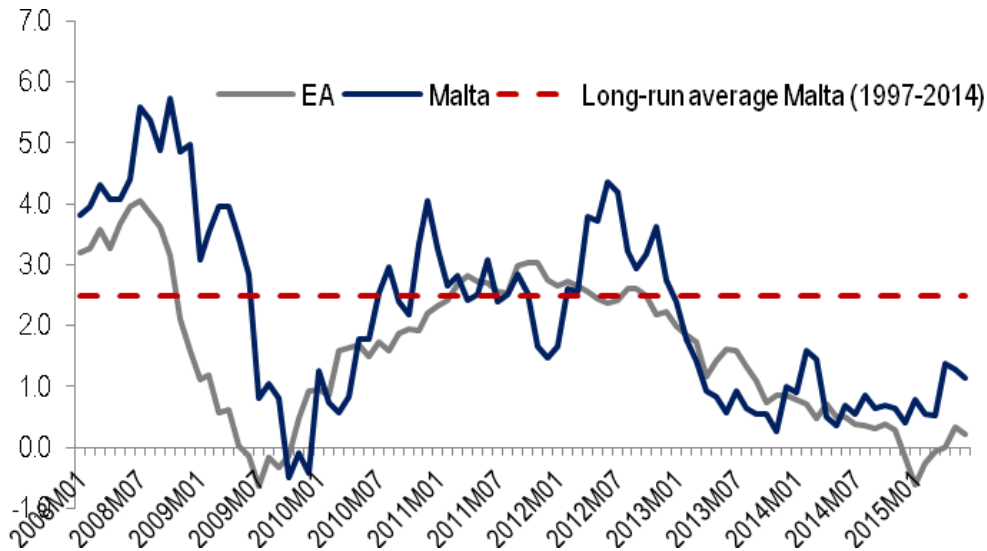
Inflationary pressures in Malta, the smallest and one of the most open economies in the euro area, have been weak after the crisis despite above average economic growth. Inflation followed a similar pattern as in other euro area countries, with two disinflation periods; one starting around mid-2008 and the second one in 2012 (see Figure 1). While the first period was driven mainly by developments in the energy and food components, the second period was much more prolonged and more broad-based, driven by the contribution of energy from the reduction in utility tariffs and services inflation. Since 2013, inflation has also been systematically over-predicted and has been lower than what a Phillips curve would imply, especially given the strong GDP growth, the drop in unemployment to historical lows and the closure of the output gap.

Against this background, this study asks the following question: given the typical co-movements between macroeconomic variables, which group of variables does the best job explaining inflation dynamics after the crisis? This question is answered using forecasts of inflation conditional on three groups of variables – real activity, external and financial variables – over the two different disinflation periods computed with a Bayesian VAR (BVAR) framework.

For Malta, the forecasts conditional on the path of the external variables are the closest to the actual path of inflation in both periods. On the contrary, in the euro area, while external variables are best in explaining the disinflation period starting in 2008, the forecasts conditional on domestic real activity are the closest to the actual

path of inflation for the second period. This pattern is shared by the largest members of the monetary union but not the smallest ones. This points to significant cross-country heterogeneity among euro area countries even in the face of apparently similar patterns in headline inflation.

The rest of the paper is organized as follows. Section 2 provides a brief literature review. Section 3 describes the model and section 4 reports the main findings for Malta. Section 5 tests the sensitivity of the results and section 6 applies the same framework on a number of euro area economies. Section 7 concludes.



Source: own calculations using Eurostat data

Figure 1 - HICP inflation in Malta and the euro area: 2008-2015 (annual growth rates)

Brief literature review

Various facets of the inflation process in Malta have been well-studied in recent years. Since the mid-1990s, the inflation rate in Malta has fluctuated around a broadly constant mean of 2.5%, higher than the corresponding inflation in the euro area. Estimates of inflation persistence in Malta stand at around 0.3, implying a half-life of slightly more than six months (Micallef and Ellul 2013). These estimates are lower than those typically found for the euro area, which range between 0.4 and 0.8 (Altissimo *et al.* 2006).

Inflation in Malta tends to be more volatile than in the euro area, in part reflecting the interplay of external shocks, such as high commodity prices, with domestic rigidities, such as monopolistic practices and low competition in certain sectors of the economy. The latter are, to a certain extent, structural features of a small economy. Using a two-country DSGE model of a monetary union, Micallef (2013) finds that around two-thirds of the inflation differentials between Malta and the euro area are explained by cost-push shocks. Gatt (2015) documents a weakening in the slope of the Phillips curve in Malta over time, whereas the link between import prices and domestic inflation has increased since the late 1990s. The flattening of the Phillips curve, which downplays the relationship between inflation and real economic activity, has been documented for a number of advanced economies in recent years (Blanchard *et al.* 2015).

Despite the increasing literature, there is no single narrative on the drivers of low inflation after the crisis in most advanced economies, including in the euro area. After the 2009 global financial crisis, Ball and Mazumder (2011) document 'missing deflation' in most developed economies, that is, the drop in inflation being less than what a Phillips curve would imply. On the contrary, Constancio (2015) refers to 'excessive disinflation' in the euro area after 2012, as price pressures have declined by more than suggested by economic fundamentals. Contrary to the flattening of the Phillips curve hypothesis, some studies find that, at least since 2013, the relationship between inflation and economic activity in the euro area has been strengthened (Riggi and Venditti 2015; Oinonen and Paloviita 2014). In addition, some countries also find an asymmetric relationship between inflation and activity, with inflation being more responsive to shocks in the contractionary phase of the business cycle (Alvares *et al.* 2015).

Another growing body of literature argues that inflation is heavily influenced by global factors. This is due, for instance, to the process of globalization which increased the sensitivity of inflation to foreign disturbances

such as commodity prices, the prices set by competitors and the synchronization of monetary policies across the globe. Within this strand of the literature, Ciccarelli and Mojon (2010) argue that a global common factor explains a substantial portion of the variation in inflation across countries.

This paper is closest to Jarocinski and Bobeica (2016) who use both reduced form and structural analysis to assess the relative importance of domestic and external factors in driving inflation in the euro area and the US after the crisis. These authors attribute the disinflation period after the 2009 recession to external factors but the subsequent period of low inflation starting in 2012 to mostly domestic factors. On the contrary, the situation in the US is different than in the euro area, with the first fall in inflation being more domestic in nature while the second one was more externally driven.

The Models

Following Jarocinski and Bobeica (2016), this study applies a reduced form approach to determine which group of variables does the best job in explaining inflation dynamics after the crisis. This is done using conditional forecasts of inflation computed with VAR models condition on the actual values of three groups of variables: real activity, external and financial variables. In turn, the in-sample conditional forecasts of inflation are compared with the actual values of inflation.

Importantly, this exercise does not depend on any assumptions regarding shock identification and follows the approach that Jarocinski and Smets (2008) used to study the drivers of the US housing boom.

In addition to the price index (HICP), the baseline BVAR includes 12 variables that are grouped in three broad categories. The first group refers to business cycle variables. These include three real activity indicators – real GDP, the unemployment rate and real investment – together with wages. The category is intended to capture the linkages between the real economy and the labor market. For reporting purposes, a distinction is made between this category with and without wages. This is done to single out the potentially important role of structural changes in the labor market that kept wage pressures contained. The second group refers to foreign variables and consists of the following four variables: foreign demand, oil prices in US dollars, the nominal effective exchange rate (NEER) and the non-energy commodity prices. This category is especially important for a small and open economy with a high degree of import content. The third group refers to the financial variables and consists of a short-term money market interest rate (3-month Euribor), as well as the lending rate and real credit to non-financial corporations (NFCs).

In addition, a larger VAR incorporating 16 variables is also estimated to cross-check the results from the baseline model. This VAR takes into consideration a bigger financial block intended to better account for the crucial changes in monetary policy and financial conditions after the crisis. More precisely, it adds a measure of long-term interest rates, proxies for the lending conditions for households (interest rate and loans) and a stock price index. Appendix A summarizes the variables included in each VAR and the data sources.

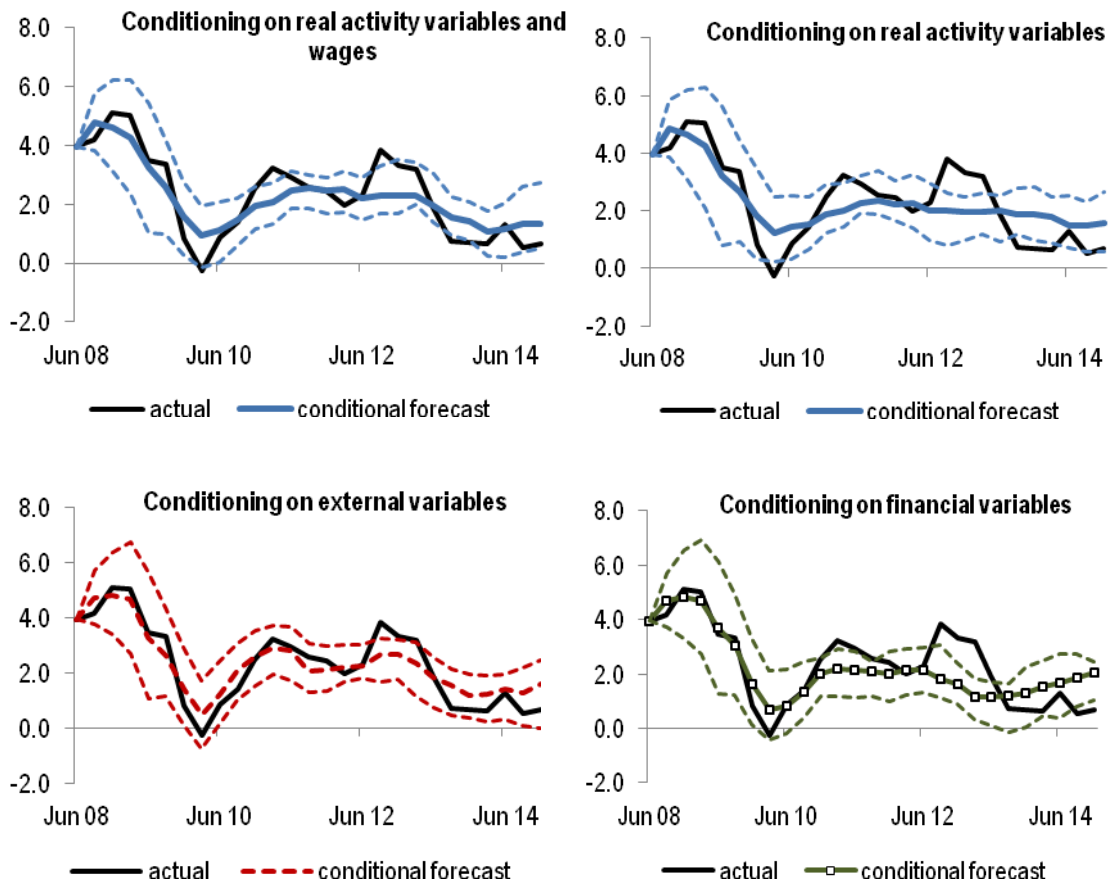
All the variables are measured at the quarterly frequency over the sample 2000Q1 to 2014Q4. The VARs are estimated using Bayesian methods in the tradition of Sims *et al.* (1990). All variables are included in log levels and seasonally adjusted, except interest rates using Bayesian priors of Litterman (1979) and Sims and Zha (1998) with standard settings. Thus, in terms of the Sims and Zha (1998) notation, the 'tightness' parameter $\lambda_1 = 0.2$, the 'other weight' parameter $\lambda_2 = 1$, the 'decay' parameter $\lambda_3 = 1$, the standard deviation of the constant term $\lambda_4 = 100$, the weight of the 'no-cointegration prior' $\lambda_5 = 1$, and the weight of the 'one unit root prior' $\lambda_6 = 1$. All the VARs include an intercept. As is the common practice in quarterly VARs, I include four lags of the endogenous variables.

Empirical Results

Figure 2a illustrates the main findings using the baseline BVAR with headline HICP inflation. The four panels plot the actual path of inflation (the solid black line) and the median conditional forecast based on each group of variables. While the BVAR is specified in terms of the (log) price level index, for the purpose of reporting the levels are transformed into year-on-year changes. The exercise is in-sample and the forecast starts from 2008Q2 onwards.

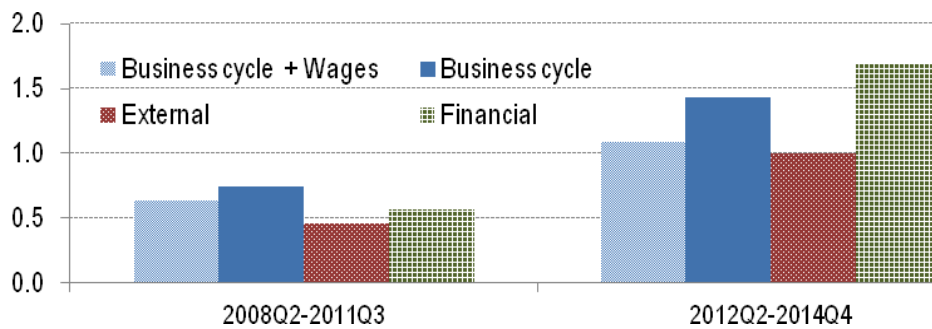
Figure 2b summarizes the findings by reporting a summary measure of the difference between actual inflation and each conditional forecast in the two episodes (2008Q2-2011Q3 and 2012Q2-2014Q4). This is done using the root mean squared error (RMSE), computed by averaging the squared difference between the actual inflation and the median conditional forecast over the indicated period.¹

¹The results also hold when normalizing the RMSE with a measure of inflation variability over each period.



Source: own calculations

Figure 2a - Conditional forecasts of HICP (annual growth rates)



Source: own calculations

Figure 2b: RMSE of conditional forecasts of HICP inflation from baseline BVAR

The main result is that in both sub-periods, the forecast conditioning on the external variables are closest to the actual inflation. It is also worth mentioning that actual inflation lies below the conditional forecast based on all four blocks of variables in the second disinflation period. However, only in the external case does actual inflation remain within the 95% confidence bands during this period.

It is important to note that during this period, inflation was also affected by policy initiatives, such as the reduction in utility tariffs for households in March 2014. The introduction of this policy is not captured by the model. However, it is likely that the drop in inflation is still captured by the external category as it coincided with the decline in non-energy commodity prices and, in mid-2014, by the collapse in international oil prices. For instance, the contribution of food to headline HICP averaged 0.2 percentage points in 2014Q2 and 2014Q3, down

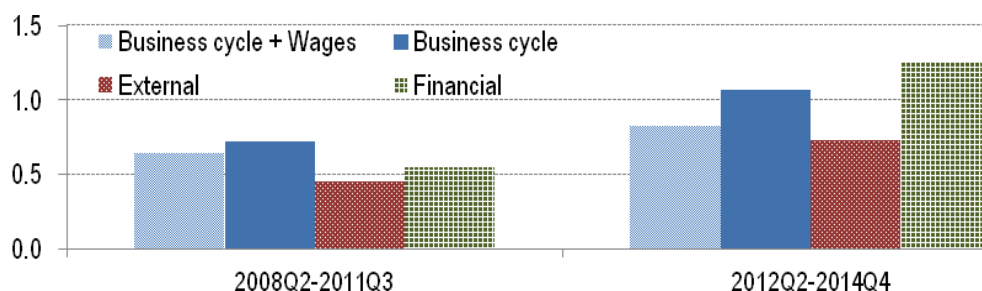
from 0.5 percentage points in the preceding two quarters. The decline in international oil prices in mid-2014 also works in favor of the external category despite the fact that energy prices in Malta are regulated and that Malta's energy corporation entered into oil hedging agreements intended to provide stability in utility prices.

The inclusion of wages in the real activity category lowers the RMSE in both periods given that wage pressures were relatively subdued in the post-crisis period. In the model, wages are intended to capture the structural changes in the domestic labor market, for instance, the various policy initiatives to raise the female participation rate, the influx of migrant workers and the pension reform that gradually increased the retirement age.² All these changes led to a sharp increase in the labor supply that kept wage pressures contained despite robust economic growth and a decline in the unemployment rate.

In the second disinflation period, forecasts conditioning on financial variables produce the largest RMSE given the absence of stress in the domestic financial system since Malta was not affected by the European sovereign debt crisis of 2012.

Finally, no category is able to capture the high inflation in mid-2012, with this period being generally outside the confidence bands. This is due to methodological changes adopted by the country's statistical authority in the measurement of travel and accommodation prices, which led to a sharp increase this category's price index.

The main findings from the baseline BVAR are confirmed using the large BVAR (see Figure 3). In particular, the inclusion of a more comprehensive financial block did not yield any significant improvement in the RMSE of the financial category.



Source: own calculations

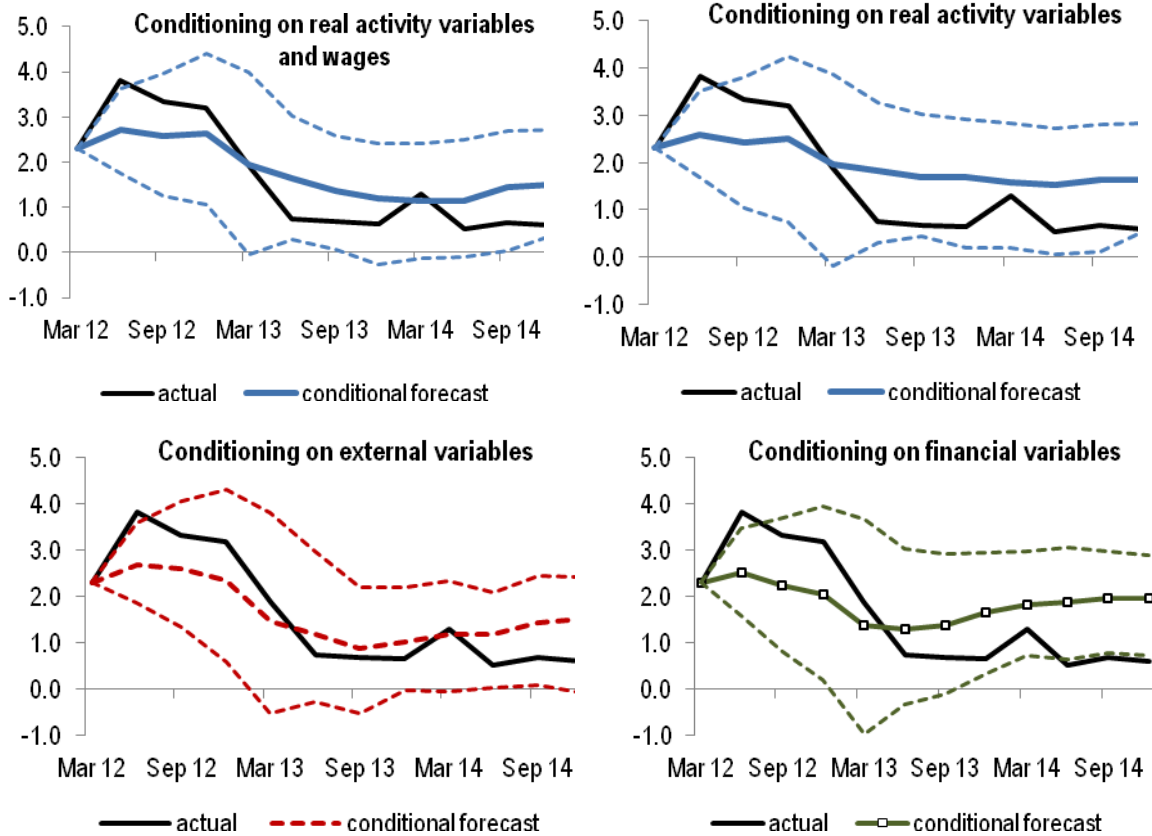
Figure 3 - RMSE of conditional forecasts of HICP inflation from large BVAR

Sensitivity analysis

The main findings are tested for robustness along two dimensions. First, the whole process is repeated by starting the conditioning in 2012Q2, thereby focusing only on the second disinflation period. The latter may be considered to be more interesting than the first one as the prolonged period of low inflation took many policy institutions and forecasters by surprise, leading to a sequence of inflation over-predictions.

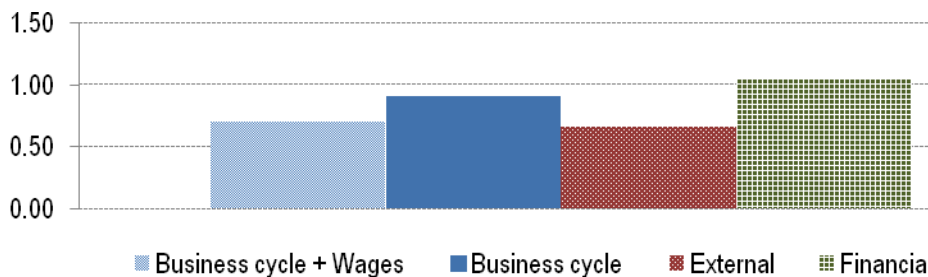
The main results remain broadly unchanged. In all cases, actual inflation stood lower than the conditional forecasts during 2013 and 2014. Forecasts conditioning on external variables produced the lowest RMSE, followed closely by the real activity group with wages. As in the previous section, the latter category fared much better in terms of RMSE than the same group without wages. Forecasts conditioning only on financial variables produced the highest RMSE, with actual inflation from mid-2014 even lying outside the confidence bands.

² Details on the impact of the increase in the female participation rate and migration on the Maltese labour market are available in Micallef (2015) and Grech (2015), respectively.



Source: own calculations

Figure 4a - Conditional forecasts of HICP (conditioning period: 2012Q2-2014Q4)



Source: own calculations

Figure 4b - RMSE of conditional forecasts of HICP inflation for period 2012Q2-2014Q4

Second, both the baseline and the large BVAR were estimated using 3 different measures of inflation to investigate the drivers of several price indices. In each case, the headline HICP index was replaced with the following price variable: (i) HICP excluding energy and unprocessed food; (ii) HICP with constant taxes and (iii) GDP deflator.

Table 1 reports the categories with the RMSE for the four different measures of inflation and the two sub-periods. While most specifications confirm the findings of the previous section, there are some differences among the prices indices, reflecting the different sectorial exposure of the groupings. As expected, the importance of external variables is reduced when considering core inflation, defined as HICP excluding energy and food prices, with the financial variables and the business cycle (with wages) producing the lowest RMSEs. On the contrary, foreign variables yield the lowest RMSE for HICP using constant taxes since Malta did not experienced any of the tax changes that had to be imposed on stressed countries in order to consolidate their budgetary position. External and financial variables produce the lowest RMSEs for the GDP deflator (depending on the time period and VAR used) although this price index exhibited somewhat different dynamics than the HICP, remaining more resilient during 2013 and 2014, hovering around 2%.

Table 1 - Sensitivity analysis

	2008Q2-2011Q3							
	Baseline BVAR				Large BVAR			
Price index	Real	External	Financial	Real + Wages	Real	External	Financial	Real + Wages
HICP	0.76	0.47	0.57	0.65	0.73	0.45	0.55	0.64
HICP excluding energy & food	0.68	0.70	0.63	0.62	0.64	0.62	0.58	0.59
HICP constant taxes	0.71	0.44	0.66	0.67	0.74	0.37	0.49	0.71
GDP deflator	0.77	0.59	0.66	0.78	0.76	0.56	0.53	0.79
	2012Q2 - 2014Q4							
	Baseline BVAR				Large BVAR			
Price index	Real	External	Financial	Real + Wages	Real	External	Financial	Real + Wages
HICP	1.11	0.77	1.30	0.84	1.07	0.73	1.26	0.82
HICP excluding energy & food	1.06	0.85	1.08	1.01	1.12	0.90	1.07	1.01
HICP constant taxes	1.26	0.69	1.35	0.94	1.16	0.72	1.19	0.91
GDP deflator	0.54	0.40	0.36	0.44	0.49	0.40	0.38	0.48

Source: Author's calculations

Cross-country comparison

The disinflation after the crisis, especially the one starting in 2012, was a widespread phenomenon among euro area countries, affecting both those economies that were the most affected by the sovereign debt crisis but also the least affected ones. In addition, low inflation in the euro area is not entirely attributable to developments in international commodity prices, like energy and food, since other components of the euro area's price index, such as non-energy industrial goods and services, have also been characterized by subdued dynamics. As a result, weak aggregate demand could also be playing an important role in explaining the low inflation developments (Constancio 2014).

This section compares the Maltese results with those from the euro area by running the baseline BVAR model with euro area data. In addition to the euro area average, it also assesses whether the drivers of low inflation differ between the four largest economies in the euro area and the smallest member states. Overall, these countries include both those that were heavily affected by the impact of the 2009 recession and the sovereign debt crisis as well as some that emerged largely unscathed.

The results show that, in the euro area, while external variables are best in explaining the disinflation period starting in 2008, the forecasts conditional on domestic business cycle (which also includes wages) are the closest to the actual path of inflation for the second phase of the crisis.

The results point to cross-country heterogeneity among the largest and smallest members of the monetary union, especially in the second phase of the crisis. In the first phase of the crisis, external factors were the dominant category in explaining the drop in inflation in both large and small economies. After 2012, however, domestic factors were the most important category in explaining low inflation in the four largest economies of the euro area. This could be due, for instance, to the protracted weakness in activity and investment in some economies and the need to regain competitiveness, which, together with the relatively high unemployment, kept wage pressures contained. On the contrary, with a few exceptions, external factors continued to play the most important role in explaining headline inflation in most of the small economies.

Table 2: Cross-country comparison

	FIRST PHASE			SECOND PHASE		
	Business cycle	External	Financial	Business cycle	External	Financial
Euro area		X		X		
<i>Large economies</i>						
Germany		X		X		
France		X		X		
Italy		X		X		
Spain		X		X		
<i>Small economies</i>						
Malta		X			X	

	FIRST PHASE			SECOND PHASE		
	Business cycle	External	Financial	Business cycle	External	Financial
Cyprus			X		X	
Slovenia		X			X	
Luxembourg		X			X	
Portugal		X		X		

Source: Author's calculations based on the LIFT results

Conclusion

This paper investigates the drivers of low inflation in Malta after the crisis using conditional forecasts within a Bayesian VAR framework. The reduced form nature of the exercise, however, captures correlations and not causal relationships. The latter requires a more structural approach, which is beyond the scope of this paper.

The two phases of low inflation since the crisis in Malta were both driven mainly by external factors. This is not surprising given the Malta is one of the most open economies in the EU with a high degree of import content. These results are also consistent with the view of a flattening of the Phillips curve in Malta, which explains why the robust GDP growth and the drop in unemployment to historical lows did not result in inflationary pressures. The inclusion of wages in the real activity indicators improves the fit of the model, suggesting that the structural changes in the domestic labor market could have potentially played an important role in keeping price pressures contained.

Cross-country comparisons point to a considerable degree of heterogeneity among the largest and smallest members of the monetary union, especially in the second phase of the crisis. For the euro area as a whole, the first disinflation period is best explained by the external variables but the second period was driven to a larger extent by domestic factors. This pattern is shared among the biggest economies but not by the smallest ones, for which external factors remain the most important category.

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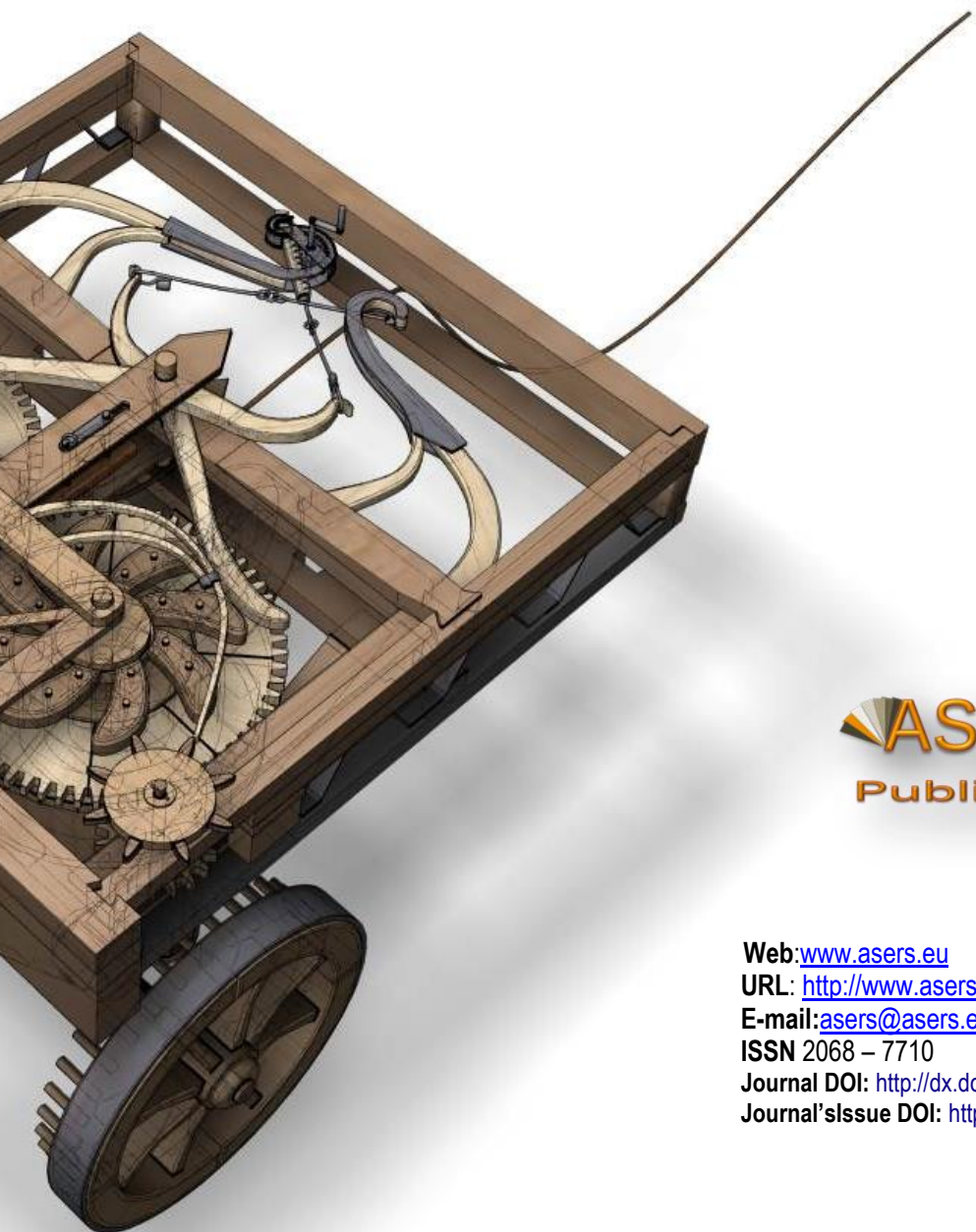
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Appendix A
Variables included in the Bayesian Vector Auto regression Models

Variable	Baseline BVAR	Large BVAR	Source
<i>Price index</i>			
HICP	X	X	Eurostat
<i>Wages</i>			
Compensation per employee	X	X	ECB Statistical Data Warehouse
<i>Real activity variables</i>			
Real GDP	X	X	Eurostat
Unemployment rate	X	X	Eurostat
Real investment	X	X	Eurostat
<i>Foreign variables</i>			
Price of oil in USD	X	X	ECB Statistical Data Warehouse
Price of non-energy commodities	X	X	ECB Statistical Data Warehouse
Nominal effective exchange rate	X	X	ECB Statistical Data Warehouse
Foreign demand	X	X	European Central Bank
<i>Financial variables</i>			
3-month Euribor	X	X	Eurostat
10-year government bond yield		X	Eurostat
Lending rate to NFCs	X	X	Central Bank of Malta
Mortgage interest rate		X	Central Bank of Malta
Loans to NFCs	X	X	Central Bank of Malta
Loans for house purchase		X	Central Bank of Malta
Stock index		X	Central Bank of Malta

Notes: Symbol x implies that a variable is included in the VAR.

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