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Abstract

In this study we analyze the impact of fiscal sustainability on the formation of inflation expectations of private sector agents – consumers and professional forecasters – in European countries. According to the unpleasant monetarist arithmetic and the fiscal theory of the price level, high public debt should lead to the increase of the price level. The debt crisis in Europe that caused significant increase in indebtedness of several European economies might cause inflation expectations to respond to this increase in debt, if economic agents believed that this would lead to increase of inflation. In this paper we estimate models of inflation expectations with the public debt among explanatory variable as well as we derive perceived inflation targets. We analyse whether these results are affected by the degree to which fiscal policy is sustainable in European economies. We find that fiscal stance influences inflation expectations of consumers and professional forecasters. Our results do not confirm the view that in economies with unsustainable fiscal policy, the response of inflation expectations to public debt is stronger than in the economies with responsible fiscal policy. Vice versa, it seems that in the case of Consensus Economics forecasts, countries with sustainable fiscal policy display stronger reaction of these forecasts to public debt than economies with less disciplined fiscal policy.

JEL: D84, E62, H31, H39

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1. Introduction

According to the traditional approach in economics, inflation is a monetary phenomenon, and therefore the control of inflation should deal with an independent central bank whose primary objective is to ensure price stability. In fact, many countries followed the theoretical recommendations, by granting central banks a high degree of independence in conducting monetary policy. This traditional approach, however, started to be criticized. Since the 90's the fiscal theory of the price level has emerged in the literature (Woodford, 1994, 1995, 1996, 1998, 2001; Sims, 1994, 2001; Leeper, 1991; Cochrane, 2000, 2001). The name of this approach reflects the view, according to which monetary policy alone is not sufficient to ensure price stability, but it is also necessary for this purpose to pursue an appropriate fiscal policy. A key element of the fiscal theory of the price level is the intertemporal government budget constraint, under which the accumulated real value of government debt must be equal to the present value of future budget surpluses. The equation of intertemporal government budget constraint is also a part of the traditional quantity theory of money, but in contrast to the fiscal theory of the price level it does not imply that the government must adjust fiscal policy so that the budget constraint is fulfilled. On the contrary, in the regime known as fiscal dominance, central bank is forced to adjust monetary policy so as to meet the budget constraints. Thus, the result of discretionary fiscal policy may be higher inflation. Sargent and Wallace (1981) were the first authors drawing attention to this problem. Their "unpleasant monetarist arithmetic" shows that fiscal authorities are those, who ultimately decide the level of money supply. The authors show that if the fiscal authorities are able to finance the deficit only by issuing new bonds, the monetary authorities will be eventually forced to an additional issue of money, and thus, to accept higher inflation. This concept then gave rise to the development of the fiscal theory of the price level. According to this theory, a high public debt could lead to higher inflation, even if the central bank's preferences are anti-inflationary. From this perspective it seems interesting whether high debt in developed economies with independent central banks can also lead to higher inflation. Empirical studies verifying the fiscal theory of the price level are unfortunately few. A well-known study by Canzoneri *et al.* (2001) verified the accuracy of this theory using US data. The authors, on the basis of results from VAR models, concluded that empirical evidence does not support the fiscal theory of the price level. This method was then used in subsequent studies, although it was criticized (Cochrane, 1998). Creel and Le Bihan (2006), trying to combine Canzoneri *et al.* (2001)

approach with its critique by Cochrane (1998), show that for neither European country under consideration the data support the fiscal theory of the price level.

Since fiscal policy can affect inflation, the question arises if it also affects inflation expectations. According to the hypothesis of rational expectations (Lucas, 1972), economic agents are familiar with the processes governing the economy and do not commit systematic forecasts errors. Thus, knowing the relationship between public debt and inflation and observing the increasing level of debt, they should expect higher inflation. The possibility of losing control over inflation expectations by the central bank, arising from the fiscal theory of the price level, was suggested by Leeper and Walker (2013). However, there is little empirical research examining the effects of fiscal policy on inflation expectations. One of them is the study by Cerisola and Gelos (2009) for Brazil. The authors show that an increase in the budgetary surplus (deficit reduction) causes a drop in expected inflation. Galati *et al.* (2011) show a statistically significant reaction of inflation expectations, especially the short-term ones, to the increase in debt in the euro zone. In the older study, Webb (1986) analyzed the situation in Germany in 1919-1923 showing that high inflation was the result of high debt and expected further budget deficits and inflation expectations react to events in the public sector. The empirical literature, even if scarce, seems thus to confirm the existence of the relationship between the fiscal stance and inflation expectations of economic agents, as suggested by theoretical literature.

In this study we analyze the impact of fiscal policy stance on inflation expectations in the European economies. According to our hypothesis high public debt (or unsustainable fiscal policy) should be associated with higher inflation expectations. Our contribution is that we analyse the response of inflation expectations to fiscal variables depending on fiscal sustainability or a lack thereof. In our view, inflation expectations may react to debt differently in countries with sustainable and unsustainable fiscal policy. In the study we firstly provide evidence on fiscal sustainability in European economies and, secondly, we estimate models of inflation expectations of two groups of agents, i.e. consumers and professional forecasters. These models include, apart from the public debt to GDP ratio, a rich set of variables that may potentially influence inflation expectations of economic agents. We check if in countries with unsustainable fiscal policy the reaction of inflation expectations to debt was different than in the economies with sustainable fiscal policy. For this aim, we split the sample into two groups of countries – with sustainable and unsustainable fiscal policy. The models of expectations' formation are estimated for individual countries as well as using

panel estimation methods, for each group of countries separately. Another variable possibly affecting the impact of fiscal policy stance on inflation expectations is the level and volatility of inflation. Therefore, this is the second criterion of division the countries into groups applied in our paper.

Fiscal dominance should not only affect the response of inflation expectations to fiscal policy stance, but also should influence the perceived ability of the central banks to achieve theirs inflation targets in the long-term, i.e. it should influence the anchoring of inflation expectations. Therefore, in addition we analyse the degree of anchoring of inflation expectations of professional forecasters, using the method proposed by Demertzis *et al.* (2010). Having estimated so-called implicit (perceived) anchors for inflation expectations we check, weather in countries, where fiscal dominance prevailed, the actual anchors deviate more from the inflation targets than in the countries with sustainable fiscal policy.

1. Measuring fiscal sustainability in European economies

In our study we assume that fiscal policy may start to affect inflation expectations of economic agents when it is on an unsustainable path. Therefore, the crucial issue in the analysis of the impact of fiscal stance on inflation expectations is a proper indicator of fiscal sustainability.

Empirical literature has used different approaches to test fiscal sustainability. Initially, purely statistical methods of time series analysis were applied, i.e. tests for unit roots in public debt or deficit series or for cointegration between public revenues and expenditures (Hamilton and Flavin, 1986; Trehan and Walsh, 1991; Quintos 1995). In this approach stationarity or difference-stationarity of debt or deficit as well as cointegration between revenues and spending were interpreted as conditions for fiscal sustainability.

Bohn (1998, 2007) criticized this approach, showing that tests for unit roots have low power in rejecting non-stationarity of debt series and that the debt series integrated in any finite order constitutes a sufficient condition for the intertemporal budget constraint to be satisfied. He proposed to test fiscal sustainability by estimating fiscal reaction functions of the following form:

$$pb_t = \alpha d_t + \beta Z_t + \varepsilon_t \quad (1)$$

where *pb* is the primary balance in relation to GDP, *d* is the government debt-to-GDP ratio, *Z* is a set of other determinants of the primary balance, α measures the responsiveness of primary balance to debt, and ε is an error term. In this concept, widely used in empirical literature, a positive coefficient α is a sufficient condition for fiscal sustainability, regardless of the results of tests for debt stationarity.

The above interpretation of α relies on the assumption that the interest rate on government bonds is not affected by fiscal policy (i.e. it is constant or deviates from the long-run mean in a random way). Even if this assumption can be justified in some economies, including US economy analysed by Bohn (1998, 2007), in many other economies this assumption is doubtful. As the interest rate incorporates a risk premium, it may increase in line with the increase in debt, as shown in many studies (cf. Barrios *et al.*, 2009; Baldaci and Kumar, 2010; Maltritz, 2012; Afonso and Rault, 2015). An increase in debt that increases interest rates leads to a rise in interest payments and this, in turn requires a larger primary surplus to stabilize debt. Therefore with an endogenous interest rate the parameter α larger than 0 is not necessarily a sufficient condition for the debt being sustainable.

Addressing this issue Ghosh *et al.* (2013) introduced a concept of the debt limit, i.e. the level of public debt above which the government is no longer able to service its obligations, which makes the risk premium raise to infinity. A sufficient condition for fiscal sustainability in this set-up is that the response of primary balance to debt is greater than the interest rate – GDP growth rate differential. In the case of the a linear fiscal reaction function, as assumed in Bohn (1998), this condition can be expressed as follows:

$$\alpha > r^* - g \quad (2)$$

where r^* is a risk-free interest rate and *g* denotes the rate of growth of real GDP (treated as constant).

The assumption that the public debt below the debt limit is associated with the risk-free interest rate seems reasonable in the case of advanced economies, analyzed in Ghosh *et al.* (2013). Governments in many other emerging and transition countries face, however, higher costs of borrowing and the risk premium is positive (e.g. Paret, 2017). In order to take into account the possibility of endogenous interest rate, Mackiewicz-Łyziak and Łyziak (2019)

assume that the long-term interest rate consists of the risk-free interest rate, *r**, and the default risk, depending on the level of debt:

$$r_t = r^* + \beta d_t \tag{3}$$

In this case interest payments become a square function of debt. The authors show that in such circumstances fiscal sustainability is achieved if the difference between interest payments and primary balance, *z(d)*, is decreasing, i.e.:

$$z'(d) = r^* + 2\beta d - g - \alpha < 0 \Leftrightarrow \alpha > r^* + 2\beta d - g \tag{4}$$

In line with the above condition, fiscal sustainability requires parameter α to compensate additionally for the risk premium that is increasing with debt. For the countries that are able to borrow at a risk-free rate, this condition reduces to (2). In the remaining countries, the reaction of primary balance to debt has to be accordingly stronger to sustain sustainability.

To assess the degree of fiscal sustainability Mackiewicz-Łyziak and Łyziak (2019) propose a synthetic fiscal sustainability indicator (FSI), based on equation (4) and defined as follows:

$$FSI = \alpha - r^* - 2\beta d + g \tag{5}$$

Positive values of FSI indicate prudent fiscal policy, whose response to public debt is sufficiently strong to absorb the effects of pricing debt in financial markets. Its negative values suggest that fiscal policy sustainability is at risk.

According to this approach fiscal sustainability was confirmed in the case of 8 European countries, including Belgium, the Czech Republic, Denmark, Germany, Poland, Slovakia, Sweden and UK. In the case of two further countries – Romania and Slovenia – fiscal sustainability indicator was positive, but its value was not statistically different from zero. For these countries fiscal sustainability cannot be confirmed with certainty.

2. Assessing of impact of fiscal policy on inflation expectations

2.1. Methods

The principal way of assessing the impact of fiscal variables on inflation expectations in European economies is based on models of inflation expectations proposed by Cerisola and Gelos (2009). They explain inflation expectations with lagged inflation, central bank inflation

target, proxied with the constant term, and a broad set of macroeconomic variables that can influence future inflation. They include: the deviation of the real interest rate from the trend ($\hat{r}$)[1], the deviation of the nominal effective exchange rate from the trend ($\hat{e}^r$), industrial output gap ($\hat{y}$), unemployment gap ($\hat{u}$), the rate of growth of oil prices in international markets ($\Delta\pi^o$) and the deviation of public debt from its trend ($\hat{d}$). The estimated equation is the following:

$$\pi^e_{t+12|t} = \alpha_0 + \alpha^b \pi_{t-2} + \alpha^r \hat{r}_{t-l^r} + \alpha^e \hat{e}^r_{t-l^e} + \alpha^y \hat{y}_{t-l^y} + \alpha^u \hat{u}_{t-l^u} + \alpha^o \Delta\pi^o_{t-l^o} + \alpha^f \hat{d}_{t-l^d} + \varepsilon_t \quad (6)$$

In the case of variables expressed as deviations from their trends, the latter ones are approximated with the Hodrick-Prescott filter, similarly as in Cerisola and Gelos (2009). The choice of lags for independent variables ($l^{\cdot}$) is driven by their public availability at time *t* and statistical significance.

Another analytical approach to assess how fiscal policy impacts inflation expectations is based on derivation of implicit anchors for inflation expectations and checking their correlation with the Fiscal Sustainability Index. In estimating implicit anchors for inflation expectations we follow two approaches, based either on single-equation models (Kabundi *et al.*, 2015; Łyziak and Paloviita, 2018) or VAR models (Demertzis *et al.*, 2008, 2009; Łyziak and Paloviita, 2017).

The first approach uses the hybrid model of expectations' formation, which combines the models of static (simple adaptive) expectations and rational expectations (e.g. Gerberding, 2001; Carlson and Valev, 2002; Heineman and Ullrich, 2006; Łyziak and Mackiewicz-Łyziak, 2014):

$$\pi^e_{t+n|t} = \alpha_0 + \alpha^{INF} \pi_{t-1} + \alpha^{RE} \pi_{t+n} + \varepsilon_t, \quad (7)$$

where $\pi^e_{t+n|t}$ denotes inflation expectations set at time t with the forecast horizon $t+n$, π_{t-1} is the most recent inflation rate available to economic agents forming expectations, while π_{t+n} is the future inflation in the month corresponding to the forecasting horizon. Łyziak and

[1] We use inflation expectations of professional forecasters to calculate real interest rates.

Paloviita (2018) show that the implicit (perceived) inflation target, to which private sector inflation expectations converge in the long run, can be expressed as:

$$\pi^* = \frac{\hat{\alpha}_0}{1 - \hat{\alpha}^{INF} - \hat{\alpha}^{RE}} \tag{8}$$

with the share of economic agents setting their expectations in line with the perceived inflation target equal to $1 - \hat{\alpha}^{INF} - \hat{\alpha}^{RE}$. A similar approach was used by Kabundi *et al.* (2015) to calculate implicit inflation targets for analysts, business and trade unions in South Africa.

The second approach to estimate implicit inflation targets, based on Demertzis *et al.* (2008, 2009), uses bivariate VAR models, in which actual inflation and inflation expectations are endogenously determined, instead of single-equation models. In this way we consider the fact that inflation and inflation expectations are intrinsically related. We estimate VAR(p) models of the form:

$$\begin{bmatrix} \pi_t \\ \pi^e_{t|t+n} \end{bmatrix} = \begin{bmatrix} \alpha_0 \\ c_0 \end{bmatrix} + \begin{bmatrix} c_1 & d_1 \\ \dots & \dots \\ c_p & d_p \end{bmatrix} \begin{bmatrix} \pi_{t-1} & \dots & \pi_{t-p} \\ \pi^e_{t-1|t+n-1} & \dots & \pi^e_{t-p|t+n-p} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \tag{9}$$

for which the long-run solution is:

$$\pi = \frac{\alpha_0}{1-\alpha_1-\dots-\alpha_p} + \frac{b_1+\dots+b_p}{1-\alpha_1-\dots-\alpha_p}\pi^e \tag{10}$$

$$\pi^e = \frac{c_0}{1-d_1-\dots-d_p} + \frac{c_1+\dots+c_p}{1-d_1-\dots-d_p}\pi \tag{11}$$

On the basis of equation (11) the implicit perceived target and the share of economic agents setting expectations on its basis are given by:

$$\pi^* = \frac{c_0}{1-d_1-\dots-d_p-c_1-\dots-c_p} \tag{12}$$

$$\lambda = 1 - \frac{c_1 + \ldots + c_p}{1 - d_1 - \ldots - d_p} \tag{13}$$

In estimations, the selection of lags is based on the information criteria and the assessment of autocorrelation of residuals.

2.2. Data

In our study we use several different measures of inflation expectations for 23 EU countries[2]. As far as expert forecasters are concerned, we use 1-year-ahead and 2-year-ahead inflation forecasts based on Consensus Economics (CE) survey. As original CE data represent fixed-date forecasts, we calculate fixed-horizon forecasts calculated in line with Gerlach (2007), Dovern *et al.* (2012) and Łyziak and Paloviita (2017). In the case of consumers, we use mean of the distribution of expected inflation quantified on the basis of qualitative survey data from the European Commission Consumer Survey. Details of the measurement of consumer inflation expectations in European economies are discussed in Łyziak and Mackiewicz-Łyziak (2014) and Łyziak and Paloviita (2017).

As the measure of fiscal stance we use general government debt to GDP ratio. To ensure stationarity the variable is expressed as deviation from trend obtained by Hodrick-Prescott filter. The data on general government debt is published by Eurostat with quarterly frequency. For the aims of the study the data have been seasonally adjusted and transformed into monthly data using linear interpolation.

In addition to fiscal variable we use a set of controls that could potentially affect inflation expectations. As explained above, following Cerisola and Gelos (2009), lagged inflation represents backward-looking component of inflation expectations. Inflation rate is measured as a percentage change in consumer price index over 12 months. The forward-looking component of inflation expectations may be affected by the following variables (in addition to fiscal policy): real short-term interest rate, nominal effective exchange rate, industrial production and unemployment rate (all measured as deviation from trend) and the rate of growth of oil prices. The sources of these data are: IMF, OECD and national statistical offices.

[2] We included all EU countries, for which data were available.

For estimations for individual countries we use monthly data, ranging from January 2002 to September 2017 in the case of most countries (depending on data availability). For panel regression we use quarterly data.

3. Results

3.1. Individual countries

Tables 1-3 present estimation results based on the hybrid model of expectations formation (6), using 1-year-ahead CE expert inflation forecasts, 2-year-ahead CE expert inflation forecasts and 1-year-ahead consumer inflation expectations, respectively.

We observe that experts' inflation forecasts are less backward-looking than inflation expectations of consumers. For all countries lagged inflation is statistically significant in the formation of expert forecasts, but its weight is substantially lower than for consumers. The forward-looking component of forecasts is affected mainly by the real short-term interest rate and the exchange rate, in particular in the case of shorter forecasts, as well as industrial output. The results suggest that longer forecasts are less responsive to macroeconomic factors than shorter forecasts. However, the factors that influence forecasts of professionals are differentiated between countries.

Consumers attach much more weight to past inflation rate while forming expectations. They pay, however, less attention to other macroeconomic variables in comparison with professional forecasters. In fewer countries other macroeconomic factors were taken into account in forming consumer inflation expectations than in the case of experts.

Fiscal policy does not seem to be important factor influencing inflation expectations. In a majority of economies under consideration fiscal policy performance does not exert a statistically significant influence on inflation of the private sector.

In the case of 1-year-ahead and 2-year-ahead inflation forecasts by experts, large values of public debt lead to increase of expectations in Germany, Italy and Slovenia only. In the case of 1-year-ahead consumer inflation expectations, large values of public debt lead to increase of expectations in Germany, Italy, Austria and Finland. Among the above economies Fiscal Sustainability Indicator is negative in Austria and Italy only.

The concept of implicit anchors for inflation expectations refers to long-term expectations, which – under credible monetary policy – should not respond to movements in current inflation, but stay close to central bank inflation target. Therefore we derive the implicit inflation targets only for 2-year-ahead Consensus Economics forecasts (Table 4). In general they stay at levels consistent with the inflation targets of central banks under consideration. Table 5 shows that the correlation of the implicit targets with the Fiscal Sustainability Indicator is rather weak. As far as the weight of implicit targets is concerned, it displays a weak positive correlation with FSI. It would suggest that in countries with sustainable fiscal policy inflation expectations are more anchored and after shocks return to their implicit anchors faster relative to countries with unsustainable fiscal policy. However, these correlations are on the edge of statistical significance, therefore this relationship is not confirmed in a robust way.

A relatively small impact of fiscal policy performance on inflation expectations suggests that the private sector agent do not form their inflation expectations in accordance with the fiscal theory of the price level. It can reflect high degree of central bank credibility in analysed economies as well as the fact that fiscal policy in majority of these economies is constrained by the Stability and Growth Pact.

3.2. Panel regressions

In order to verify the main hypothesis of the study stating that the reaction of inflation expectations on fiscal variables may be different depending on the fiscal performance (sustainability vs. unsustainability of fiscal policy), we perform a panel analysis in addition to the estimation for individual countries. In this case we use quarterly data, therefore output gap replaces industrial production and unemployment as a measure of real activity. The rest of the variables are defined as before. We estimate equations for inflation expectations of consumers and professional forecasters using the whole sample of countries as well as for countries with sustainable and unsustainable fiscal policy separately. The division of countries into these both groups was made on the basis of the results presented in Mackiewicz-Łyziak and Łyziak (2019). The group of countries with sustainable fiscal policy includes Belgium, the Czech Republic, Denmark, Germany, Poland, Slovakia, Sweden and UK. The rest of the countries constitutes the group with unsustainable fiscal policy. In addition, we divide the whole sample of countries into two groups depending on the average level and volatility of inflation. According to our hypothesis in the countries with higher and more volatile inflation rate,

inflation expectations may react stronger to changes in macroeconomic environment, including fiscal variables. We perform the estimations using the fixed effects model with panel corrected standard errors.

Estimation results (Table 6) suggest that in general – for the whole sample of countries – inflation expectations of economic agents increase in response to increase in public debt level. Surprisingly, dividing the sample into groups of countries according to fiscal sustainability, a statistically significant impact of the fiscal variable on inflation expectations may be observed for the group of countries with sustainable fiscal policy. This result holds for both consumers' and professional forecasters' expectations. One possible interpretation of this finding may be that fiscal authorities conduct more responsible fiscal policy in those countries, where the reaction of economic agents on fiscal variables is stronger.[3]

As far as the differences between economies with lower and higher inflation are concerned, the only regularity similar for both consumers and professional forecasters is that in countries with higher inflation the role of current inflation in forming of inflation expectations is higher, i.e. expectations are more backward-looking than in countries with lower inflation. The response of expert forecasts to public debt is stronger in countries with higher inflation. The opposite effect may be observed in the case of consumer expectations.

Comparing the impact of other variables on inflation expectations of both groups of private sector agents, panel analysis confirms the results based on individual country data. Consumers seem to be more backward-looking than professional forecasters. They pay less attention to the output gap and the real interest rate, but they are more responsive to the exchange rate and oil prices than experts. This finding may constitute an important policy advice for central banks trying to influence inflation expectations of general public. Policy signaling through interest rates may be less effective than through the exchange rate. Using fiscal policy to affect inflation expectations may be successful only in selected countries.

3.3. Sensitivity analysis

To check the robustness of our results, we used alternative measures of fiscal sustainability to divide the EU countries into groups according to fiscal performance. For this aim we used two

[3] This would be in line with our previous results (Łyziak and Mackiewicz-Łyziak, 2019), showing that in countries with more sustainable fiscal policy, yields on long-term T-bonds react more to fiscal variables than in the economies with unsustainable fiscal policy (the effect of market-based fiscal discipline).

sustainability indicators published by the European Commission (EC), i.e. S1 and S2. The former indicator measures fiscal sustainability in the medium term, while the latter – in the long term.[4] We used the latest data from the Fiscal Sustainability Report 2018 (European Commission, 2019). EC assigns medium to high fiscal risk in the medium-term to the countries for which indicator S1 is higher than 0, and in the long-term – to the countries for which the value of indicator S2 is higher than 2. Therefore, the group of countries enjoying fiscal sustainability includes those with S1 indicator lower than 0, and – in the second case – with S2 indicator lower than 2.

The results of panel estimations for groups of countries divided according to S1 and S2 indicators (Table 7) confirm our findings concerning the impact of developments in public debt on professional forecasts of inflation. Independently of the indicator, according to which the division is made, professional forecasters take into account public debt in countries with fiscal sustainability, and do not pay attention to debt in the remaining countries. The opposite results we obtained for consumers. In the countries with higher fiscal risk consumers seem to respond to public debt increasing inflation expectations, while in the countries with low risk they do not pay attention to fiscal performance. This finding supports our hypothesis but, given our previous results, the effect of public debt on consumer inflation expectations is unclear and requires further research.

4. Conclusions

In this study we estimate the impact of public debt on the formation of inflation expectations of two groups of economic agents, consumers and professional forecasters. Our aim was to verify whether the strength of the response of inflation expectations to public debt depends on sustainability of fiscal policy. According to theory, fiscal performance may start to influence price level, if public debt is on unsustainable path. In consequence, unsustainable fiscal policy should affect inflation expectations, if economic agents are at least to some extent forward-looking. We estimate the inflation expectations equations for individual countries as well as we perform panel analysis dividing the countries into two groups: with sustainable and unsustainable fiscal policy, according to the results in Mackiewicz-Łyziak and Łyziak (2019). In addition, we analyze the perceived inflation targets and compare the results with the fiscal sustainability tests.

[4] The detailed description of the indicators can be found in European Commission (2019).

In general, our results do not support the hypothesis of the study. Although there is evidence that fiscal policy may affect inflation expectations, this impact differs across countries. Surprisingly, this impact is stronger in countries with sustainable fiscal policy. One possible interpretation of this fact may be that fiscal authorities conduct more responsible fiscal policy in those countries, where the reaction of economic agents to fiscal variables is stronger. The confirmation of this interpretation requires, however, further studies.

A relatively small impact of fiscal policy performance on inflation expectations can reflect high degree of central bank credibility in the analysed economies as well as the fact that fiscal policy in majority of these economies is constrained by the Stability and Growth Pact. Conclusions regarding factors that influence the forward-looking components of inflation expectations may have, however, important policy implications. Our results, apart from confirming much higher weight attached by consumers to past inflation than by professional forecasters, suggest that consumer expectations respond strongly to exchange rate and oil prices. This may indicate channels through which policymakers could affect inflation expectations of general public. Using fiscal policy for this aim may be effective only in selected economies.

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Tables

Table 1. Formation of 1-year-ahead CE expert inflation forecasts

	lagged inflation	interest rate	exchange rate	industrial output	unempl. rate	oil prices	public debt
Germany	0.440***	-0.328***	-3.534	4.704***	-0.024	-0.028	0.085**
	(0.047)	(0.123)	(2.989)	(1.374)	(0.237)	(0.106)	(0.036)
France	0.404***	-0.246**	-5.781**	2.972***	0.162	0.163*	-0.036
	(0.033)	(0.096)	(2.928)	(0.967)	(0.089)	(0.089)	(0.415)
UK	0.247***	-0.767***	2.065	14.304***	-0.555*	0.397**	0.061
	(0.060)	(0.177)	(2.120)	(4.615)	(0.295)	(0.178)	(0.372)
Italy	0.526***	-0.252***	-1.413	0.640	-0.042	0.290***	0.077***
	(0.021)	(0.073)	(1.868)	(1.086)	(0.069)	(0.084)	(0.028)
Netherlands	0.557***	-0.128	-8.609	0.359	-0.213	0.114	-0.097*
	(0.049)	(0.209)	(5.349)	(1.475)	(0.243)	(0.135)	(0.053)
Spain	0.441***	-0.113	-3.046	-0.854	-0.003	-0.132	0.029
	(0.040)	(0.103)	(2.765)	(1.843)	(0.088)	(0.102)	(0.035)
Sweden	0.414***	-0.513***	5.893***	1.965*	-0.022	0.109	0.004
	(0.024)	(0.093)	(1.482)	(1.101)	(0.060)	(0.073)	(0.031)
Austria	0.321***	-0.292**	-11.148**	3.082**	-0.062	-0.015	-0.015
	(0.042)	(0.118)	(4.755)	(1.239)	(0.096)	(0.010)	(0.022)
Belgium	0.293***	-0.219**	-2.187	0.648	-0.121	0.119	-0.050
	(0.024)	(0.105)	(2.777)	(0.904)	(0.079)	(0.082)	(0.035)
Denmark	0.332***	-0.009	-3.259	-0.475	-0.110	0.155*	-0.028
	(0.029)	(0.077)	(4.260)	(0.626)	(0.125)	(0.081)	(0.023)
Finland	0.389***	-0.373***	-6.495**	0.833	0.335	0.118	-0.041
	(0.029)	(0.125)	(3.165)	(0.815)	(0.220)	(0.079)	(0.026)
Greece	0.555***	-0.261*	-9.088	0.016	0.274	-0.341	0.013
	(0.065)	(0.161)	(5.767)	(2.293)	(0.229)	(0.247)	(0.030)
Ireland	0.269***	-0.385**	7.131	-0.401	-0.072	-0.324**	-0.022
	(0.038)	(0.153)	(5.626)	(0.383)	(0.150)	(0.145)	(0.031)
Portugal	0.306***	-0.458	-45.949*	-3.933	-0.078	-0.691	-0.006
	(0.117)	(0.223)	(25.380)	(4.857)	(0.440)	(0.503)	(0.080)
Czech Rep.	0.439***	-0.326**	-4.331*	1.489	0.149	0.118	-0.097
	(0.027)	(0.136)	(2.410)	(1.768)	(0.188)	(0.130)	(0.080)
Hungary	0.571***	-0.133	-10.079***	0.278	-0.267	-0.181	0.011
	(0.036)	(0.087)	(3.445)	(2.354)	(0.286)	(0.235)	(0.072)
Poland	0.457***	-0.315**	1.296	3.507**	-0.138	0.189	-0.005
	(0.023)	(0.134)	(1.056)	(1.673)	(0.126)	(0.143)	(0.026)
Croatia	0.409***	-0.023	-2.770	-2.267	-0.023	0.283	0.033
	(0.033)	(0.057)	(5.318)	(1.458)	(0.259)	(0.211)	(0.080)
Estonia	0.478***	-0.048	-27.209**	4.584*	-0.210	-0.085	0.023
	(0.035)	(0.167)	(10.600)	(2.433)	(0.143)	(0.248)	(0.273)
Latvia	0.447***	-0.115*	-10.849	10.273**	-0.255	-0.093	-0.088
	(0.043)	(0.066)	(9.496)	(4.595)	(0.160)	(0.351)	(0.101)
Lithuania	0.425***	-0.389***	-4.441	0.270	-0.502***	-0.371*	0.012
	(0.026)	(0.089)	(6.262)	(1.107)	(0.126)	(0.193)	(0.085)
Slovakia	0.566***	-0.137	-13.367	-1.794	0.131	-0.349	-0.089
	(0.050)	(0.294)	(9.214)	(2.282)	(0.247)	(0.212)	(0.173)
Slovenia	0.623***	-0.097	-15.965**	-1.452	0.154	-0.481***	0.089***
	(0.022)	(0.093)	(7.664)	(1.430)	(0.127)	(0.143)	(0.032)

Explanations: Ordinary least squares with Newey-West HAC standard errors. Numbers in parentheses below estimated coefficients are standard errors. *** denotes confidence level at 99 per cent; ** denotes confidence level at 95 percent; * denotes confidence level at 90 per cent.

Source: own calculations.

Table 2. Formation of 2-year-ahead CE expert inflation forecasts

	lagged inflation	interest rate	exchange rate	industrial output	unempl. rate	oil prices	public debt
Germany	0.227***	-0.122	-0.553	3.436**	-0.109	-0.148	0.067*
	(0.051)	(0.132)	(3.485)	(1.637)	(0.297)	(0.115)	(0.036)
France	0.239***	-0.051	-2.381	1.693*	0.339***	0.023	-0.072*
	(0.030)	(0.089)	(3.080)	(0.952)	(0.129)	(0.077)	(0.038)
UK	0.096***	-0.273**	-1.245	10.350***	-0.196	0.003	0.022
	(0.047)	(0.126)	(1.661)	(3.741)	(0.283)	(0.142)	(0.096)
Italy	0.370***	-0.123	-3.118	-1.555	-0.089	0.177**	0.071**
	(0.030)	(0.078)	(1.940)	(1.107)	(0.095)	(0.086)	(0.031)
Netherlands	0.358***	0.149	-13.846***	0.032	-0.315	0.133	-0.073
	(0.041)	(0.255)	(4.950)	(1.392)	(0.278)	(0.161)	(0.059)
Spain	0.263***	0.018	-1.157	-4.747***	0.118	-0.147	-0.040
	(0.040)	(0.095)	(2.999)	(1.707)	(0.084)	(0.125)	(0.043)
Sweden	0.197***	-0.028	3.685**	1.437	0.068	0.172**	0.021
	(0.024)	(0.129)	(1.474)	(1.037)	(0.082)	(0.086)	(0.034)
Austria	0.183***	-0.125	-5.782	2.855**	-0.020	-0.111	0.007
	(0.048)	(0.098)	(4.073)	(1.189)	(0.094)	(0.087)	(0.017)
Belgium	0.183***	-0.012	-2.841	-0.153	0.061	-0.043	-0.049
	(0.021)	(0.081)	(1.807)	(0.601)	(0.062)	(0.064)	(0.031)
Denmark	0.181***	0.031	-4.667	-0.433	-0.132	0.112**	-0.022
	(0.028)	(0.058)	(3.223)	(0.552)	(0.082)	(0.055)	(0.018)
Finland	0.248***	-0.218*	-8.378**	0.126	0.216	0.059	-0.041
	0.025)	(0.119)	(3.490)	(0.725)	(0.204)	(0.061)	(0.028)
Greece	0.235***	-0.151	-9.624*	1.871	0.169	-0.703**	-0.003
	(0.076)	(0.176)	(5.429)	(1.752)	(0.221)	(0.289)	(0.019)
Ireland	0.142***	-0.354**	0.579	0.238	-0.137	-0.360**	0.016
	(0.036)	(0.167)	(5.559)	(0.410)	(0.162)	(0.155)	(0.031)
Portugal	0.296***	-0.367*	-41.642*	-3.295	0.159	-0.689	0.006
	(0.103)	(0.189)	(21.239)	(4.333)	(0.353)	(0.442)	(0.070)
Czech Rep.	0.227***	0.149	-7.778***	0.196	-0.065	0.069	-0.052
	(0.039)	(0.170)	(2.587)	(2.099)	(0.200)	(0.174)	(0.106)
Hungary	0.335***	-0.163*	-12.707**	-1.058	-0.233	-0.258	-0.026
	(0.048)	(0.098)	(5.597)	(3.004)	(0.421)	(0.307)	(0.088)
Poland	0.226***	-0.009	1.446	4.040**	-0.222*	0.236	0.022
	(0.028)	(0.111)	(1.285)	(1.937)	(0.137)	(0.149)	(0.039)
Croatia	0.260***	-0.039	-7.131	-1.378	-0.113	0.115	0.041
	(0.034)	(0.053)	(4.811)	(1.621)	(0.286)	(0.214)	(0.075)
Estonia	0.306***	-0.280	-32.892**	2.618	-0.025	-0.296	-0.333
	(0.039)	(0.178)	(13.907)	(2.509)	(0.141)	(0.267)	(0.319)
Latvia	0.230***	-0.128	-24.677**	9.114*	-0.400*	0.208	-0.044
	(0.051)	(0.103)	(12.246)	(5.214)	(0.212)	(0.353)	(0.124)
Lithuania	0.274***	-0.430***	-10.534	0.009	-0.539***	-0.291	0.002
	(0.034)	(0.109)	(8.060)	(1.444)	(0.165)	(0.204)	(0.095)
Slovakia	0.435***	0.161	-18.641*	-2.947	-0.050	-0.470	-0.077
	(0.054)	(0.316)	(9.661)	(2.155)	(0.367)	(0.280)	(0.182)
Slovenia	0.527***	-0.012	-14.052*	-3.383**	0.077	-0.562***	0.078**
	(0.018)	(0.101)	(7.202)	(1.479)	(0.139)	(0.154)	(0.034)

Explanations: Ordinary least squares with Newey-West HAC standard errors. Numbers in parentheses below estimated coefficients are standard errors. *** denotes confidence level at 99 per cent; ** denotes confidence level at 95 percent; * denotes confidence level at 90 per cent.

Source: own calculations.

Table 3. Formation of 1-year-ahead consumer inflation expectations

	lagged inflation	interest rate	exchange rate	industrial output	unempl. rate	oil prices	public debt
Germany	0.898***	-0.029	-3.003	1.883*	0.199	-0.122	0.046**
	(0.059)	(0.115)	(2.360)	(1.090)	(0.180)	(0.085)	(0.022)
France	0.659***	0.046	3.059	4.702***	0.090	0.007	0.546***
	(0.072)	(0.184)	(6.283)	(1.809)	(0.183)	(0.079)	(0.105)
UK	0.740***	-0.188*	-0.138	3.321	-0.333*	0.371***	-0.036
	(0.055)	(0.108)	(1.317)	(2.714)	(0.177)	(0.118)	(0.060)
Italy	0.852***	0.786**	-7.994*	4.432**	0.445**	-0.283	0.255***
	(0.063)	(0.358)	(4.069)	(2.119)	(0.220)	(0.231)	(0.114)
Netherlands	0.463***	-0.037	-6.127	-0.447	-0.370	0.309***	-0.092***
	(0.074)	(0.140)	(3.907)	(1.303)	(0.244)	(0.112)	(0.035)
Spain	0.911***	0.054	9.102	6.917**	0.115	0.133	-0.050
	(0.056)	(0.153)	(5.585)	(3.150)	(0.179)	(0.187)	(0.085)
Sweden	0.718***	-0.213	2.403**	0.491	0.099	0.058	0.020
	(0.081)	(0.142)	(0.966)	(0.790)	(0.070)	(0.057)	(0.028)
Austria	0.815***	0.032	-2.554	1.112	0.190**	0.053	0.038**
	(0.086)	(0.114)	(5.567)	(1.351)	(0.086)	(0.067)	(0.019)
Belgium	0.697***	0.421**	-6.603	-0.082	-0.109	0.111	0.103
	(0.131)	(0.213)	(5.249)	(1.643)	(0.125)	(0.179)	(0.067)
Denmark	x	x	x	x	x	x	x
Finland	0.671***	-0.035	-5.572***	-0.114	0.025	0.123***	0.034*
	(0.060)	(0.080)	(1.971)	(0.488)	(0.117)	(0.045)	(0.019)
Greece	0.940***	0.150	-11.232	1.055	-0.853***	-0.086	0.020
	(0.059)	(0.228)	(7.389)	(2.313)	(0.308)	(0.216)	(0.019)
Ireland	x	x	x	x	x	x	x
Portugal	1.081***	-0.013	-26.667	5.964*	-0.406	0.956***	0.072
	(0.060)	(0.135)	(17.740)	(3.579)	(0.302)	(0.262)	(0.099)
Czech Rep.	1.118***	-0.229	-15.844***	4.153	0.230	0.577***	-0.011
	(0.042)	(0.225)	(3.779)	(2.808)	(0.284)	(0.173)	(0.126)
Hungary	1.472***	0.316	-22.563*	-0.280	-0.924	0.562	0.030
	(0.077)	(0.223)	(12.885)	(7.148)	(0.980)	(0.569)	(0.229)
Poland	1.082***	-0.090	-6.080	15.421**	0.082	0.081	0.075
	(0.084)	(0.253)	(3.741)	(6.999)	(0.246)	(0.233)	(0.068)
Croatia	0.980***	-0.071*	1.951	1.088	-0.191	-0.449***	-0.102
	(0.031)	(0.042)	(3.749)	(1.858)	(0.231)	(0.150)	(0.067)
Estonia	x	x	x	x	x	x	x
Latvia	0.728***	0.155**	-29.100**	11.832**	-0.245	1.346***	-0.019
	(0.034)	(0.075)	(11.260)	(5.526)	(0.184)	(0.420)	(0.085)
Lithuania	x	x	x	x	x	x	x
Slovakia	1.208***	-0.522	-39.260***	3.930	-0.066	0.549	-0.356
	(0.063)	(0.424)	(12.007)	(3.164)	(0.455)	(0.454)	(0.239)
Slovenia	1.231***	0.657***	-27.582	-3.114	0.616	-0.034	0.106
	(0.080)	(0.309)	(21.468)	(6.904)	(0.368)	(0.530)	(0.120)

Explanations: Ordinary least squares with Newey-West HAC standard errors. Numbers in parentheses below estimated coefficients are standard errors. *** denotes confidence level at 99 per cent; ** denotes confidence level at 95 percent; * denotes confidence level at 90 per cent.

Source: own calculations.

Table 4. Implicit anchors for 2-year-ahead CE expert inflation forecasts

	Inflation	VAR		Single equation	
		anchor	weight	anchor	weight
Germany	1.42	1.71	0.72	1.66	0.77
France	1.40	1.54	0.74	1.54	0.75
UK	2.16	2.65	1.02	2.70	0.87
Italy	1.68	1.68	0.61	1.76	0.55
Netherlands	1.66	1.66	0.94	1.69	0.65
Spain	2.02	1.90	0.65	2.09	0.46
Sweden	1.21	1.95	0.78	1.98	0.75
Austria	1.87	1.74	0.75	1.74	0.79
Belgium	1.93	1.70	0.78	1.71	0.81
Denmark	1.62	1.90	0.76	1.93	0.78
Finland	1.37	1.82	0.75	1.82	0.76
Greece	1.87	1.69	0.67	2.11	0.46
Ireland	1.53	1.81	0.69	2.12	0.60
Portugal	1.79	1.90	0.96	2.90	0.64
Czech Rep.	1.97	2.40	0.91	2.68	0.63
Hungary	3.77	3.39	0.76	3.39	0.72
Poland	1.99	2.54	0.74	2.72	0.68
Croatia	1.98	2.55	0.65	2.67	0.74
Estonia	3.20	2.75	0.73	2.76	0.67
Latvia	3.87	2.58	0.78	2.36	0.66
Lithuania	2.59	2.52	0.70	2.51	0.66
Slovakia	2.85	2.69	0.80	3.27	0.45
Slovenia	2.51	2.39	0.54	2.68	0.51

Source: own calculations.

Table 5. Correlations of FSI and implicit anchors for 2-year-ahead CE expert inflation forecasts

	Inflation	VAR		Single equation	
		implicit anchor	weight	implicit anchor	weight
Pearson correlation	-0.34	-0.02	0.26	0.02	0.26
Spearman correlation	-0.20	0.09	0.38	-0.02	0.28

Source: own calculations.

Table 6. Formation of 1-year-ahead consumer and CE experts' inflation expectations, panel analysis

	Whole sample	Countries with sustainable fiscal policy	Countries with unsustainable fiscal policy	Countries with higher inflation	Countries with lower inflation
Consumers					
Inflation	0.763***	0.995***	0.737***	0.787***	0.636***
	(0.043)	(0.059)	(0.047)	(0.048)	(0.024)
Output gap	-0.080	-0.031	-0.109	-0.128	0.046**
	(0.056)	(0.053)	(0.076)	(0.096)	(0.021)
Real interest rate	0.232	0.260**	0.173	0.357	-0.076
	(0.236)	(0.110)	(0.292)	(0.349)	(0.049)
Exchange rate	-21.039***	-6.416*	-44.774***	-36.265***	-3.313*
	(5.054)	(3.368)	(12.830)	(8.525)	(1.964)
Oil price	0.510***	-0.173	0.816***	1.245***	0.409***
	(0.182)	(0.186)	(0.243)	(0.357)	(0.067)
Debt	0.035*	0.075***	0.009	0.050	0.022**
	(0.019)	(0.028)	(0.023)	(0.037)	(0.010)
Adj. R^2	0.756	0.717	0.767	0.700	0.729
Professional forecasters					
Inflation	0.567***	0.468***	0.590***	0.601***	0.373***
	(0.013)	(0.015)	(0.014)	(0.014)	(0.013)
Output gap	0.030***	0.054***	0.006	0.036**	0.034***
	(0.011)	(0.015)	(0.016)	(0.016)	(0.011)
Real interest rate	-0.136***	-0.026	-0.186***	-0.162***	-0.024
	(0.042)	(0.038)	(0.053)	(0.059)	(0.028)
Exchange rate	-6.393***	-1.532	-17.430***	-10.171***	-1.580
	(1.656)	(1.152)	(3.820)	(2.553)	(1.395)
Oil price	0.013	0.209***	-0.027	0.119	0.337***
	(0.055)	(0.058)	(0.077)	(0.100)	(0.043)
Debt	0.017***	0.031***	-0.005	0.022**	0.002
	(0.006)	(0.009)	(0.009)	(0.011)	(0.006)
Adj. R^2	0.862	0.834	0.874	0.871	0.773

Source: own calculations.

Table 7. Formation of 1-year-ahead consumer and CE experts' inflation expectations, different samples

	Consumers		Professional forecasters	
	Countries with sustainable fiscal policy	**Countries with unsustainable fiscal policy**	**Countries with sustainable fiscal policy**	**Countries with unsustainable fiscal policy**
Sustainability measure: S1				
Inflation	0.494*** (0.087)	0.929*** (0.044)	0.424*** (0.016)	0.652*** (0.014)
Output gap	-0.065 (0.077)	0.065 (0.044)	0.085*** (0.013)	-0.028 (0.018)
Real interest rate	0.166 (0.324)	0.231 (0.152)	-0.176*** (0.044)	-0.068 (0.062)
Exchange rate	-22.231*** (6.315)	-18.300** (7.524)	-4.260*** (1.294)	-7.960*** (2.820)
Oil price	0.776*** (0.286)	0.491*** (0.180)	0.332*** (0.064)	0.070 (0.078)
Debt	0.019 (0.030)	0.056*** (0.020)	0.014* (0.007)	0.005 (0.010)
Adj. R^2	0.433	0.903	0.815	
Sustainability measure: S2				
Inflation	0.401*** (0.145)	0.872*** (0.035)	0.361*** (0.018)	0.617*** (0.013)
Output gap	-0.063 (0.124)	0.018 (0.032)	0.152*** (0.014)	-0.035*** (0.014)
Real interest rate	0.035 (0.284)	0.236 (0.237)	-0.169*** (0.037)	-0.149* (0.084)
Exchange rate	-27.614** (11.294)	-15.896*** (5.195)	-2.470 (2.054)	-7.064*** (1.846)
Oil price	0.715** (0.359)	0.577*** (0.157)	0.433*** (0.078)	0.264*** (0.063)
Debt	0.006 (0.057)	0.041*** (0.014)	0.022* (0.012)	-0.006 (0.007)
Adj. R^2	0.327	0.890	0.816	0.899

Source: own calculations.