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Asymmetric effects in the Polish monetary policy rule

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ABSTRACT

In this paper we investigate whether the reaction function of the National Bank of Poland (NBP) is asymmetric according to the level of inflation gap and the level of output gap. Moreover, we test whether these asymmetries might possibly stem from nonlinearities in the Phillips curve. Threshold models are applied and two cases of unknown and known threshold values are investigated. Our results show that the Polish central bank responds more strongly to the level inflation when the level of inflation is relatively high. We find very weak evidence that the level of inflation reacts more strongly to the output gap when the output gap is relatively high. Thus, the asymmetries in the monetary policy rule seem to indicate asymmetric preferences of the central bank.

1. Introduction

The aim of this paper is to search for asymmetric effects in the reaction function of the National Bank of Poland (NBP). We check whether the Polish monetary policy rule is asymmetric concerning the levels of the fundamental macroeconomic variables: inflation and output gaps. Encompassing the asymmetric elements in the reaction function might give a better explanation of the central bank's behavior. This, in turn, could help to form better expectations and forecasts and could be used to build more accurate econometric models of the economy.

Positive and negative deviations of inflation and output from the reference levels may be treated by monetary authorities differently. On the one hand, central banks may have asymmetric preferences. Some central banks attempt to stabilize output fluctuations accepting inflation being more volatile, it is because they might face some political heat or social pressure. These banks would have greater aversion to recessions than to expansions. Other central banks might be focused on inflation stabilization (e.g. strict inflation targeters) and have greater aversion to high than low inflation because, for instance, they need to build credibility after implementing an inflation targeting strategy. Cukierman and Muscatelli (2008) distinguish between recession avoidance preferences (RAP) and inflation avoidance preferences (IAP). In the former a central bank takes more precautions against negative output gaps, while in the latter more precautions are taken against positive inflation gaps. Such asymmetric preferences lead to nonlinear reaction functions, as the authors show RAP leads to concave Taylor rule while IAP to convex rule in both the inflation and output gaps.

On the other hand, central banks might take into account asymmetries in different channels of the monetary transmission process. Most importantly, the aggregate supply curve might be nonlinear. In empirical studies it is often argued that when the output gap is positive it has a positive impact on inflation, while when the output gap is negative it has very small deflationary impact (Baghli et al., 2007; Buchmann, 2009; Laxton et al., 1999; Pyyhtia, 1999). There are various explanations of this phenomenon, discussed later on, such as for instance nominal wage rigidities, capacity constraints, costly price adjustments, volatility of aggregate demand and supply shocks.

Lastly, the uncertainty regarding the NAIRU or the growth rate of productivity may lead to nonlinear interest rate policy, in such a case monetary authorities might need more time and data to make the decision. Therefore central banks might be more aggressive when the output gap reaches a certain threshold and more cautious when the output gap is small.

In this paper we follow a single equation approach. The structure of the economy is usually described by two basic equations, one represents the Phillips curve, and one the aggregate demand curve. And the monetary policy is assumed to minimize a loss function. If we assume that a central bank has a quadratic loss function in the inflation and output gaps and minimizes it subject to the linear structure of the economy, then we will obtain a linear reaction function. But the loss function and the structure of the economy may be nonlinear. Thus, when creating the model, there arise problems: how to choose the central bank's loss function, and should the AS and AD curves be forward-looking and/or backward-looking, and, perhaps nonlinear. Concerning the relevant theoretical models, Cukierman and Muscatelli (2008) and Fiodendji (2013) employ nonlinear loss functions making the assumption that the economic structure is linear. While Dolado et al. (2004) and Surico (2007) allow for both a nonlinear loss function and a nonlinear Phillips curve.

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Each of these studies uses either a fully backward-looking economy structure (Dolado et al., 2004; Fiodendji, 2013) or a fully forward-looking economy structure (Cukierman and Muscatelli, 2008; Surico, 2007).

Choosing the specific model is difficult and problematic. It requires imposing certain functional forms and making certain simplifications, and may lead to quite complicated formulas for a central bank's reaction function, particularly, for Poland which is a small open economy and is affected by a number of external factors. Moreover, the Polish Phillips curve seems to have both backward and forward-looking components. Therefore, in this study we do not assume any particular structure of the model and estimate single equations.

The structure of this paper is as follows. The next section contains a brief review of the literature concerning symmetric Taylor rule and asymmetric effects in both Taylor rule and Phillips curve. Sections 2 and 3 present our empirical strategy and data set. Section 4 reports the empirical results. The last section concludes.

2. Literature review

2.1. Studies on the Taylor rule

Originally Taylor (1993) specified a simple monetary policy rule, where a central bank's rate tends to increase when the inflation is above its target value and when the actual output is above the potential output. This original Taylor rule has been modified in many ways. The adjustment of the monetary policy rate appears not to be immediate, because central banks dislike jumps and tend to smooth adjustments in their interest rates (Judd and Rudebusch, 1998). The central bank's rate seems to depend on forecasts, because the effects of the change of a monetary policy rate appear with delay. The monetary authorities taking into account these delays set policy rates according to future movements of inflation and output gaps (Clarida et al., 2000). In estimations it is suggested to use real time data, which are available to policymakers at the time of making the decision (Orphanides, 2001, 2010). Moreover, many economists argue that central banks look on a broader set of factors, thus, standard monetary policy rules should be augmented by other macroeconomic variables. It is often proposed to extend the standard rule by: exchange rate, monetary aggregates, asset prices, long term and foreign interest rates, as well as some measures of financial stability. But in the empirical studies these variables often seem to have negligible impact.

Finally, many recent papers include threshold effects in a monetary policy reaction function. It is argued that the linear specifications can be too simple. Such an approach, also applied in our paper, enables us encompass the asymmetric behavior of central banks.

Bunzel and Enders (2010) find out strong evidence of threshold behavior of the Federal Reserve in a number of time periods between 1965 and 2007. Among others the authors present a model where the central bank is active when inflation is higher than the interim threshold and when the output gap is negative. It appears that the central bank is more aggressive when the system is above the threshold than when it is below. The model seems to fit the data best, what is more, the models with asymmetric effects give better out-of-sample forecasts than the linear models. But, the authors notice also a number of statistical problems that might arise while analyzing the asymmetries and result in quite dubious results. For example, the threshold value and Hansen's F statistic decrease when increasing the starting date, moreover, in the high inflation regime an excessive amount of interest rate smoothing may be observed.

Cukierman and Muscatelli (2008) using smooth transition regressions study nonlinearities in the monetary policy rule for the UK and the US. They emphasize that the character of nonlinearities changes substantially over different time periods and depends mainly on the regime and the macroeconomic situation. For instance in the 1979–1990 period in the UK the Taylor rule seems to be concave, that can be interpreted as dominance of recession avoidance preferences, whereas in 1992–2005 it appears to be convex, that might be interpreted as dominance of inflation avoidance preferences. Similar findings are presented for the US – where the Taylor rule varies across different chairmen of the Fed – inflation avoidance preference dominated under Martin and recession avoidance preference during Burns/Miller and Greenspan.

The asymmetric effects in the European Central Bank (ECB) reaction function were studied by many researchers. Aguiar and Martins (2008) point out that when a central bank needs to build credibility then it would be more precautionary as far as a price stability is concerned. Therefore, it would prefer to have inflation below the target level than above. Such asymmetry is shown for the Euro area throughout 1995–2005, as during this time period monetary policy had to establish its credibility. Whereas Surico (2003) estimates the asymmetric Taylor rule for the ECB concerning the sample 1997:7–2002:10 and finds equal reaction to inflation and deflation, but larger policy easing during output recessions than policy tightening during output expansions. Gerlach and Lewis (2011) estimate the ECB's monetary policy rule in 1999–2010 and detect a structural break after November 2008 (i.e. the switching point). Interestingly, they use a smooth transition model to avoid a discrete break. The authors focus on the recent financial crisis and show that the zero lower bound did not constrain monetary policy during the crisis.

Martin and Milas (2004), using a simple structural model, analyze monetary policy in the UK between 1963 and 2000, and test how the policy changed after implementing an inflation targeting strategy in 1992. The results show that after implementing the new strategy, monetary authorities were more concerned about the level of inflation. Moreover, they were more concerned about relatively higher than lower levels of inflation, thus, their behavior was asymmetric.

Fiodendji (2013), estimating a model derived from the optimization of central bank's behavior, examines the nonlinearities in the monetary policy reaction function in Canada. The author finds that the Bank of Canada reacted more aggressively to positive deviations of inflation from the target than to negative ones. Fiodendji underlines that the Bank of Canada implemented inflation targeting (IT) in 1991, that makes it a good case for testing the asymmetric effects. Similarly, the National Bank of Poland, which implemented the IT in 1998, seems to be an interesting case.

Vasicek (2012) investigates the Taylor rules for the Czech Republic, Hungary, and Poland and searches for asymmetries assigned to the level of inflation, output gap and financial stress. Vasicek does not find nonlinearities in the Polish Phillips curve and, that is rather strange, he finds little evidence of any linear or nonlinear relationship between inflation and the stance of the business cycle. The author states that there are no asymmetries in the Taylor rule as far as the level of inflation is concerned, but there are some along the business cycle. Our results are very different, it is probably because of different specifications of the Phillips curve and the Taylor rule, such as different calculations of the output and inflation gaps, different interbank rates used as well as consideration of different time periods.

2.2. Nonlinear Phillips curve and its implications

The Phillips curve has generally been estimated in a linear framework,[1] even though the original work of Phillips (1958) and many other theoretical works pointed to a nonlinear relationship. Nonlinearity of the Phillips curve means that the effectiveness of monetary policy depends on the phase of the business cycle and that the cost of disinflation is changing. Thus, a nonlinear monetary policy reaction function might stem from a nonlinear Phillips curve.

Convexity of the Phillips curve implies that when the output gap becomes more positive inflationary effects of shifts in aggregate demand are ceteris paribus higher while real effects are lower. If the economy

[1] The studies mainly concerned the neutrality of money in the short and the long terms and the existence of the relation between economic activity and inflation at all.