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RESPONSES OF THE POLISH ECONOMY TO DEMAND AND SUPPLY SHOCKS UNDER ALTERNATIVE FISCAL POLICY RULES



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Responses of the Polish economy to demand and supply shocks under alternative fiscal policy rules

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Abstract

Recent experiences of many countries during the crisis restored the important dilemma that fiscal policymakers face of how to alleviate the demand contraction while ensuring sustainability of public finances in the long-term.

In this paper we study the consequences of the demand and supply shocks for Poland under alternative policy scenarios. Using a macroeconomic model of the Polish economy, we analyse the response of the economy to shocks under several fiscal policy rules. We try to answer the questions which fiscal rule works best in terms of public finance sustainability and business cycle fluctuations stabilization while taking into account the source of shocks to the economy.

We found that structural balance rule and expenditure rule act counter-cyclically in the whole simulation period, but at the same time the pace at which they stabilize public debt is quite slow.

Keywords: fiscal rules, model simulations, demand shocks, supply shocks

JEL Classification: E17, E37, E62, H30, H62, H63

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1 Introduction

Recent experiences of the crisis restored the important dilemma that fiscal policymakers face of how to alleviate the demand contraction while ensuring sustainability of public finances in the longer term. As the crisis aggravated, countries all over the world introduced fiscal impulses into the economy during 2008-2009 period. That has led to the sharp increase in fiscal deficits and public debt both in advanced as well as developing countries (OECD, 2009).

In light of the above, the notion of fiscal rules reappeared. Fiscal rules are institutional mechanisms aimed at supporting fiscal credibility and discipline. Essential goal of a fiscal rule is to promote debt sustainability. However, apart from being credible, fiscal rule should also be sufficiently flexible in response to shocks hitting the economy. The situation in Poland during the crisis might be treated as an example of how automatic stabilizers cushioned the global shock. Owing to them, economic slowdown in Poland probably was not that severe as it could be otherwise. Moreover, perfect timing of the fiscal stimulus contributed significantly to better than in other European countries economic situation in Poland (see e.g. OECD, 2010). Thus, important aspect of a fiscal rule is its flexibility to respond to shocks affecting the economy.

In the spirit of the discussion above, in this paper we analyse alternative fiscal policy rules in terms of both their effectiveness in restoring sustainable public debt position as well as their ability to cushion several shocks affecting the economy. We consider four fiscal policy rules: simple balance rule, structural balance rule, augmented growth-based balance rule and expenditure rule. The behaviour of these rules is analysed under four scenarios in which different shocks affect Polish economy. We consider a boom-bust scenario, interest rates shock scenario, positive price shock scenario and positive productivity shock scenario (a supply shock scenario).

The paper is organized as follows. Section 1 introduces. In section 2 we briefly present fiscal stance in Poland after recent crisis and argue that there is a huge need of designing new fiscal policy rules. In this context, in section 3 we discuss so far introduced fiscal rules in Poland. Section 4 discusses properties of alternative fiscal policy rules and refers to simulation conclusions of the analysis conducted by the IMF (2009). In section 5 we introduce fiscal policy rules that we simulate in the econometric model of the Polish economy developed within the Ministry of Finance (eMPF model). Section 6 presents results of our simulations and section 7 concludes.

2 Fiscal policy rules in the current crisis context – the case of Poland

Although Poland is the only country among OECD members that recorded positive GDP growth in 2009, economic activity has weakened considerably and GDP growth decelerated from 6.0% on average in 2006-2008 to 1.8% in 2009. As first symptoms of economic slowdown in Poland at the end of 2008 occurred, the country's authorities started to stabilize the economy with the magnitude of an implemented anti-crisis plan of about 0.7% of GDP in 2009 as measured in terms of changes in the structural balance (according to OECD, 2010). In 2008 general government deficit widened to 3.7% of GDP (from 1.9% of GDP in 2007), breaching the Maastricht Treaty reference value of 3% GDP. It was caused by cyclical factors, i.e. decreasing public revenues together with increasing expenditure as GDP growth weakened. In 2009 general government deficit expanded towards 7.1% of GDP with public debt amounting to 51.0% of GDP. It resulted both from cyclical deterioration of the economic activity as well as structural reforms (among others lowering the tax wedge started in 2007 and continued in 2009 as well as children allowance). In July 2009 the ECOFIN Council imposed the Excessive Deficit Procedure on Poland with the recommendation that the country corrects its general government deficit by lowering its value to below 3% of GDP by the end of 2012.

Figure 1a may serve as an illustration of the fiscal situation in Poland depending on the business cycle phase. On this graph the change in the primary cyclically adjusted government balance versus the output gap is presented. As is visible from this graph, in 2008 we observed pro-cyclical relaxation in Poland. In 2009 the situation changed and there was counter-cyclical relaxation in the country. Both Polish experts as well as international institutions have agreed that the timing of the fiscal stimulus in Poland was an important factor that supported Poland during the crisis (see e.g. OECD, 2010). On average, during 2008-2009 fiscal policy in Poland turned to pro-cyclical relaxation meaning that adverse developments of 2008 (from the budget deficit point of view) prevailed. On Figure 1b Poland's situation in this context is illustrated together with the situation in other EU countries. While fiscal policy in Poland in 2008-2009 was pro-cyclically relaxed, fiscal policy loosening was counter-cyclical on average in the European Union and euro area. However, the relaxation in Poland at that time was less pro-cyclical than in the Czech Republic, Cyprus and Slovenia, and significantly less pro-cyclical than in Greece, Slovakia and Romania.

It is apparent that fiscal policy was used as a stabilization instrument during the crisis. As crisis is ending, an important "exit strategy" question emerges in all countries touched by the crisis. Main challenge for fiscal policy is to develop credible strategies for strengthening public finances. To be stable, the recovery should be followed by consistent improvement of the

country's fiscal position. The crisis restored the discussion of implementation and effectiveness of alternative fiscal policy rules. One confirmation of this are ongoing discussions within the European Commission concerning strengthening the institutional framework of fiscal policy.

Fiscal rules are institutional mechanisms aimed at supporting fiscal credibility and discipline. Essential goal of the fiscal rules is to promote debt sustainability. As Wyplosz (2005) remarks, the difficulty here is that, as opposed to the monetary policy for instance, fiscal discipline objective is not as clear-cut. It is due to the fact that government respects its intertemporal budget constraint, which by definition refers to (possibly infinitely) long horizon. A rule has to be credible in order to put the debt back on the sustainable path, but it should also have adequate flexibility in responding to shocks. As rules are aimed at long-term fiscal discipline, short-term goal of stabilizing business cycle is ignored, implying the risk that fiscal policy becomes procyclical (Wyplosz, 2005). The IMF (2009) also mentions the "sufficient flexibility to respond to shocks" as one of the three dimensions of effectiveness of the fiscal policy rules. Simulation analysis of the IMF (2009) shows that cyclically balanced rules are superior in dealing with output shocks, but at the same time cyclical adjustment is needed. In the short run, fiscal policy may also make a contribution to output stabilization over the business cycle.

However, in transition from crisis to normalcy, the specific circumstances of a country should be taken into account while designing appropriate fiscal rule. In countries that need substantial fiscal consolidation, realistic consolidation plan should precede the implementation of the rule. As the IMF notice, early implementation of the rule in a highly uncertain after-the-crisis environment may be infeasible in terms of the real economy adjustment needed (IMF, 2009). In addition, working on the fiscal rule the cyclical position of the economy should be taken into account.

3 Fiscal rules in Poland

As the EU member state, Poland is committed to comply with the Stability and Growth Pact (henceforth SGP) meaning that excessive (i.e. more than 3% of GDP) general government deficit is to be avoided and the public debt-to-GDP ratio should not surpass 60% of GDP.

The only one formal fiscal rule in Poland, introduced in the constitution, is consistent with SGP debt criterion. In addition, there are two intermediate debt thresholds at 50% and 55% defined in the Public Finance Act to prevent the 60% ratio from being breached. According to this act, if the public debt exceeds 50% of GDP in year t , the state budget deficit for the following year $t+2$ cannot be larger as a share of total revenues than in the current year $t+1$. If public debt exceeds 55% in year t , among others the following steps are switched on. The state

budget deficit must be reduced to zero for the following year $t + 2$ or set at a level that ensures that the debt to GDP ratio will not exceed the level reached in year t . Moreover, wages in the public sector are frozen starting with year $t + 2$ and indexation of pensions is limited to inflation in the current year $t + 1$. There are also restraints on the level of deficit for the sub-national governments, with allowed increases in expenditure mainly resulting from the co-financing of EU related projects. Finally, if the public debt breaches 60% of GDP, the government has to submit to Parliament an economic programme to lower the debt to GDP ratio to below 60%. In addition, all automatic consolidation measures at the central government level at above the 55% threshold apply, but also the proposed local budgets have to be balanced for the next year $t + 2$ and public finance entities cannot issue new guarantees.

In response to deteriorating public finance situation due to crisis, in January 2010 the government published a development and public finance consolidation plan which heralds introduction of the two fiscal rules. First one, temporary, would aim at reduction of the structural deficit to 1% of GDP (i.e. to the medium term objective level - MTO). It would be based on limiting real expenditure growth of the central government to 1% annually. However, as it applies only to expenditure that is "not determined by already enacted laws", it will effectively cover only up to 15% of general government sector expenditure. Second rule, of more permanent character, would stabilize the structural deficit at the MTO level. It is meant to be counter-cyclical and refers to the average GDP growth in several years. The plan also states that an additional mechanism reducing public expenditure below 40% GDP may also be needed.

4 Properties of alternative fiscal rules

In this section properties of alternative fiscal policy rules against several economic policy objectives are discussed. The so far theoretically discussed fiscal rules will then be considered in the context of model simulations in section 5 and 6.

There are essentially four general kind of rules (IMF, 2009):

- Budget balance rules that target either overall balance, structural balance, cyclically adjusted balance, or balance "over the cycle"; they help ensure that the debt-to-GDP ratio converges to the finite level
- Debt rules targeting the public debt in percent of GDP
- Expenditure rules setting the limits on total, primary or current spending. As they usually do not constrain the revenue side at the same time, they might lead to widening deficit and debt

- Revenue rules that set ceilings or floors on revenues and are aimed at boosting revenue collection and/or preventing an excessive tax burden. As they usually do not constrain the spending side at the same time, they might lead to widening deficit and debt.

Of the abovementioned fiscal rules, two of them render the risk of pro-cyclicality by definition: budget balance rule and debt rule. As automatic stabilizers are stronger on the revenue side, also revenue rules tend to result in pro-cyclical fiscal policy. It means that these rules might prove less effective in terms of stabilizing business cycle fluctuations. A cyclically adjusted and structural balance rule allow automatic stabilizers to operate in full, though there is no leeway for discretionary fiscal stimulus. Expenditure rules are consistent with cyclical and discretionary reductions in tax revenues, but they do not normally permit discretionary expenditure stimulus (IMF, 2009).

The IMF (2009) simulates behaviour of several fiscal rules under alternative macroeconomic scenarios. In a baseline scenario considered by the IMF GDP growth of 4.0% in the simulation period is assumed. The alternative scenarios taken into account are large shock scenario which assumes that GDP growth declines in period $T + 1$ to -3.0% from 4.0% in T , low growth scenario in which GDP growth declines to 3.0% in period $T + 1$ and the boom-bust scenario. Three alternative cyclically adjusted balance rules are considered: a basic structural balance, an augmented growth-based and an augmented structural balance rule (for details see IMF, 2009).

As authors of the analysis conclude, all rules considered allow for progressive narrowing of the budget deficit after the initial shock according to the large growth shock scenario. Basic structural balance rule outperforms other rules in terms of letting automatic stabilizers operate during the periods in which there is a non-zero output gap. However, it is less effective in reducing public debt. More successful in providing fiscal policy correction (and also debt sustainability) are the augmented structural balance and augmented growth-based balance rules. However, it is at the cost of a more limited counter-cyclical response to the shock (stronger for the augmented structural balance rule). The authors stress that simulations highlight the trade-off between macroeconomic volatility and debt sustainability (see IMF, 2009).

In the low-growth scenario, the augmented growth-based balance rule ensures debt consolidation. This rule leads to fastest reduction in debt as overall balance is tightened both as a result of a return of the output growth to trend growth and operation of a deficit-convergence mechanism. In the low-growth scenario considered, basic structural balance rule could lead to explosive debt-to-GDP ratio as it allows automatic stabilizers to expand. This can be amended with structural balance rules by requiring the deficit to eventually converge to zero but this process is slow.

In the boom-bust scenario, augmented structural balance rule works better. Under this scenario, all rules considered reduce the fluctuations in fiscal balance compared to basic structural

balance rule, since they include mechanisms for reducing the surplus as output-or GDP growth-increasingly deviates from potential. In the long run however, all rules induce a surplus in the primary balance and consequently, the debt ratio would follow a downward path following the bust period (IMF, 2009).

The abovementioned analysis of the IMF experts was an inspiration for us to simulate the behaviour of the Polish economy in response to several shocks under alternative fiscal policy rules. As our simulations are run within the macroeconomic model of the Polish economy, we are able to take into account the feedbacks between economy and fiscal policy. Our analysis seems to be different from that of the IMF's in that they use exogenous paths for macroeconomic variables (such as GDP growth and output gap) and in our case all variables are determined within the system.

5 Rules to be simulated within the model of the Polish economy

The performance of various fiscal rules in the Polish economy will be analysed within the structural macroeconomic model developed in the Polish Ministry of Finance (the eMPF model – for description see Dudek et al., 2010). eMPF is a medium-scale quarterly econometric model of the Polish economy. It consists of 250 equations, of which 50 are stochastic. The supply side is modelled in accordance with the classical paradigm and in the short-run the adjustments are in place. Behavioural equations are of standard error correction mechanism form which enables short-run deviations from a long-run equilibrium to be corrected. As it is developed within the Ministry of Finance, it contains detailed general government sector block. However, there are no fiscal policy rules built in so far.

Alternative fiscal rules will be confronted both in terms of their ability to stabilize public debt-to-GDP ratio as well as their flexibility in responsiveness to different macroeconomic shocks. The following shocks will be considered: a boom-bust world economy development, interest rate increase, positive price shock and positive shock to productivity. In this context, alternative fiscal policy rules will be analysed, namely the balance rule, the structural balance rule, the augmented growth-based balance rule and the expenditure rule.

The balance rule assumes that the budget balance in a given year is equal to the medium-term balance target. The rule may be simply written as follows:

$$b_t = b^*, \tag{1}$$

where b_t means budget balance in a given year and b^* – medium-term balance target (medium-term target of -1% GDP is assumed).

The structural balance rule is a variant of the simple balance rule that assumes nominal budget balance is adjusting towards medium-term balance target corrected for a cyclical position of an economy (measured with the output gap). It may be written as:

$$b_t = b^* + agap_t, \quad a > 0, \quad (2)$$

where gap_t means output gap (as a percentage of a potential GDP) in a given year and a stands for semi-elasticity of the balance in response to the output gap. We assume that semi-elasticity in response to the output gap equals 0.5.

The augmented growth-based balance rule is similar to the structural balance rule, but the medium-term budget balance is adjusted for the difference between actual and long-term (trend) GDP growth instead of changes in the output gap. We may write this rule as:

$$b_t = b^* + a(g_t^y - g_t^{y*}) + c(b_{t-1} - b^*), \quad a > 0.5, 0 < c < 1, \quad (3)$$

where g_t^y stands for actual GDP growth in a period t , g_t^{y*} is trend GDP growth (the average GDP growth of the last five years is taken as a target) and measures the speed of adjustment when nominal budget balance departs from the medium-term target. We assume 0.1 elasticity of the budget balance in response to the budget balance gap and 0.5 elasticity in response to the GDP growth gap.

The expenditure rule sets limit for public expenditures according to the cyclically adjusted public revenues. This rule may be written as follows:

$$exp_t = rev_t / (1 + gap_t), \quad (4)$$

where exp_t is expenditure ceiling in the budget, rev_t is the actual revenue and gap_t is the output gap in period t .

In all simulations the budget deficit target of 1% GDP is assumed. The simulations are run in a way that main adjustment category is public sector wage. At the same time constant ratio of public sector investments to compensation in this sector is assumed, so that in practice also public investments are adjusting in response to shocks. We assumed quarterly adjustment in response to shocks what is due to numerical optimization procedures.

6 Empirical results

The behaviour of the abovementioned rules is simulated under four alternative macroeconomic scenarios in the eleven-year period (44 quarters). The simulation results are presented in a comparison to the baseline scenarios. There are altogether four baseline scenarios - one for each

fiscal rule. This is due to differences in behaviour of fiscal policy rules considered, implying different paths for macroeconomic variables in each baseline scenario. As a point of departure, the economy in the model was put on the path that ensures 1% of GDP budget deficit. Thus, the characteristics of the economy introduced into the model in a point of departure are far from actual situation in Poland. This was done in order to let the rules switch on and operate according to their properties, so that the responses of the rules to various macroeconomic shocks could be analysed.

In the boom-bust scenario (S1) a 4% real GDP growth during four consecutive years is assumed, 6% decline in the next three years, and stagnation afterwards. Under the supply shock scenario (S2) it is assumed that quarterly productivity growth doubles in the first year of the simulation period (an impulse shock), meaning that it reaches around 5% growth annually. Another scenario (S3) tests the responses of the fiscal rules to a 1 pp. interest rate increase shock in all periods (a sustained shock). Scenario S4 assumes that deflator of the value added in a market sector goes up by 3% in the first quarter of the simulation period (an impulse shock). Table 1 below summarizes these scenarios assumptions.

Table 1. Scenarios assumptions

Period	T+1	T+2	T+3	T+4	T+5	T+6	T+7	T+8	T+9	T+10	T+11
Scenarios											
Weighted external demand (%)											
Boom-bust scenario (S1)	+4pp.			-6pp.			0pp.				
Scenario 2 (S2) TFP shock	+100%										
Scenario 3 (S3) Interest rate	+1 pp.										
Scenario 4 (S4) Price shock	+3% q1										

Source: own compilation

As discussed above, the aim of our analysis is to present the response of the Polish economy to shocks under alternative fiscal policy rules. Effectiveness of the rules will be analysed both in terms of their ability to stabilize public debt to GDP ratio as well as their counter-cyclicity. The assessment will be done more in qualitative than quantitative terms, on the basis of the impulse response functions. In respect to the first criterion, as public debt stabilizes for all rules considered (see further this section), the pace of debt convergence to the baseline after a shock is taken into account. Counter-cyclicity condition (our second assessment criterion) is defined in a way that it is met if government sector balance improves when percentage deviation of the output gap from the baseline is positive and deteriorates when this deviation is negative.

Reactions of several fiscal and macroeconomic variables are presented on the graphs for all rules under each scenario. The responses of relevant variables are presented as a deviation from the baseline scenario either in percentage of the baseline or in percentage points, depending on how a specific variable is expressed. The results are presented on Figures 2 to 6 at the end of the paper. Our scenarios results are discussed in more detail below.

Scenario 1

Under the boom-bust development of the world economy (S1), Polish GDP varies accordingly in the whole simulation period. The boom period leads to reduction of the share of the public sector in the economy, resulting in lower public revenues and expenditures as well as public debt in relation to GDP. As expenditures fall by more than revenues (in relation to GDP), it results in fiscal policy contraction and fiscal deficit reduction with all the rules acting, apart from the simple balance rule. As a consequence, GDP growth slows down. In the recession phase of the cycle, these tendencies are reversed.

Although all the rules apart from the simple balance rule act counter-cyclically (government sector balance improves when percentage deviation of the output gap from the baseline is positive and deteriorates as this deviation is negative), at the ending part of the simulation period the augmented growth-based balance rule starts acting pro-cyclically. All the rules behave very similarly in terms of stabilizing public debt, but simple balance rule stabilizes this category most quickly (however at the expense of lower business cycle stability) (see Figure 2).

Scenario 2

Under positive shock to productivity (scenario S2), potential GDP growth is higher than in the baseline scenario. The consequence of initial misalignment of real versus potential GDP growth is fiscal policy relaxation and government deficit widening in the first part of the simulation period under the operation of all the rules.

All rules are effective in terms of business cycle stabilization (they act counter-cyclically), although shortly after the initial impulse the augmented growth-based balance rule becomes slightly pro-cyclical what is a result of this rule defined in reference to the average GDP growth in five years. Similarly to other rules it is also counter-cyclical in the reminder simulation period. All rules stabilize public debt, although simple balance rule and augmented growth-based balance rule lead to debt-to-GDP ratio stabilization at only slightly higher level than in the baseline (see Figure 3).

Scenario 3

Under interest rate shock (scenario S3) government expenditures are growing in the whole sim-

ulation period as debt service expenses are increasing. At the same time, government sector balance deteriorates (with respect to the baseline scenario) only just after introduction of the shock. Since then, the balance significantly improves (most rapidly in case of augmented growth-based rule) as a result of the operation of the rules.

Again, structural balance rule and expenditure rule both act counter-cyclically in the whole period considered. At the very end of the simulation period the augmented growth-based balance rule turns out to be pro-cyclical. All rules lead to stabilizing public debt-to-GDP ratio, however the pace of adjustment is different depending on the rules. Simple balance rule and augmented growth-based balance rule both stabilize public debt much more rapidly than other two rules (see Figure 4).

Scenario 4

Under positive price shock (scenario S4), inflationary loop works towards higher price growth as compared with the initial impulse at the beginning part of the simulation period, leading to a decline in domestic and external demand. As a result, real GDP growth falls in the first part of the simulation period in comparison with the baseline scenario. GDP and output gap contraction make fiscal rules acting. After the initial impulse export is feeding on the real depreciation of the exchange rate resulting in GDP growth.

Structural balance rule and expenditure rule both act counter-cyclically in the whole period considered. At the very end of the simulation period the augmented growth-based balance rule turned out to be pro-cyclical. Simple balance rule proves the least effective in terms of business cycle stabilization, but at the same time it is able to stabilize public debt most quickly (see Figure 5).

As debt stabilization is one of the two criteria of comparison for the rules, in addition to the above observations, we also extend the simulation sample by twenty years (80 quarters) to better illustrate long-run behavior of the public debt after the shocks. On Figure 6 we present debt to GDP ratio altogether for the four rules considered under our simulation scenarios. From the graph it is visible that debt-to-GDP-ratio stabilizes under all scenarios at around 26-33%, depending on a rule and scenario. This is a result of our assumptions concerning world demand and medium-term budget target.

Table 2 below summarizes the properties of different types of fiscal rules considered under all scenarios against our two assessment criteria (rules objectives). From this table the apparent trade-off between the pace of debt stabilization and business cycle fluctuations alleviation is visible. Rules stabilizing debt more quickly are worse in terms of macroeconomic shocks sup-

pression (and vice versa).

Table 2. Properties of alternative fiscal rules in all scenarios against two objectives

Objectives	Rules			
	Simple balance	Structural balance	Augmented growth-based balance	Expenditure
<i>Debt sustainability</i>				
S1	++	+	+	+
S2	++	+	++	+
S3	++	+	+	+
S4	++	+	+	+
<i>Counter-cyclical</i>				
S1	0	++	-	++
S2	0	++	-	++
S3	0	++	-	++
S4	0	++	-	++

+ indicates goal achievement, - indicates lack of goal achievement, 0 means that the goal does not apply for the rule

Source: own compilation

7 Conclusions

The aim of this paper was to analyse alternative fiscal policy rules in terms of both their effectiveness in restoring the sustainable debt level as well as their ability to cushion several shocks affecting the economy. Simulations of the four fiscal rules under alternative macroeconomic scenarios were conducted within the macroeconometric model of the Polish economy. The behaviour of fiscal rules was compared in each scenario with the baseline scenario. In general, our simulations show that there is virtually no difference in operation of the structural balance and expenditure rule. Our results reveal the trade-off between fiscal consolidation and business cycle fluctuations alleviation. This was also found by the International Monetary Fund experts (IMF, 2009).

We found that structural balance rule and expenditure rule act counter-cyclically in the whole simulation period, but at the same time the pace at which they stabilize public debt is relatively slow. It should be kept in mind though, that we assume the constant level of budget balance target, so it does not take into account the long-term GDP growth. As we could expect, the simple balance rule proves the least effective in terms of business cycle stabilization, but at the same time under operation of this rule public debt-to-GDP ratio stabilizes most rapidly. However, it should be kept in mind that results presented here are dependant on the assumptions made, especially in terms of the parameters of rules introduced into the model.

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Figure 1a. Cyclicity of fiscal policy in Poland, 1996-2009

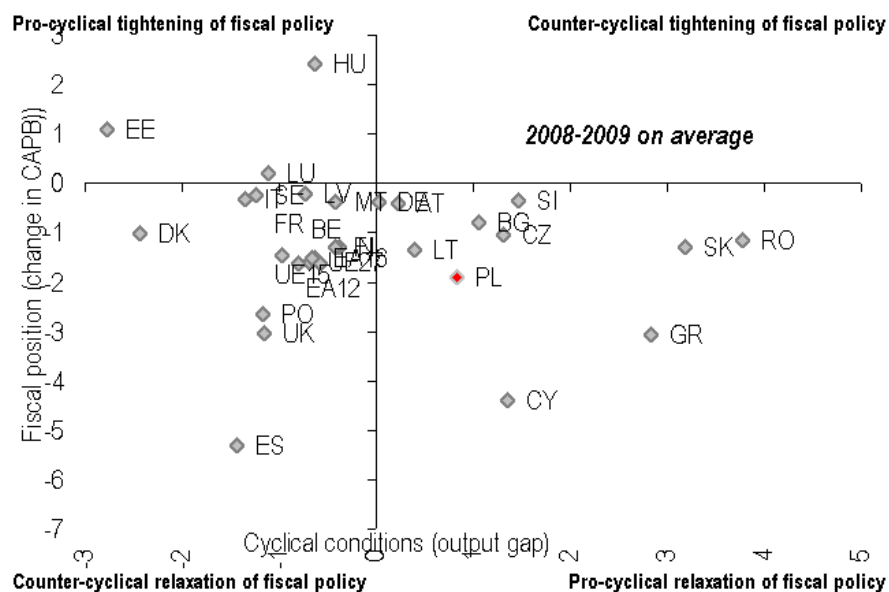
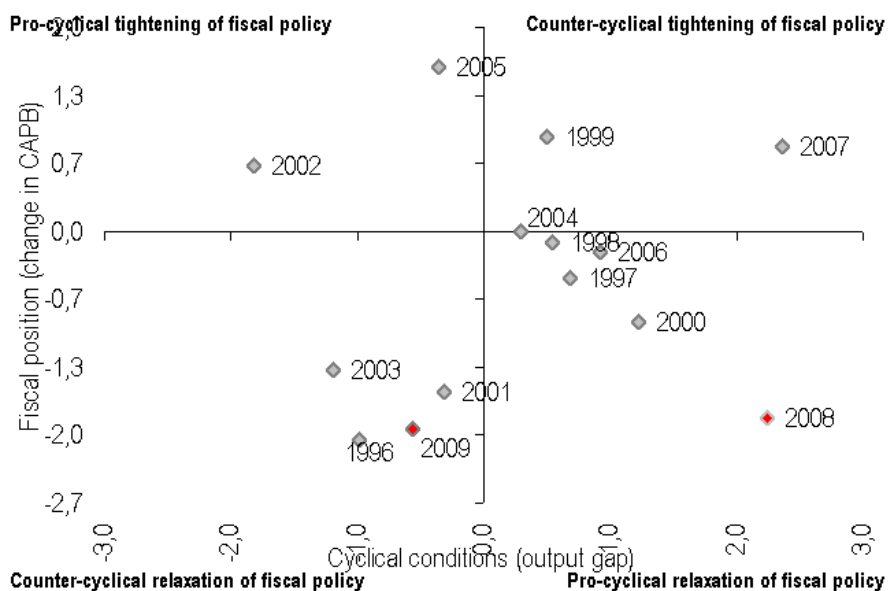
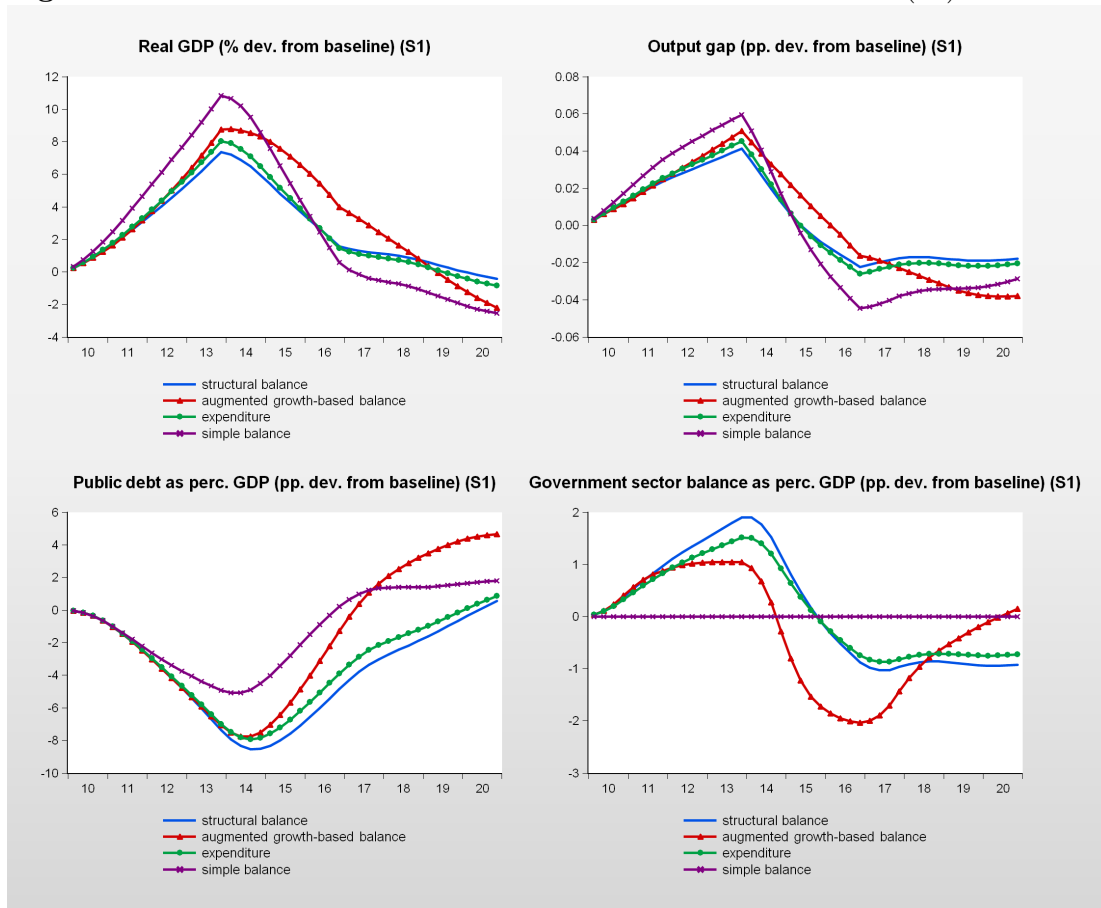


Figure 1b. Cyclicity of fiscal policy in Poland and other European countries



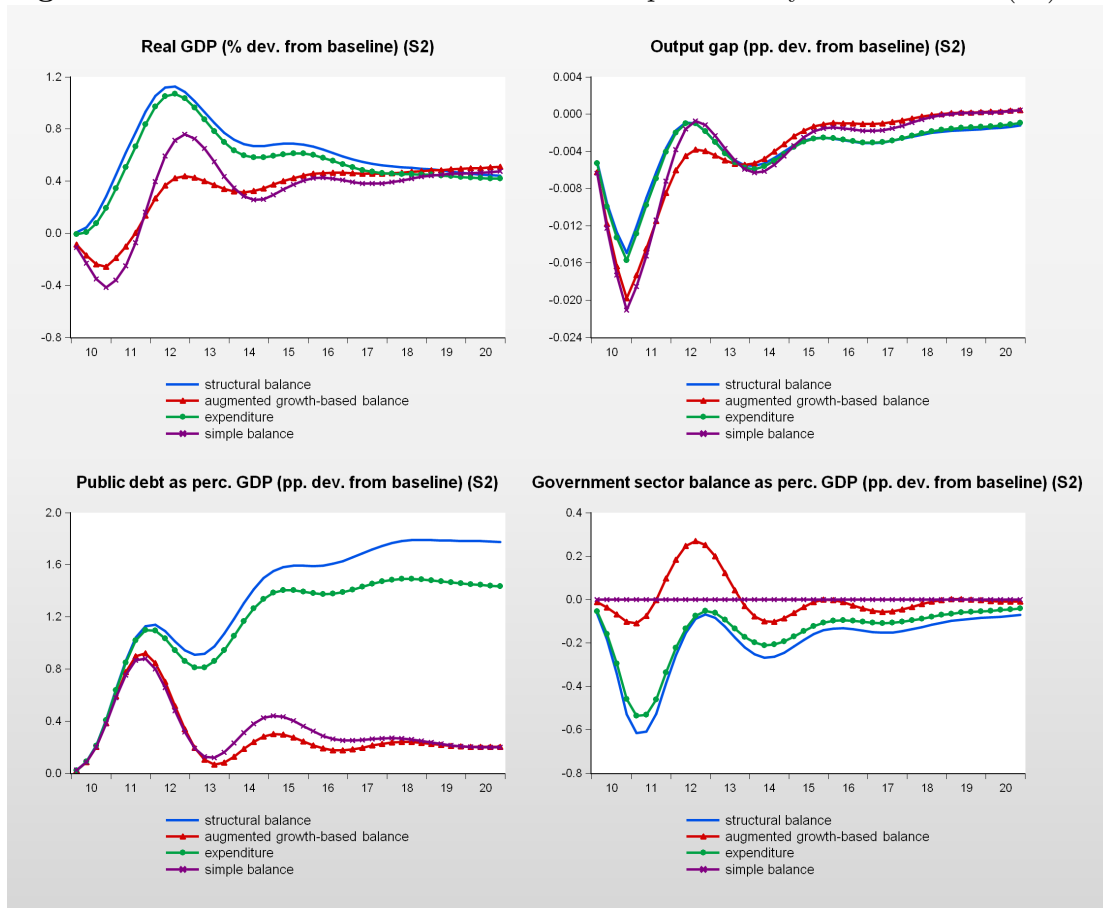
Source: own calculations using AMECO database

Figure 2. Behaviour of the fiscal rules under the boom-bust scenario (S1)



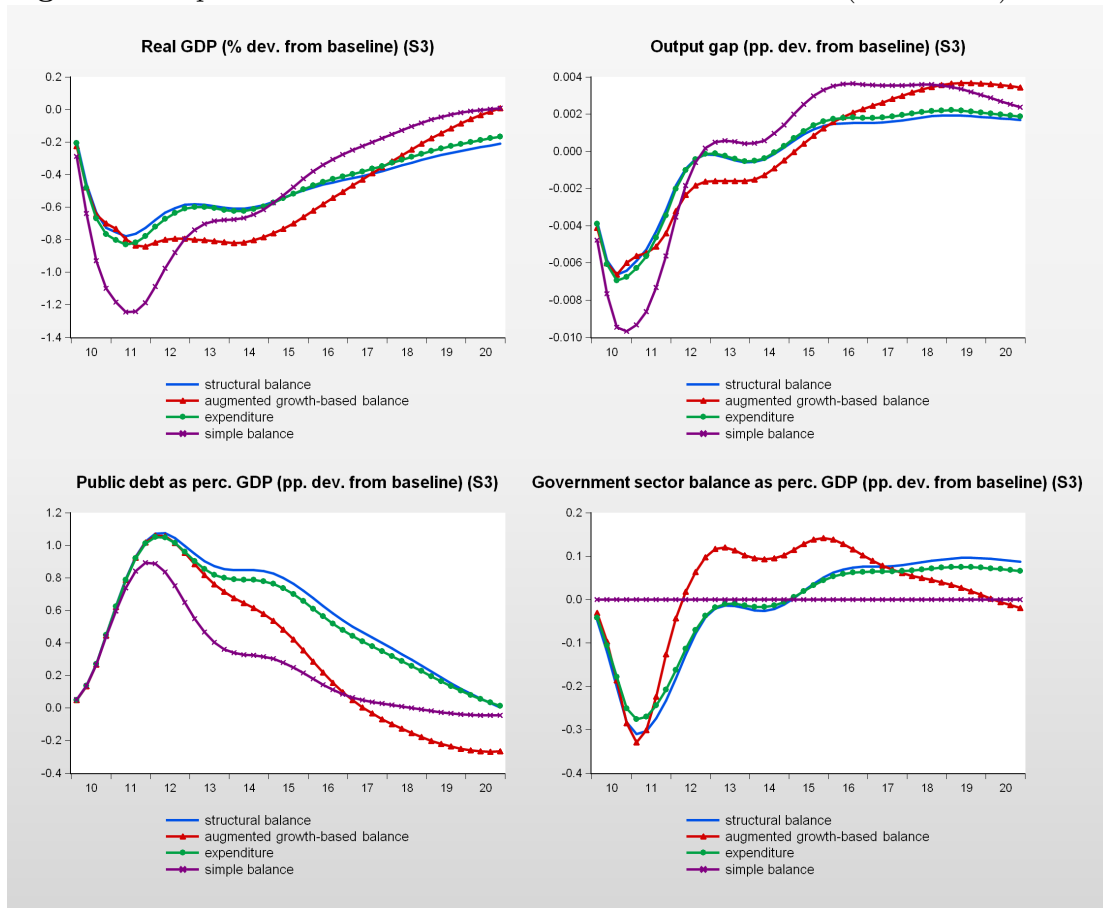
Source: own calculations

Figure 3. Behaviour of the fiscal rules under the productivity shock scenario (S2)



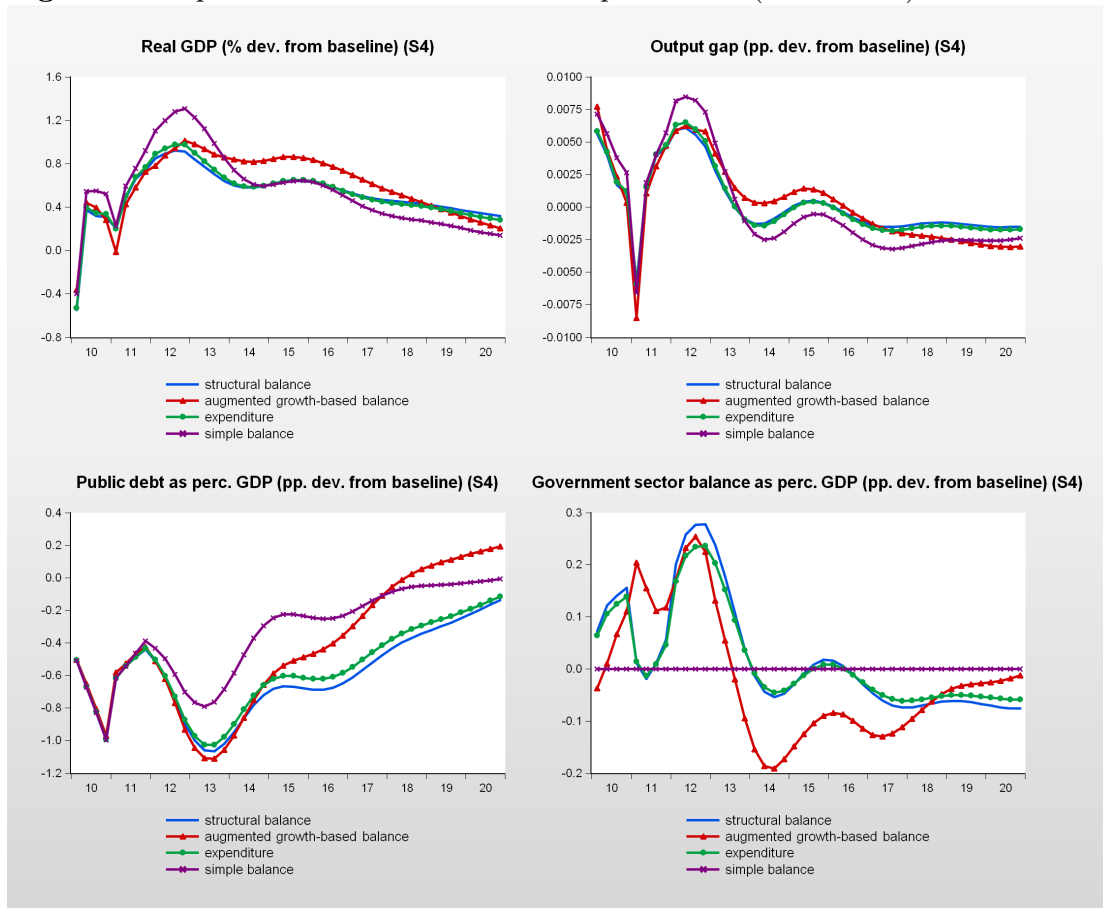
Source: own calculations

Figure 4. Responses of the fiscal rules to the interest rate shock (scenario S3)



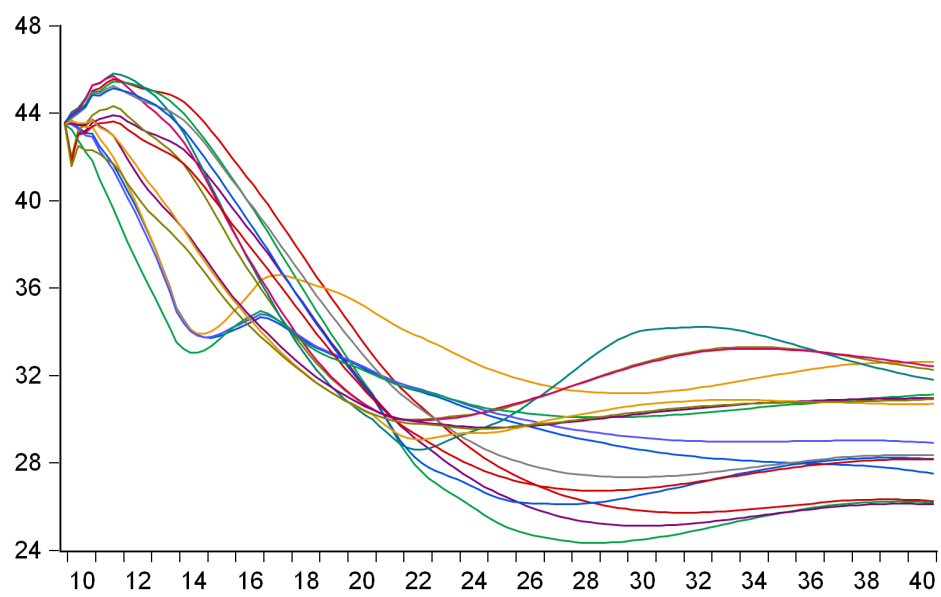
Source: own calculations

Figure 5. Responses of the fiscal rules to the price shock (scenario S4)



Source: own calculations

Figure 6. Debt to GDP ratio (in %) for all fiscal rules under all scenarios



Source: own calculations