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WORKING PAPER

Russia from Bust to Boom: Oil, Politics or the Ruble?

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April 2007

2007/461

D/2007/7012/32

Russia from Bust to Boom: Oil, Politics or the Ruble?*

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Abstract

This paper develops and estimates a small macroeconomic model of the Russian economy. The model is tailored to analyze the impact of the oil price, the exchange rate, private sector confidence and fiscal policy on economic performance. The model does very well in explaining Russia's recent economic history in the period 1995-2004. Simulations suggest that the Russian economy is vulnerable to downward oil price shocks. We substantiate two mechanisms that mitigate the economic effects of oil price shocks, namely the stabilisation brought by the Oil Stabilisation Fund and the Dutch disease effect. The negative effect of a shock in private sector confidence on real GDP is comparable to the effect of an oil price shock, although the transmission of both shocks runs along different channels. The fiscal policies of the Putin administration temper economic fluctuations caused by oil price shocks, but it remains to be seen whether these policies will be continued.

Keywords: Russia, Macroeconomic Modeling, Macroeconomic stabilization
JEL codes: C70, E17, E58, E16, E63

*The authors thank the participants at the "Growth and Convergence" session of the IAES- conference, held in Lisbon, March 12 2004, the participants at "Economic and Political Relations after the EU Enlargement: The Visegrad Countries and Russia, Ukraine, Belarus and Moldova" held in Budapest, February 5-6 2004 and two anonymous referees for their comments. Bruno Merlevede acknowledges the financial support received from F.W.O. (Fonds voor Wetenschappelijk Onderzoek Vlaanderen).

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1 Introduction

Russia is the largest neighbor of the enlarged European Union. The economies of the EU and Russia are increasingly integrated through rising flows of goods, services, capital, and people between the two blocks. Russia also plays an important strategic role as a supplier of energy and raw materials to the EU, decreasing the EU's dependence on Middle East energy sources. Gaining insight in the economy of this strategic partner to the EU is therefore not without importance. In this paper we model Russia's macroeconomic evolution during the last decade (1995-2004) and use this model to simulate Russia's economic future under several scenarios. The period of transitional recession before the Russian crisis of 1998 was marked by high inflation, failing stabilization and disappointing macroeconomic performance. Although the Russian government embarked on an exchange rate based stabilization in 1995, it did not succeed to balance its budget and had to draw increasingly on foreign lending to fund its recurrent deficits. This unsustainable policy mix and the prolonged political and economic instability culminated in a severe economic and political crisis in August 1998. The Russian government was forced to abandon its exchange rate policy, devalue the ruble, suspend payments on government paper, and announce a moratorium on the Russian foreign debt. By September 20 the ruble had fallen from 6 to 22 rubles per dollar.[1]

Rather than the expected final blow, the crisis turned out to be Russia's economic catharsis.[2] Indeed, real GDP growth after 1999 averaged 7% annually and the volatility of nominal variables such as prices, wages, interest rates and exchange rates has declined markedly. Several explanations for the recent good macroeconomic performance of Russia have been suggested. Ahrend (1999) claims that the deadly stabilization of 1995-1997 was the consequence of an inappropriate exchange rate policy. The overvaluation of the ruble during the period of the 'corridor' policy yielded stabilization at the cost of a prolonged economic recession. In the line of this argument the devaluation of the ruble in August 1998 kick-started economic growth through a broad process of import substitution across all sectors. Others put forward that Russia's economic boom is largely explained by the oil price. Due to a string of external events oil prices increased rapidly after 1998 from a relatively low

[1] World Bank (2002) offers a detailed survey of the transitional experience in the countries of Eastern Europe and the Former Soviet Union. EBRD (1998) and Gobbin and Merlevede (2000) provide a detailed account of the Russian Crisis of August and September 1998.

[2] OECD (2004) compares the consensus growth forecast and its own forecast to actual growth performance in 2000-2003. Actual Russian GDP growth consistently outperformed the expectations during this period.

level below 15$ to more than 60$ per barrel in 2005. As largest crude oil producer and second-largest crude oil exporter of the world, Russia strongly benefited from higher world oil prices. Finally, some political economists argue that the political and economic stabilization brought by president Putin reduced economic and political risk, which supposedly created the confidence and trust so badly needed for economic recovery (see for example Berglöf *et al.*, 2003). This also allowed the Putin administration to initiate a number of interesting fiscal policy reforms.

We develop and estimate a dynamic open economy macro-model of Russia. The model contains the basic macroeconomic relations that govern macroeconomic adjustment[3], but it is also specifically tailored to capture the effects of the oil price, private sector confidence and fiscal policy reform on the Russian economy. Our main variable of interest is the oil price. In our view, it is not sufficient to estimate the oil price elasticity of exports, the current account or government revenues. Fiscal policy, the exchange rate, and exports are only three direct channels through which the oil price affects the Russian economy. Indirectly, all other variables in the model will be affected through second order effects. We then employ the model to simulate Russia's economic future under different scenarios regarding the oil price, private sector confidence and fiscal policy. The simulations suggest that the Russian economy is vulnerable to downward oil price shocks. We find two mechanisms that mitigate the economic effects of oil price shocks, namely the stabilization brought by the Oil Stabilization Fund (OSF) and the Dutch disease effect. The effect of a negative shock in private sector confidence on real GDP turns out to be comparable in magnitude to the effect of an oil price shock, although the transmission of both shocks runs along different channels. The fiscal policies of the Putin administration are found to temper the economic fluctuations caused by oil price shocks.

In the next section we present the model. Section 3 describes the data and the estimation methodology and comments on the estimation results. In section 4 we evaluate how oil price shocks, changes in private sector confidence and in fiscal policy influence Russia's economic future by means of a set of simulations. The final section summarizes and presents conclusions.

[3]Notably private consumption, investment, exports, imports, the exchange rate, labour demand, wage inflation, consumer price inflation and producer price inflation.

2 A macroeconomic model of the Russian economy

In this section we construct a small, stylized model of the Russian economy. A complete dynamic general equilibrium model of the Russian economy would not be appropriate for theoretical and empirical reasons. Financial sector inefficiencies for example imply that most Russian consumers feel forced to consume their current incomes instead of optimally smoothing their consumption as implied by DSGE models. Instead, we estimate a dynamic open economy macromodel (see Merlevede et al., 2003, and Basdevant, 2000), consisting of a set of macroeconomic relations, (3)-(15), a policy rule, (16), and a set of definitions, (17)-(23). The theoretical model is presented in its long-term form in annex A. This model is suited to analyze macro-economic adjustment in the short-run to various types of macro-economic shocks. The model is build around four blocks and a monetary policy rule. The real side is captured in the IS block that contains the relations governing consumption, investment, exports, and imports. The monetary block is made up by equations for the money supply, the exchange rate, and consumer and producer prices. The labour market is incorporated in the model via wage and employment equations. Finally, in the fiscal block government expenditures and revenues are modelled.

We start from a fairly standard model and adapt it to the specificity of the Russian economy. Therefore the model highlights the impact of the oil price, private sector confidence and changes in fiscal policy. With respect to the importance of the oil price, we separately model oil exports (5) and other exports (6) and the oil price is allowed to affect the exchange rate, modelling possible dutch disease effects. Also government revenues (14) and expenditures (15) are modelled as a function of the oil price, a typical feature of the Russian economy (see Rautava, 2004, and Kirsanova and Vines, 2002). Vladimir Putin became acting president in 2000, after the surprising new year's eve resignation speech of President Yeltsin and after having won Duma support in the December 1999 elections. This led to a period of relative political and economic stability. Therefore we can expect changes in consumption and investment due to increased confidence. We capture the economic effects of increased private sector confidence by means of dummy variables in equations (3) and (4). The Putin administration also introduced more active policies regarding government revenues and expenditures (cf. infra for the Oil Stabilization Fund). Again we try to capture the effects by means of dummy variables in equations (14) and (15). In the next paragraphs we elaborate on the implementation of these specific characteristics in the model.

Real private consumption in (3) is a function of real disposable income. Real private investment in (4) is specified as a function of real output and the real interest rate. Both the consumption and investment equation are augmented with a dummy variable (d_c and d_i respectively) that takes the value 1 from 2000:I onwards. These dummy variables capture the possible positive effect of increased private sector confidence on investment and consumption. Admittedly, this is a crude approach to a no-doubt very complicated issue. But confidence and trust are hard to measure accurately and the average Russian would note on the effects of the Putin administration that it at least managed to establish "nimnogo poryadka" (some order) in the country. It is therefore not unimaginable that increased confidence led to such a shift-effect. Finally, its simplicity is appealing in terms of the simulation exercise and the approach seems to work quite well.

We model oil exports as a reduced form equation. Since Russia is a price-taker on the world market, it faces a flat demand curve for USD-denominated oil. On the supply side the main determinants are, next to the oil price, the level of proven oil reserves, the capital invested in extraction, the investment climate for oil extraction, the export infrastructure, the management of this export infrastructure. A detailed analysis of the latter variables is outside the scope of our model. We proxy these unobserved institutional supply shifters by the evolution of world trade. We estimate the export equation in values rather than in volumes. If we were to use the oil export volume as dependent variable it would imply that both the long and short run oil price elasticity are restricted to one. Our approach puts this constraint to the test rather than assuming it. We expect the short-run elasticity to differ from one because of the predominance of term contracts in the oil market. Therefore nominal USD-denominated oil exports are modelled in (5) as a positive function of the oil price and world trade. Note that USD-denominated oil exports do not feed directly into ruble-denominated GDP, since they are converted into rubles through the exchange rate, which is also a function of the oil price. In equation (6) we model the non-oil exports as an increasing function of world trade and a decreasing function of the real exchange rate. In the model, non-oil exports are therefore directly affected by real exchange rate swings: a real ruble devaluation or depreciation makes the non-oil exports more competitive on world markets and vice versa. In (7) ruble denominated real imports are modelled as an increasing function of both real output, capturing import demand, and the real exchange rate, since a real ruble appreciation makes import products more competitive on the Russian market.

The nominal exchange rate in (9) is also driven by the oil price, with higher prices related to appreciations, and by changes in the interest rate. For obvious reasons, this relation will only be estimated for the period of managed float since the beginning of 1999. This implies both import substitution after a real ruble depreciation, and a Dutch disease-effect after a real ruble appreciation due to higher oil prices that crowds out non-oil exports.

Government revenues in (14) depend on the level of real GDP and on the oil price. Oil prices are expected to affect government revenues positively. Under President Yeltsin the fiscal obligations of oil and gas companies were not well defined and subject to *ad hoc* negotiations. This has been referred to as informal fiscal rules (see Tompson, 2002). The outcome of these negotiations was largely subject to the oil price. The Putin administration introduced a number of measures to increase the state's share in the profits from oil price windfalls. Afanasev (2004) shows that the upward shift in budget revenues as a function of oil prices already took place in 2001 (one year after Putin's coming to power), mainly through increased profit taxes. Further fiscal improvements were enacted and became effective in 2002, 2003 and 2004. Very important measures in this respect were the introduction in January 2002 of variable export duties (where the duty is a increasing function of the oil price) and the introduction in January 2004 of a unified extraction tax that is also a function of the oil price. In our model fiscal revenues are a function of the oil price, but the oil price elasticity of fiscal revenues is allowed to differ before and after the first quarter of 2001. We implement this by introducing a dummy variable that takes the value 0 until the end of 2000 and 1 thereafter.

Government expenditures in (15) are also related to both real GDP and oil prices. If the government is aware of a strong link between revenues and oil prices, it is reasonable to expect that changes in oil prices will be transmitted to budgeted government expenditure. Indeed, recent government budgets have been explicitly based on oil price expectations, and this was implicitly the case before. In 2002, the Putin administration introduced a formal provision to channel higher than budgeted revenues into a special financial reserve fund to meet future debt-service payments (Robinson, 2003). The OECD (2004) finds that in 2003 the fiscal surplus was exactly equal to the windfall gain of higher oil prices, suggesting that the provision was followed through in that year. In February 2004 the remaining resources of the financial reserve fund were transferred to the newly founded Oil Stabilization Fund (OSF) that saves windfall gains from higher than budgeted oil prices. Since we expect the oil price elasticity to differ before and after 2003, we introduce a dummy variable that takes the value 0 until the end of 2002 and 1 thereafter.[4]

As regards the monetary policy rule in (16), we allow the Central Bank of Russia (CBR) to set the nominal short-term interest rate in function of the output gap, inflation and the real exchange rate (see Taylor, 2001). This rule is estimated for the period after 1998, i.e. after the collapse of the crawling exchange rate band. The introduction of the real exchange rate in the policy rule allows the possibility that the CBR would mitigate Dutch disease effects through its monetary policy. Inflation is defined as changes in the GDP deflator rather than changes in the CPI because the latter for a considerable part consists of administered prices (e.g. district heating, electricity). Esanov et al. (2005) document that the exchange rate has been an official CBR monetary policy target in various forms since 2002, and may have been a de facto target since the CBR abandoned its exchange rate corridor in August 1998. The interest rate directly affects investment and the exchange rate, and indirectly affects inflation through the money supply, which also depends on the interest rate.

The remaining relationships receive a standard treatment. Money in (8) is specified as a decreasing function of the short-term interest rate and an increasing function of real output and the real exchange rate. Domestic output prices in (10) are modelled as a non-decreasing function of domestic factor costs, represented by the (private) wage costs, and import prices, proxied by EU-prices[5] converted to rubles. Consumer prices are modelled in (11) as a increasing function of domestic producer prices and foreign producer prices. Both consumer and producer prices are also affected by the euro exchange rate and money growth. The labour market is modelled in equations (12) and (13). Nominal per capita wages in (12) depend positively on consumer prices (reflecting a price indexing elasticity), and negatively on unemployment (reflecting a Phillips curve relation). When unemployment is rising, workers are more concerned with jobs than with wages. This constrains their wage claims, while at the same time the presence of a larger pool of employable workers will allow employers to moderate their wage offers. Finally, the nominal per capita wages depend positively on real economic activity. Domestic labour demand in (13) depends on real economic activity and on real wages.

[4] Note that the timing of fiscal policy measures differs for the expenditure and revenue side.

[5] Most of Russia's imports originate from the EU.

3 Model estimation and interpretation

Quarterly data were drawn from the International Financial Statistics database from the IMF. These data are identical to those supplied by Goskomstat. The share of oil exports in total exports is from the CBR. The Census X12-method is used to obtain seasonally adjusted data. This method has the advantage that the seasonal component can change from year to year. The non-stationarity of the seasonally adjusted variables, is taken into account by estimating the model in error-correction form (ECM)[6], according to the Engle-Granger representation theorem, which can be expressed for K explanatory variables as follows:

$$\Delta y_t = c + c^{\alpha} y_{t-1} + \sum_{k=1}^{K} c_k^{\beta} x_{k,t-1} + \sum_{k=1}^{K} \sum_{l=0}^{L_k} c_{k,l}^{\delta} \Delta x_{k,t-l} + \sum_{m=1}^{M} c_m^{\gamma} \Delta y_{t-m} + \varepsilon_t \qquad (1)$$

where ε_t is a white noise error term and $-1 < c^{\alpha} < 0$. Given the restricted number of observations in our dataset we assume M equal to 1 and L_k equal to 0 for all k. In short, we only use current values of first differenced explanatory variables, $\Delta x_{k,t}$, and the one period lagged first differenced dependent variable, Δy_{t-1}:

$$\Delta y_t = c + c^{\alpha} y_{t-1} + \sum_{k=1}^{K} c_k^{\beta} x_{k,t-1} + \sum_{k=1}^{K} c_k^{\delta} \Delta x_{k,t} + c^{\gamma} \Delta y_{t-1} + \varepsilon_t \qquad (2)$$

The cointegrating equation in (1) ($c^{\alpha} y_{t-1} + \sum_{k=1}^{K} c_k^{\beta} x_{k,t-1}$) captures the long run macroeconomic relations of our model ((3)-(15)). These can be expressed as $y = -\left(1/c^{\alpha}\right) \sum_{k=1}^{K} c_k^{\beta} x_k$. Specific long run parameters are calculated as $-c_k^{\beta}/c^{\alpha}$. The cointegration properties of y and x_k are tested by investigating the stationarity of the residuals from the estimated long run relationships. Our estimation technique will be valid if these residuals are stationary. We report two tests, one with a unit root as null hypothesis (augmented Dickey-Fuller, ADF) and one with stationarity as null hypothesis (Kwiatkowski-Phillips-Schmidt-Shin, KPSS). For the ADF-tests we use the adjusted critical values for cointegration tests from Davidson and MacKinnon (1993). The short run dynamics Δy_t are governed by short run changes in the other variables $\Delta x_{k,t}$, on period lagged changes in the dependent variable Δy_{t-1} and deviations from the long run equilibrium, $c^{\alpha} \left(y_{t-1} + \left(1/c^{\alpha}\right) \sum_{k=1}^{K} c_k^{\beta} x_{k,t-1} \right)$.

[6] The monetary policy rule in (16) is a reaction function rather than a long run macroeconomic relation and is therefore not estimated in error correction form.

The equations are estimated one by one using OLS. Generally the period of estimation is 1995:II-2004:III, but the sample size varies across the equations due to data availability. Since parsimonity fosters tractability, we remove insignificant variables. Detailed estimation results are in annex B.[7]

Taking into account the limited sample and the anomaly of the August 1998 crisis, the explanatory power of the estimations is fairly high. Equation (24) reveals that real disposable income has a strong and significant long run impact on consumption of about 0.968 ($-\beta_k/\alpha_1$ = -0.123/-0.127). The short run impact is only a little bit smaller than the long run impact. Russian economic growth is clearly driven by consumption decisions. Real investment in (25) is negatively related to the real interest rate and positively to real economic activity. The long run real output elasticity of investment is fairly high at 0.873 (0.172/0.197). The short run impact of real output on investment is also high and significant, while the real interest rate is found to have a short run effect. Both private sector confidence dummies are economically significant. *Ceteris paribus*, consumption growth is 1.4% higher since 2000 and investment growth even 3.3%. Both dummies also pass the hurdle of statistical significance.

Equation (26) shows that dollar denominated oil exports are strongly related to oil price swings. The long run elasticity of the oil price on the dollar value of exports is, not unexpectedly, very close to 1. In fact, we cannot reject the hypothesis that it is exactly 1 (0.436/0.435 $\simeq$ 1), indicating that the volume of oil exports does not react to the oil price in the long run. In the short run though, the oil price elasticity is only about 0.5, which suggests that higher oil prices are only translated into higher dollar-denominated oil export proceeds with a lag. This reflects the importance of term contracts in the oil market, as expected. The world trade variable is also statistically significant but has a smaller long run elasticity of only 0.8 (0.348/0.435). Real non-oil exports (equation (27)) react positively to higher world trade, while real appreciations affect the non-oil exports negatively. Economically, world demand effects seem to have dominated real exchange rate effects both in the short and the long run. Real ruble-denominated imports in (28) rise with real exchange rate appreciations and with real output, as expected. The impact of output dominates both economically and statistically.

Since the Putin administration introduced a number of measures to increase the state's share in the profits from oil price windfalls (see above), the model allows the oil price elasticity

[7] All equations pass stability tests that are available on request.

of real fiscal revenues to change. In (35) we indeed observe that the long run oil price elasticity of revenues rises from 0.265 (= 0.187/0.705) before 2001 to 0.362 (=0.255/0.705) thereafter, giving direct evidence of improved fiscal policy. We found no changes in the short-run elasticity. Real GDP remains a crucial fiscal base with a long run elasticity of 0.885 (= 0.624/0.705). As regards government expenditure, we expect the oil price elasticity of government expenditure to fall in January 2003 (see above). In (36) we find indeed that the short run oil price elasticity of government expenditure is significantly lower after 2003, indicating the effect of the OSF on the Russian economy. We find no long run effect of oil prices on expenditure though, while the most important determinant of expenditure is again real GDP with a long run elasticity of 0.898 (=0.123/0.137). Controlling for oil price swings, one can infer that there is no automatic fiscal stabilizer since the elasticity of expenditures and revenues to real economic activity is almost identical (0.898 and 0.885 respectively). An automatic fiscal stabilizer is provided though by the OSF that renders revenues much more elastic to oil price swings than expenditures. In case of a downward oil price shock, revenues will therefore fall more than expenditures. This will ultimately yield a fiscal deficit that raises disposable income (*cf.* (23)) hereby affecting real consumption and ultimately all endogenous variables. The reverse effect occurs in case of a hike in oil prices. The OSF therefore clearly mitigates the effect of oil price swings on the Russian economy, as it is designed to do.

The monetary policy rule (37) yields very sensible results. The CBR reacts to lower inflation, higher output gaps and a real appreciation (lower s) with a more relaxed monetary policy. The estimation results also suggest that the immediate interest rate reaction to real exchange rate shocks is partially offset in the next period (*cf.* Taylor, 2001). Apparently the CBR smooths the effect of abrupt exchange rate shocks, that in the period under study mainly come from oil price shocks. This captures very well the Russian reality, where the CBR explicitly tries to stabilize the exchange rate. Changes in the nominal exchange rate (30) are well explained by changes in the oil price, although the long run elasticity is not very high at -0.215 (-0.049/0.228). The negative elasticity suggests that higher oil prices are associated with an appreciation of the nominal exchange rate, suggesting a mild Dutch disease effect for the Russian economy. Indeed, high oil prices positively affect the dollar value of oil exports, but also lead to an appreciation of the ruble exchange rate. This in turn negatively affects other exports, stimulates imports and in this way mitigates the positive effect of increasing oil prices on the Russian economy. Lower interest rates are found to have an immediate effect on the exchange rate, suggesting that the CBR's monetary policy of managed float is to some extent effective.

Both producer and consumer prices in equation (31) and (32) are well explained by our highly stylized model. EU prices are of considerable importance in explaining consumer and producer prices, reflecting the effects from pass-through. The exchange rate shows the expected pattern, with an appreciation related to inflation in both producer and consumer prices. Both the producer and the consumer price equation also exhibit a positive lagged dependent variable, reflecting the amount of inflation persistence. Last quarter's inflation feeds current quarter's inflation. In equation (31) nominal *per capita* wages exert a considerable long run impact on producer prices with a long run elasticity of 0.513 (0.141/0.275). Equation (33) finds a long run relationship between nominal wages, consumer prices, the number of unemployed and real economic activity. The long run elasticities of consumer prices and real economic activity are high (0.908 and 0.660), for unemployment it is at -0.600. Employees are thus to a large extent compensated for price increases and also profit from changes in real economic activity, while unemployment exerts downward pressure on wages, as expected. In the short run changes in consumer prices have a positive contemporaneous effect on changes in nominal wages. For employment we only find a long term relationship in (34) with real economic activity and the wage level.

Before simulating future scenarios for the Russian economy, we check the model's in sample tracking ability of Russian macroeconomic adjustment in Annex C by means of a stochastic, dynamic in-sample simulation. The model tracks the evolution of the real side, the monetary block, the labour market and the fiscal block quite accurately. The good tracking ability of the model apparent in Figure 3 testifies of the stability of the model.

4 Simulating shocks in the oil price, private sector confidence and fiscal policy intervention

We now employ the model to simulate Russia's economic future under different assumptions regarding the oil price, private sector confidence and fiscal policy intervention. From the first quarter of 2005 onwards, the oil price is either fixed at 45$ per barrel, shifts to 70$ per barrel or collapses to 20$ per barrel and remains at these respective levels for the remainder of the simulation period. Private sector confidence refers to the dummies in the consumption and investment equations. Fiscal policy intervention refers to the dummies in the fiscal revenues and expenditures equations. Fading confidence or discontinuation of fiscal policy intervention is simulated by setting the dummies to zero from the first quarter of 2003 onwards. The simulations allow us to compare the effects of different scenarios and to uncover their transmission channels. The model's parsimonity fosters the tractability and interpretability of the results. A simulation starts by fixing the future deterministic scenarios with respect to the level of the oil price, private sector confidence, and fiscal policy measures. We then add a random shock to each equation to allow for model uncertainty and solve the model.[8] We repeat this 1000 times, each time drawing new shocks, and report the average result.

We consider two sets of simulations, together 7 simulations as shown in table 1. Both sets of simulations are compared with the baseline scenario 1 that assumes a constant oil price of 45$ per barrel[9] from 2005:I onwards, lasting private sector confidence and sustained fiscal policy intervention in both revenues and expenditures. Figures 1 and 2 report the simulations as percentage deviations from the baseline scenario 1, which is represented by a horizontal line at zero. Both figures show the main simulated endogenous variables during 2003:I-2007:IV.

In the first set of simulations, shown in Figure 1, we concentrate on the effect of oil price shocks on Russia's economic future. We compare the baseline scenario to three oil price scenarios (cf. table 1) that lie symmetrically around the baseline scenario: i) scenario 2 (the solid line with triangular dots in Figure 1) assumes an abrupt shift of the oil price to 70$ per barrel in the first quarter of 2005; ii) scenario 3 (the solid line in Figure 1) assumes an abrupt collapse of the oil price to 20$ per barrel in the first quarter of 2005 ; iii) scenario 4 (the dashed line in Figure 1) assumes an abrupt collapse of the oil price to 20$ per barrel in the first quarter of 2005 in combination with fading private sector confidence and the discontinuation of fiscal policy intervention in 2003:I.

In a second set of simulations, shown in Figure 2, we concentrate on the effect of private sector confidence and fiscal policy intervention on Russia's economic future, keeping the oil price constant at 45$ per barrel. We compare our baseline scenario 1 to three different

[8] The Gauss-Seidel algorithm is used to solve the model.
[9] This reflects the actual market condition in 2004:IV.

Scenario	Oil price per barrel	Private sector confidence	Fiscal policy intervention
1 (baseline)	constant at 45$	yes	yes
2	shift to 70$	yes	yes
3	collapse to 20$	yes	yes
4	collapse to 20$	no	no
5	constant at 45$	no	yes
6	constant at 45$	yes	no
7	constant at 45$	no	no

Table 1: Scenario overview

scenarios (cf. table 1) : i) scenario 5 (the solid line in Figure 2) simulates the reappearance of political and economic uncertainty by setting the confidence dummies in the investment and consumption relation to 0 (from 2003:I onwards) ; ii) scenario 6 (the solid line with triangular dots in Figure 2) assumes the discontinuation of fiscal policy intervention; iii) scenario 7 (the dashed line in Figure 2) shows what happens if private sector confidence crumbles and fiscal policy intervention weakens.

[**Insert Figure 1 around here**]

The simulations of the oil price in Figure 1 show that oil price shocks will yield substantial swings in Russia's economic success, highlighting Russia's striking oil-dependence found in the empirical model. The real GDP path is strongly affected by oil price shocks, mainly because oil prices have a huge direct impact on oil exports, and hence real GDP and ultimately all endogenous variables. The model incorporates two mechanisms that mitigate the effect of oil price hikes on economic growth. The first mitigating mechanism is the automatic fiscal stabilization provided by the Oil Stabilization Fund (OSF). Because of the OSF, expenditures are less elastic to the oil price than revenues. This implies that the positive oil price shock of scenario 2 leads to a fiscal surplus (see the fiscal balance under scenario 2 in Figure 2), which mitigates the positive effect of the oil price on consumption and ultimately through a series of second-order effects on all other endogenous variables. This automatic stabilizer effect of the OSF is present both with upward and downward oil price swings. The second mitigating mechanism is the Dutch disease effect. The oil price hike to 70$ per barrel is transmitted in a sustained appreciation of the ruble (see scenario 2 for the exchange rate in Figure 1). This Dutch disease scenario leads to lower non-oil exports, higher imports, lower consumer price inflation, and ultimately tempers real GDP growth. This is precisely what has happened in Russia in 2003-2005. The monetary policy rule ensures that the CBR tries to counter the Dutch disease effect by a more relaxed monetary policy, in turn yielding mildly higher inflation.

The effect of large negative oil price shocks dominates the effect of private sector confidence and fiscal policy intervention brought by the Putin administration. Indeed the additional effect on real GDP of setting all dummies to zero (renewed uncertainty, fiscal policy back to Yeltsin standards) is relatively small, compared to the effect of a collapse in the oil price. This can be seen by comparing scenario 3 and 4 in Figure 1. Taking away private sector confidence (scenario 4) strongly affects real private sector consumption and investment, which affects real GDP negatively, but the withdrawal of fiscal policy intervention magnifies the fiscal deficit (remind the Yeltsin years) which mildly stimulates real GDP. Since both effects go in opposite directions, the net effect on real GDP is much more limited.

[**Insert Figure 2 around here**]

This can also be seen more explicitly by comparing scenario 5, 6 and 7 in Figure 2. Inspecting the effect on real GDP, we see that the crumbling of private sector confidence (scenario 5) induces lower growth, while the abandoning fiscal policy intervention (scenario 6) stimulates economic growth. Scenario 7 indicates that the net effect of combining both scenarios is much more limited indeed, as mentioned before.

We find that the collapse of private sector confidence (scenario 5) has relatively large effects. If we compare scenario 3 in Figure 1 to scenario 5 in Figure 2, we observe that the negative effect on real GDP of a collapse in private sector confidence is comparable to the effect of an oil price collapse, although the transmission of both shocks runs along different channels. The confidence effect (scenario 5) works directly through consumption and investment, and has further knock-on effects through real GDP on most other variables. The fiscal variables do not play a big role however in the transmission of shocks in private sector confidence. Indeed renewed uncertainty would lead to both lower expenditures and revenues, leaving the fiscal balance virtually untouched. This is because the elasticity of expenditures and revenues to real economic activity is almost identical in our model. The fiscal policy dummies on the other hand mainly affect the fiscal variables. Specifically, if we set the fiscal policy intervention dummies to zero (scenario 6 in Figure 2), the elasticity of expenditures to the oil price rises, while the elasticity of revenues to the oil price falls. *Ceteris paribus* this will mildly stimulate economic growth, since lower revenues and higher expenditures yield a higher deficit that feeds into higher disposable income. Our model therefore confirms that the OSF moderates real GDP growth of the Russian economy. Indeed without the OSF current growth would even be higher. This automatic fiscal stabilization operates in both directions, something critics of the OSF tend to forget. Scenario 7 of Figure 2 shows what would happen if all dummies are set to zero. This amounts to applying the policies and confidence of the Yeltsin era to the Putin era oil price of 45$ per barrel. Results show that real economic growth would be lower than the baseline scenario. This is because the negative effects of lost confidence dominate the stabilizing effects from the Putin administration fiscal policies.

Russia has been aware of the fact that its recent economic success hinges to a considerable extent on the thread of the oil price, but has repeatedly bowed to within-year pressures resulting from high oil prices to increase budgeted expenditure (IMF, 2004). The desire to resist such pressures has first given rise to the introduction in 2002 of a financial reserve fund, that was supposed to save the fiscal windfall gains from higher than budgeted oil prices. Already in early 2003 there was heated debate about the foundation of a more permanent Oil Stabilization Fund (OSF). The idea of such an OSF is to try and balance the budget over the oil price cycle. The fund should ensure that oil price related budget surpluses are saved for a rainy day instead of wasted. This idea was fancied by the IMF and by reformist Russian policymakers, but still faces a lot of resistance inside Russia. The main criticism is that the OSF tempers Russia's economic growth, which we found indeed it does.

The OSF was established in February 2004 with a transfer of 106 billion ruble from the 2003 budgetary oil windfall gain (Ollus, 2005). The OSF is currently regulated by the budget code of the Russian Federation. The saved money is held on account at the Central Bank of Russia (CBR). The initial OSF-rules stipulate that oil tax revenues (including both crude oil export duties and natural resource extraction taxes) due to an oil price above 20$ per barrel are to be assigned to the fund and that OSF resources can only be spent if the fund surpasses the pre-agreed limit of 500 billion ruble. The oil price hike in 2004 however ensured that this limit was reached fairly quickly, even before the end of 2004. The domestic political discussion on the future of the OSF quickly concentrated on two issues, namely whether the threshold level of 20$ per barrel should be increased and how the excess OSF funds should be spent. The IMF(2005) has stated that it is in favor of leaving the OSF threshold of 20$ per barrel unchanged. Still, it has been decided to raise the OSF threshold level from 20$ to 27$ per barrel in the 2006 budget.

As regards the question how to spend the spoils of the financial reserve fund and the OSF, Russia has been relatively wise. In 2005 about half of the OSF proceeds in excess of the 500 billion ruble cap have been transferred to the pension fund to cover the gap left by the cut in the unified social tax (IMF, 2004). Another large share of the OSF funds has been assigned though to early debt repayment. On January 31, 2005 Russia completed the early repayment of its entire outstanding obligations (2,19 billion SDR) to the IMF, while the final repayment would have taken place only in 2008 under the original schedule.[10] In May 2005 Russia struck a deal for early repayment of $15bn. of Paris Club debt. Early debt repayment of this magnitude is unique in Paris Club history. This early repayment was financed by the OSF and completed in August 2005. On June 23 2006 the Paris Club released a press statement indicating that the Paris Club and Russia reached an agreement regarding the early repayment of all Russia's Paris Club debt of about $22bn. (Paris Club, 2006). After this repayment Russia will no longer be a Paris Club debtor. It will save the Russian budget $6bn. in interest payments that would otherwise have been due by the year 2020. Meanwhile the fund had assets of $43bn. at the end of 2005 and $89.1bn. at the end of 2006.

The central problem is however that there are no clear and transparent rules on how the excess funds should be used. There has for example been pressure to use the excess funds to pay for increased wages and pensions in the aftermath of the mismanaged social sector reforms. Further pressure comes from the plan to use OSF funds to finance lower VAT and profit taxes. Davis *et al.* (2001) found that in many countries with oil stabilization funds, the fund did not succeed in stabilizing government income and expenditure over fluctuations. Our model suggests though, that the new fiscal policies of the Putin administration have indeed decreased the elasticity of government expenditure to the oil price. This means that the OSF has worked surprisingly well in 2003-2004, but the domestic pressure to spend the spoils is mounting and it remains to be seen whether the Putin administration will be able

[10] IMF Press Release No. 05/19 of February 2, 2005

to resist pressure to forego long term stability for higher short term economic growth.

5 Conclusions

Macroeconomic adjustments in the Russian economy have displayed remarkable variations during the last decade. A first period marked by severe instability culminated in the August 1998 crisis. The crisis proved to be a purifying event, because the real side of the economy has improved substantially and the volatility of nominal variables such as prices, wages, interest rates and exchange rates declined markedly since 1999. Various explanations for Russia's recent economic successes have been put to the fore. Some observers have suggested that the devaluation of the ruble in August 1998 kickstarted economic growth through a broad process of import substitution across all sectors. Others have put forward that Russia's economic well-being depends largely on the favorable evolution of the oil price. Thirdly, some political economists argue that the current success is due to the political and economic stabilization and policies brought by the Putin administration.

We estimate a dynamic open economy model to analyze macro-economic adjustment in the Russian economy. We separately model oil and non-oil exports. Another novel feature of the model is the direct link between the oil price and fiscal policy. We explicitly model the improved fiscal policy by allowing a different the oil elasticity of revenues before and since 2001 and a different oil elasticity of expenditures before and after 2003. The found decreased oil elasticity of fiscal expenditure since 2003 reflects the introduction of the Oil Stabilization Fund (OSF). The oil price also affects the exchange rate, which allows Dutch disease effects in the model. We also introduce an 'increased confidence' effect in the consumption and investment equations, in line with the argument that, since Putin became acting president in 2000, economic and political risk have decreased. We find that Russia's macroeconomic evolution can be understood by looking at standard macro-economic relations, provided the specific role of oil is taken into account.

The simulations suggest that a considerable part of Russia's current macroeconomic success is due to the gradually increasing oil price, but also that the Russian economy is still vulnerable to downward oil price shocks. We substantiate two mechanisms that mitigate the effects of oil price shocks on the Russian economy, namely the stabilization brought by the OSF and the Dutch disease effect. We also find however that the negative effect on real GDP of a shock in private sector confidence is comparable to the effect of a large negative oil price shock, although the transmission of both shocks runs along different channels. The fiscal policies of the Putin administration, that reveal themselves in changed oil price elasticities of revenues and expenditures, temper economic fluctuations caused by oil price shocks, but their effect on real GDP is dominated by the effect of a shock in private sector confidence.

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6 Annex A - The model in detail

IS Block

$$
\begin{aligned}
c &= \alpha_0 + \alpha_1\, y_d + d_c && (3)\\
i &= \beta_0 - \beta_1\,(R - \Delta p_y) + \beta_2 y + d_i && (4)\\
x_{oil}^{USD} &= \gamma_0 + \gamma_1 wtr + \gamma_2 p_{oil} && (5)\\
x_{non-oil} &= \chi_0 + \chi_1 wtr + \chi_2 s && (6)\\
z &= \delta_0 + \delta_1 y - \delta_2 s && (7)
\end{aligned}
$$

LM Block

$$
\begin{aligned}
m_1 &= \vartheta_0 - \vartheta_1 R + \vartheta_2 y - \vartheta_3 e && (8)\\
e &= \zeta_0 - \zeta_1 p_{oil} + \zeta_2 R && (9)\\
p_y &= \phi_0 + \phi_1 w + \phi_2 p_y^{EUR} + \phi_3 e^{EUR} + \phi_4 m_1 && (10)\\
p_c &= \kappa_0 + \kappa_1 p_y + \kappa_2 p_c^{EUR} + \kappa_3 e^{EUR} + \kappa_4 m_1 && (11)
\end{aligned}
$$

Labour Block

$$
\begin{aligned}
w &= \lambda_0 + \lambda_1\, p_c + \lambda_2 y - \lambda_3 u && (12)\\
n &= \mu_0 + \mu_1 y + \mu_2\,(w - p_y) && (13)
\end{aligned}
$$

Fiscal Block

$$
\begin{aligned}
rev &= \rho_0 + \rho_1(d_{rev} \cdot p_{oil}) + \rho_2((1 - d_{rev}) \cdot p_{oil}) + \rho_3 y && (14)\\
gex &= \theta_0 + \theta_1(d_{gex} \cdot p_{oil}) + \theta_2((1 - d_{gex}) \cdot p_{oil}) + \theta_3 y && (15)
\end{aligned}
$$

Monetary Policy Rule

$$
R = \tau_0 \Delta p_y - \tau_1 GAP + \tau_2 s + \tau_3 s_{t-1} \qquad (16)
$$

Definitions

$$c \equiv \log\left(\frac{C}{P_c}\right), i \equiv \log\left(\frac{I}{P_y}\right), \tag{17}$$

$$x_{oil}^{USD} \equiv \log\left(X_{oil}^{USD}\right), x_{non-oil} \equiv \log\left(\frac{X_{non-oil}}{P_y}\right), z \equiv \log\left(\frac{Z}{P_y}\right) \tag{18}$$

$$m_1 \equiv \log\left(\frac{M_1}{P_y}\right), e \equiv \log(E^{USD}), s \equiv e + \log\left(\frac{P_y^{USD}}{P_y}\right) \tag{19}$$

$$w \equiv \log(W), n \equiv \log(N), u \equiv \log(U), U \equiv N^s - N \tag{20}$$

$$rev \equiv \log\left(\frac{REV}{P_y}\right), gex \equiv \log\left(\frac{GEX}{P_y}\right) \tag{21}$$

$$Y \equiv C + I + G_{C,I} + X_{non-oil} + X_{oil}^{USD}E^{USD} - Z - CIN, \tag{22}$$

$$Y_D \equiv Y - REV + GEX - G_{C,I}, y_d \equiv \log\left(\frac{Y_d}{P_c}\right) \tag{23}$$

The (unknown) parameters are assumed to be non-negative, Δ denotes the first difference operator, lower-case variables are defined in logarithms, the superscript USD denotes the US dollar as foreign currency and the superscript EUR denotes the euro as foreign currency. The variables are defined as follows: c denotes real private consumption, i real investment, x_{oil}^{USD} the dollar value of oil exports, $x_{non-oil}$ the real ruble value of non-oil exports, z real imports, m_1 real money supply, e the nominal exchange rate defined as the nominal price in rubles of one unit of an indicated foreign currency (so a rise in e corresponds to a devaluation of the home currency), p_y the producer price index, p_c the consumer price index, w the nominal wage per employee, n the employment level, rev the real government revenues and gex the real government expenditure, R the short term interest rate and GAP the deviation of GDP from potential GDP. Potential output is modeled as a six period moving average. An HP-filter definition of potential output yields qualitatively the same results in the monetary policy rule regressions, but has the disadvantage that it makes simulations very cumbersome.

The identities in equations (17) to (23) close the model. Consumer prices p_c are used to deflate consumption and disposable income, while producer prices p_y are used to calculate the other real variables. Aggregate output in rubles is defined as the sum of consumption C, investment I, ruble denominated exports $X = (X_{non-oil} + X_{oil}^{USD}E^{USD})$, government consumption and investment $G_{C,I}$ (in the simulations this is a fixed proportion of government expenditures) minus imports Z. Inventory changes CIN are added as an exogenous variable to arrive at identity. Finally, unemployment U is defined as the labour supply N^s (measured by the labour force) minus the employment level N.

7 Annex B - Estimation results

IS Block

$$\begin{aligned}
\Delta c_t &= \underset{(1.68)}{0.014} d_c - \underset{(-1.66)}{0.127} c_{t-1} + \underset{(1.67)}{0.123} y_{d,t-1} + \underset{(1.92)}{0.144} \Delta y_{d,t-1} \\
&\quad - \underset{(-3.56)}{0.102} crisis
\end{aligned} \tag{24}$$

Adj. R^2= 0.59; 1995:II - 2004:III; ADF = -3.361*; KPSS = 0.066

$$\begin{aligned}
\Delta i_t &= \underset{(2.91)}{0.033} d_i - \underset{(-3.78)}{0.197} i_{t-1} + \underset{(3.76)}{0.172} y_{t-1} + \underset{(3.61)}{0.754} \Delta y_t \\
&\quad - \underset{(-6.61)}{0.075} \Delta \left(R_t - \Delta p_{y,t}\right) - \underset{(-5.86)}{0.215} crisis
\end{aligned} \tag{25}$$

Adj. R^2= 0.71; 1995:II - 2004:III; ADF = -4.044***;KPSS = 0.202

$$\begin{aligned}
\Delta x_{oil,t}^{USD} &= -\underset{(0.77)}{0.076} - \underset{(-4.03)}{0.435} x_{oil,t-1}^{USD} + \underset{(2.02)}{0.348} wtr_{t-1} + \underset{(4.84)}{0.436} p_{oil,t-1} \\
&\quad + \underset{(5.50)}{0.499} \Delta p_{oil,t} + \underset{(2.92)}{1.065} \Delta wtr_t
\end{aligned} \tag{26}$$

Adj. R^2= 0.76; 1995:II - 2004:III; ADF = -3.741* ; KPSS = 0.109

$$\begin{aligned}
\Delta x_{non-oil,t} &= \underset{(4.01)}{1.739} - \underset{(-5.10)}{0.637} x_{non-oil,t-1} + \underset{(4.63)}{0.557} wtr_{t-1} + \underset{(4.95)}{0.492} s_{t-1} \\
&\quad + \underset{(11.52)}{0.816} \Delta s_t + \underset{(6.93)}{1.443} \Delta wtr_t
\end{aligned} \tag{27}$$

Adj. R^2= 0.85; 1995:II - 2004:III; ADF = -4.563***; KPSS = 0.179

$$\begin{aligned}
\Delta z_t &= \underset{(1.08)}{0.889} - \underset{(-3.83)}{0.631} z_{t-1} + \underset{(3.50)}{0.520} y_{t-1} - \underset{(-1.89)}{0.051} s_{t-1} \\
&\quad + \underset{(2.67)}{0.803} \Delta y_t - \underset{(-1.98)}{0.144} \Delta s_t
\end{aligned} \tag{28}$$

Adj. R^2= 0.34; 1995:II - 2004:III; ADF = -4.348*** ; KPSS = 0.169

LM block

$$\Delta m_{1,t} = \underset{(-1.94)}{-3.433} - \underset{(-2.82)}{0.243} m_{1,t-1} - \underset{(-2.70)}{0.158} R_{t-1} + \underset{(2.44)}{0.072} y_{t-1} \tag{29}$$
$$-\underset{(2.53)}{0.090} e_{t-1} + \underset{(3.03)}{1.077} \Delta y_t + \underset{(2.55)}{0.391} \Delta m_{t-1}$$

Adj. R^2= 0.29 ; 1996:I - 2004:IV; ADF = -4.515** ; KPSS = 0.130

$$\Delta e_t = \underset{(5.63)}{0.938} - \underset{(-3.85)}{0.228} e_{t-1} - \underset{(-2.03)}{0.049} p_{oil,t-1} - \underset{(-1.84)}{0.074} \Delta p_{oil,t} - \underset{(-2.72)}{0.261} \Delta R_t \tag{30}$$

Adj. R^2= 0.58 ; 1999:I - 2004:IV; ADF = 16.692***; KPSS = 0.111

$$\Delta p_{y,t} = \underset{(0.97)}{0.062} - \underset{(-4.73)}{0.275} p_{y,t-1} + \underset{(3.65)}{0.141} w_{t-1} + \underset{(4.21)}{0.085} p^{EU}_{y,t-1} \tag{31}$$
$$+\underset{(2.44)}{0.066} e^{EUR}_{t-1} + \underset{(1.93)}{0.290} \Delta w_t + \underset{(3.37)}{0.368} \Delta p_{y,t-1}$$

Adj. R^2=0.89; 1995:III - 2004:III; ADF = -3.527*; KPSS = 0.216

$$\Delta p_{c,t} = \underset{(2.23)}{0.118} - \underset{(-2.37)}{0.209} p_{c,t-1} + \underset{(1.81)}{0.115} p_{y,t-1} + \underset{(2.64)}{0.096} e^{EUR}_{t-1} \tag{32}$$
$$+\underset{(13.40)}{0.422} \Delta e^{EUR}_t + \underset{(2.26)}{3.274} \Delta p^{EUR}_{c,t} + \underset{(1.94)}{0.152} \Delta m1_t + \underset{(2.22)}{0.186} \Delta p_{c,t-1}$$

Adj. R^2=0.91; 1995:II - 2004:IV; ADF = -4.305**; KPSS = 0.317

Labour block

$$\Delta w_t = \underset{(-0.37)}{-0.423} - \underset{(-2.28)}{0.098} w_{t-1} + \underset{(1.78)}{0.089} p_{c,t-1} + \underset{(1.98)}{0.065} y_{t-1} \tag{33}$$
$$-\underset{(-2.06)}{0.059} u_{t-1} + \underset{(4.14)}{0.472} \Delta p_{c,t} + \underset{(2.03)}{0.385} \Delta y_t + \underset{(2.29)}{0.273} \Delta w_{t-1}$$

Adj. R^2= 0.83; 1995:I - 2004:III; ADF = -3.668* ; KPSS = 0.296

$$\Delta n_t = \underset{(1.04)}{0.151} - \underset{(-4.02)}{0.115} n_{t-1} + \underset{(3.82)}{0.043} \log\left(Y_{t-1}/P_{y,t-1}\right) - \underset{(-4.01)}{0.052} w_{t-1} \tag{34}$$
$$+\underset{(5.08)}{0.524} \Delta n_{t-1}$$

Adj. R^2= 0.65; 1995:I - 2003:IV; ADF = -3.465* ; KPSS = 0.162

Fiscal block

$$\Delta rev_t = \underset{(-0.43)}{-0.811} - \underset{(-5.30)}{0.705} rev_{t-1} + \underset{(3.37)}{0.624} y_{t-1} + \underset{(1.97)}{0.267} \Delta p_{oil,t} \tag{35}$$
$$+\underset{(3.20)}{0.187} \left(1 - d_{rev}\right) p_{oil,t-1} + \underset{(2.33)}{0.255} d_{rev} p_{oil,t-1}$$

Adj. R^2= 0.41; 1995:I - 2004:III; ADF = -4.177** ; KPSS = 0.196

$$\Delta gex_t = -\underset{(4.74)}{0.288} crisis - \underset{(-2.06)}{0.137} gex_{t-1} + \underset{(2.11)}{0.123} y_{t-1} - \underset{(-5.22)}{0.482} \Delta gex_{t-1} \tag{36}$$
$$+\underset{(2.40)}{0.478} \Delta y_t + \underset{(3.20)}{0.237} \left(1 - d_{gex}\right) \Delta p_{oil,t} - \underset{(2.33)}{0.152} d_{gex} \Delta p_{oil,t}$$

Adj. R^2= 0.64; 1995:I - 2004:III; ADF = -3.624* ; KPSS = 0.183

Monetary Policy rule

$$R_t = \underset{(-1.93)}{-0.123} + \underset{(2.25)}{0.190} \Delta p_{y,t-1} - \underset{(-2.07)}{0.275} GAP_{t-1} + \underset{(2.95)}{0.347} s_t - \underset{(-2.15)}{0.272} s_{t-1} \tag{37}$$

Adj. R^2=0.70; 1999:I - 2004:IV

8 Annex C - Dynamic in-sample simulation of the model

Before making predictions about the Russian economy, we need to check the model's tracking ability of Russian macroeconomic adjustment. We therefore apply a stochastic, dynamic in-sample simulation. We focus on the subset of model variables displayed in Figure 3. Except for the exchange rate and the interest rate[11], we use estimates based on the full sample to perform a simulation for the period 1999:I-2004:IV, i.e. the period after the August 1998 crisis. In Figure 3, solid lines indicate the actual adjustments, while dashed lines indicate the adjustments predicted by the simulation for the period 1999:I-2004:IV. We also show the 5% and 95% confidence intervals of the simulations. The good tracking ability of the model apparent in Figure 3 testifies of the stability of the model.

[**Insert Figure 3 around here**]

The model picks up very well real investment, real consumption and real GDP. The simulation produces an accurate replication of the dynamics of exports and imports. Note how well the model tracks actual oil and non-oil exports. Also actual exchange rate fluctuations are followed closely by the model. The stabilizing and even slowly appreciating nominal exchange rate in 2004 is tracked accurately. Given our simple specification in (30), it is clear that the oil price played a major role in the appreciation of the ruble. The monetary policy rule provides an appropriate interpretation of the short term interest rate path set by the CBR. The interest rate evolution in 2001-2004 clearly reflects the CBR's desire to manage oil-driven exchange rate fluctuations. The model devotes a lot of attention to the fiscal side of the economy, with explicit and detailed specifications for government revenues and government expenditures. The effort put in modelling the fiscal variables yields a respectable tracking ability. Indeed, although the fiscal balance is not directly modelled (the model considers revenues and expenditures separately), the deficit or surplus implied by the model closely mimics the actual fiscal balance. The Russian economy has not only gone through a period of gradual stabilization of the real side. Also nominal variables like prices (PPI, CPI), wages, and M1-money have seen a dramatic shift from high inflation and volatility to more stability since 1999. The model tracks Russia's gradual disinflation dynamics by accurately replicating the evolution of both consumer and producer prices.

[11] Before 1999 the exchange rate is an exogenous variable in the model, which fits the reality of the ruble corridor exchange rate policy. In the post-devaluation time window the exchange rate was relatively flexible and could fully play its endogenous role. The interest rate is also exogenous before 1999. Since 1999 the interest rate follows endogenously from the estimated monetary policy rule.

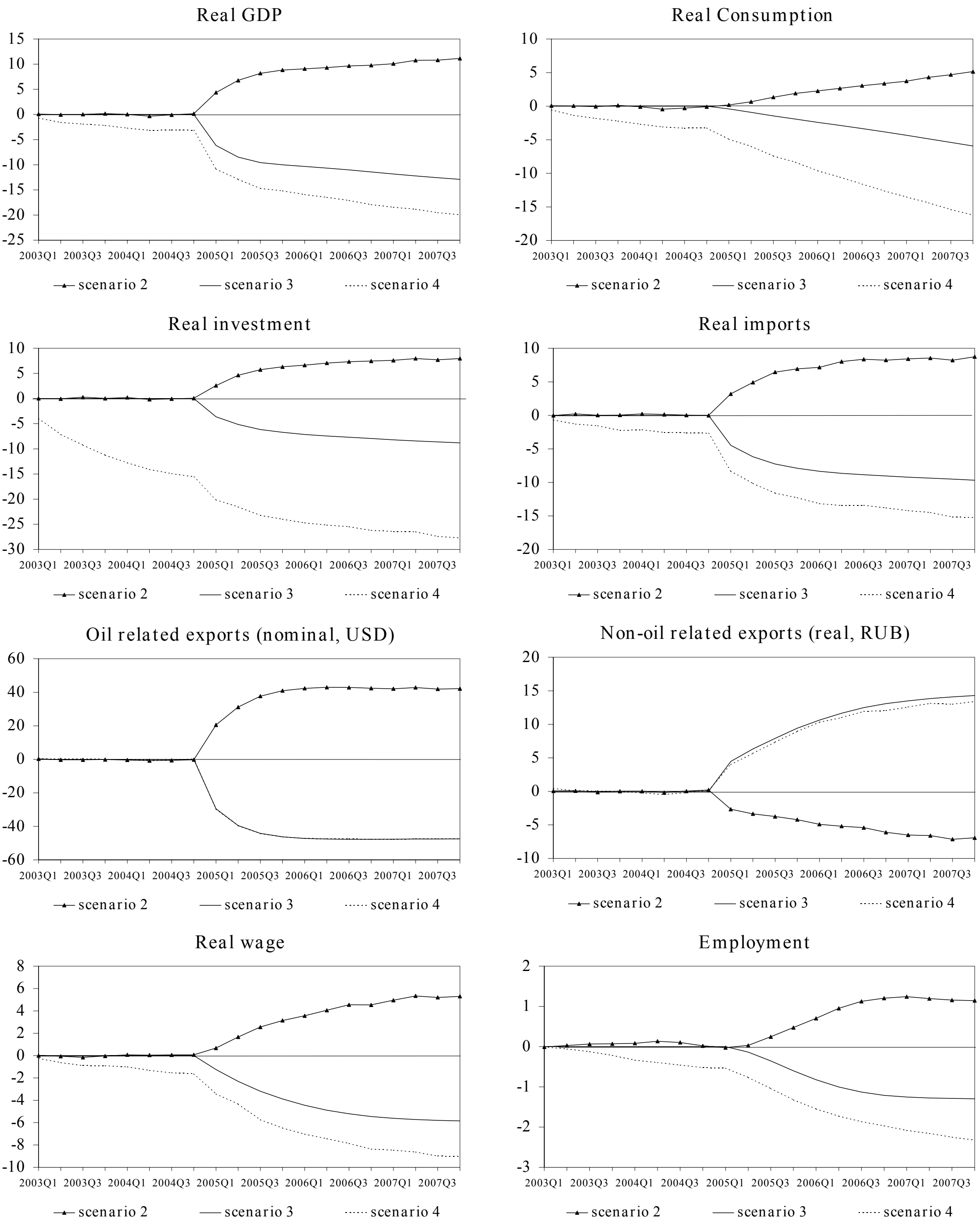

Figure 1: Oil price shock simulations (%deviations from scenario 1 unless indicated otherwise)

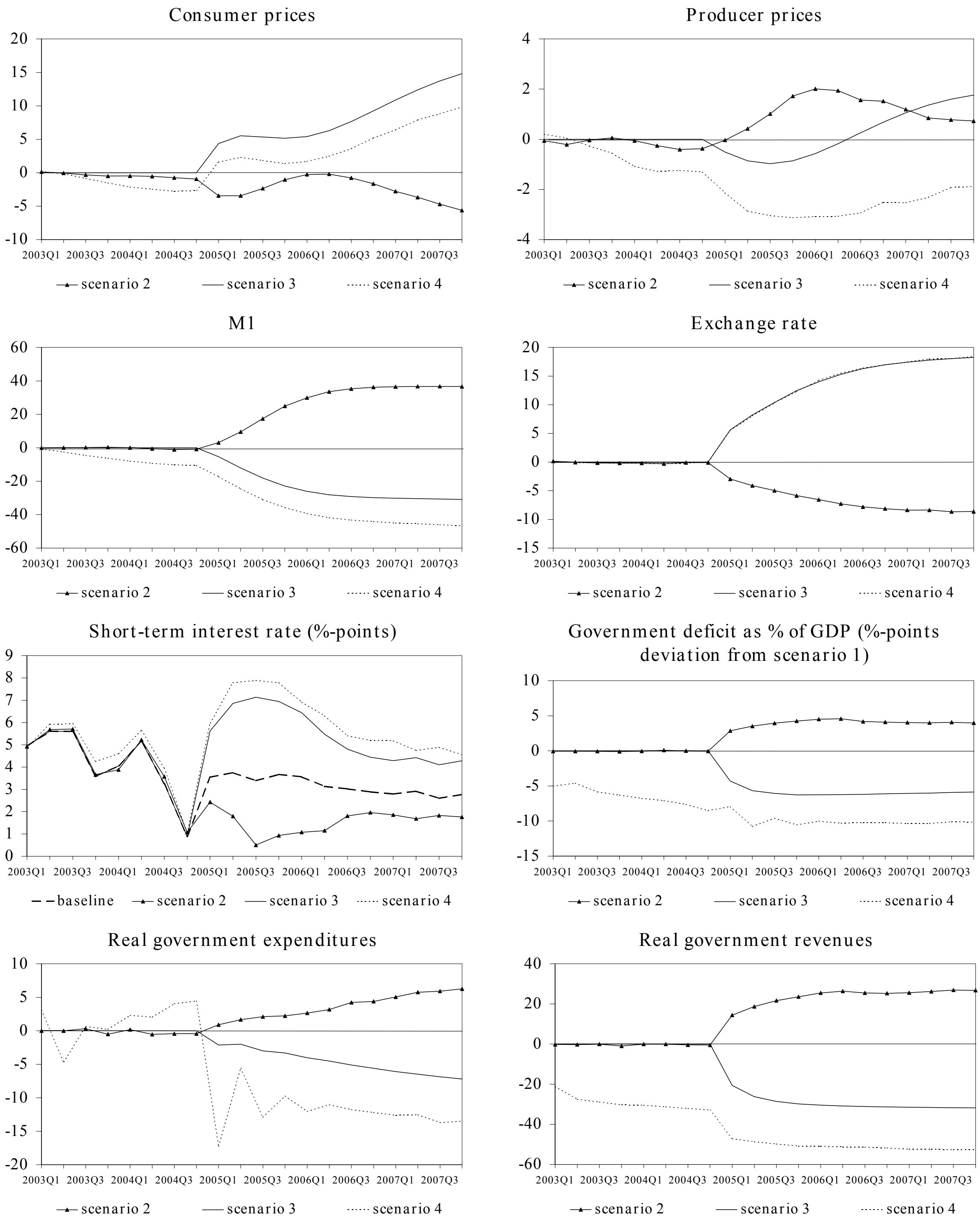

Figure 1 *cntd.*: Oil price shock simulations (%deviations from scenario 1 unless indicated otherwise)

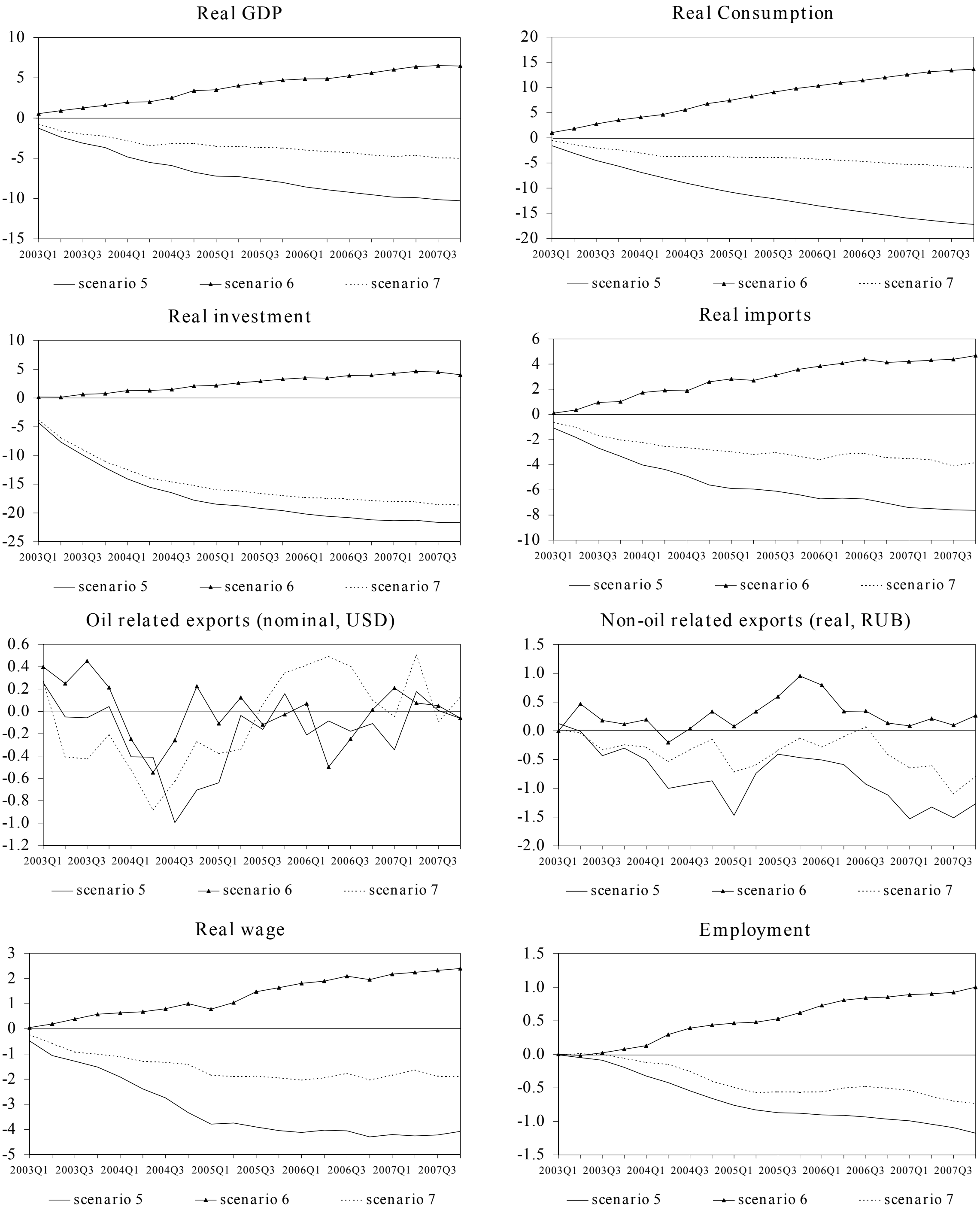

Figure 2: Private sector confidence and fiscal policy intervention simulation (%deviations from scenario 1 unless indicated otherwise)

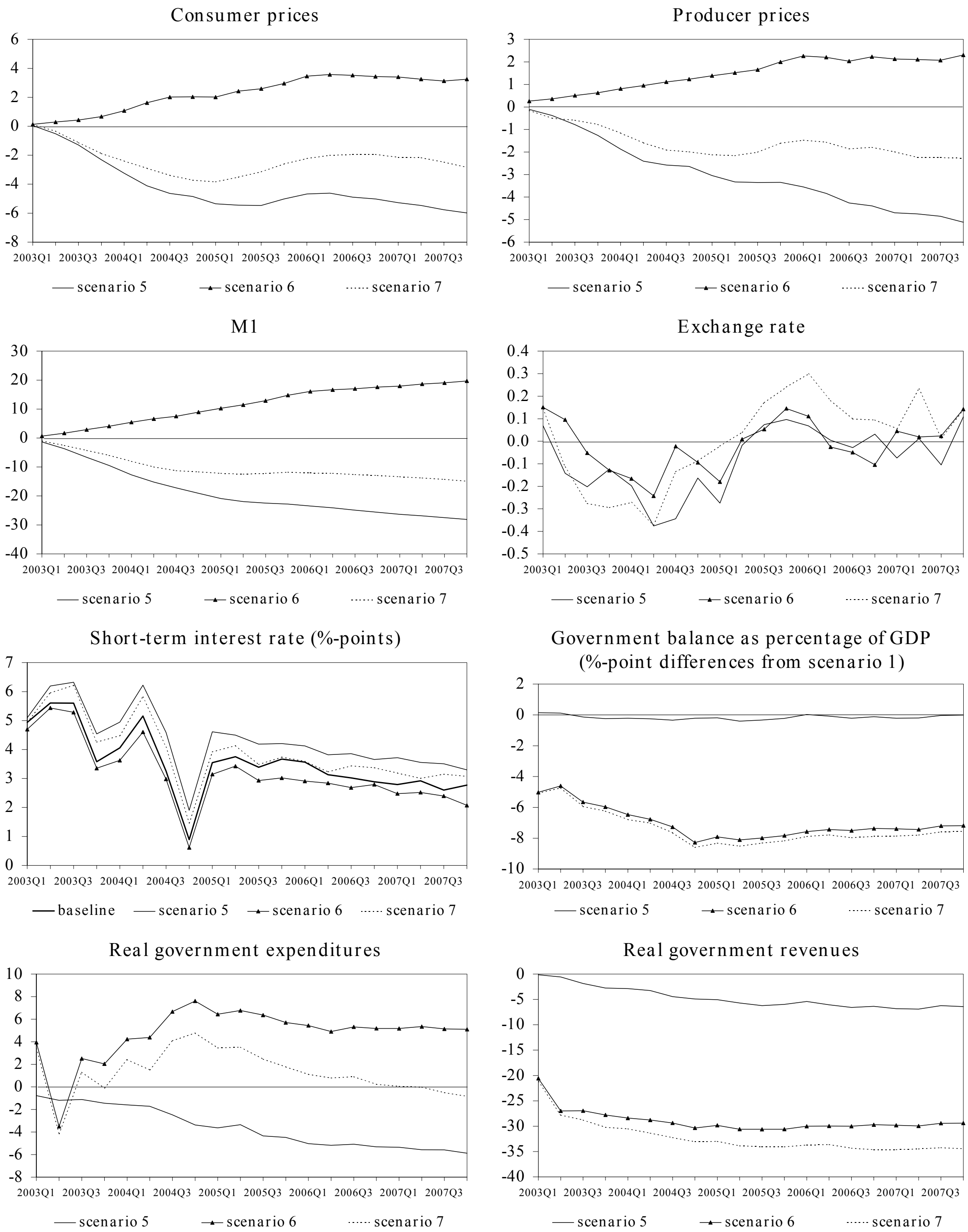

Figure 2 *cntd.*: Private sector confidence and fiscal policy intervention simulation (%deviations from scenario 1 unless indicated otherwise)

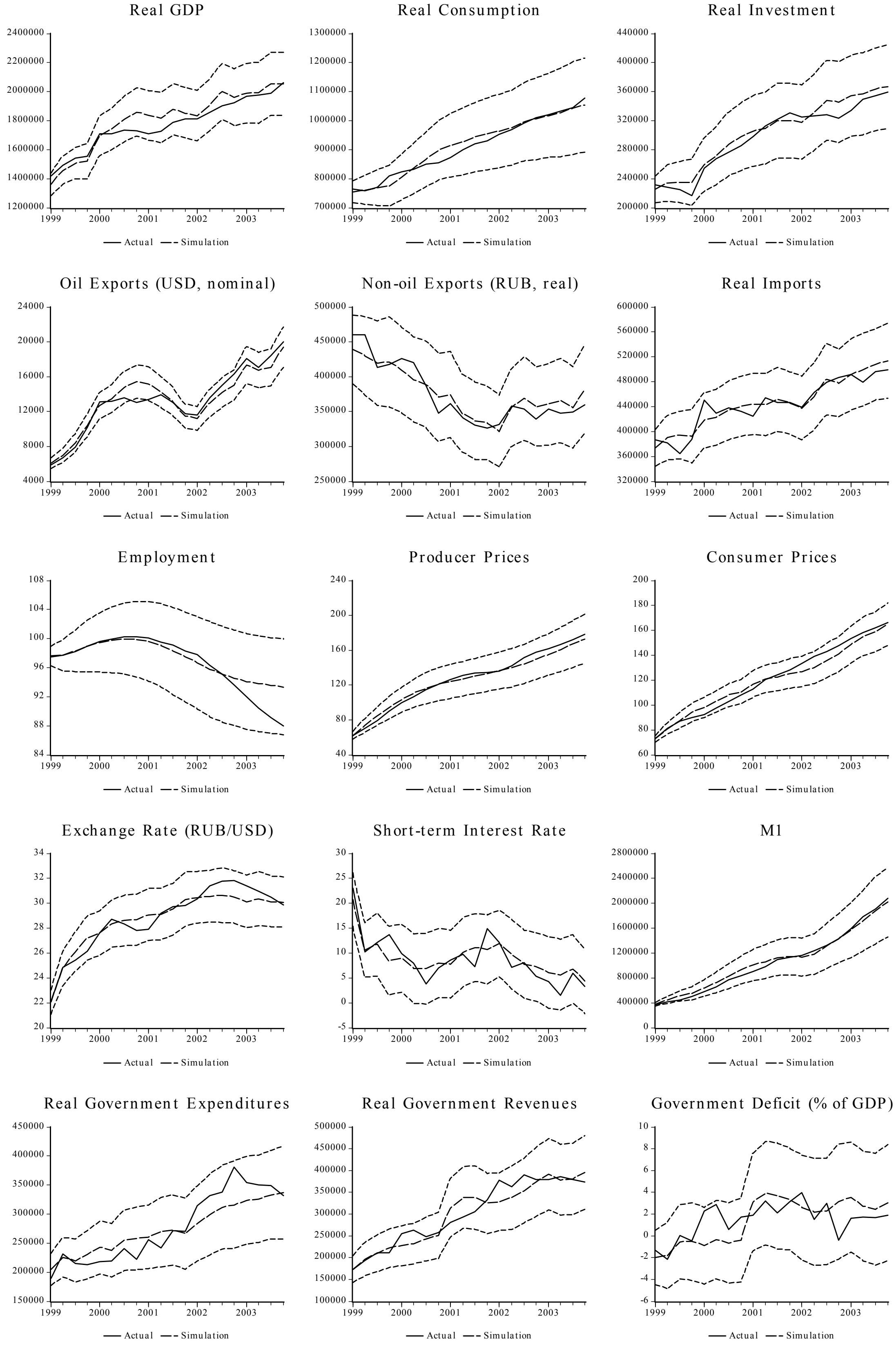

Figure 3: Dynamic in-sample simulation 1999:I-2003:IV