

Re-estimation of the quarterly model of the Polish economy
NECMOD 2011

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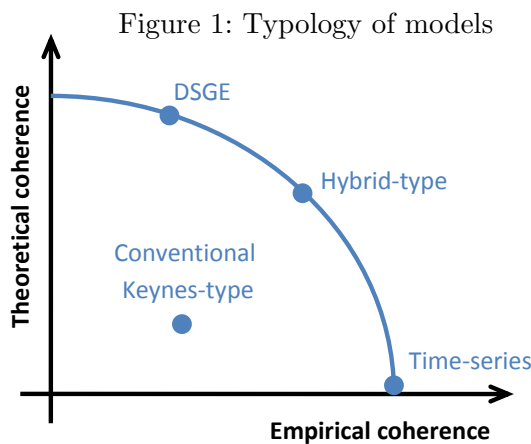
1 Introduction

The present document describes the NECMOD model and discusses major changes introduced to the model following its re-estimation performed in May 2011 (previous versions of the model were reported in: Budnik et al., 2009ab, Greszta et al. 2010). The model's parameters are estimated once a year and, on such occasion, some blocks of the model are also modified. In 2008, the most important changes included: the extension of the labour market component, introduction of forward-looking expectations to the model, disaggregation of investments and accounting for the impact of world market prices on domestic prices. In 2009, the major modification involved changing the foreign trade block specification. During re-estimation rounds in 2010 and 2011 changes focused on modifications in price equations.

The second chapter describes major features of the NECMOD model. The third chapter presents changes in the model implemented in 2011. The fourth chapter discusses the model's response to selected impulses. Annex A contains current estimates of the parameters of the NECMOD model behavioural equations and Annex B - definition of variables.

2 The NECMOD model

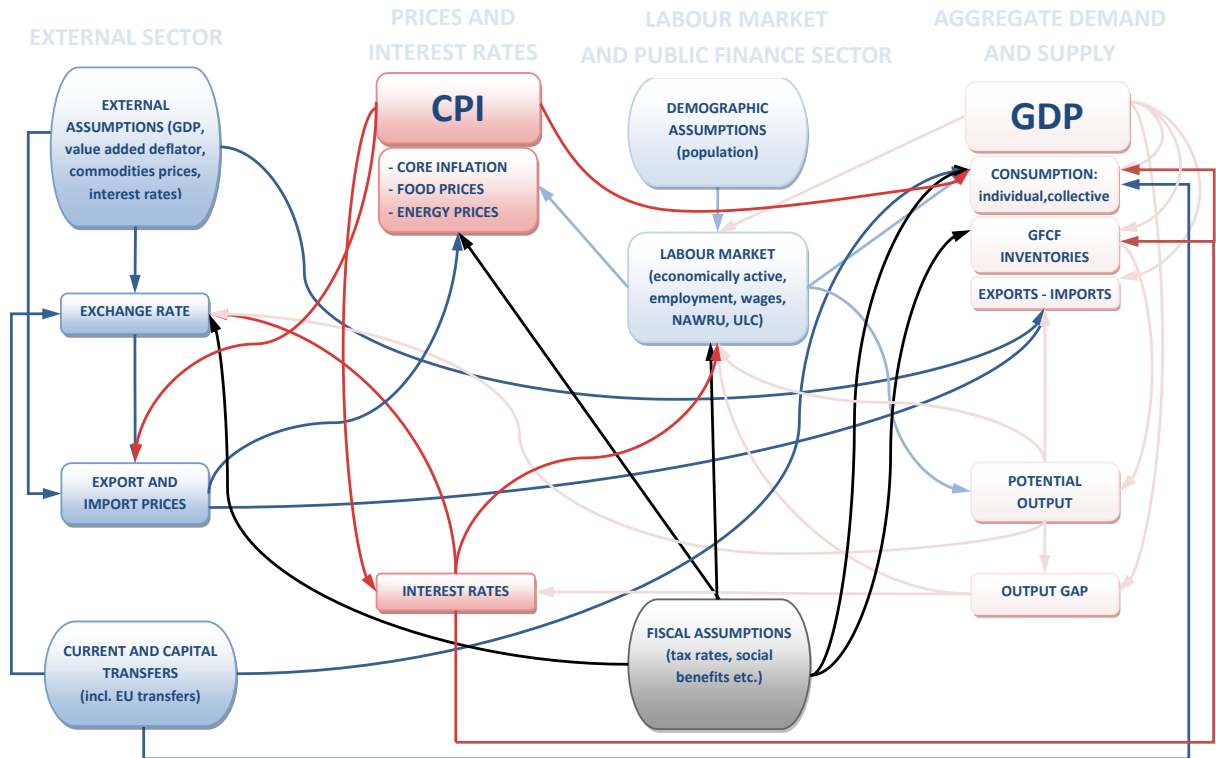
The NECMOD model is an econometric model used at the National Bank of Poland for preparing inflation projections published in *Inflation Reports*. It was constructed as a hybrid model where the long-term equilibrium (there are mechanisms in the model assuming variables' return to their equilibrium level) is based on theoretical foundations, while short-term dynamic features of the model are dependent upon econometric estimates whose main criterion is adjustment to the data. This places the NECMOD model between deeply rooted in theory DSGE-type models and a-theoretical time series models, represented by VAR and DFM models, at the other end (cf. Figure 1).



Source: Hara N. et al. (2009).

The forecasting version of the NECMOD model comprises 283 equations and 382 variables, allowing to describe economic processes of high degree of disaggregation, with many channels through which particular sectors of the economy influence each other. A simplified diagram of the model mechanisms is presented in Figure 2, its major features are listed below.

Figure 2: The NECMOD model structure



Core inflation developments in the model are affected by unit labour costs, import prices, labour market gap and model-consistent inflation expectations. Core inflation and growth in food and energy prices, driven by agricultural and energy commodity prices in the global markets, respectively, are components of the CPI inflation.

The NECMOD model takes into account specific features of the Polish economy. In particular, six types of EU transfers with various degrees of impact on the economy have been distinguished (transfers under the Common Agricultural Policy (CAP), transfers under the Rural Development Plan (RDP), transfers for the financing of current expenditure of the public sector, transfers for the financing of capital expenditure of the public sector, transfer for human resources development, and other transfers mainly to enterprises). The foreign trade block in the model accounts for a rising share of volume of exports and imports in GDP, observed since the beginning of the transformation period, and an appreciation of the real effective equilibrium exchange rate resulting from domestic growth exceeding growth abroad.

The NECMOD model, as compared to other models in this class, has an extended supply side and fiscal sector block. In particular, the (NAWRU) unemployment rate and the labour force activity rate are explained in the model and depend, among others, on tax rates and replacement rates, which means that fiscal policy has a direct impact on the potential output. The model distinguishes three types of investment, modeled separately: residential, corporate and public investment. Only public and corporate investment increase productive capital, and, as a result, have impact on potential output developments.

3 Changes in the model

Changes, as compared to the previous version of the model (Greszta et al. 2010), result from the extension of the re-estimation sample (including the year 2010), as well as from the modifications introduced to certain blocks of the model. Major changes are described below.

1. **Domestic energy prices.** In the NECMOD model, domestic energy prices are dependent, apart from other variables, on global index of energy commodity prices, which is a weighted average of hard coal, crude oil and natural gas prices. The equation was modified to diversify the speed of the impact, that changes of certain commodities prices have on domestic energy prices. First, estimates of natural gas imported from Russia were introduced into the model, which, in the short term, are dependent upon delayed quotes of crude oil prices in the global markets, and, in the long term, on quotes of natural gas prices ¹. Second, due to the predominant share of domestic hard coal in electricity generation, energy prices were made dependent upon domestic hard coal prices (according to the Central Statistical Office), and not – as in the 2010 model version – directly on the prices of this commodity abroad. As a result, there is a time lag in foreign prices being fed through to domestic prices (coal prices abroad affect domestic coal prices, and these, in turn, impact energy prices). Third, it was assumed that energy prices developments in the short term are largely driven by changes in crude oil prices as they are rapidly fed through into fuel prices and because of regulations in the electrical energy and gas markets (for individual customers). Yet, the above mentioned changes did not affect the strength of commodity prices translating into domestic prices in the long term – it continues to be the highest in the case of hard coal which has the largest share in domestic consumption.

2. **Re-estimation of the short-term exchange rate equation.**

The difficulties faced while modeling the exchange rate are summed up by Sarno and Valente (2009), who claim that information derived from the fundamentals may provide an explanation for a large part of changes in the exchange rate, yet it is not possible to choose a model *ex ante*. The reason is the behavior of the exchange rate which, in the short-term, is close to the random walk process; moreover, factors influencing exchange rate developments change over time. Hence, specification of the

¹The price paid by Poland for gas imported from Russia is a trade secret. The equation was specified on the basis of developments of prices paid by Germany.

exchange rate equation has been to a greater extent than previously, based on a research conducted outside the NECMOD model. In particular, the speed of exchange rate convergence to the equilibrium level has been made dependent upon the distance of the current exchange rate value from the equilibrium: $\Delta q_t = \beta(q_{t-1} - q_{t-1}^*) + z_t$, where q_t – effective exchange rate, q_t^* – equilibrium exchange rate (fundamental), $\beta = -(1 - \exp(-\gamma(q_{t-1} - q_{t-1}^*)^2))$, z_t – other factors (Michael et al., 1997). γ parameter was calibrated on the basis of studies indicating that half of the life of shocks ranging from 1 to 5% does not exceed three years (Sarno and Taylor, 2009, p. 72). Moreover, due to a moderate, as compared to the findings of other studies, exchange rate response to monetary shocks, the previously estimated parameters, corresponding to the impact of interest rate disparity on exchange rate, have been calibrated based on the references (Evans and Lyons, 2002; Clarida et al., 2009 et al.). Another change in the equation was the adoption of a risk premium as an approximation in lieu of public finance sector deficit, an index being the sum of standardized variables: public sector deficit (+), domestic output gap (-), foreign output gap (-), terms of trade (-), current account deficit (+), NFA/GDP (-), real interest rates disparity (+), where + (-) means the exchange rate depreciating (appreciating) factor.

3. **Impact of indirect taxes on prices.** In short-term equations of core inflation, energy prices and food prices, parameters were calibrated, given effective rates of indirect taxes, on the basis of an estimated pass-through of changes in VAT rates into consumer prices after January 1, 2011 (while the specification of long-term equations for these variables has not changed).
4. **Accounting for hysteresis effects.** An OECD study (2009) shows that a 1% rise in unemployment rates feeds through, in the longer term, into a 0.7% increase in the equilibrium unemployment rate. This phenomenon has not been so far fully incorporated into the NECMOD model. The impact of the current unemployment rate on the equilibrium unemployment rate is reflected in the present version of the model in a different manner - a persisting high unemployment rate increases equilibrium in the wage equation, and consequently, the NAWRU unemployment rate.
5. **Change in the external sector weights.** In the recent period a change in the behaviour of particular euro area countries has been observed - business cycle convergence of particular economies has declined. The pace of recovery of the German economy (Poland's main trading partner) largely exceeds the one observed in France or Spain. During the model re-estimation, the euro area was divided into Germany and other euro area countries. Thus, Germany's weight in the external sector of the model increased (the importance of German economy in Polish foreign trade largely exceeds Germany's share in GDP of the euro area) which, among other things, boosted GDP growth abroad in the past few quarters.
6. **Change in the breakdown of the economically active population.** In the present version of the NECMOD model, the participation rate is modeled in four age groups. In the new version of the model, as compared to the previous version, population aged 45 years and older was divided into two age groups: 45-59/64 years

and 60/65 years and more. This would allow for more precise modeling of the labour force activity in the age group with growing share in the population as a whole (and to account for specific variables explaining economic activity of the population at a post-production age).

7. **Revision of the TFP estimate.** Generally, total factor productivity (TFP) is estimated by smoothing the so-called Solow residual through the HP filter. The disadvantage of this approach is cyclical behaviour of the estimated TFP growth (in particular, underestimation of TFP level during the global crisis). During the model re-estimation, TFP level was re-estimated using the guidelines of the European Commission under which HP filter used to smooth TFP series is extended by information contained in additional variables (i.e. production capacity utilization) (European Commission, 2008, 2009).

4 Analysis of response to the impulse

After the re-estimation, the model has changed its behaviour in response to certain impulses. In particular, monetary impulse has deepened (interest rate fluctuations translate stronger into foreign exchange rate, inflation and GDP), changes in indirect tax rates are fed through into inflation more rapidly and the impact of changes in energy commodities prices on domestic energy prices has changed.

The behaviour of the model is presented based on the description of selected impulses. Unless otherwise indicated, changes are unexpected and the monetary rule is enabled (interest rates are formed according to the Taylor rule). Variables responses to an impulse are presented in the horizon of 28 quarters (cf. Figures 3-7).

4.1 Analysis of the effects of monetary shock

A monetary impulse is defined as an unexpected increase in the short-term interest rates of 100 basis points for the period of four quarters (cf. Figure 1). After the shock interest rates behave according to the Taylor rule, remaining temporarily above the baseline scenario as a result of the rule's mechanism smoothing the path of interest rates.

The increase in short-term interest rates, which, in turn, causes a hike in long-term rates, leads to an increase in costs of raising capital, and consequently, reduces both corporate and household investment (residential investment).

In turn, lower residential investment leads to a drop in housing prices and, consequently, to the decline in household assets reducing consumer demand. Higher interest rates also curb private consumption by shifting consumption in time, especially in the case of durable goods. On the other hand, individual consumption is increased by the appreciation of the national currency, which is improving Poland's net foreign asset position, and higher interest on public debt.

The appreciation of the Polish currency, through its impact on foreign trade prices, reduces export growth and increases the growth rate of imports. In consequence, the exchange rate channel is contributing to a reduction in net exports.

As a result, GDP growth falls by about 0.4 percentage points, with the strongest decline coming three quarters after the monetary shock.

The effect of the interest rate rise on inflation is associated with a lower growth of import prices due to domestic currency appreciation and lower labour costs, resulting from the reduced growth rates of wages and employment in response to the slowdown in economic activity. Consequently, CPI inflation falls by about 0.35 percentage points five quarters after the increase in interest rate.

In response to the decline in GDP growth, as well as lower inflation, the monetary shock is followed by a monetary policy easing, in line with the Taylor rule. Lower interest rates leading to increased economic activity and faster price growth, bring the economy back to the baseline path.

4.2 Analysis of the effects of exchange rate disturbances

The impulse has been defined as unsustained 10-percent appreciation of the real (and nominal) exchange rate.

Exchange rate appreciation leads to a decline in import prices and thus in all the components of CPI inflation (core inflation, energy prices and food prices). The maximum reduction in CPI inflation (a drop of 2.4 percentage points) is observed three quarters after the shock occurs.

Along with the appreciation of the exchange rate, domestic products become less competitive abroad, which leads to weakening exports with the concurrent rise in imports, and thus to a negative contribution of net exports to GDP growth. The strongest decline in GDP occurs in the third quarter after the impulse. Due to weaker sales opportunities, enterprises reduce their investments. The economic slowdown also leads to a deterioration in the labour market situation and, consequently, to a reduction of disposable income of households and a consumption decline.

In response to falling prices and lower economic growth, monetary policy is being relaxed, supporting the economy in its return to the equilibrium state.

4.3 Impulse of changes in energy commodity prices

The impulse was defined as a sustained 10-percent increase in the prices of crude oil, gas and coal in the world markets (in the NECMOD model these prices are components of the energy commodity price index) (cf. Figure 5).

The increase in energy commodity prices leads directly to a higher growth rate of import prices (change of approx. 1 percentage points, after three quarters) and energy prices in the domestic market (change of approx. 1.7 percentage points, after three quarters). Changes in crude oil prices translate much faster than changes in foreign hard coal prices due to a relatively small share of imported coal in domestic consumption and the absence of regulations in the petrol and diesel market. The trade balance deterioration, caused by less favourable terms of trade, translates into the weakening of the equilibrium exchange rate, and consequently, lower current exchange rate. The above factors drive up inflation, with the highest level (change of approx. 0.35 percentage points) recorded in the third quarter after the impulse. The consequence of inflation growth is monetary policy tightening.

Enterprises incur additional costs associated with rising energy prices and higher credit costs, which curbs their investment, and translates, with some delay, into a decline of productive capital. This leads to a reduction in the level of potential output and wealth. Wealth is further reduced by the depreciation of the exchange rate, which affects the level of potential output and wealth. Wealth is further reduced by the depreciation of the exchange rate, which affects the level of net foreign assets. The reduction in assets and real income of households (as a result of higher consumer prices) permanently decreases consumer demand, which, combined with a decline in investment translates into lower growth in domestic demand and GDP (change of approx. 0.2 percentage points after eight quarters).

4.4 Impulse of changes in agricultural commodity prices

The impulse was defined as a sustained 10-percent increase, expressed in US dollars, in agricultural commodity prices in the world markets (cf. Figure 6).

The rise in agricultural commodity prices abroad translates into higher domestic prices of these commodities. This leads to growing domestic food prices (CPI component) - in

the third quarter after the impulse by slightly over 2 percent, which means a rise in CPI inflation by approx. 0.5 percentage points. The impact of growth in agricultural commodity prices on domestic inflation is thus, in the short period, stronger than in the case of energy commodities, which is connected with higher weight of food prices in the CPI and the absence of regulated prices in this market.

The rise in agricultural commodity prices has also resulted in a decline in GDP growth. This is so because inflation growth diminishes the real household income and leads to monetary policy tightening. Higher interest rates affect the decisions of households and enterprises by curbing consumption, investment and inventories. Higher interest rates are also a factor behind exchange rate appreciation which results in lower exports and higher imports. A slowdown in economic activity translates, with some delay, into the situation in the labour market: wage cuts and higher unemployment rate.

4.5 Analysis of the effects of higher VAT rate

The impulse was defined as a permanent rise in VAT rate by 1 percentage points (cf. Figure 7).

Increased VAT income in the short term will improve the public sector balance by approx. 0.3 percent of GDP, at the same time, boosting inflation and curbing GDP growth.

Rising tax burden translates partly into higher consumer prices (inflation growth in the first year of 0.3 percentage points), and partly is taken over by producers, which is conducive, in turn, to diminishing households income from operating surplus. Also income from hired work is lower - higher prices combined with rigid, in the short term, wages decrease real wage fund. Both these factors diminish households disposable income and, in consequence, reduce consumption. Lower households expenditures and higher production costs affect decisions of enterprises to cut down investment and inventories. Exchange rate appreciation being the consequence of monetary policy tightening (the effect of higher CPI inflation) is an additional factor reducing economic activity. The maximum decline in GDP growth is recorded in the third quarter after the impulse (fall by 0.2 percentage points).

In the longer term horizon, lower economic growth translates into a deterioration in the labour market and further decline in real wage fund and private consumption. Unfavourable situation in the labour market and limited demand brings inflation in the medium term below the base scenario.

Figure 3: Analysis of the effects of monetary shock

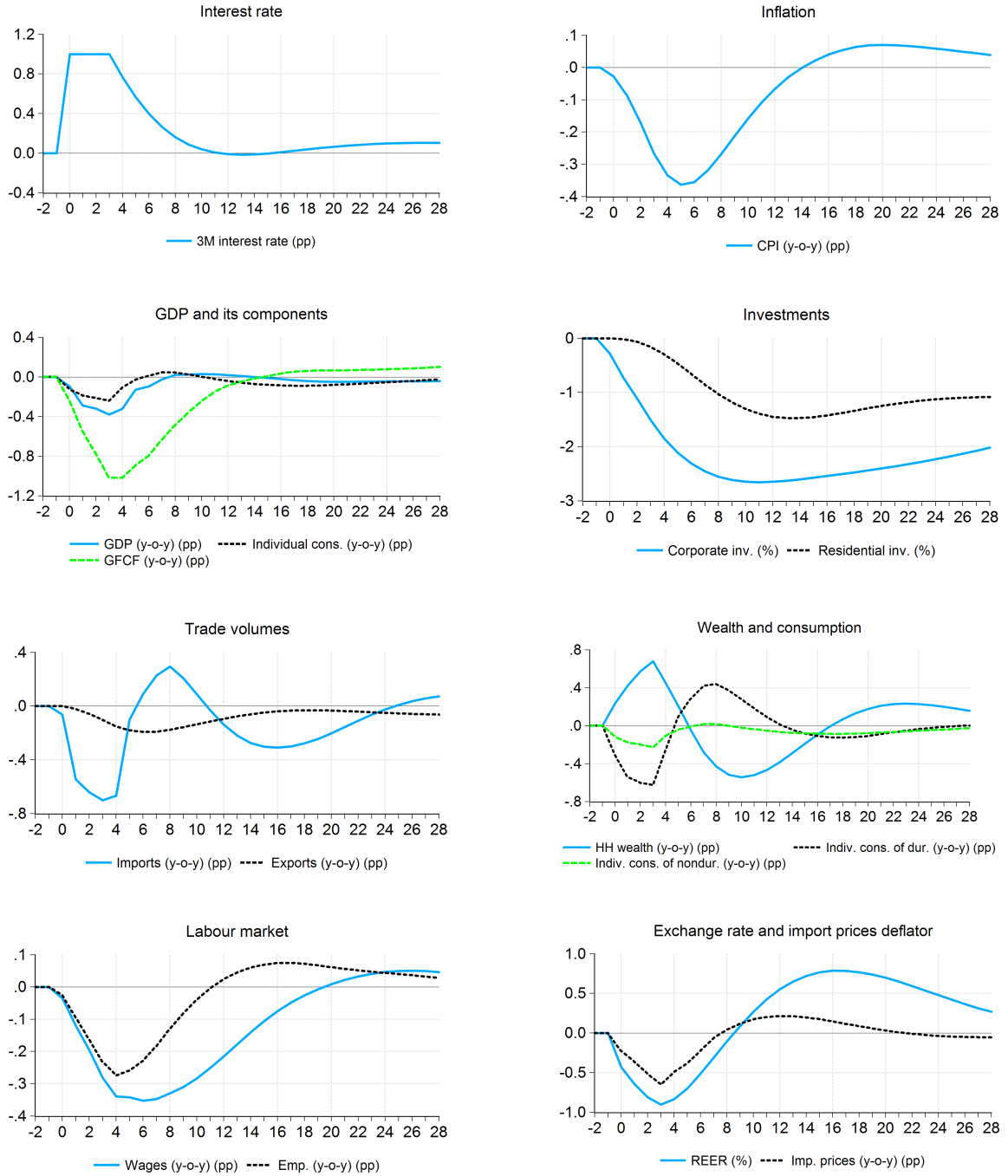


Figure 4: Analysis of the effects of exchange rate disturbances



Figure 5: Analysis of changes in energy commodity prices

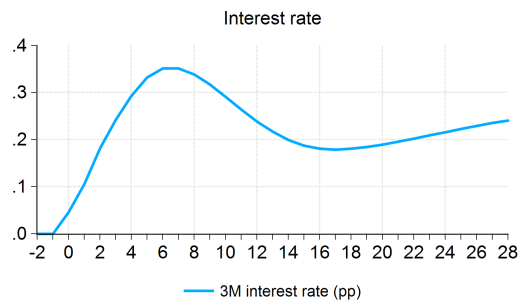
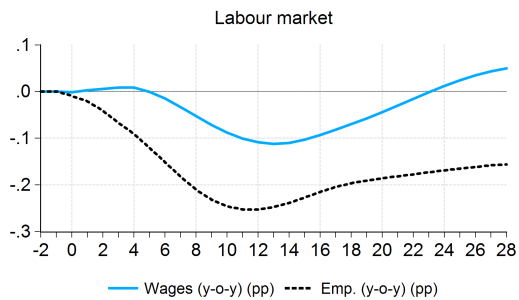
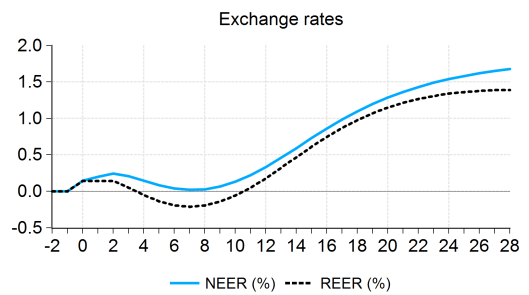
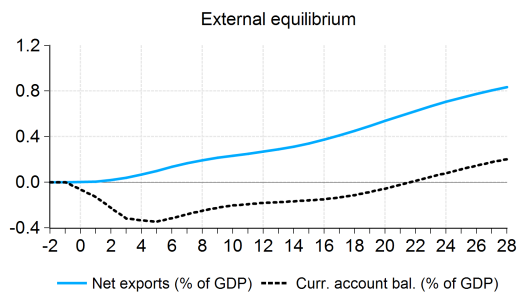
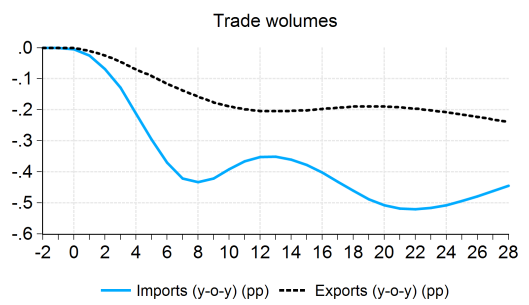
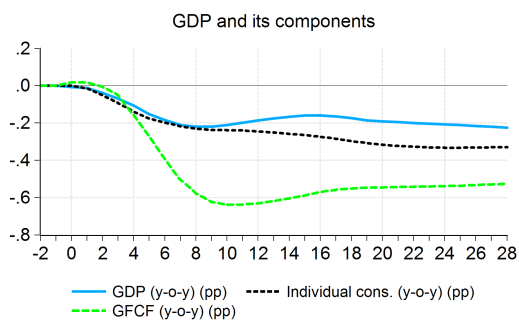
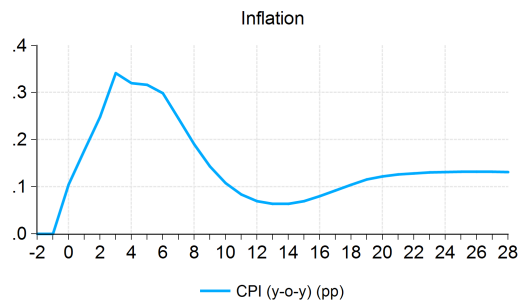
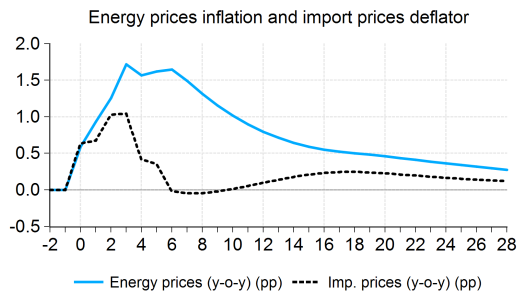


Figure 6: Analysis of changes in agricultural commodity prices

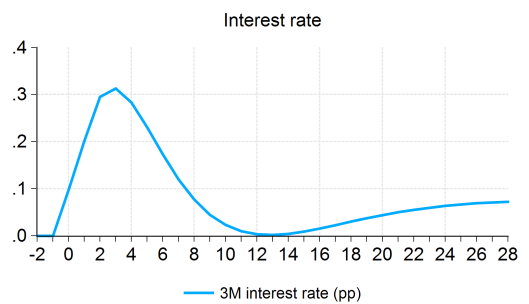
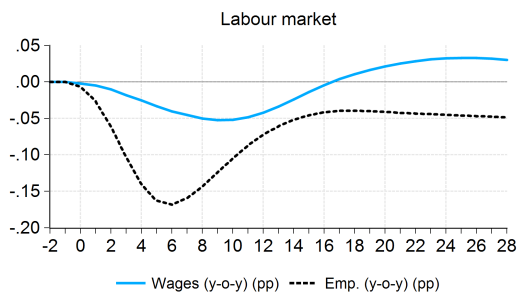
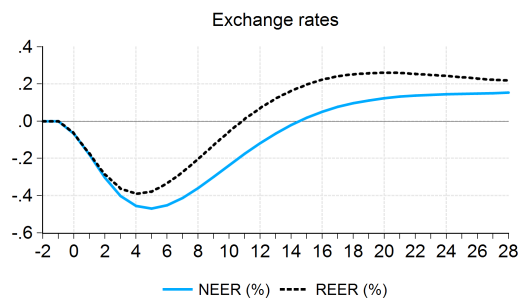
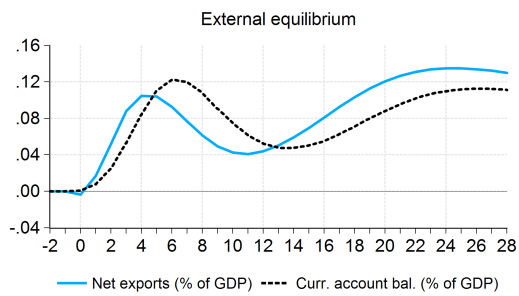
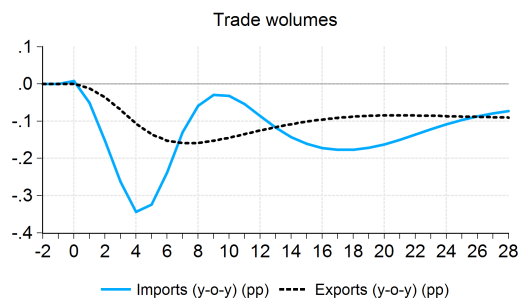
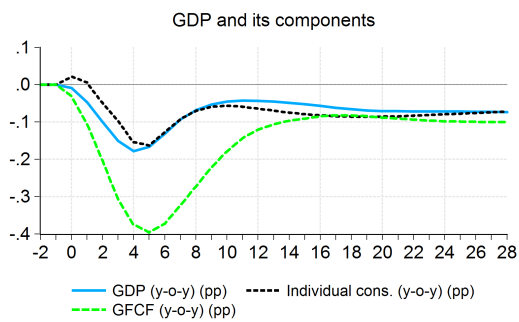
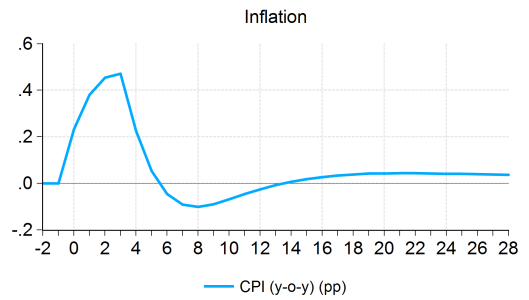
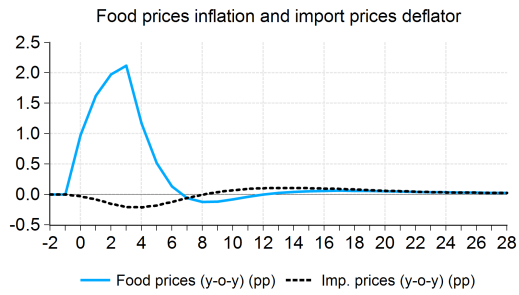
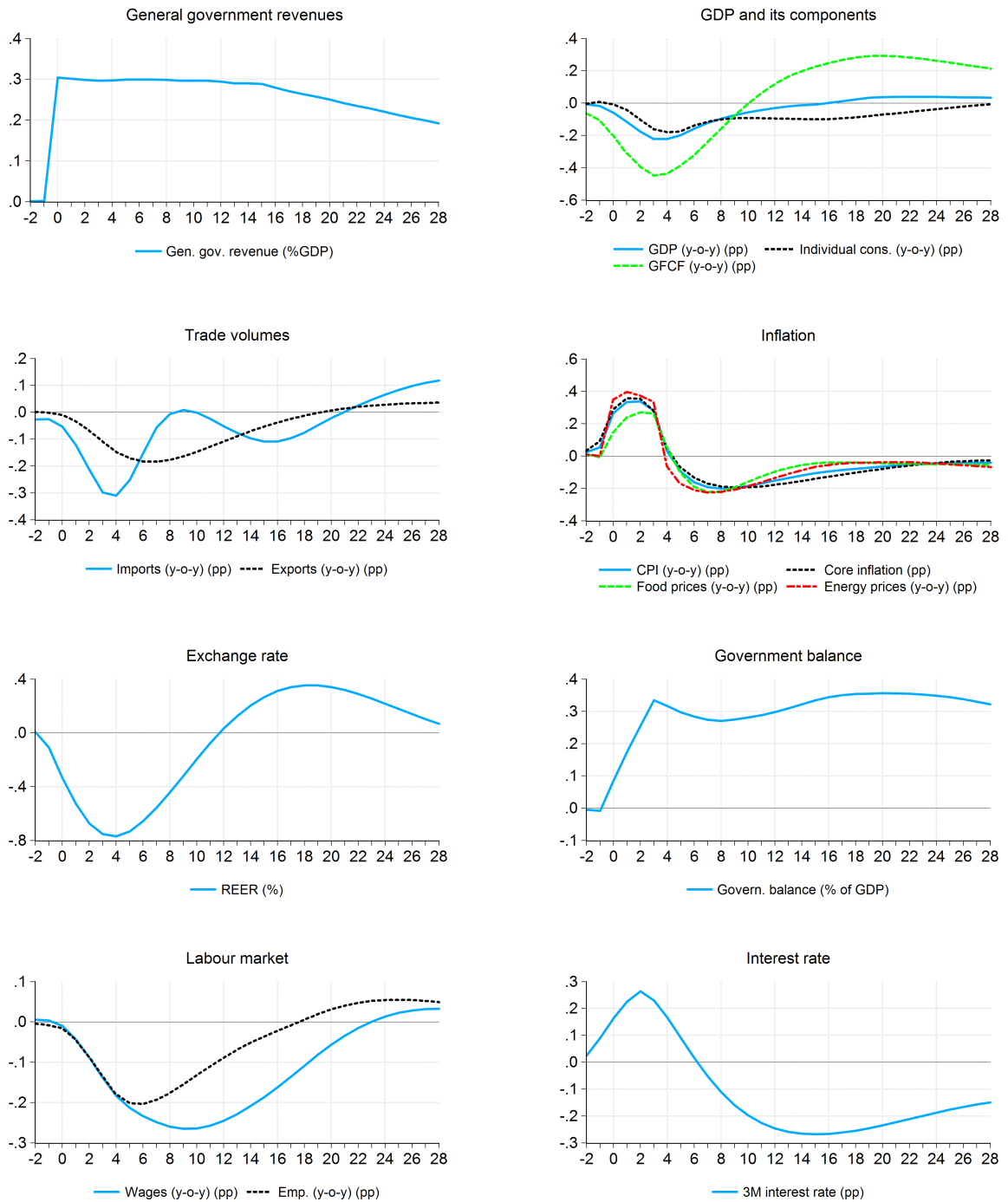


Figure 7: Analysis of the effects of higher VAT rate



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A NECMOD equations²

A.1 Prices

Core inflation

$$\begin{aligned} corecpi_t^* = & C_CORE_t + 0.70 \cdot (wage_n_t + \log(1 + GR_CORP_TR_t)) \quad (1) \\ & + 0.70 \cdot (1/0.67 - 1) \cdot (gdp_t - k_t) - 0.70 \cdot 1/0.67 \cdot tfp_trend_t \\ & + (1 - 0.70) \cdot (pimp_core_t^c + (1 + GR_TAR_TR_t)) \\ & + GR_CORE_TR_t \end{aligned}$$

$$\begin{aligned} \Delta corecpi_t = & \log(1 + INF_TARGET_t)/4 \cdot (1 - \underset{(0.07)}{0.27} - \underset{(0.11)}{0.30} - \underset{(0.03)}{0.05} \quad (2) \\ & - \underset{(0.006)}{0.02}) + \underset{(0.07)}{0.27} \cdot \Delta corecpi_{t-1} + \underset{(0.11)}{0.30} \cdot \Delta(corecpi_{t+1}) \\ & + \underset{(0.03)}{0.05} \cdot (\Delta wage_n_t + \Delta \log(1 + GR_CORP_TR_t)) \\ & - \Delta tfp_trend_t/0.67 + \underset{(0.006)}{0.02} \cdot \Delta(pimp_core_{t-1}^c \\ & + \log(1 + GR_TAR_TR_{t-1})) + 0.3 \cdot \Delta(GR_VAT_TR_t) \\ & - \underset{(0.02)}{0.10} \cdot (corecpi_{t-1} - corecpi_{t-1}^*) \end{aligned}$$

*Adjusted R*² = 0.94

S. E. of equation = 0.003

test J (p-value) = 0.001

Estimation period: 1996q4 - 2010q4

Deflator of value-added

$$\begin{aligned} pva_t^* = & C_PVA_t + 0.67 \cdot (wage_n_t + \log(1 + GR_CORP_TR_t)) \quad (3) \\ & + 0.67 \cdot (1/0.67 - 1) \cdot (gdp_t - k_t) - 0.67 \cdot 1/0.67 \cdot tfp_trend_t \\ & + (1 - 0.67) \cdot pimp_t^c \end{aligned}$$

²Standard errors of parameters are reported below their point estimates in brackets.

$$\begin{aligned}
\Delta pva_t = & \log(1 + INF_TARGET_t)/4 \cdot (1 - \frac{0.17}{(0.03)} - \frac{0.13}{(0.05)} - \frac{0.17}{(0.04)} - \frac{0.01}{(0.01)}) \quad (4) \\
& + \frac{0.17}{(0.03)} \cdot \Delta(pva_{t-1}) + \frac{0.13}{(0.05)} \cdot \Delta(pva_{t+1}) \\
& + \frac{0.17}{(0.04)} \cdot (\Delta wage_n_t + \Delta \log(1 + GR_CORP_TR_t) - \Delta tfp_trend_t/0.67) \\
& + \frac{0.01}{(0.01)} \cdot \Delta pimp_{t-1}^c - \frac{0.18}{(0.02)} \cdot (pva_{t-1} - pva_{t-1}^*)
\end{aligned}$$

*Adjusted R*² = 0.71

S. E. of equation = 0.006

test *J* (*p-value*) = 0.001

Estimation period: 1996q4 - 2010q4

Inflation of energy prices

$$\begin{aligned}
enercpi_t^* = & -0.30 + 0.53 \cdot p_ener_pl_t + (1 - 0.53) \cdot pva_t \quad (5) \\
& + GR_ENER_TR_t + dummies
\end{aligned}$$

$$\begin{aligned}
\Delta enercpi_t = & (1 - \frac{0.13}{(0.18)} - \frac{0.43}{(0.30)} - \frac{0.05}{(0.01)}) \cdot \Delta pva_t + \frac{0.13}{(0.18)} \cdot \Delta enercpi_{t-1} \quad (6) \\
& + 0.6 \cdot \Delta(GR_ENER_TR_t) + \frac{0.43}{(0.30)} \cdot \log(1 + INF_TARGET_t)/4 \\
& + \frac{0.05}{(0.01)} \cdot \Delta \log(P_OIL_t \cdot S_USD_PLN_t) \\
& - \frac{0.18}{(0.07)} \cdot (enercpi_{t-1} - enercpi_{t-1}^*) + dummies
\end{aligned}$$

*Adjusted R*² = -0.37

S. E. of equation = 0.013

LM test (*p-value*) = 0.06

Estimation period: 1999q1 - 2010q3

Inflation of food prices

$$\begin{aligned}
foodcpi_t^* = & -0.17 + 0.23 \cdot (p_food_t + s_usd_pln_t^c) \quad (7) \\
& + (1 - 0.23) \cdot pva_t + GR_VAT_TR_t + dummies
\end{aligned}$$

$$\begin{aligned}\Delta foodcpi_t &= \frac{0.38}{(0.12)} \cdot \Delta foodcpi_{t-1} + (1 - \frac{0.38}{(0.12)} - 0.1) \cdot \Delta pva_t & (8) \\ &+ 0.1 \cdot \Delta \log(P_FOOD_t \cdot S_USD_PLN_t) \\ &+ 0.35 \cdot \Delta(GR_VAT_TR_t) - \frac{0.23}{(0.06)} \cdot (foodcpi_{t-1} - foodcpi_{t-1}^*)\end{aligned}$$

Adjusted R² = 0.51

S. E. of equation = 0.01

LM test (p-value) = 0.05

Estimation period: 1996q2 - 2010q3

A.2 Labour market

Employment

$$emp_t^* = (1/0.67) \cdot gdp_t - (1/0.67) \cdot tfp_trend_t - (0.33/0.67) \cdot k_t \quad (9)$$

$$\begin{aligned}\Delta emp_t &= -\frac{0.10}{(0.03)} \cdot (emp_{t-1} - emp_{t-1}^*) + \frac{0.35}{(0.14)} \cdot \Delta emp_{t-1} & (10) \\ &+ \frac{0.59}{(0.10)} \cdot \Delta(\log(LF_M_t + LF_O_t) + \log(1 - NAWRU_t)) \\ &+ \frac{0.25}{(0.10)} \cdot \Delta GAP_t \\ &- \frac{0.04}{(0.04)} \cdot (\Delta(wage_n_t + \log(1 + GR_CORP_TR_t) - pva_t) \\ &- \Delta tfp_trend_t / 0.67)\end{aligned}$$

Adjusted R² = 0.71

S. E. of equation = 0.004

LM test (p-value) = 1.00

Estimation period: 1996q2 - 2010q4

Younger labour force (15-24 years)

$$\begin{aligned} \left(\frac{LF_Y_t}{POP_Y_t \cdot (1 - STUDENT_t)} \right)^* &= 0.65 + 0.26 \cdot GAP_t & (11) \\ &- 0.19 \cdot GR_DIR_TR_t \\ &- 0.19 \cdot GR_INDIR_TR_t \\ &- 0.1 \cdot RR_NLF_Y_t + dummies \end{aligned}$$

$$\begin{aligned} \Delta l f_y_t &= -\frac{0.20}{(0.10)} \cdot \left(\frac{LF_Y_{t-1}}{POP_Y_{t-1} \cdot (1 - STUDENT_{t-1})} \right) & (12) \\ &- \left(\frac{LF_Y_{t-1}}{POP_Y_{t-1} \cdot (1 - STUDENT_{t-1})} \right)^* \\ &+ \frac{0.31}{(0.11)} \cdot \Delta l f_y_{t-1} + \frac{(0.31)^2}{(0.11)} \cdot \Delta l f_y_{t-2} \\ &+ \left(1 - \frac{0.31}{(0.11)} - \frac{0.31^2}{(0.11)} \right) \cdot \Delta \ln(POP_Y_t \cdot (1 - STUDENT_t)) \\ &+ \frac{0.14}{(0.17)} \cdot (\Delta(wage_n_{t-1} - cpi_{t-1}) - \Delta t f p_trend_{t-1}/0.67) \end{aligned}$$

*Adjusted R*² = 0.22

S. E. of equation = 0.01

LM test (p-value) = 0.007

Estimation period: 1996q2 - 2010q4

Middle-aged labour force (25-44 years)

$$\begin{aligned} \left(\frac{LF_M_t}{POP_M_t} \right)^* &= 0.99 + 0.05 \cdot GAP_t - 0.23 \cdot GR_DIR_TR_t & (13) \\ &- 0.23 \cdot GR_INDIR_TR_t - 0.1 \cdot RR_NLF_M_t \end{aligned}$$

$$\begin{aligned} \Delta l f_m_t &= -\frac{0.11}{(0.05)} \cdot \left(\frac{LF_M_{t-1}}{POP_M_{t-1}} - \left(\frac{LF_M_{t-1}}{POP_M_{t-1}} \right)^* \right) & (14) \\ &+ \frac{0.003}{(0.03)} \cdot (\Delta(wage_n_{t-1} - cpi_{t-1}) - \Delta t f p_trend_{t-1}/0.67) \\ &+ \Delta pop_m_t \end{aligned}$$

*Adjusted R*² = 0.60

S. E. of equation = 0.002

LM test (p-value) = 0.2

Estimation period: 1996q4 - 2010q4

Old-age labour force (45-59/64 years)

$$\left(\frac{LF_O_t}{POP_O_t}\right)^* = 0.79 + 0.16 \cdot GAP_t - 0.19 \cdot GR_DIR_TR_t \quad (15)$$
$$- 0.19 \cdot GR_INDIR_TR_t - 0.1 \cdot RR_NLF_O_t + dummies$$

$$\Delta lf_o_t = -\frac{0.17}{(0.05)} \cdot \left(\frac{LF_O_{t-1}}{POP_O_{t-1}} - \left(\frac{LF_O_{t-1}}{POP_O_{t-1}}\right)^*\right) \quad (16)$$
$$+ \frac{0.22}{(0.08)} \cdot \Delta lf_o_{t-1} + \frac{(0.22)^2}{(0.08)} \cdot \Delta lf_o_{t-2}$$
$$+ (1 - \frac{0.22}{(0.08)} - \frac{0.22^2}{0.08}) \cdot \Delta pop_o_t + dummies$$

Adjusted R² = 0.46

S. E. of equation = 0.005

LM test (p-value) = 0.18

Estimation period: 1997q1 - 2010q4

Post-production labour force (60/65 + years)

$$\left(\frac{LF_PW_t}{POP_PW_t}\right)^* = 0.11 + \left(\frac{LF_PW_A_t}{POP_PW_t}\right) - 0.04 \cdot GR_INDIR_TR_t \quad (17)$$
$$- 0.04 \cdot GR_DIR_TR_t - 0.1 \cdot RR_NLF_PW_t$$
$$+ dummies$$

$$\Delta \ln(LF_PW_t - LF_PW_A_t) = -0.5 \cdot \left(\frac{(LF_PW_{t-1} - LF_PW_A_{t-1})}{POP_PW_{t-1}}\right.$$
$$\left. - \left(\frac{(LF_PW_{t-1} - LF_PW_A_{t-1})}{POP_PW_{t-1}}\right)^*\right)$$
$$+ \Delta pop_pw_t + dummies \quad (18)$$

Adjusted R² = 0.03

S. E. of equation = 0.04

LM test (p-value) = 0.003

Estimation period: 1996q3 - 2010q4

Wages

$$\begin{aligned} wage_n_t^* = & C_WAGE_t + tfp_trend_t + (1 - 0.67) \cdot k_t + cpi_t & (19) \\ & - 0.84 \cdot (UNRATE_t - UNRATE_AVER_t) \\ & + 0.2 \cdot RR_UNEMP_t + 0.5 \cdot gr_indir_tr_t \\ & - (1 - 0.5) \cdot gr_dir_tr_t - 0.5 \cdot \log(1 + GR_CORP_TR_t) \\ & + 1.35 \cdot RUCC_t + 0.1 \cdot minw_t \end{aligned}$$

$$\begin{aligned} \Delta wage_n_t = & \underset{(0.06)}{-0.04} \cdot (wage_n_{t-1} - wage_n_{t-1}^*) + \underset{(0.15)}{0.41} \cdot \Delta wage_n_{t-1} & (20) \\ & + (1 - 0.41) \cdot ((\log(1 + INF_TARGET_t)/4 + \Delta tfp_trend_t/0.67) \\ & + \underset{(0.10)}{0.22} \cdot (\Delta gdp_t - \Delta tfp_trend_t/0.67) \\ & - \underset{(0.08)}{0.09} \cdot (UNRATE_t - UNRATE_AVER_t/0.74) \\ & + \underset{(0.08)}{0.11} \cdot GAP_t + dummies \end{aligned}$$

*Adjusted R*² = 0.85

S. E. of equation = 0.006

LM test (p-value) = 0.08

Estimation period: 1996q1 - 2010q4

A.3 Foreign trade

Exports volume

$$\begin{aligned} gdp_exp_t^* = & gdp_ext_t - 22.05 + 1.55 \cdot gdp_pot_t & (21) \\ & - 1.16 \cdot (pexp_t - (pva_ext_t + s_neer_t)) \\ & + dummies \end{aligned}$$

$$\begin{aligned}
\Delta gdp_exp_t = & \underset{(0.14)}{0.92} \cdot (1.82 \cdot 0.67 \cdot \Delta gdp_pot_{t-1} + 1.98 \cdot 0.67 \cdot \Delta gdp_ext_pot_{t-1}) \\
& + \underset{(0.56)}{2.43} \cdot \Delta \left(gdp_ext_t - \frac{1}{0.67} \cdot tfp_ext_t \right) + (1 - \underset{(0.14)}{0.92}) \cdot \Delta gdp_exp_{t-1} \\
& - \underset{(0.03)}{0.05} \cdot (gdp_exp_{t-1} - gdp_exp_{t-1}^*) \tag{22}
\end{aligned}$$

*Adjusted R*² = 0.37

S. E. of equation = 0.022

LM test (p-value) = 0.59

Estimation period: 1996q3 - 2010q4

Imports volume

$$\begin{aligned}
gdp_imp_t^* = & gdp_t - 11.52 + 1.55 \cdot gdp_ext_pot_t \tag{23} \\
& - 1.47 \cdot (pimp_core_t + \log(1 + GR_TAR_TR_t) - pva_t) \\
& + dummies
\end{aligned}$$

$$\begin{aligned}
\Delta gdp_imp_t = & \underset{(0.07)}{-0.20} \cdot \Delta (pimp_core_t^c - pva_t + \log(1 + GR_TAR_TR_t)) \tag{24} \\
& + \underset{(0.04)}{0.34} / OPEN_t \cdot \Delta (\log(0.35 \cdot GFCF_P_t + 0.35 \cdot INV_t \\
& + 0.2 \cdot CONP_t + 0.15 \cdot (CONGOV_t \\
& + GFCF_G_t + GFCF_H_t)) - \frac{1}{0.67} \cdot tfp_trend) \\
& + \underset{(0.09)}{0.60} \cdot \Delta (gdp_exp_t - (1.82 \cdot 0.67 \cdot gdp_pot_t \\
& + 1.98 \cdot 0.67 \cdot gdp_ext_pot_t)) \\
& + \underset{(0.06)}{0.88} \cdot (1.91 \cdot 0.67 \cdot \Delta gdp_pot_{t-1} + 1.89 \cdot 0.67 \cdot \Delta gdp_ext_pot_{t-1}) \\
& + (1 - \underset{(0.08)}{0.88}) \cdot \Delta gdp_imp_{t-1} - \underset{(0.03)}{0.06} \cdot (gdp_imp_{t-1} - gdp_imp_{t-1}^*)
\end{aligned}$$

*Adjusted R*² = 0.86

S. E. of equation = 0.013

LM test (p-value) = 0.25

Estimation period: 1998q3 - 2010q4

Deflator of exports

$$(pexp_t - pva_ext_t - s_neer_t)^* = -2.19 - 0.66 \cdot s_reer_t + dummies \quad (25)$$

$$\begin{aligned} \Delta pexp_t = & -0.25 \cdot ((pexp_{t-1} - pva_ext_{t-1} - s_neer_{t-1}) \\ & \text{(0.05)} \\ & - (pexp_{t-1} - pva_ext_{t-1} - s_neer_{t-1})^*) \\ & + 1.16 \cdot (\Delta(pva_ext_t + s_neer_t) - 0.66 \cdot \Delta s_reer_t) \\ & \text{(0.07)} \\ & + (1 - 1.16) \cdot \Delta pexp_{t-1} + dummies \\ & \text{(0.07)} \end{aligned} \quad (26)$$

*Adjusted R*² = 0.47

S. E. of equation = 0.024

test *Q* (*p-value*) = 0.88

Estimation period: 1995q3 - 2010q4

Deflator of imports

$$\begin{aligned} (pimp_t - pva_t)^* = & -2.54 + 0.40 \cdot s_reer_t \\ & + 0.06 \cdot (p_oil_t + s_usd_pln_t - pva_t) \\ & + 0.03 \cdot (p_gas_t + s_usd_pln_t - pva_t) \\ & + dummies \end{aligned} \quad (27)$$

$$\begin{aligned} \Delta pimp_core_t = & -0.32 \cdot ((pimp_{t-1} - pva_{t-1}) - (pimp_{t-1} - pva_{t-1})^*) \\ & \text{(0.08)} \\ & + 1.10 \cdot (\Delta pva_t + 0.40 \cdot \Delta s_reer_t) \\ & \text{(0.07)} \\ & + (1 - 1.10) \cdot \Delta pimp_core_{t-1} \\ & \text{(0.07)} \end{aligned} \quad (28)$$

*Adjusted R*² = 0.53

S. E. of equation = 0.023

test *Q* (*p-value*) = 0.88

Estimation period: 1995q3 - 2010q4

Real effective exchange rate

$$\begin{aligned}
 s_reer_t^* = & \frac{1}{(1 - 1.16) \cdot (-0.66) - (1 - 1.47/0.91) \cdot 0.40 + 0.91} \quad (29) \\
 & \cdot \left(\frac{TCAB_t - CAB_TRANS_INC_GDP_t}{OPEN_t} \right. \\
 & - \left(-22.05 + 11.52 + (-1.16 + 1) \cdot (-2.19) \right. \\
 & - (-1.47/0.91 + 1) \cdot (-2.54) \\
 & + (1.55 - 1) \cdot (gdp_pot_t - gdp_ext_pot_t) \\
 & + 1.47 \cdot \log(1 + GR_TAR_TR_t) \\
 & - 0.06 \cdot (p_oil_t + s_usd_pln_t - pva_ext_t - s_neer_t) \\
 & - 0.03 \cdot (p_gas_t + s_usd_pln_t - pva_ext_t - s_neer_t) \\
 & \left. \left. + dummies \right) \right)
 \end{aligned}$$

$$\begin{aligned}
 \Delta s_neer_t = & -(s_reer_{t-1} - s_reer_{t-1}^*) \cdot \left(1 - e^{-2 \cdot (s_reer_{t-1} - s_reer_{t-1}^*)^2} \right) \quad (30) \\
 & - 0.5 \cdot \Delta(I.3M_t - I.3M_EXT_t - INF_TARGET_t + 0.02) \\
 & - 0.85 \cdot ((I.3M_{t-1} - I.3M_EXT_{t-1} \\
 & - INF_TARGET_{t-1} + 0.02)/4 - 0.04/4) \\
 & + \frac{0.26}{(0.10)} \cdot \Delta(s_reer_{t-1}) + \frac{0.32}{(0.15)} \cdot \Delta(s_reer_{t+1}) \\
 & + (1 - 0.26 - 0.32) \cdot \left(\frac{\log(1 + INF_TARGET_t) - 0.02}{4} \right. \\
 & \left. - 0.65 \cdot (\Delta gdp_pot_t - \Delta gdp_ext_pot_t) \right) \\
 & - \frac{0.23}{(0.11)} \cdot s_neer_premium_t
 \end{aligned}$$

*Adjusted R*² = 0.26

S. E. of equation = 0.041

J statistic (p-value) = 0.63

Estimation period: 1998q3 - 2010q4

$$\begin{aligned}
s_neer_premium_t &= (G_BALANCE_N_{t-1}/GDP_N_{t-1} + 0.044)/1.9 & (31) \\
&+ \Delta(G_BALANCE_N_t/GDP_N_t)/1.2 + GAP_{t-1}/2.4 \\
&+ \Delta GAP_t/0.6 + \Delta(CAB_t \cdot S_EUR_PLN_t/GDP_N_t)/1.7 \\
&+ \Delta(NFA_GDP_t)/12.1 + (gdp_ext_{t-1} - gdp_ext_pot_{t-1})/1.3 \\
&+ \Delta(gdp_ext_t - gdp_ext_pot_t)/0.5 + \Delta tot_t/2 \\
&+ dummies + (I_5Y_EUR_{t-1} - I_5Y_{t-1} + 0.06)/4.7 \\
&+ \Delta(I_5Y_EUR_t - I_5Y_t)/0.8
\end{aligned}$$

A.4 Households' sector

Individual consumption of durable goods

$$\begin{aligned}
comp_dur_t^* &= -3.27 + 0.7 \cdot yd_t + (1 - 0.7) \cdot wealth_t & (32) \\
&- 0.5 \cdot I_3MR_CPI_t
\end{aligned}$$

$$\begin{aligned}
\Delta comp_dur_t &= \frac{0.74}{(0.11)} \cdot \Delta gdp_t + (1 - \frac{0.74}{(0.11)}) \cdot \Delta comp_dur_{t-1} & (33) \\
&- \frac{0.15}{(0.04)} \cdot (comp_dur_{t-1} - comp_dur_{t-1}^*) \\
&- 0.15 \cdot \Delta I_3MR_CPI_t
\end{aligned}$$

*Adjusted R*² = 0.39

S. E. of equation = 0.016

LM test (p-value) = 0.021

Estimation period: 1997q2 - 2010q4

Residential services consumption

$$\begin{aligned}
comp_resid_t^* &= comp_t - 5.05 - 2.97 \cdot UNRATE_t & (34) \\
&- 0.7 \cdot (pgfcf_h_t - cpi_t + rucc_h_t)
\end{aligned}$$

Individual consumption of non-durable goods and services

$$\begin{aligned} \text{comp_ndur}_t^* = & -0.35 + 0.93 \cdot yd_t + (1 - 0.93) \cdot \text{wealth}_t \\ & - 0.4 \cdot I_3MR_CPI \end{aligned} \quad (35)$$

$$\begin{aligned} \Delta \text{comp_ndur}_t = & 0.75 \cdot \Delta \text{gdp_pot}_t \\ & + 0.05 \cdot \Delta \text{comp_ndur}_{t-1} - 0.05^{3/2} \cdot \Delta \text{comp_ndur}_{t-2} \\ & + (1 - 0.75 - 0.05 - 0.05^{3/2}) \cdot \Delta yd_t \\ & - 0.03 \cdot (\text{comp_ndur}_{t-1} - \text{comp_ndur}_{t-1}^*) \\ & - 0.1 \cdot \Delta I_3MR_CPI_t + 0.17 \cdot \Delta \text{gdp}_t \end{aligned} \quad (36)$$

*Adjusted R*² = 0.028

S. E. of equation = 0.006

LM test (p-value) = 0.08

Estimation period: 1997q2 - 2010q4

Gross fixed residential capital formation

$$\begin{aligned} (\text{gfcf_h}_t - \text{gdp_pot}_t)^* = & 0.26 \cdot (\text{pgfcf_h}_t - \text{pva}_t \\ & + \log(1 - 0.32 \cdot \text{GR_VAT_TR}_t)) - 3.47 \end{aligned} \quad (37)$$

$$\begin{aligned} \Delta \text{gfcf_h}_t = & 1.07 \cdot \Delta \text{gdp_pot}_t \\ & - 0.21 \cdot (\text{gfcf_h}_{t-1} - \text{gdp_pot}_{t-1} - (\text{gfcf_h}_{t-1} - \text{gdp_pot}_{t-1})^*) \\ & + 0.44 \cdot \Delta (\text{pgfcf_h}_{t-1} - \text{pva}_{t-1} + \log(1 - 0.32 \cdot \text{GR_VAT_TR}_{t-1})) \\ & + (1 - 1.07) \cdot \Delta \text{gfcf_h}_{t-1} + \text{dummies} \end{aligned} \quad (38)$$

*Adjusted R*² = 0.41

S. E. of equation = 0.054

LM test (p-value) = 0.97

Estimation period: 1996q2 - 2010q4

Deflator of gross fixed residential capital formation

$$\begin{aligned}
 \Delta pgfcf_h_t &= \underset{(0.07)}{0.18} \cdot \log(1 + INF_TARGET_t)/4 & (39) \\
 &+ (1 - \underset{(0.07)}{0.18} + \underset{(0.14)}{0.28}) \cdot \Delta pgfcf_h_{t-1} \\
 &- \underset{(0.03)}{0.04} \cdot (comp_resid_{t-1} - comp_resid_{t-1}^*) \\
 &- \underset{(1.71)}{0.45} \cdot \Delta RUCC_H_t - \underset{(0.40)}{0.81} \cdot \Delta UNRATE_t \\
 &- 0.28 \cdot \Delta pgfcf_h_{t-2}
 \end{aligned}$$

Adjusted R² = 0.81

S. E. of equation = 0.016

LM test (p-value) = 0.17

Estimation period: 1999q2 - 2010q4

A.5 Interest rates

WIBOR 3M quaterly average

$$\begin{aligned}
 I_3M_t &= \underset{(0.01)}{0.88} \cdot I_3M_t + (1 - \underset{(0.01)}{0.88}) \cdot (I_3MR_EQ_t + INF_{t+1} & (40) \\
 &+ \underset{(0.32)}{1.17} \cdot (INF_{t+1} - \overline{INF_TARGET}_{t+3}) + 0.5 \cdot GAP_t)
 \end{aligned}$$

Adjusted R² = 0.98

S. E. of equation = 0.006

J statistic (p-value) = 0.81

Estimation period: 2000q4 - 2010q4

Yield on 5-year government bonds

$$\begin{aligned}
 I_5Y_t &= \underset{(0.04)}{0.38} \cdot I_5Y_{t-1} + (1 - \underset{(0.04)}{0.38}) \cdot (\frac{1}{17} \cdot I_3M_t & (41) \\
 &+ (1 - \frac{1}{17}) \cdot I_5Y_{t+1} - \underset{(0.01)}{0.0045} \cdot G_BALANCE_GDP_t)
 \end{aligned}$$

*Adjusted R*² = 0.99
S. E. of equation = 0.005
J statistic (p-value) = 0.95
Estimation period: 1995q4 - 2010q4

A.6 Accumulation

Gross fixed corporate capital formation

$$KP^* \text{ meets condition : } \frac{MPC_t}{MPL_t} = \frac{RUCC_t}{RUCL_t} \quad (42)$$

$$\begin{aligned}
 \Delta gfcf_p_t &= -0.05 \cdot (kp_t + 0.055 - kp_t^*) \quad (43) \\
 &\quad (0.04) \\
 &+ 0.23 \cdot \Delta gfcf_p_{t-1} + 0.23^{3/2} \cdot \Delta gfcf_p_{t-2} \\
 &\quad (0.09) \quad (0.09) \\
 &+ (1 - 0.23 - 0.23^{3/2}) \cdot \Delta gdp_t + dummies - 0.006 \cdot \Delta_4 \left(\frac{p_ener_t}{pva_t} \right) \\
 &\quad (0.09) \quad (0.09) \quad (0.05)
 \end{aligned}$$

*Adjusted R*² = 0.30
S. E. of equation = 0.033
J statistic (p-value) = 0.47
Estimation period: 1999q2 - 2010q4

Inventories

$$\begin{aligned}
 \Delta(INV_t/SALES_t) &= -0.07 \cdot (\Delta sales_t - \Delta gdp_pot_t) \quad (44) \\
 &\quad (0.07) \\
 &- 0.41 \cdot \Delta((STOCK_{t-1}/SALES_{t-1})) \\
 &\quad (0.10) \\
 &- (0.57 - 0.08 \cdot I_3MR_PVA_{t-1}) \\
 &- 0.11 \cdot ((STOCK_{t-1}/SALES_{t-1})) \\
 &\quad (0.04) \\
 &- (0.57 - 0.08 \cdot I_3MR_PVA_{t-1}) \\
 &- 0.06 \cdot \Delta(INV_{t-1}/SALES_{t-1}) \\
 &\quad (0.13)
 \end{aligned}$$

*Adjusted R*² = 0.37
S. E. of equation = 0.006
LM test (p-value) = 0.04
Estimation period: 1996q2 - 2010q4

B NECMOD variables

Symbols in the brackets following the variable name stand for: EX – exogenous, EN – endogenous.

- C_CORE (EX) – time-varying constant in core inflation equation
- C_PVA (EX) – time-varying constant in value added equation
- C_WAGE (EX) – time-varying constant in wages equation
- CAB (EN) – current account balance (including the capital account)
- CAB_TRANS_INC_GDP (EN) – ratio of current account income and transfer balances to GDP
- CONGOV (EN) – collective consumption
- CONP (EN) – individual consumption
- CONP_DUR (EN) – individual consumption of durable goods
- CONP_NDUR (EN) – individual consumption of non-durable goods and services
- CONP_RESID (EN) – residential services consumption
- CORECPI (EN) – core CPI index (CPI net of food and energy prices)
- CPI (EN) – consumer price index
- EMP (EN) – employment
- ENERCPI (EN) – index of consumer energy prices
- FOODCPI (EN) – index of consumer food prices
- G_BALANCE_GDP (EN) – General Government balance to GDP ratio
- G_BALANCE_N (EN) – General Government balance
- GAP (EN) – output gap
- GDP (EN) – gross domestic product
- GDP_EXP (EN) – exports volume
- GDP_EXT (EX) – foreign GDP (weighted average of the respective variables for euro area, the UK, and the USA)
- GDP_EXT_POT (EX) – foreign potential output (weighted average of the respective variables for euro area, the UK, and the USA)
- GDP_IMP (EN) – imports volume

- GDP_N (EN) – nominal gross domestic product
- GDP_POT (EN) – domestic potential output
- GFCF_G (EN) – gross fixed public capital formation
- GFCF_H (EN) – gross fixed residential capital formation
- GFCF_P (EN) – gross fixed corporate capital formation
- GR_CORE_TR (EN) – effective rate of taxes imposed on prices of goods and services which are in a core inflation basket
- GR_CORP_TR (EN) – effective rate of social security contributions paid by employers
- GR_DIR_TR (EN) – effective rate of direct taxes imposed on gross wages
- GR_ENER_TR (EN) – effective rate of taxes imposed on energy prices
- GR_INDIR_TR (EN) – effective rate of indirect taxes
- GR_TAR_TR (EN) – effective rate of import duties
- GR_VAT_TR (EN) – effective rate of VAT
- I.3M (EN) – WIBOR 3M quarterly average
- I.3MR_CPI (EN) – real 3-month interest rate (deflated with CPI)
- I.3MR_EQ (EX) – equilibrium real interest rate
- I.3MR_EXT (EN) – real 3-month foreign interest rate deflated with foreign value-added deflator
- I.3MR_PVA (EN) – real 3-month interest rate deflated with the value-added deflator
- I.5Y (EN) – yield on 5-year government bonds
- I.5Y_EUR (EX) – yield on 5-year Bunds
- INF_TARGET (EX) – inflation target
- $\overline{INF_TARGET}$ (EX) – smoothed inflation target (four-quarter moving average)
- INV (EN) – change in inventories
- K (EN) – productive capital
- KP (EN) – corporate productive capital
- LF (EN) – labour force supply
- LF_M (EN) – middle-aged labour force (25-44 years)

- LF_O (EN) – older labour force (45-59/64 years)
- LF_PW (EN) – post-production labour force (60/65+ years)
- LF_PW_A (EX) – number of economically active in agriculture (60/65+ years)
- LF_Y (EN) – younger labour force (15-24 years)
- MINW (EN) – relation of minimum wage to average gross wage in the economy
- MPC (EN) - marginal product of corporate capital
- MPL (EN) - marginal product of labour after adjusting for current GDP
- NAWRU (EN) – non-accelerating wage inflation rate of unemployment
- NFA_GDP (EN) – net foreign assets to GDP
- OPEN (EN) – measure of openness; ratio of imports and exports to GDP
- P_ENER (EX) – index of global energy commodity prices
- P_ENER_PL (EN) – index of energy commodity prices in PLN
- P_FOOD (EX) – index of global agricultural commodity prices
- P_GAS (EN) – price of Russian gas per 1000 cubic meters
- P_OIL (EX) – price of BRENT oil
- PEXP (EN) – deflator of exports
- PEXP^c (EN) – export prices corrected for equilibrium exchange rate fluctuations
- PGFCF_H (EN) – deflator of gross fixed residential capital formation
- PIMP (EN) – deflator of imports
- PIMP^c (EN) – imports prices corrected for equilibrium exchange rate fluctuations
- PIMP_CORE (EN) – deflator of imports excluding prices of oil and gas
- PIMP_CORE^c (EN) – imports prices excluding prices of oil and gas corrected for equilibrium exchange rate fluctuations
- POP (EX) – total population
- POP_M (EX) – middle-aged population (25-44 years)
- POP_O (EX) – older population (45-59/64 years)
- POP_PW (EX) – post-production population (60/65+ years)
- POP_Y (EX) – younger population (15-24 years)
- PVA (EN) – deflator of value-added

- PVA_EXT (EX) – deflator of foreign value-added
- RR_NLF_Y (EN) – relationship between expected income in case of staying economically inactive to expected income in case of being economically active person in the age group 15-24 years
- RR_NLF_M (EN) – relationship between expected income in case of staying economically inactive to expected income in case of being economically active person in the age group 25-44 years
- RR_NLF_O (EN) – relationship between expected income in case of staying economically inactive to expected income in case of being economically active person in the age group 45-59/64 years
- RR_NLF_PW (EN) – relationship between expected income in case of staying economically inactive to expected income in case of being economically active person in the age group 60/65+ years
- RR_UNEMP (EN) – replacement rate for unemployed (including unemployment benefits and social relief)
- RUCC (EN) – real user cost of capital
- RUCC_H (EN) – real user cost of residential capital
- RUCL (EN) - real cost of labour
- S_EUR_PLN (EN) – EUR/PLN exchange rate
- S_NEER (EN) – nominal effective exchange rate
- S_NEER_PREMIUM (EN) – currency risk premium
- S_USD_PLN (EN) – USD/PLN exchange rate
- S_USD_PLN^c (EN) – USD/PLN exchange rate corrected for equilibrium exchange rate fluctuations
- S_REER (EN) – real effective exchange rate
- SALES (EN) – level of sales; variable composed of the sum of private and government consumption, total investment and the volume of exports
- STOCK (EN) – level of inventories
- STUDENT (EX) – ratio of non-extramural students to total younger population
- TCAB (EN) – the equilibrium current account to GDP ratio
- TFP_TREND (EN) – total factor productivity trend
- TFP_EXT (EN) – total factor productivity abroad

- TOT (EN) – terms of trade
- ULCNA (EN) – unit labour costs in non-agricultural sector
- UNRATE (EN) – unemployment rate
- UNRATE_AVER (EN) – long-lasting unemployment rate – geometrical average of unemployment rate multiplied by 0.74,
- WAGE_N (EN) – average nominal gross wage
- WEALTH (EN) – households' wealth
- YD (EN) – real disposable income of households