Re-estimation of the quarterly model of the Polish economy NECMOD 2012

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Contents

1 Introduction

The present document describes the NECMOD model and discusses major changes introduced to the model following its re-estimation performed in May 2012 (previous versions of the model were reported in: Budnik et al., 2009ab, Greszta et al. 2010, Greszta et al. 2011). 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 changes were introduced in the specification of the foreign trade block. During re-estimation rounds in 2010 and 2011 changes focused on modifications in price equations. In 2012, the economic activity block was re-specified to ensure stronger impact of legal changes limiting the number of persons eligible for retirement pay on the number of economically active persons.

The second chapter describes major features of the NECMOD model. The third chapter presents changes in the model implemented in 2012. 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).

The forecasting version of the NECMOD model comprises 276 equations and 369 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.

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 sec-

Figure 1: Typology of models
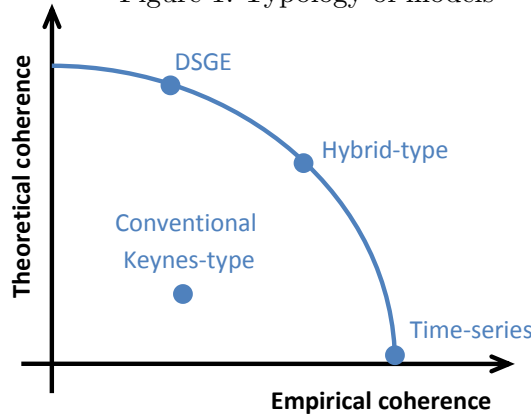
Source: Hara N. et al. (2009).

tor, 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. 2011), result from the extension of the re-estimation sample (including the year 2011), as well as from the modifications introduced to certain blocks of the model. As compared to the previous re-estimation rounds, the extent of modifications introduced to the model was minor - in fact, it was limited to two modifications referred to below.

1. **Re-specification of the economic activity block.** The main change introduced to the model during its re-estimation involved re-specification of the economic activity block, to ensure stronger, as compared to the last version of the model, translation of legal changes limiting the number of persons eligible for retirement pay into the number of the economically active persons. These modifications were driven by a too weak response of the model to the change in the number of old-age pensioners which resulted in a forecast bias. Therfore, parameters determining the influence of the change into the number of old-age pensioners (adjusted for the impact of demographic fluctuations) into the economic activity rate, were calibrated. As a result of

Figure 2: The NECMOD model structure
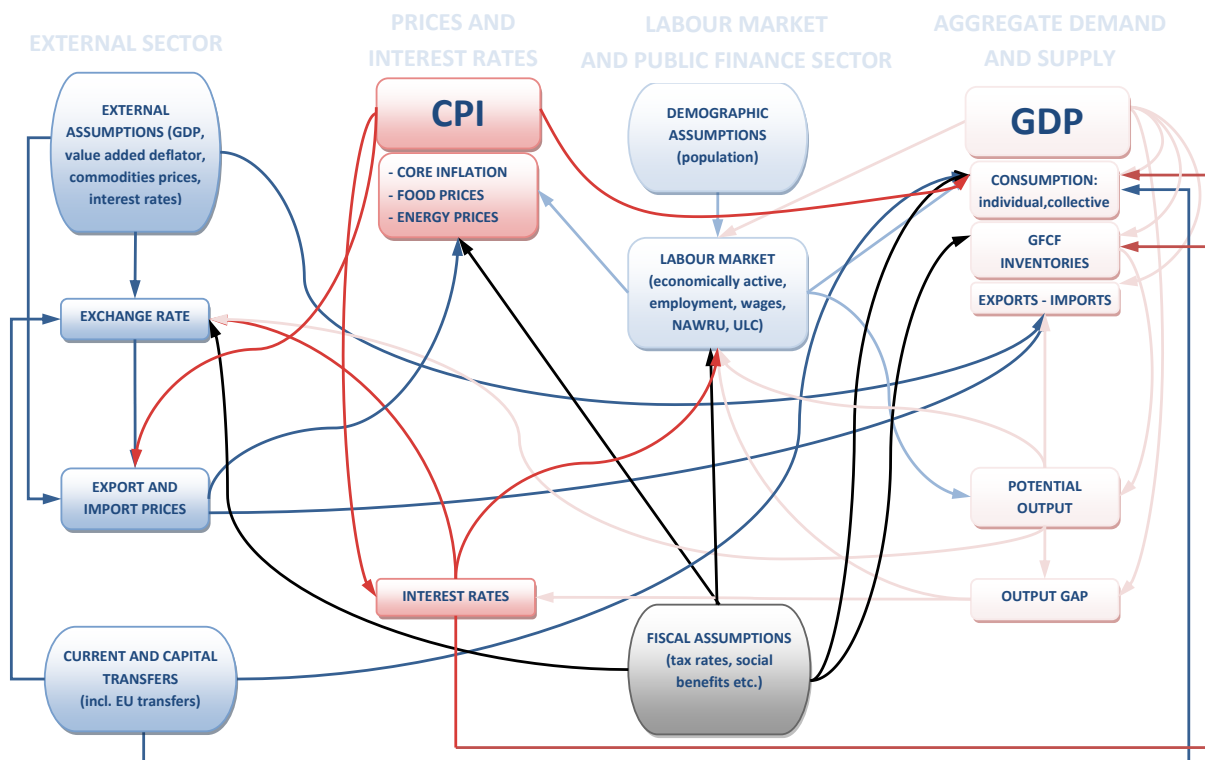
the introduced changes, growth in the number of the economically active persons in response to a drop of 100 thousand in the number of old-age pensioners, went up from 5 to 32 thousand persons (four quarters after the shock, cf. Figure 3).

2. **Stronger translation of the situation abroad into domestic economy.** As compared to other non-euro area countries, the business cycle of the Polish economy is strongly correlated with the business cycle of the euro area (Skrzypczyński, 2010). In the previous version of the NECMOD model, the response of the domestic economy to shifts in the euro area's business cycle was less significant than indicated by empirical research. Therefore, in the model new channels, apart from the foreign trade block, through which external economic activity affects domestic economic activity have been added. Short-term equations of corporate investment, inventory, residential investment and consumption of durable goods have been extended by adding variables reflecting business conditions abroad (foreign output gap or changes in the gap level). Changes in these equations may be seen as accounting for the impact of external business conditions on the corporate and household sentiment (and decisions). This modification, through enhancing the model's response to changes in GDP abroad (cf. point 4.3) reduced the extent of expert adjustments in the July forecasting round.

3

Figure 3: Impact of a drop of 100 thousand in the number of old-age pensioners on the number of the economically active (in thousands of persons) in subsequent quarters.
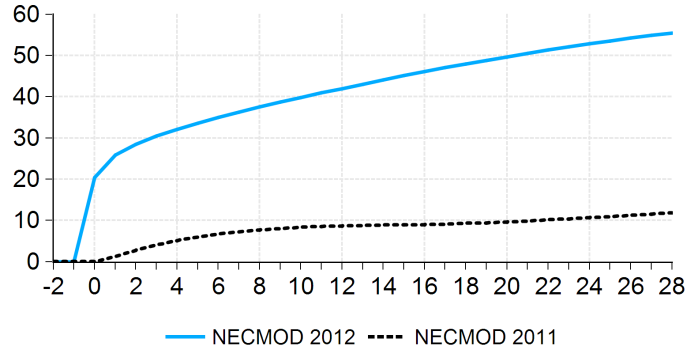
4 Impulse response analysis

After the re-estimation, the model has changed its behaviour in response to certain impulses - mainly stronger translation of changes in foreign GDP into domestic economic activity and a stronger impact of a change in the number of old-age pensioners on participation rate (cf. Chapter 3).

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 4-8).

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 4). Following the monetary shock, interest rates get back to the baseline scenario level (the Taylor rule has been excluded).

Due to its particular importance for monetary policy, the NBP conducts in-depth research on monetary transmission mechanism in Poland (Demchuk et al., 2012), based, among other things, on the Transmission Mechanism Model developed specifically for this purpose (MMT, see Łyziak et al., 2011).The results of this research were taken into account when calibrating certain parameters of the NECMOD model; consequently, the model's response is similar to the response of the linear version of the Transmission Mechanism Model (cf. Figure 4).

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 ap-

preciation of the national currency, which is improving Poland's net foreign asset position, and higher interest on public debt. Appreciation of the domestic currency, through its impact on foreign trade prices, also affects the volume of imports or exports. The export growth rate declines, whereas realization of increased demand for imports, driven by lower import prices, is limited by production capacity abroad. As a result, the growth of import expressed in domestic currency improves in the quarter in which the shock has been introduced and deteriorates later on. Consequently, exchange rate fluctuations improve net exports three quarters after the shock.

As a result, GDP growth falls by about 0.53 percentage points, with the strongest decline coming 4 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 0.41 percentage points 4 quarters after the increase in interest rate.

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 (cf. Figure 5).

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 2.0 percentage points) is observed 3 quarters after the shock occurs.

Along with the appreciation of the exchange rate, foreign trade prices change. Domestic products become less competitive abroad, which undermines exports. At the same time, demand for foreign goods increases on account of lower import prices as expressed in domestic currency. Consequently, import growth improves in the quarter in which the shock occurrs and deteriorates later on as a result of limited production capacity abroad. In total, interest rate fluctuations lead to deterioration in net exports' contribution to GDP. The strongest decline in GDP (by approx. 1.7 percentage point) is observed 3 quarters 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 Analysis of the effects of the economic slowdown abroad

The economic slowdown abroad has been defined as a reduction in GDP growth rate in the global economy (i.e. the euro area, the United States and the United Kingdom) of 1 percentage point for one quarter (cf. Figure 6). According to the model of the external environment, used in the simulation version of the NECMOD model, the growth of the world economy after the shock, remains lower than in the baseline scenario for four consecutive quarters. The slowdown in GDP growth is accompanied by a decline in the inflation rate abroad of approx. 0.7 percentage points 4 quaters after triggering the impulse. At the same

time, in response to lower inflation and weaker GDP growth interest rates abroad fall by about 0.8 percentage points. Yet another consequence of the global economic slowdown is a lower growth rate of the energy commodities and agricultural products prices in the world markets (of approx. 6.2 and 1.5 percentage points, respectively, 4 quaters after the shock).

Limited exports of Polish goods as a result of declining external demand for domestic products is the direct effect of disturbances in the external environment of the Polish economy. Lower exports are translated into GDP decline. In response to the economic downturn in the country, enterprises are cutting investments. This effect is only partially offset by lower prices of commodities in the world markets. While cutting their costs enterprises also reduce the employment and salaries of employees. As a result, the income and consumption of households are lessened. Individual consumption is also slowed down by the reduction in household's wealth associated with a lower level of productive capital.

As far as nominal economy is concerned, the slower rise in commodity prices in global markets translates into a lower growth rate of energy and food prices in the domestic market, which combined with the slowdown in the domestic growth is conducive to lower CPI inflation.

4.4 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 7).

The increase in energy commodity prices leads directly to a higher growth rate of import prices (change of approx. 1.1 percentage points, after 3 quarters) and energy prices in the domestic market (change of approx. 1.2 percentage points, after 3 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. 0.29 percentage points) recorded 5 quarters 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 investments, 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 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 9 quarters).

4.5 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 8).

The rise in agricultural commodity prices abroad translates into higher domestic prices of these commodities. This leads to growing domestic food prices (CPI component) - 2 quarters after the impulse by slightly over 0.9 percentage points, which means a rise in CPI inflation by approx. 0.2 percentage points.

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. The increase of interest rates results also in the exchange rate depreciation, leading initially to a decline in net exports' contribution to GDP growth and later on, 4 quarters after the shock, to an increase. Weaker economic activity and higher CPI inflation are translated, with a certain time lag, into the labour market situation - higher wage and rising unemployment rate.

Figure 4: Analysis of the effects of monetary shock - comparison with Transmission Mechanism Model (MMT)*
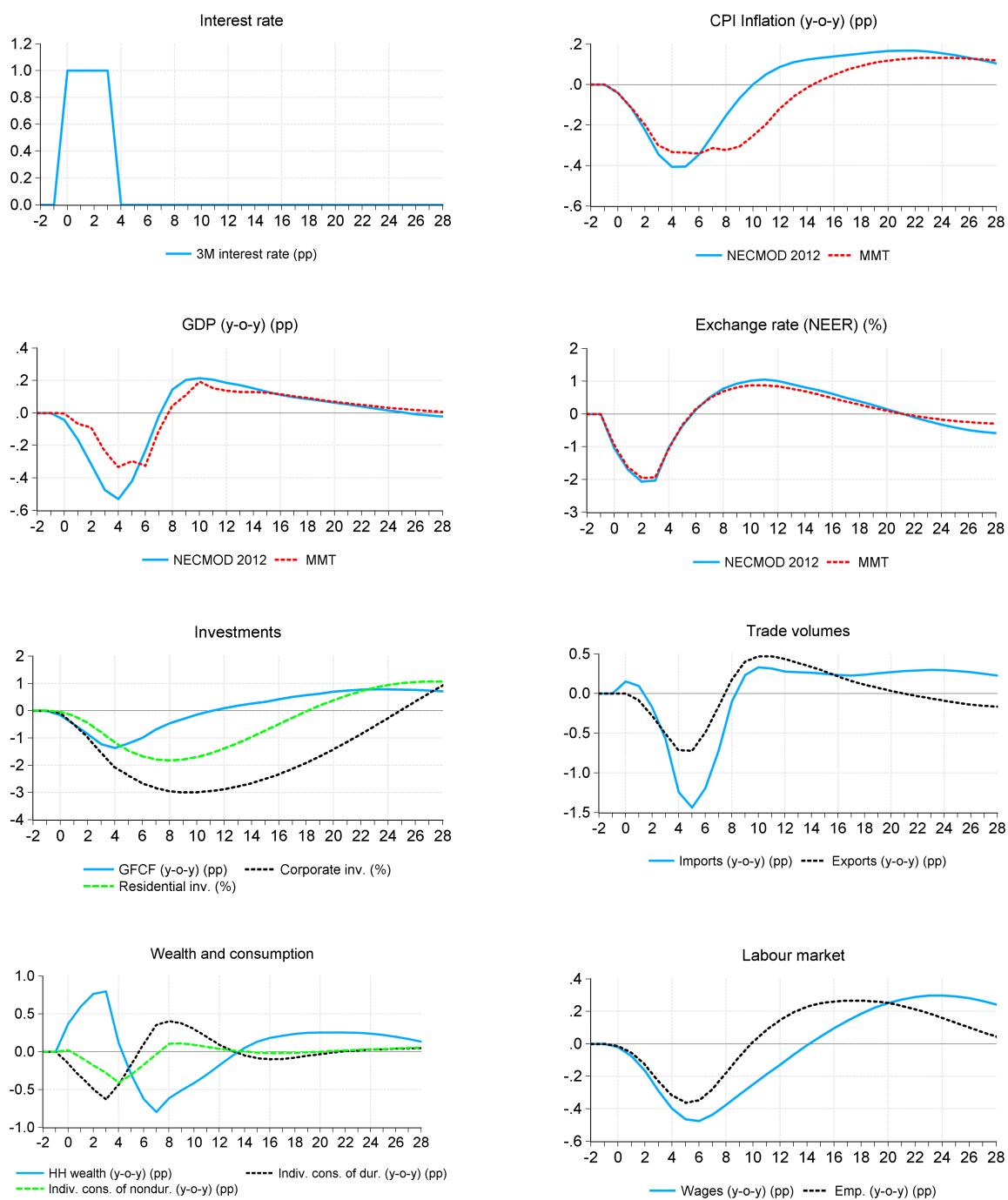
*The model is described in: Łyziak et al., 2011.

8

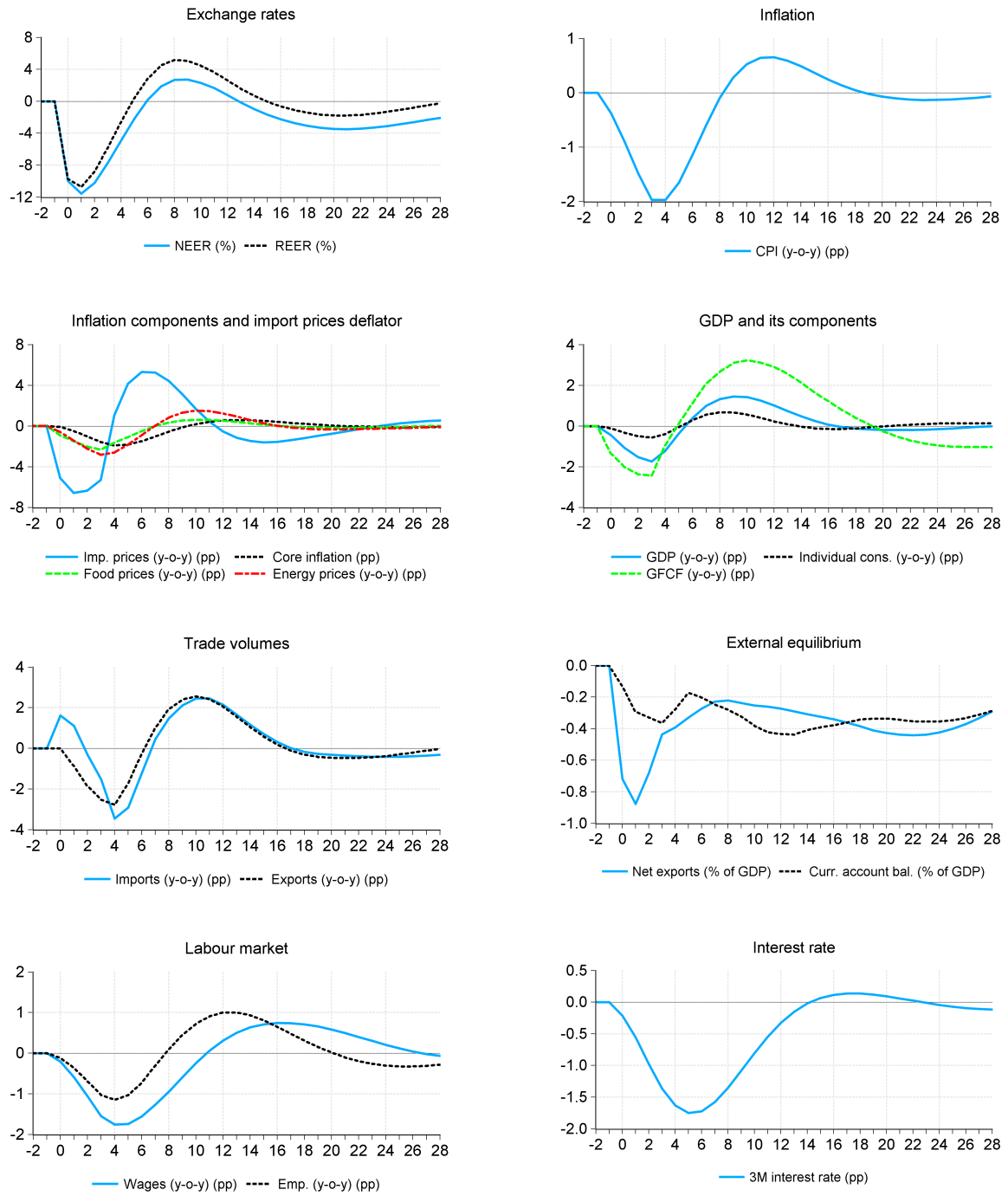Figure 5: Analysis of the effects of exchange rate disturbances

Figure 6: Analysis of the effects of the economic slowdown abroad

Developments abroad

Legend: GDP (y-o-y) (pp); VA deflator (y-o-y) (pp); 3M interest rate (pp)

Indices of agric. and energy comm. prices (USD)

Legend: Energy comm. prices (y-o-y) (pp); Agric. comm. prices (y-o-y) (pp)

GDP and its components

Legend: GDP (y-o-y) (pp); Individual cons. (y-o-y) (pp); GFCF (y-o-y) (pp)

Trade volumes

Legend: Imports (y-o-y) (pp); Exports (y-o-y) (pp)

Exchange rate

Legend: REER (%)

Inflation and components

Legend: CPI (y-o-y) (pp); Core inflation (pp); Food prices (y-o-y) (pp); Energy prices (y-o-y) (pp)

Labour market

Legend: Wages (y-o-y) (pp); Emp. (y-o-y) (pp)

Interest rate
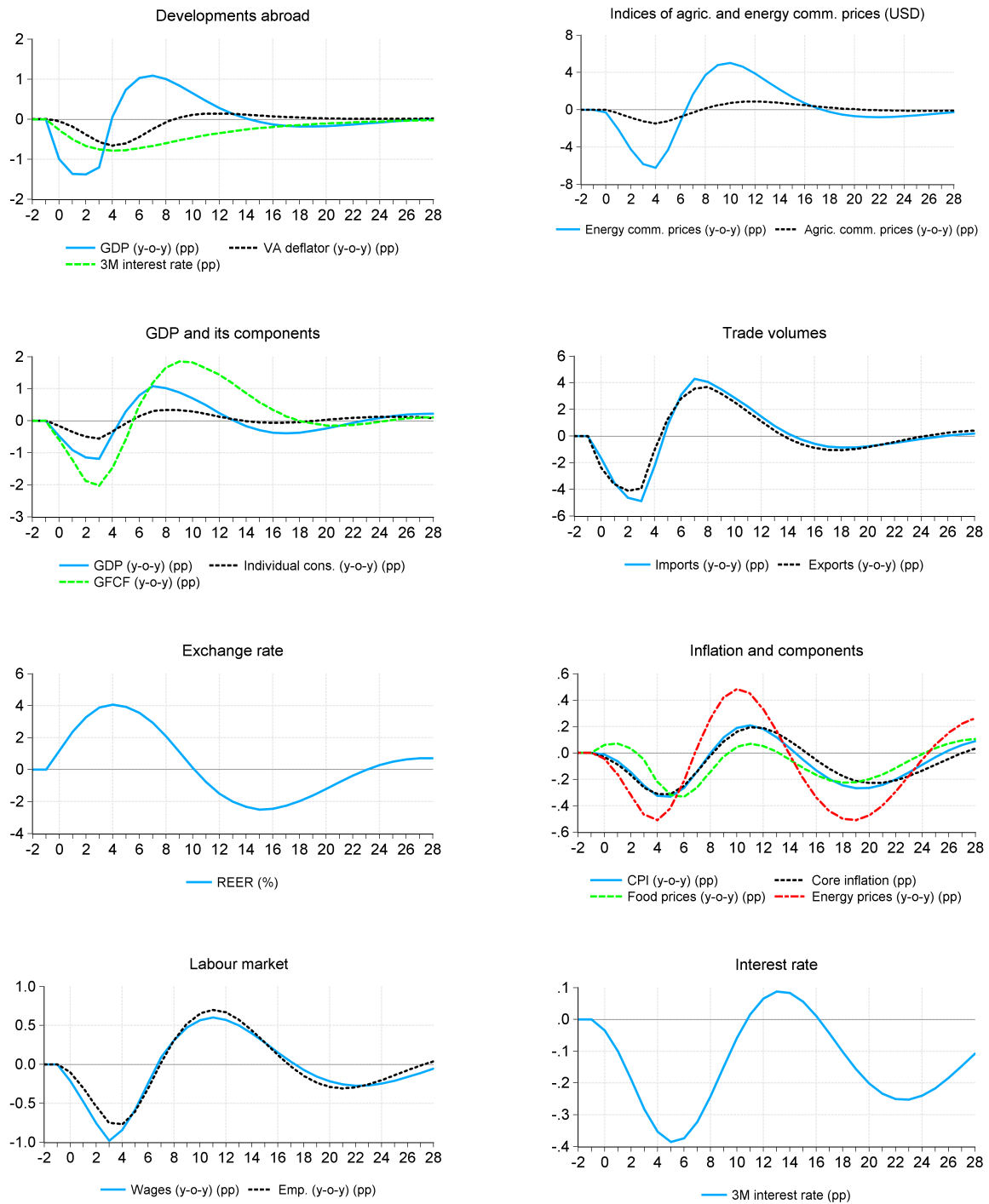
Legend: 3M interest rate (pp)

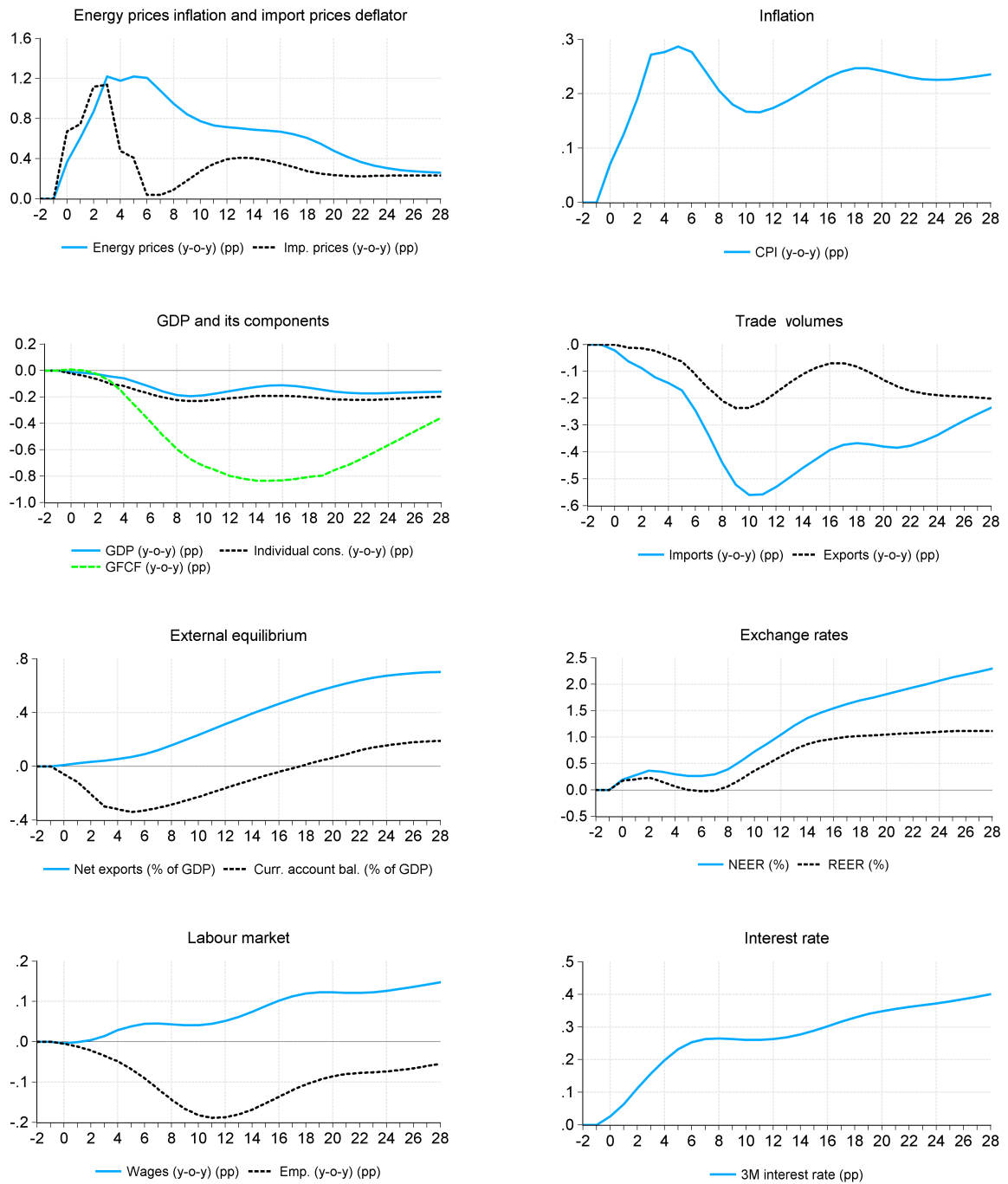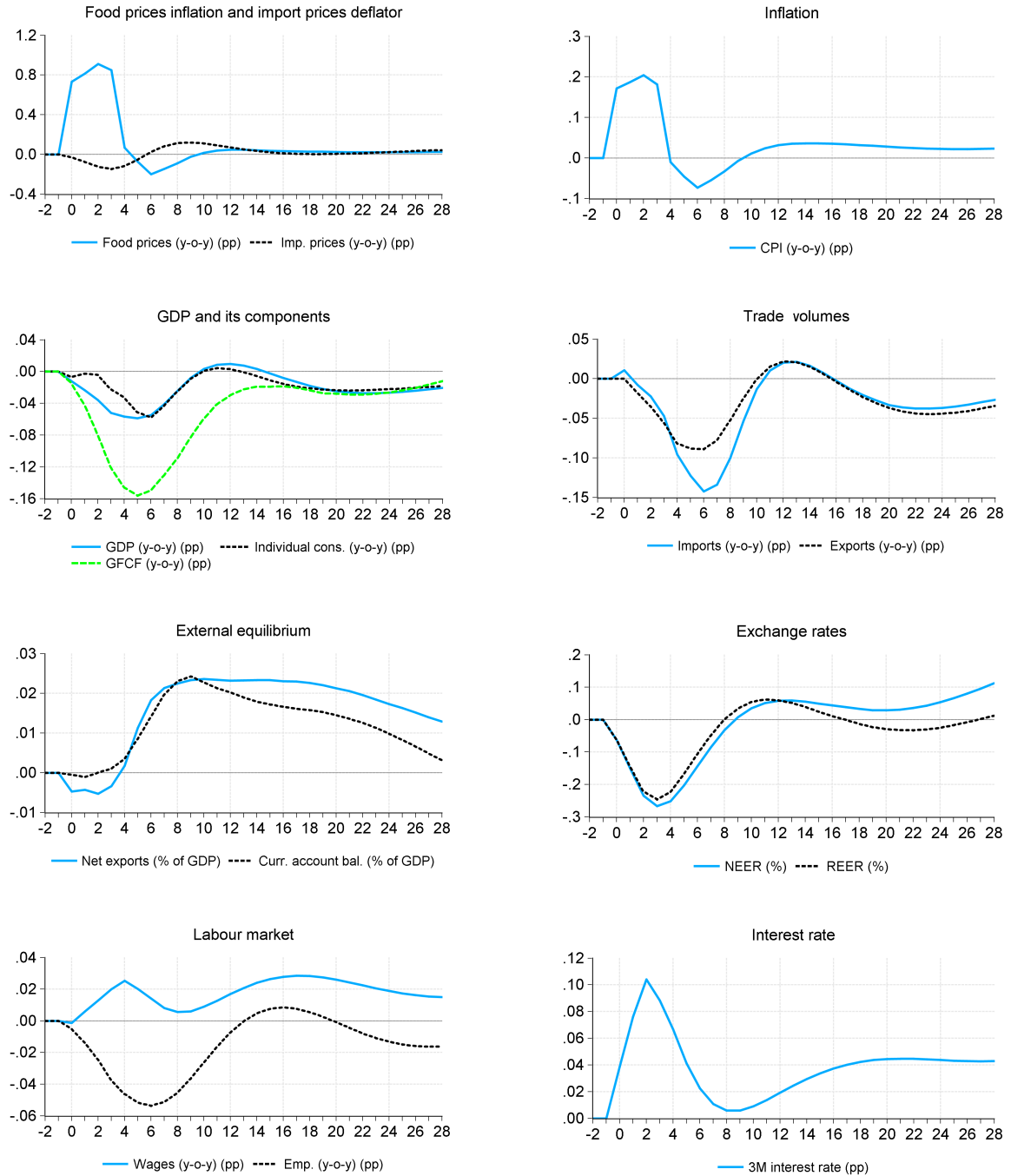Figure 7: Analysis of changes in energy commodity prices

Figure 8: Analysis of changes in agricultural commodity prices

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A   NECMOD equations[1]

A.1   Prices

Core inflation

$$corecpi_t^* = C\_CORE_t + 0.69 \cdot (wage\_n_t + (1 + GR\_CORP\_TR_t)) \quad (1)$$
$$+ 0.69 \cdot (1/0.67 - 1) \cdot (gdp_t - k_t) - 0.69 \cdot 1/0.67 \cdot tfp\_trend_t$$
$$+ (1 - 0.69) \cdot (pimp\_core_t^c + \log(1 + GR\_TAR\_TR_t))$$
$$+ GR\_CORE\_TR_t + GR\_CO2\_CORE\_TR_t$$

$$\Delta corecpi_t = -\underset{(0.02)}{0.06} \cdot (corecpi_{t-1} - corecpi_{t-1}^*) \quad (2)$$
$$+ \log(1 + INF\_TARGET_t)/4 \cdot (1 - \underset{(0.09)}{0.52} - \underset{(0.13)}{0.14} - \underset{(0.05)}{0.11} - \underset{(0.007)}{0.03})$$
$$+ \underset{(0.09)}{0.52} \cdot \Delta corecpi_{t-1} + \underset{(0.13)}{0.14} \cdot \Delta corecpi_{t+1}$$
$$+ \underset{(0.05)}{0.11} \cdot (\Delta wage\_n_t + \Delta \log(1 + GR\_CORP\_TR_t) - \Delta tfp\_trend_t/0.67)$$
$$+ \underset{(0.007)}{0.03} \cdot \Delta(pimp\_core_{t-1}^c + \log(1 + GR\_TAR\_TR_{t-1}))$$
$$+ 0.3 \cdot \Delta GR\_VAT\_TR_t + 0.3 \cdot \Delta GR\_CO_2\_CORE\_TR_t$$

Adjusted R^2 = 0.94
S.E. of equation = 0.003
Test J (p-value) = 0.069
Estimation period: 1996q4 - 2011q4

Deflator of value-added

$$pva_t^* = C\_PVA_t + GR\_CO_2\_PVA\_TR_t + 0.67 \cdot wage\_n_t \quad (3)$$
$$+ 0.67 \cdot GR\_CORP\_TR_t + 0.67 \cdot (1/0.67 - 1) \cdot (gdp_t - k_t)$$
$$- 0.67 \cdot 1/0.67 \cdot tfp\_trend_t + (1 - 0.67) \cdot pimp_t^c$$

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[1]Standard errors of parameters are reported below their point estimates in brackets.

$$\Delta pva_t = \log(1 + INF\_TARGET_t)/4 \cdot (1 - \underset{(0.04)}{0.04} - \underset{(0.1)}{0.41} - \underset{(0.04)}{0.14} - \underset{(0.02)}{0.01}) \qquad (4)$$

$$+ \underset{(0.04)}{0.04} \cdot \Delta pva_{t-1} + \underset{(0.1)}{0.41} \cdot \Delta pva_{t+1}$$

$$+ \underset{(0.04)}{0.14} \cdot (\Delta wage\_n_t + \Delta \log(1 + GR\_CORP\_TR_t) - \Delta tfp\_trend_t/0.67)$$

$$+ \underset{(0.02)}{0.01} \cdot \Delta pimp^c_{t-1} - \underset{(0.03)}{0.16} \cdot (pva_{t-1} - pva^*_{t-1})$$

$$+ 0.3 \cdot \Delta GR\_CO2\_PVA\_TR_t$$

Adjusted R^2 = 0.54
S.E. of equation = 0.008
Test J (p-value) = 0.069
Estimation period: 1996q4 - 2011q4

Inflation of energy prices

$$enercpi^*_t = -0.12 + 0.37 \cdot p\_ener\_pl_t + (1 - 0.37) \cdot pva_t \qquad (5)$$

$$+ GR\_ENER\_TR_t + GR\_CO2\_ENER\_TR_t$$

$$+ dummies$$

$$\Delta enercpi_t = (1 - \underset{(0.12)}{0.08} - \underset{(0.12)}{0.11} - \underset{(0.01)}{0.03}) \cdot \Delta pva_t \qquad (6)$$

$$+ \underset{(0.12)}{0.08} \cdot \Delta enercpi_{t-1} + \underset{(0.12)}{0.11} \cdot \Delta enercpi_{t-2}$$

$$+ \underset{(0.01)}{0.03} \cdot \Delta(p\_oil_t + s\_usd\_pln^c_t)$$

$$+ 0.6 \cdot \Delta GR\_ENER\_TR_t + 0.3 \cdot \Delta GR\_CO2\_ENER\_TR$$

$$- \underset{(0.05)}{0.19} \cdot (enercpi_{t-1} - enercpi^*_{t-1}) + dummies$$

Adjusted R^2 = 0.12
S.E. of equation = 0.013
Test LM (p-value) = 0.55
Estimation period: 1997q2 - 2011q4

Inflation of food prices

$$foodcpi^*_t = C\_FOOD_t + 0.08 \cdot (p\_food_t + s\_usd\_pln^c_t) \qquad (7)$$

$$+ (1 - 0.08) \cdot pva_t + GR\_VAT\_TR_t$$

$$\Delta foodcpi_t = \underset{(0.12)}{0.11} \cdot \Delta foodcpi_{t-1} + \underset{(0.13)}{0.18} \cdot \Delta foodcpi_{t-2} \qquad (8)$$

$$+ \underset{(0.2)}{0.24} \cdot \log(1 + INF\_TARGET)/4$$

$$+ 0.075 \cdot \Delta(p\_food_t + s\_usd\_pln_t^c)$$

$$+ (1 - \underset{(0.12)}{0.11} - \underset{(0.13)}{0.18} - \underset{(0.2)}{0.24} - 0.075) \cdot \Delta pva_t$$

$$+ 0.35 \cdot \Delta GR\_VAT\_TR_t - \underset{(0.11)}{0.46} \cdot (foodcpi_{t-1} - foodcpi_{t-1}^*)$$

$$+ \underset{(0.76)}{0.62} \cdot \Delta C\_FOOD$$

Adjusted R^2 = 0.39
S.E. of equation = 0.01
Test LM (p-value) = 0.004
Estimation period: 2000q1 - 2011q4

A.2 Labour market

Employment

$$emp_t^* = (1/0.67) \cdot gdp_t - (1/0.67) \cdot tfp\_trend_t - (0.33/0.67) \cdot k_t \qquad (9)$$

$$\Delta emp_t = \underset{(0.03)}{-0.13} \cdot (emp_{t-1} - emp_{t-1}^*) + \underset{(0.12)}{0.32} \cdot \Delta emp_{t-1} \qquad (10)$$

$$+ \underset{(0.10)}{0.39} \cdot \Delta(log(LF\_M_t + LF\_O_t) + \log(1 - NAWRU_t))$$

$$+ \underset{(0.12)}{0.23} \cdot \Delta GAP_t + \underset{(0.003)}{0.007} \cdot \Delta_4(almp\_n_{t-1}/gdp\_n_{t-1})$$

$$- \underset{(0.04)}{0.01} \cdot (\Delta(wage\_n_t + \log(1 + GR\_CORP\_TR_t) - pva_t)$$

$$- \Delta tfp\_trend_t/0.67)$$

Adjusted R^2 = 0.76
S.E. of equation = 0.003
Test LM (p-value) = 0.50
Estimation period: 1997q1 - 2011q4

16

Participation rate net of persons eligible for pension benefits and persons pursuing full-time studies aged 15-24

$$LF\_MOD_t = \frac{LF_t - LF\_RET_t - 0.05 \cdot POP\_EDU_t}{POP_t - POP\_EDU_t - (RETIRED_t - (RETIRED\_Y_t - LF\_Y\_RET_t))}$$

$$
\begin{aligned}
LF\_MOD_t^* =\ & LF\_DEMOG + 0.01 \\
& - 0.09 \cdot (LF\_TAX\_WEDGE_t + LF\_INTAX_t) \\
& - 0.16 \cdot RR\_NLF_t + 0.35 \cdot \frac{ALMP_t}{GDP\_N_t} \\
& + 0.37 \cdot \frac{EMP\_A_t}{EMP_t} + dummies
\end{aligned}
\tag{11}
$$

Participation rate for population aged 15-24 net of persons eligible for pension benefits and persons pursuing full-time studies

$$
\begin{aligned}
\Delta \left(\frac{LF\_Y_t - 0.05 \cdot POP\_EDU_t - LF\_Y\_RET_t}{POP\_Y_t - POP\_EDU_t - LF\_Y\_RET_t} \right) = \\
- 0.01 \cdot (LF\_MOD_t - LF\_MOD_t^*) \\
- \underset{(0.12)}{0.15} \cdot \Delta \left(\frac{LF\_Y_{t-1} - 0.05 \cdot POP\_EDU_{t-1} - LF\_Y\_RET_{t-1}}{POP\_Y_{t-1} - POP\_EDU_{t-1} - LF\_Y\_RET_{t-1}} \right)
\end{aligned}
\tag{12}
$$

Adjusted R^2 = 0.02
S.E. of equation = 0.01
Test LM (p-value) = 0.007
Estimation period: 1995q3 - 2011q4

Participation rate for population aged 25-44 net of persons eligible for pension benefits

$$
\begin{aligned}
\Delta \left(\frac{LF\_M_t - LF\_M\_RET_t}{POP\_M_t - RETIRED\_M_t} \right) = \\
- \underset{(0.12)}{0.02} \cdot (LF\_MOD_t - LF\_MOD_t^*) \\
- \underset{(0.1)}{0.005} \cdot \Delta emp_t + \underset{(1.17)}{1.33} \cdot \Delta \left(\frac{ALMP\_N_t}{GDP\_N_t} \right)
\end{aligned}
\tag{13}
$$

S.E. of equation = 0.004
Test LM (p-value) = 0.06
Estimation period: 2002q1 - 2011q4

Participation rate for population aged 45-59/64 net of persons eligible for pension benefits

$$\Delta \left(\frac{LF\_O_t}{POP\_O_t} \right) = -\underset{(0.10)}{0.07} \cdot (LF\_MOD_t - LF\_MOD_t^*) \qquad (14)$$

$$+ \underset{(0.03)}{0.02} \cdot \Delta_4 emp_t + \underset{(0.14)}{0.17} \cdot \Delta \left(\frac{LF\_O_{t-1}}{POP\_O_{t-1}} \right)$$

$$- \underset{(0.13)}{0.20} \cdot \Delta \left(\frac{RETIRED\_O_t}{POP\_O_t} \right)$$

Adjusted R^2 = 0.05
S.E. of equation = 0.005
Test LM (p-value) = 0.1
Estimation period: 2000q1 - 2011q4

Participation rate for population aged 60/65+ net of persons eligible for pension benefits

$$\Delta \left(\frac{LF\_PW_t - LF\_PW\_RET_t}{POP\_PW_t - RETIRED\_PW_t} \right) = \qquad (15)$$

$$- 0.01 \cdot (LF\_MOD_t - LF\_MOD_t^*)$$

$$- \underset{(0.12)}{0.33} \cdot \left(\frac{LF\_PW_{t-1} - LF\_PW\_RET_{t-1}}{POP\_PW_{t-1} - RETIRED\_PW_{t-1}} \right)$$

$$+ \underset{(0.61)}{0.47} \cdot \Delta emp_t + 0.90 \cdot \Delta \left(\frac{EMP\_A_t}{EMP_t} \right)$$

Adjusted R^2 = 0.11
S.E. of equation = 0.03
Test LM (p-value) = 0.001
Estimation period: 1995q3 - 2011q4

18

Wages

$$wage\_n_t^* = 1.78 + tfp\_trend_t + (1 - 0.67) \cdot k_t + cpi_t \tag{16}$$
$$- 0.85 \cdot (UNRATE_t - UNRATE\_AVER_t)$$
$$+ 0.2 \cdot RR\_UNEMP_t - 0.5 \cdot GR\_INDIR\_TR_t$$
$$+ (1 - 0.5) \cdot GR\_DIR\_TR_t - 0.5 \cdot GR\_CORP\_TR_t$$
$$+ 1.38 \cdot RUCC_t + 0.1 \cdot minw_t + dummies$$

$$\Delta wage\_n_t = -\underset{(0.02)}{0.05} \cdot (wage\_n_{t-1} - wage\_n_{t-1}^*) \tag{17}$$
$$+ \underset{(0.07)}{0.33} \cdot \Delta wage\_n_{t-1} + \underset{(0.07)}{0.33} \cdot \Delta wage\_n_{t-2}$$
$$+ (1 - 0.66) \cdot ((\log(1 + INF\_TARGET_t)/4 + \Delta tfp\_trend_t/0.67)$$
$$+ \underset{(0.10)}{0.42} \cdot (\Delta gdp_t - \Delta tfp\_trend_t/0.67) - \underset{(0.06)}{0.05} \cdot U\_GAP_t$$
$$+ 0.02 \cdot \Delta minw_{t-1} - \underset{(0.002)}{0.003} \cdot \Delta_4(almp\_n_{t-1}/gdp\_n_{t-1})$$
$$+ \underset{(0.07)}{0.02} \cdot (\Delta_2 cpi_t - \log(1 + INF\_TARGET_t)/2)$$

Adjusted R^2 = 0.85
S.E. of equation = 0.005
Test LM (p-value) = 0.08
Estimation period: 1996q2 - 2011q4

A.3 Foreign trade

Exports volume

$$gdp\_exp_t^* = gdp\_ext_t - 23.45 + 1.69 \cdot gdp\_pot_t \tag{18}$$
$$- 1.10 \cdot (pexp_t - (pva\_ext_t + s\_neer_t))$$
$$+ 2.80 \cdot (gdp\_ext_t - gdp\_ext\_pot_t)$$
$$+ dummies$$

$$\Delta gdp\_exp_t = \underset{(0.14)}{1.10} \cdot (1.77 \cdot 0.67 \cdot \Delta gdp_{t-1} \qquad\qquad (19)$$

$$+ \; 2.23 \cdot 0.67 \cdot \Delta gdp\_ext\_pot_{t-1})$$

$$+ \; \underset{(0.43)}{2.25} \cdot \Delta \left(gdp\_ext_t - \frac{1}{0.67} \cdot tfp\_ext_t \right)$$

$$+ \; (1 - \underset{(0.14)}{1.10}) \cdot \Delta gdp\_exp_{t-1}$$

$$- \; \underset{(0.06)}{0.05} \cdot (gdp\_exp_{t-1} - gdp\_exp^*_{t-1})$$

Adjusted R^2 = 0.39
S.E. of equation = 0.021
Test LM (p-value) = 0.26
Estimation period: 1996q3 - 2011q4

Imports volume

$$gdp\_imp^*_t = gdp_t - 12.18 + 1.69 \cdot gdp\_ext\_pot_t \qquad\qquad (20)$$

$$- \; 1.02 \cdot (pimp\_core_t + \log(1 + GR\_TAR\_TR_t) - pva_t)$$

$$+ \; 1.00 \cdot \log((CONP_t + INV_t + GFCF\_P_t)/DD_t)$$

$$\Delta gdp\_imp_t = \underset{(0.06)}{-0.24} \cdot \Delta(pimp\_core^c_t - pva_t + \log(1 + GR\_TAR\_TR_t)) \quad (21)$$

$$+ \; \underset{(0.03)}{0.38}/OPEN_t \cdot \Delta(\log(0.35 \cdot GFCF\_P_t + 0.35 \cdot INV_t$$

$$+ \; 0.20 \cdot CONP_t + 0.15 \cdot (CONGOV_t$$

$$+ \; GFCF\_G_t + GFCF\_H_t)) - \frac{1}{0.67} \cdot tfp\_trend)$$

$$+ \; 0.60 \cdot \Delta(gdp\_exp_t - (1.77 \cdot 0.67 \cdot gdp\_pot_t$$

$$+ \; 2.23 \cdot 0.67 \cdot gdp\_ext\_pot_t))$$

$$+ \; \underset{(0.05)}{0.91} \cdot (1.98 \cdot 0.67 \cdot \Delta gdp\_pot_{t-1} + 2.03 \cdot 0.67 \cdot \Delta gdp\_ext\_pot_{t-1})$$

$$+ \; (1 - \underset{(0.05)}{0.91}) \cdot \Delta gdp\_imp_{t-1} \underset{(0.03)}{-0.07} \cdot (gdp\_imp_{t-1} - gdp\_imp^*_{t-1})$$

$$+ \; dummies$$

Adjusted R^2 = 0.90
S.E. of equation = 0.011
Test LM (p-value) = 0.75
Estimation period: 1998q2 - 2011q4

20

Deflator of exports

$$
(pexp_t - pva\_ext_t - s\_neer_t)^* = -3.56 - 0.53 \cdot s\_reer_t \tag{22}
$$
$$
+ 0.10 \cdot (gdp\_pot_t - gdp\_ext\_pot_t)
$$
$$
+ dummies
$$

$$
\Delta pexp_t = -\underset{(0.08)}{0.46} \cdot ((pexp_{t-1} - pva\_ext_{t-1} - s\_neer_{t-1}) \tag{23}
$$
$$
- (pexp_{t-1} - pva\_ext_{t-1} - s\_neer_{t-1})^*)
$$
$$
+ \underset{(0.06)}{1.00} \cdot (\Delta(pva\_ext_t + s\_neer_t) - 0.53 \cdot \Delta s\_reer_t)
$$
$$
+ 0.10 \cdot \Delta (gdp\_pot_t - gdp\_ext\_pot_t)
$$
$$
+ (1 - \underset{(0.06)}{1.00}) \cdot \Delta pexp_{t-1} + dummies
$$

Adjusted R^2 = 0.51
S.E. of equation = 0.018
Test Q (p-value) = 0.50
Estimation period: 1995q3 - 2012q1

Deflator of imports

$$
(pimp_t - pva_t)^* = -2.79 + 0.44 \cdot s\_reer_t \tag{24}
$$
$$
+ 0.06 \cdot (p\_oil_t + s\_usd\_pln_t - pva_t)
$$
$$
+ 0.03 \cdot (p\_gas_t + s\_usd\_pln_t - pva_t)
$$

$$
\Delta pimp\_core_t = -\underset{(0.08)}{0.38} \cdot ((pimp_{t-1} - pva_{t-1}) - (pimp_{t-1} - pva_{t-1})^*)
$$
$$
+ \underset{(0.08)}{0.94} \cdot (\Delta pva_t + 0.44 \cdot \Delta s\_reer_t) \tag{25}
$$
$$
+ (1 - \underset{(0.08)}{0.94}) \cdot \Delta pimp\_core_{t-1}
$$
$$
+ dummies
$$

Adjusted R^2 = 0.39
S.E. of equation = 0.023
Test Q (p-value) = 0.50
Estimation period: 1995q3 - 2012q1

Real effective exchange rate

$$s\_reer_t^* = \frac{1}{(1-1.09)\cdot(-0.53)-(1-1.02/0.91)\cdot 0.44+0.91}\cdot \quad (26)$$
$$\left(\frac{TCAB_t - CAB\_TRANS\_INC\_GDP_t}{OPEN_t}\right.$$
$$- \left(-23.45 + 12.18 - \log\left(\frac{CONP_t + INV_t + GFCF\_P_t}{DD_t}\right)\right.$$
$$+ (-1.09 + 1)\cdot(-3.56 + 0.1\cdot(gdp\_pot_t - gdp\_ext\_pot_t))$$
$$- (-1.02/0.91 + 1)\cdot(-2.79)$$
$$+ (1.69 - 1)\cdot(gdp\_pot_t - gdp\_ext\_pot_t)$$
$$+ 1.02\cdot\log(1 + GR\_TAR\_TR_t)$$
$$- 0.06\cdot(p\_oil_t + s\_usd\_pln_t - pva\_ext_t - s\_neer_t)$$
$$- 0.03\cdot(p\_gas_t + s\_usd\_pln_t - pva\_ext_t - s\_neer_t)$$
$$\left.\left. + dummies\right)\right)$$

$$\Delta s\_neer_t = -(s\_reer_{t-1} - s\_reer_{t-1}^*)\cdot\left(1 - e^{-1\cdot(s\_reer_{t-1} - s\_reer_{t-1}^*)^2}\right) \quad (27)$$
$$- \Delta(I\_3M_t - I\_3M\_EXT_t - INF\_TARGET_t -$$
$$I\_3MR\_EQ_t + 0.025)$$
$$- 0.4\cdot(I\_3M_{t-1} - I\_3M\_EXT_{t-1}$$
$$- INF\_TARGET_{t-1} - I\_3MR\_EQ_{t-1} + 0.025)$$
$$+ \underset{(0.13)}{0.28}\cdot\Delta s\_reer_{t-1} + \underset{(0.13)}{0.28}\cdot\Delta s\_reer_{t+1}$$
$$+ (1 - \underset{(0.13)}{0.28} - \underset{(0.13)}{0.28})\cdot\left(\frac{\log(1 + INF\_TARGET_t) - 0.02}{4}\right.$$
$$\left. - 0.67\cdot\Delta(gdp\_pot_t - gdp\_ext\_pot_t)\right)$$
$$- \underset{(0.09)}{0.29}\cdot s\_neer\_premium_t$$

Adjusted R^2 = 0.11
S.E. of equation = 0.043
Test J (p-value) = 0.62
Estimation period: 1997q2 - 2011q4

$$
\begin{aligned}
s\_neer\_premium_t = {} & (G\_BALANCE\_N_{t-1}/GDP\_N_{t-1} && (28) \\
& - 0.019 \cdot TNFA_{t-1})/1.9 \\
& + \Delta(G\_BALANCE\_N_t/GDP\_N_t)/0.7 \\
& + GAP_{t-1}/1.7 + \Delta GAP_t/0.5 \\
& + \Delta(CAB_t \cdot S\_EUR\_PLN_t/GDP\_N_t)/1.9 \\
& + \Delta(NFA\_GDP_t)/10.1 \\
& + (gdp\_ext_{t-1} - gdp\_ext\_pot_{t-1})/1.3 \\
& + \Delta(gdp\_ext_t - gdp\_ext\_pot_t)/0.6 \\
& + \Delta tot_t/2 + (I\_5Y\_EUR_{t-1} - I\_5Y_{t-1} \\
& + INF\_TARTGET_{t-1} + I\_3MR\_EQ_{t-1} - 0.04)/4.0 \\
& + \Delta(I\_5Y\_EUR_t - I\_5Y_t)/0.7 \\
& - (G\_DEBT\_GDP_t - 47.2)/446 \\
& + dummies
\end{aligned}
$$

A.4 Households' sector

Individual consumption of durable goods

$$
\begin{aligned}
conp\_dur_t^* = {} & -3.18 + 0.44 \cdot yd_t + 0.32 \cdot M3_t/CPI_t && (29) \\
& + (1 - 0.44 - 0.32) \cdot gdp\_pot_t - 0.5 \cdot I\_3MR\_CPI_t \\
& + dummies
\end{aligned}
$$

$$
\begin{aligned}
\Delta conp\_dur_t = {} & \underset{(0.09)}{0.55} \cdot \Delta conp\_ndur_t + (1 - \underset{(0.09)}{0.55}) \cdot \Delta conp\_dur_{t-1} && (30) \\
& - \underset{(0.04)}{0.14} \cdot (conp\_dur_{t-1} - conp\_dur_{t-1}^*) \\
& - 0.15 \cdot \Delta I\_3MR\_CPI_t \\
& + \underset{(0.11)}{0.31} \cdot (gdp\_ext_t - gdp\_ext\_pot_t)
\end{aligned}
$$

Adjusted R^2 = 0.62
S.E. of equation = 0.01

Individual consumption of non-durable goods and services

$$conp\_ndur_t^* = -0.47 + 0.49 \cdot yd_t + (1 - 0.49) \cdot gdp\_pot_t \qquad (31)$$
$$+ 0.24 \cdot HH\_NET\_WEALTH\_RATIO_t$$
$$- 0.4 \cdot I\_3MR\_CPI_t$$

$$\Delta conp\_ndur_t = \underset{(0.18)}{0.54} \cdot \Delta gdp\_pot_t \qquad (32)$$
$$+ \underset{(0.08)}{0.04} \cdot \Delta conp\_ndur_{t-1} + \underset{(0.08)}{0.04} \cdot \Delta conp\_ndur_{t-2}$$
$$+ (1 - \underset{(0.18)}{0.54} - \underset{(0.08)}{0.04} - \underset{(0.08)}{0.04}) \cdot \Delta yd_t$$
$$- \underset{(0.08)}{0.19} \cdot (conp\_ndur_{t-1} - conp\_ndur_{t-1}^*)$$
$$+ \underset{(0.08)}{0.28} \cdot \Delta gdp_t$$

Gross fixed residential capital formation

$$(gfcf\_h_t - gdp\_pot_t)^* = 0.25 \cdot (pgfcf\_h_t - pva_t \qquad (33)$$
$$+ \log(1 - 0.32 \cdot GR\_VAT\_TR_t)) - 3.56$$

$$\Delta gfcf\_h_t = \underset{(0.11)}{1.12} \cdot \Delta gdp\_pot_t \qquad (34)$$
$$- \underset{(0.09)}{0.26} \cdot (gfcf\_h_{t-1} - gdp\_pot_{t-1} - (gfcf\_h_{t-1} - gdp\_pot_{t-1})^*)$$
$$+ \underset{(0.17)}{0.24} \cdot \Delta(pgfcf\_h_{t-1} - pva_{t-1} + \log(1 - 0.32 \cdot GR\_VAT\_TR_{t-1}))$$
$$+ (1 - \underset{(0.11)}{1.12}) \cdot \Delta gfcf\_h_{t-1} + \underset{(0.39)}{1.1} \cdot GAP_t$$
$$+ \underset{(0.5)}{0.38} \cdot \Delta_3 (gdp\_ext_t - gdp\_ext\_pot_t) + dummies$$

24

Adjusted R^2 = 0.48
S.E. of equation = 0.049
Test LM (p-value) = 0.41
Estimation period: 1996q2 - 2011q4

Deflator of gross fixed residential capital formation

$$\Delta pgfcf\_h_t = \underset{(0.06)}{0.15} \cdot \log(1 + INF\_TARGET_t)/4 \tag{35}$$

$$+ (1 - \underset{(0.06)}{0.15} + \underset{(0.12)}{0.33}) \cdot \Delta pgfcf\_h_{t-1}$$

$$- \underset{(0.12)}{0.33} \cdot \Delta pgfcf\_h_{t-2}$$

$$- \underset{(0.02)}{0.02} \cdot (conp\_resid_{t-1} - conp\_resid^*_{t-1})$$

$$- \underset{(0.92)}{0.30} \cdot \Delta RUCC\_H_t - \underset{(0.38)}{0.55} \cdot \Delta UNRATE_t$$

Adjusted R^2 = 0.86
S.E. of equation = 0.014
Test LM (p-value) = 0.09
Estimation period: 1995q4 - 2011q4

A.5 Interest rates

WIBOR 3M quaterly average

$$I\_3M_t = \underset{(0.01)}{0.88} \cdot I\_3M_{t-1} + (1 - \underset{(0.01)}{0.88}) \cdot (I\_3MR\_EQ_t + INF_{t+1} \tag{36}$$

$$+ \underset{(0.24)}{0.77} \cdot (INF_{t+1} - \overline{INF\_TARGET}_{t+3}) + \underset{(0.09)}{0.40} \cdot GAP_t)$$

Adjusted R^2 = 0.98
S.E. of equation = 0.005
Test J (p-value) = 0.89
Estimation period: 2001q4 - 2011q4

Yield on 5-year government bonds

$$I\_5Y_t = \underset{(0.05)}{0.37} \cdot I\_5Y_{t-1} + (1 - \underset{(0.05)}{0.37}) \cdot (\frac{1}{17} \cdot I\_3M_t \tag{37}$$

$$+ (1 - \frac{1}{17}) \cdot I\_5Y_{t+1} - \underset{(0.01)}{0.004} \cdot G\_BALANCE\_GDP_t)$$

Adjusted R^2 = 0.99
S.E. of equation = 0.005
Test J (p-value) = 0.92
Estimation period: 1995q4 - 2011q4

A.6   Accumulation

Gross fixed corporate capital formation

$$KP^* \text{ meets condition} : \frac{MPC_t}{MPL_t} = \frac{RUCC_t}{RUCL_t} \tag{38}$$

$$\Delta gfcf\_p_t = -\underset{(0.14)}{0.16} \cdot (kp_{t-1} + 0.10 - kp^*_{t-1}) \tag{39}$$

$$- \underset{(0.14)}{0.04} \cdot \Delta gfcf\_p_{t-1} + \underset{(0.11)}{0.27} \cdot \Delta gfcf\_p_{t-2} + \underset{(0.11)}{0.20} \cdot \Delta gfcf\_p_{t-3}$$

$$+ (1 + \underset{(0.14)}{0.04} - \underset{(0.11)}{0.27} - \underset{(0.11)}{0.20} + \underset{(0.78)}{0.13}) \cdot \Delta gdp_{t+1} - 0.002 \cdot \Delta_4 (p\_ener\_pl_t - pva_t)$$

$$+ \underset{(0.17)}{0.51} \cdot \Delta_3(gdp\_ext_t - gdp\_ext\_pot_t) - \underset{(0.78)}{0.13} \cdot \Delta tfp\_trend_t/0.66 + 0.4\cdot$$

$$\Delta \left(\frac{(TRANS\_GFCF\_P\_EUR_t \cdot S\_EUR\_PLN_t) / (PVA_t \cdot (1 + GR\_VAT\_TR_t))}{GFCF\_P_{t-1}} \right)$$

$$+ dummies$$

Adjusted R^2 = 0.38
S.E. of equation = 0.027
Test J (p-value) = 0.49
Estimation period: 1998q1 - 2011q4

B NECMOD variables

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

- ALMP_N (EN) – expenditure on active labour market policy (co-financed with the EU funds)

- C_CORE (EX) – time-varying constant in core inflation equation

- C_FOOD (EX) – time-varying constant in food prices inflation equation

- C_PVA (EX) – time-varying constant in value added 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

- DD (EN) – domestic demand

- EMP (EN) – employment

- EMP_A (EN) – employment in agriculture

- 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

- G_DEBT_GDP (EN) – General Government debt to GDP ratio

- 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_CO2_CORE_TR (EN) – effective rate of charges imposed on prices of goods and services, which are in the core inflation basket, connected with costs of purchasing CO_2 emission rights (the EU Climate and Energy Package effective since 2013)

- GR_CO2_ENER_TR (EN) – effective rate of charges imposed on energy prices connected with costs of purchasing CO_2 emission rights

- GR_CO2_PVA_TR (EN) – effective rate of charges connected with costs of purchasing CO_2 emission rights

- GR_CORE_TR (EN) – effective rate of taxes imposed on prices of goods and services which are in the 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

- HH_NET_WEALTH_RATIO (EN) – variable reflecting changes in households' assets and liabilities as compared to their wealth

- I_3M (EN) – WIBOR 3M quarterly average

- I_3M_EXT (EN) – nominal 3-month foreign interest rate

- I_3MR_CPI (EN) – real 3-month interest rate (deflated with CPI)

- I_3MR_EQ (EX) – equilibrium real interest rate

- 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_DEMOG (EN) – participation rate net of persons eligible for pension benefits and persons pursuing full-time studies 15-24 aged, adjusted for the impact of demographic fluctuations

- LF_INTAX (EN) – effective rate of indirect taxes

- LF_M (EN) – middle-aged labour force (25-44 years)

- LF_M_RET (EN) – number of the economically active persons aged 25-44, eligible, at the same time, for pension benefits

- LF_O (EN) – older labour force (45-59/64 years)

- LF_O_RET (EN) – number of the economically active persons aged 45-59/64, eligible, at the same time, for pension benefits

- LF_PW (EN) – post-production labour force (60/65+ years)

- LF_PW_RET (EN) – number of the economically active persons aged 60/65+, eligible, at the same time, for pension benefits

- LF_RET (EN) – number of the economically active persons eligible, at the same time, for pension benefits

- LF_TAX_WEDGE (EN) – effective rate of direct labour charges (income tax, health insurance contributions), charged to employees

- LF_Y (EN) – younger labour force (15-24 years)

- LF_Y_RET (EN) – number of the economically active persons aged 15-24, eligible, at the same time, for pension benefits

- M3 (EN) – money supply, M3 monetary aggregate

- MINW (EN) – relation of minimum wage to average gross wage

- 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 in USD

- 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

- PGFCF_H (EN) – deflator of gross fixed residential capital formation

- PIMP (EN) – deflator of imports

- PIMP^c (EN) – deflator of imports 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_EDU (EX) – population of persons pursuing full-time studies aged 15-24

- 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

- RETIRED (EX) – number of retired in the economy

- RETIRED_M (EX) – number of retired in the economy (25-44 years)

- RETIRED_O (EX) – number of retired in the economy (45-59/64+ years)

- RETIRED_PW (EX) – number of retired in the economy (60/65+ years)

- RETIRED_Y (EX) – number of retired in the economy (15-24 years)

- RR_NLF (EN) – relationship between expected income, with the exclusion of pension benefits, in case of staying economically inactive to expected income in case of being economically active person

- 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

- TCAB (EN) – the equilibrium current account to GDP ratio

- TFP_TREND (EN) – total factor productivity trend

- TFP_EXT (EN) – total factor productivity abroad

- TNFA (EN) – net foreign assets level in equilibrium (% GDP)

- TOT (EN) – terms of trade

- TRANS_GFCF_P_EUR (EN) – EU transfers intended for corporate capital investments

- UNRATE (EN) – unemployment rate

- UNRATE_AVER (EN) – long-lasting unemployment rate – geometrical average of unemployment rate multiplied by 0.74

- U_GAP (EN) – unemployment gap

- WAGE_N (EN) – average nominal gross wage

- YD (EN) – real disposable income of households