EUROPEAN CENTRAL BANK

WORKING PAPER SERIES
NO 654 / JULY 2006

BCE ECB EZB EKT EKP

THE GERMAN BLOCK OF THE ESCB MULTI-COUNTRY MODEL

by Igor Vetlov
and Thomas Warmedinger

EUROPEAN CENTRAL BANK

WORKING PAPER SERIES

NO 654 / JULY 2006

THE GERMAN BLOCK OF THE ESCB MULTI-COUNTRY MODEL [1]

by Igor Vetlov [2]
and Thomas Warmedinger [3]

In 2006 all ECB publications will feature a motif taken from the €5 banknote.

1 The views expressed in this paper are those of the authors and may not reflect the views of the affiliated institutions. We thank J. Morgan, T. Karlsson and members of the ESCB Working Group on Econometric Modelling for their valuable comments. The very constructive comments and suggestions by an anonymous referee are also fully acknowledged.
2 Bank of Lithuania, Totoriu 4, LT-01121 Vilnius, Lithuania; e-mail: ivetlov@lb.lt. The work was prepared during a secondment to the Directorate General Research of the ECB.
3 Corresponding author: European Central Bank, Kaiserstrasse 29, 60311 Frankfurt am Main, Germany; Tel.: +496913446518, e-mail: thomas.warmedinger@ecb.int

Address
Kaiserstrasse 29
60311 Frankfurt am Main, Germany

Postal address
Postfach 16 03 19
60066 Frankfurt am Main, Germany

Telephone
+49 69 1344 0

Internet
http://www.ecb.int

Fax
+49 69 1344 6000

Telex
411 144 ecb d

ISSN 1561-0810 (print)
ISSN 1725-2806 (online)

CONTENTS

Abstract

The paper presents the German block of the ESCB multi-country model. It builds on previous modelling work on the Area Wide Model and other country blocks of the ESCB multi-country-model. Whilst being analogous to these models in following a common modelling approach and the same theoretical framework, the German model has also some unique features for instance with regard to the modelling of the investment components, imports and employment. The paper provides a brief overview of the theoretical framework of the model, its estimation results, and a discussion of the dynamic model properties. The model is primarily used for preparing quarterly projections for the German economy as well as for policy analysis.

JEL classification: C3, C5, E1, E2.

Keywords: Macro-econometric Modelling, Germany.

Non-technical summary

The paper presents the German block of the ESCB multi-country model (DE-MCM). It builds on previous modelling work on the Area Wide Model (AWM) and other country blocks of the ESCB multi-country-model (MCM). Whilst being analogous to these models in following a common modelling approach and the same theoretical framework, the DE-MCM has also some features that are unique to that model. Regarding the data, the sample period for the estimation of the model includes German unification. This poses a unique challenge in terms of the structural break at the point of unification as well as the various adjustments that occurred afterwards. The other main differences between the German and the other country blocks are *inter alia* related to the modelling of the investment components, imports and employment.

The modelling approach followed a combination of theoretically consistent features in the long-run with a good fit to the data in the short-run. Regarding the long-run, the design of the DE-MCM relies on a neo-classical-Keynesian synthesis, i.e. aggregate supply governs long-run properties and aggregate demand factors determine short-run dynamics. The supply curve is vertical in the long run with the level of output being ruled by technology and population levels, both of which are exogenous. Aggregate demand can deviate from long-run output over the short run. Such deviations, or output gaps, trigger wage and price adjustments that bring the model into long-run equilibrium. The goods market in the DE-MCM is characterised by monopolistic competition. Facing a downward-sloping demand curve, firms set the price of their products as a mark-up over marginal unit-labour costs. The labour market is imperfectly competitive. Various market frictions (union bargaining power, income taxes, unemployment benefits, etc.) drive a wedge between the marginal product of labour and the real wage. Long-run unemployment is a function of the labour productivity growth rate and labour market imperfections. Furthermore, in the current specification, the DE-MCM block is fully characterised by backward looking behaviour. The expectation formation enters the model implicitly through lagged values in the dynamic equations.

The DE-MCM is used for a variety of purposes. First it is used as a tool for the projections of the German economy. For that purpose, as mentioned above, it is vital that the model follows the data very closely. In the context of the projections the model is also used to conduct variant simulations that are specific to the German economy. Second, the model is also used for policy analysis (e.g. effects of monetary and fiscal policy changes). Finally, the model is part of the ESCB multi-country model. The linked MCM is mainly used for policy analysis, with particular emphasis on the spillover effects between the euro area economies.

1. Introduction

The paper presents the German block of the ESCB multi-country model (DE-MCM). It builds on previous modelling work on the Area Wide Model (AWM) and other country blocks of the ESCB multi-country-model (MCM)[1]. Whilst being analogous to these models in following a common modelling approach and the same theoretical framework, the DE-MCM has also some features that are unique to that model. Regarding the data, the sample period for the estimation of the model includes German unification. This poses a unique challenge in terms of the structural break at the point of the unification as well as the various adjustments that occur afterwards. The other main differences between the German and the other country models are related to the modelling of the investment components, imports and employment.

The modelling approach is a combination of theoretically consistent features in the long-run with a good fit to the data in the short-run. Regarding the long-run, the design of the DE-MCM relies on a neo-classical-Keynesian synthesis, i.e. aggregate supply governs long-run properties and aggregate demand factors determine short-run dynamics. The supply curve is vertical in the long run with the level of output being ruled by technology and population levels, both of which are exogenous. Aggregate demand can deviate from long-run output over the short run. Such deviations, or output gaps, trigger wage and price adjustments that bring the model into long-run equilibrium.

The goods market in the DE-MCM is characterised by monopolistic competition. Facing a downward-sloping demand curve, firms set the price of their products as a mark-up over marginal unit-labour costs. The labour market is imperfectly competitive. Various market frictions (union bargaining power, income taxes, unemployment benefits, etc.) drive a wedge between the marginal product of labour and the real wage. Long-run unemployment is a function of the labour productivity growth rate and labour market imperfections.

Although the supply side is largely based on first-order conditions obtained from a representative firm's profit maximisation exercise, the demand side equations do not rely on rigorous microeconomic analysis and are largely postulated. The latter allows for a more flexible econometric specification of the demand side of the model, and thus a better fit to the data.

Furthermore, in the current specification, the DE-MCM block is fully characterised by backward looking behaviour. The expectation formation enters the model implicitly through lagged values in the dynamic equations.

[1] Detailed model documentation is available for the AWM (Fagan et al., 2001), MCM blocks of Netherlands (Angelini et al., 2006a), Italy (Angelini et al., 2006b), France (Boissay and Villetelle, 2005) and Spain (Estrada and Willman, 2002).

The DE-MCM is used for a variety of purposes. First it is used as a tool for the projections[2] of the German economy. For that purpose, as mentioned above, it is vital that the model follows the data very closely. In the context of the projections the model is also used to conduct variant simulations that are specific to the German economy. Second, the model is also used for policy analysis (e.g. effects of monetary and fiscal policy changes). Finally, the model is part of the ESCB multi-country model (MCM). The linked MCM is mainly used for policy analysis, with particular emphasis on the spillover effects between the euro area economies.

The remainder of the paper is structured as follows. Section 2 provides a brief overview of the theoretical framework of DE-MCM. Estimation results for the model's key behavioural equations are presented in section 3. It is followed by a discussion of the dynamic model properties in section 4. In the concluding part we highlight some of the potential directions of future modelling work related to the DE-MCM development. Finally, a full list of model variables, the model code in Troll format, and tables summarizing the model response to various shocks are provided in the appendix.

[2] Projections for Germany by ECB staff form part of the Eurosystem staff macroeconomic projection exercises (ECB, 2001).

2. Theoretical framework

The theoretical framework employed in the DE-MCM closely resembles the one employed for the other MCM country blocks and the AWM. Therefore, in this section we limit our discussion to a summary presentation of the model structure emphasising some specific features of the DE-MCM setup, in particular, a different modelling of the capital stock and investment, labour and import demand and the term structures for interest rates. A detailed discussion of the theoretical background of these models is provided in the ECB working papers documenting the respective models (Angelini et al. (2006a,b), Boissay and Villetelle (2005), Estrada and Willman (2002), Fagan et al. (2001)).

2.1 Supply side

Aggregate supply is represented by a Cobb-Douglas production function with constant returns to scale and labour-augmenting technological progress. The latter is assumed to grow at a constant rate γ.

$$Y = \alpha K^{\beta}(e^{\gamma t}L)^{1-\beta}, \qquad [2.1]$$

where Y is the real output, K is the real capital stock, L is employment, α is the technology scale factor, t is the time trend, β is the income share of capital.

The equilibrium factor demand and the output price are derived from the profit maximisation problem for a representative firm. Labour demand is obtained by inverting production, while the desired capital stock is determined by equilibrating the marginal product of capital and the marginal cost of capital. The equilibrium output price is set as the mark-up over marginal labour costs[3].

$$L^* = e^{-\gamma t}\left[\frac{Y}{\alpha K^{\beta}}\right]^{\frac{1}{1-\beta}}, \qquad [2.2]$$

$$K^* = \frac{Y}{\alpha e^{\gamma t(1-\beta)}}\left[\frac{\beta}{(1-\beta)}\frac{W}{P(r+\delta)}\right]^{1-\beta}, \qquad [2.3]$$

$$P^* = \frac{\varepsilon}{(\varepsilon-1)(1-\beta)}\frac{WL}{Y}, \qquad [2.4]$$

where L^* is the equilibrium level of employment, K^* is the equilibrium level of the capital stock, W is labour compensation per head, P^* is the price of consumption and capital goods, ε

[3] The notion of equilibrium (the star variables) used in equations [2.2]-[2.4] refers to the existence of a long-run relationship between the variables rather then explicit analytical solutions of the model.

is the price elasticity of demand for goods and services, $(r+\delta)$ is the real cost of capital, r is the real interest rate and δ is the capital depreciation rate.

A feature which is not included in the other MCM country blocks is the disaggregation of capital and investment in DE-MCM. The optimal and actual capital stocks as well as investment are disaggregated into their non-residential private, residential and public components. The three disaggregated capital stocks are in the long-run assumed to constitute fixed proportions of the total capital stock, where the shares are equal to their in-sample average[4]. The corresponding disaggregated investment demand components are an important feature for the use of the model in the projections and for simulation analyses that are specific for instance to residential investment. The advantage in the context of the projections is twofold. First, the separate modelling of the three investment components allows for differences in the dynamic specifications, including different explanatory variables. The housing investment equation for instance contains the retail mortgage rate as an explanatory variable. The second advantage of this disaggregation is that factors that are specific to any of the disaggregated variables can be incorporated into the projections. For instance in the case of housing investment, housing subsidy schemes have often played a role for this variable, but not for the other investment components.

The definition of the nominal user cost of the capital stock is influenced by a wider range of interest rates in DE-MCM compared to other MCM blocks. These are in particular the government bonds long term interest rate, the corporate credit interest rate and the retail mortgage rate. In addition, DE-MCM is characterised by specific interest rate term structures for each of these interest rates.

Supply-side equations [2.2]–[2.4] in combination with exogenous labour force growth (n) and the equilibrium rate of unemployment set the steady-state level of the economy. The key parameters of the supply side are calibrated on the basis of the sample data (the estimates are reported in the model estimation section below):

$$\hat{\beta} = \frac{1}{T}\sum_{t=1}^{T}\left(\frac{(r+\delta)K}{\frac{W}{P}L+(r+\delta)K}\right),\quad \hat{\varepsilon} = \frac{1}{T}\sum_{t=1}^{T}\left(\frac{PY}{PY-WL-P(r+\delta)K}\right),$$

$$\hat{\gamma} = \frac{1}{T}\sum_{t=1}^{T}\Delta\log\left(\frac{Y}{L}\right),\quad \hat{\alpha} = \frac{1}{T}\sum_{t=1}^{T}\left(\frac{Y}{K^{\hat{\beta}}(e^{\hat{\gamma}t}L)^{1-\hat{\beta}}}\right),\hat{n} = \frac{1}{T}\sum_{t=1}^{T}\Delta\log\left(\overline{L}\right),$$

where T is the total number of observations within the sample, $\overline{L}$ is the labour force.

[4] The in-sample averages for the private non-residential, the residential and the public capital stocks are 0.71, 0.13 and 0.16 respectively.

2.2 Demand side

The demand side of the economy is given by separate equations for private consumption, gross fixed capital formation (with the three sub-components outlined above), changes in inventory stocks, exports of goods and services, and imports of goods and services. Government consumption is treated as being exogenous. For all demand equations long-run homogeneity has been imposed in order to ensure compatibility with a long-run steady-state.

Over the long run, private consumption (C^*) is determined by real disposable income (Y_d) and real wealth (V). Real disposable income is defined as the sum of real wage compensation, government transfers to households net of direct taxes, and other income. The definition of real wealth assumes that households own all assets in the economy. This includes the stock of private capital, net foreign assets and public debt.

$$C^* = \theta_0 Y_d^{\theta_1} V^{1-\theta_1}, \qquad [2.5]$$

where $\theta_0 > 0$ and $\theta_1 > 0$ are coefficients.

The specification of the consumption function possesses attributes of both the life-cycle and standard Keynesian consumption theories. In this regard, θ_1 shows the share of credit constrained agents for whom consumption closely follows contemporaneous income.

The demand for investment is driven by the difference between the actual and optimal capital stock. Over the long run, the actual capital stock converges to its equilibrium level and the level of real investment (I^*) will eventually match capital depreciation adjusted for exogenous labour productivity and labour force growth so that the investment-to-capital-stock ratio converges to a constant:

$$I^* = K^* (\gamma + \delta + n) / (1 + \gamma + n). \qquad [2.6]$$

As outlined above, in DE-MCM the optimal level for each investment demand component is explicitly modelled such that each investment expenditure adjusts to the corresponding desired capital stock.

The stock of equilibrium inventory investment (LSR^*) is assumed to be a fraction of the level of output, which depends negatively on the real interest rate:

$$LSR^* = \varphi_0 Y e^{\varphi_1 r}, \qquad [2.7]$$

where $\varphi_0 > 0$ and $\varphi_1 < 0$ are coefficients.

The equilibrium levels of exports (X^*) and imports (M^*) are postulated in standard forms. Real exports are related to the level of foreign demand[5] (WDR) and relative price

[5] When linking DE-MCM to the ESCB MCM, the intra-euro-area components of the foreign variables are determined endogenously. These variables are foreign demand (WDR), which is the trade-weighted

competitiveness, which is defined as the ratio of the domestic exports deflator (*XTD*) over a trade-weighted average of the export prices of foreign trade partners (*CXD*), such that

$$X^* = \eta_0 WDR\left(\frac{XTD}{CXD}\right)^{\eta_1}, \qquad [2.8]$$

where $\eta_0 > 0$ and $\eta_1 < 0$ are coefficients. η_0 is restricted to be equal to one. The export equation can thus be interpreted as a market share equation, where gains and losses in market shares are determined by gains and losses in competitiveness.

Equilibrium real imports depend on the level of an import demand indicator and relative prices. The import demand indicator (*WER*) is a weighted average of private consumption, investment, stocks, exports and government consumption. The weights are taken from Input-Output tables for Germany and represent the import content of each final demand component[6]. Import price competitiveness is defined as the ratio between the import deflator[7] (*MTD*) and the GDP deflator at factor cost (*YFD*)

$$M^* = \psi_0 WER\left(\frac{MTD}{YFD}\right)^{\psi_1}, \qquad [2.9]$$

where $\psi_0 > 0$ and $\psi_1 < 0$ are coefficients. The homogeneity restriction $\psi_0 = 1$ applies.

average of the trading partners imports, and competitors' prices (CXD and CMD), which are the trade-weighted averages of the trading partners' export prices.

[6] An adjustment is made to the import contents of investment and exports in order to capture the trend that was observed in the growth of imports. See the estimation Section for more details.

[7] The import deflator used in the import equation is adjusted for the impact from oil prices. See the estimation Section for more details on this adjustment.

3. Model estimation

In this section we report the empirical part of the DE-MCM with a focus on the key behavioural equations. Calibration techniques were adopted to determine the key supply-side parameters. Most behavioural equations are then estimated following the two step procedure proposed by Engle and Granger (1987). Long run (co-integrating) relationships are estimated first, next dynamic equations are estimated in error correcting specification form. In some cases the estimation follows the single equation approach (Banerjee et al., 1998).

The model is estimated on an equation by equation basis over the period from 1980Q1 quarter till 2004Q4 quarter using ESA 79 seasonally adjusted quarterly data[8]. It is noteworthy that the estimation period contains the period of German re-unification. This has been a unique economic (and political) shock experienced by the German economy which complicates the econometric estimation. However, instead of using only the post-unification period (which would effectively result in the estimation period cut roughly by a half) we retain the longer estimation period. The structural break at the point of unification is taken care of by means of step dummies[9]. The adjustment process that started after unification is more difficult to address in a simple way[10]. In most cases it was assumed that the values of the estimated coefficients would not change as a result of unification.

In various cases actual data tends to depart from the equilibrium values suggested by the theory over the estimation sample. Constants and time trends (in some cases dummies as well) are in such cases included in the level equations which allows to obtain mean-reverting intermediate or medium run target values for the variable in question.

In the exposition of the model estimation and simulation results we make use of the conventional variable notation employed in the MCM model code. The full list of the variable acronyms is reported in the appendix.

3.1 Supply side

3.1.1 Long run

The long run of the supply side is given by the estimated equations corresponding to the theoretical equations in [2.1]-[2.4]. The key parameters of the supply side are calibrated as described previously and reported in the table below.

---

[8] The ESA 79 data set was used instead of ESA 95 since the former comprised a more complete set of required time series at the time of the model estimation. Re-estimation of the model based on the ESA 95 data could be envisaged in the future modelling work.

[9] With few exceptions we do not report estimates of dummies' coefficients in the main text, but focus rather on the key elasticises of the macroeconomic variables. The complete presentation of the model equation estimates is provided in the appendix.

[10] Convergence in economic conditions and behaviour between East and West Germany has been studied in Tödter (1992). This study utilises the separate recording of East and West German data which was maintained until 1994.

Table 1: Calibrated parameters

$\hat{\beta}$	$\hat{\gamma}$	$\hat{\varepsilon}$	$\hat{\alpha}$	$\hat{n}$	$\hat{\delta}_{KP}$	$\hat{\delta}_{KH}$	$\hat{\delta}_{KG}$
0.360	0.0029	12.1	2.359	0.0025	0.010	0.025	0.004

β represents the capital share in the production function. The value of 0.36 and the corresponding value (1-β) of 0.64 for the labour share are in line with the standard priors for this parameter (see for instance Deutsche Bundesbank, 2000). The value for γ corresponds to the labour augmenting technological progress of about 1.1 % per year. ε is the price elasticity of the demand for goods. The average mark-up is given as $\varepsilon/(\varepsilon - 1)$ = 1.09. n is the growth rate of working-age population which is estimated at 0.7 % per year for the German pre-unification period and 0.2 % per year for the post-unification period. In out-of-sample period (for the steady state simulations) we assume population growth of 1% per year. This together with γ indicates a growth rate of potential output of 2.1 % per year. The depreciation rates δ are determined separately for the three capital components.

Potential Output and Output Gap

At the heart of the supply side is the economy's potential output which determines the long run level of production:

Potential output (YFT)

$$\log(YFT_t) = \log(\alpha) + \beta \log(KSR_t) + (1-\beta)\cdot\left(\gamma \cdot TIME_t + \log(LNT_t)\right) + 0.0008$$

where

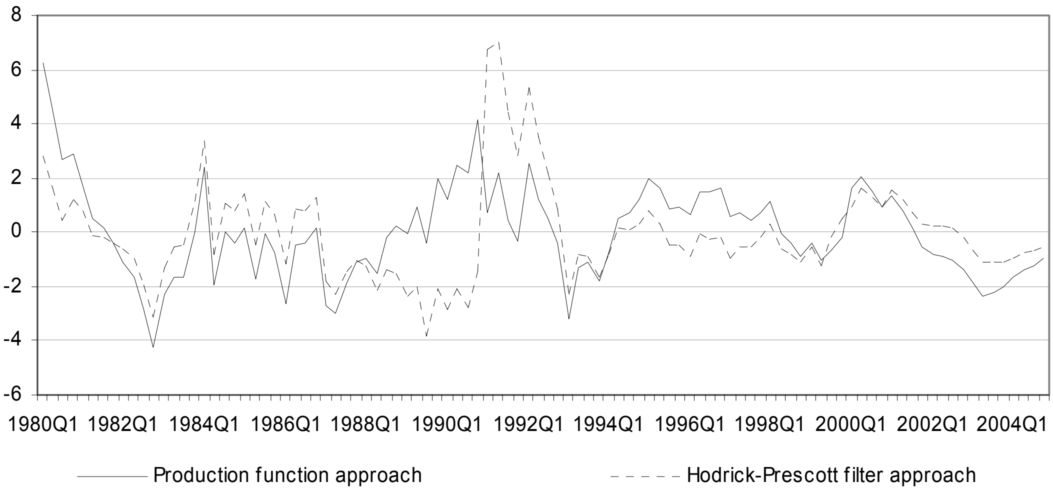
KSR = total real capital stock

LNT = trend employment

TIME = linear time trend

In the short run actual output might deviate from its potential level. The deviations are measured by the output gap variable (YGA). Figure 1 depicts fluctuations of the estimated DE-MCM output gap over the estimation period. For comparison purposes we also report an output gap obtained by applying the Hodrick-Prescott filter with λ=1600. Both series share overall similar dynamics, except for the period of German unification where the H-P filter based output gap displays a sizeable jump at that point. By visual inspection one can detect in the period under consideration at least three full growth cycles with actual output growth deviating from the potential rate by 2-4 percentage points. It is noteworthy that the amplitude of the cycles shrinks considerably towards the end of the period.

Figure 1: Output gap (in percentage points of potential output)



Capital Stock

As discussed in the previous section, the structure of the capital stock in the DE-MCM block is different from the one employed in other MCM country blocks. The optimal total stock of overall capital is analogous to that in the other models. It is increasing in line with the level of production and adjusts to changes in the relative factor costs, i.e. labour compensation and the user cost of capital. The optimal target values for the sub-components (non-residential private, public and residential capital stocks) are determined through fixed shares of the optimal total capital stock.

Equilibrium level of total capital stock (KSTAR)

$$\log(KSTAR_t) = (1-\beta)\cdot(\log(\beta/(1-\beta)) + \log(\frac{WUN_t}{CC0_t}) - \gamma \cdot TIME_t) + \log(YFR_t) - \log(\alpha)$$

where

α, β, γ	= parameters in the production function
WUN	= compensation per head
YFR	= real GDP expenditure (at factor cost)
CC0	= user cost of capital.
TIME	= linear time trend.

In DE-MCM the empirical counterpart to a theoretical concept of output is the real GDP at factor costs. It represents the national product net of taxes and subsidies, which is a more economically meaningful measure than GDP at market prices.

Equilibrium levels of private sector non-residential capital stock (KPSTAR), government sector capital stock (KGSTAR) and residential capital stock (KHSTAR):

$$\log(KPSTAR_t) = \log(0.714 \cdot KSTAR_t) - 0.128$$
$$\log(KGSTAR_t) = \log(0.160 \cdot KSTAR_t) - 0.091$$
$$\log(KHSTAR_t) = \log(0.126 \cdot KSTAR_t) + 0.145$$

where
KSTAR = equilibrium level of total capital stock

Employment

Equilibrium demand for labour is obtained via inversion of the production function. Dummy variables are required to capture shocks to the labour market associated with German unification. These shocks reflected two types of changes to the labour market. On the one hand, total employment after unification was about 30 per cent higher compared to former West Germany. On the other hand, heterogeneity of the labour skills increased substantially.

Equilibrium level of total employment (LSTAR):

$$\log(LSTAR_t) = \frac{\left(\log\left(YFR_t\right) - \log(\alpha) - \beta \cdot \log(KSR_t)\right)}{(1-\beta)} - \gamma \cdot TIME_t - 0.003$$

where
YFR = real GDP at factor cost
KSR = total real capital stock
LNN = employment
TIME = linear time trend
α, β, γ = parameters in the production function

Trend Unemployment

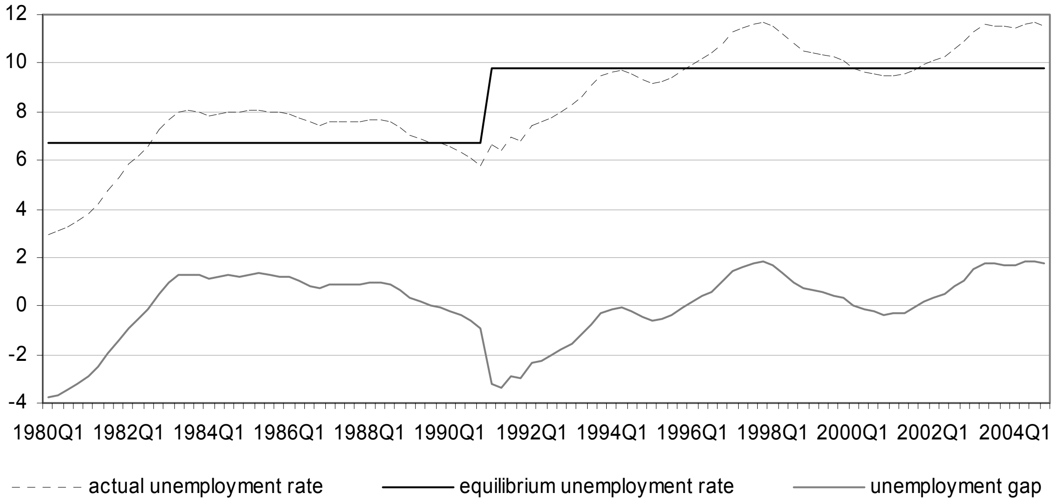
Another component of the supply side is the equilibrium level of unemployment. For a given labour supply, equilibrium unemployment determines the long run employment and, therefore, the level of potential output. The estimated equilibrium unemployment rate for the post-unification period exceeds the pre-unification equilibrium unemployment rate by about 3 percentage points[11]. This is at first a reflection of the change in the level of equilibrium unemployment due to the immediate structural change. Moreover, there are no signs that the equilibrium rate of unemployment would have reverted towards the pre-unification level. This indicates that unification implied both an immediate structural shock and a long-run adjustment process which is still under way.

Figure 2 below shows the actual unemployment rate, the “step-shaped” equilibrium rate and the difference between the two, which is the unemployment gap. It can be seen that the

[11] The rather simple procedure in estimating the NAIRU employed in the current paper is in line with estimation techniques used in other MCM blocks. For more sophisticated estimates of the NAIRU in Germany see for instance Franz (2005), Laubach (2001)).

impact of unification on the unemployment rate was not immediate, but it launched a transition to a new equilibrium level.

Figure 2: Actual and trend unemployment rates and unemployment gap



Equilibrium level of unemployment (URT):

$$URT_t = 6.720 \cdot (1 - D911P_t) + 9.803 \cdot D911P_t$$

where

D911P = step dummy variable equal to one as of 1991:1

GDP Deflator at Factor Cost (Central Price Equation)

The central price in DE-MCM is the GDP deflator at factor costs[12]. The central price variable is an integral part of the supply side and the key determinant of other price variables in the model. Together with the nominal wages the output price adjusts towards the level consistent with the equilibrium real wages (defined by the nominal wages and GDP deflator ratio). The latter is set by the marginal product of labour (from equation [2.4] above).

Equilibrium level of real wages (RWUNSTAR):

$$\log(RWUNSTAR_t) = \log\left(\frac{\varepsilon - 1}{\varepsilon} \cdot (1 - \beta) \cdot \frac{YFR_t}{LNN_t}\right) + 0.133$$

where

YFR = GDP at factor cost

LNN = employment

β = parameter in the production function

[12] The name for the GDP deflator at factor costs is in the more recent system of national accounts GDP deflator at basic prices.

3.1.2 Short run

The long run relationships which identify the equilibrium or target levels of the endogenous supply-side variables were discussed in the previous section. This section describes the dynamic adjustments of the supply side. The dynamic equations are specified in terms of error-correction mechanisms whereby changes in a variable depend on the deviation of its actual values from the optimal long-run levels as well as from dynamics of other related variables. The capital stock adjustments will be discussed in the section on demand side dynamics. In this section we report the estimation results of the dynamic equations of the labour demand, GDP deflator, and wages.

Employment

In the specification of the dynamic employment equation public employment is treated as an exogenous variable. The overall employment adjustment is thus only due to employment changes in the private sector. The estimation results below indicate that deviations of actual employment from its equilibrium level have a relatively small effect on the short-run employment dynamics. This implies *ceteris paribus* rather long periods of labour market disequilibria. We find a significant and large impact from lagged employment growth, pointing to a high degree of inertia in employment. Furthermore, employment growth is negatively related to real wage growth, as expected from theory. The elasticity of employment growth with respect to domestic activity[13] is about 0.2 spread over two quarters.

Regarding the measurement of domestic activity, there is a specific feature in DE-MCM. Domestic activity in the employment equation is represented by a labour demand indicator. This variable is calculated on the basis of an Input-Output table[14] for the German economy. From this Input-Output table it is possible to derive the labour content of the final demand components. More specifically, the calibrated labour content shares are 0.41 for private consumption, 0.25 for government consumption, 0.16 for investment expenditures, and 0.18 for exports. A relatively high labour content of private consumption can be attributed to services that are part of consumption, as they tend to be highly labour intensive. On the other hand, the low labour content of exports can be attributed to its relatively high import content which reflects to some extent the globalisation of production (see more details in the context of the import equation further below). According to the Input-Output table the labour content

[13] The elasticity of employment with respect to domestic activity may be asymmetric. This asymmetry may be related either to different elasticities with respect to positive and negative growth rates in domestic activity, or to different elasticities with respect to domestic activity growing above or below potential output growth. These two hypotheses have been tested using F-tests by splitting the samples accordingly. The differences in the respective elasticities turned out to be insignificant, which led to a rejection of these hypotheses.

[14] The Input-Output table used for these calculations refers to 1995. Our calculations are close to those from the German Statistical Office (Statistisches Bundesamt, 1995).

share of stocks is close to zero, but in the model it was set to zero for two reasons: First, deviation of stocks from their long-run GDP share are usually a temporary phenomenon which would normally not have an impact on the firm's hiring decision. Second, the data for inventories includes statistical discrepancies, and there should not be any economic effect from this volatile component.

The use of the labour demand indicator enriches the labour market treatment in the model and facilitates analysis of specific episodes of macroeconomic developments in Germany. As an example, growth in recent years has been driven almost entirely by foreign trade, which has even offset at some times a negative growth contribution from domestic demand. It was observed that there was basically no impulse from this export-led growth for employment to pick up. In the equation this is captured by the labour demand indicator which has a relatively low weight on exports. Actual GDP enters the employment equation only indirectly through the long-run supply side of the model. Given that the coefficient on the error-correction term is relatively small, the short-term impact from activity on employment is fully characterised by the labour demand indicator. The relative labour content shares, like for instance a high labour content of private consumption and a low labour content of exports, give indeed an intuitive explanation for the dismal performance of the labour market observed over the same period.

Whole economy employment (LNN):

$$\left(\Delta\log(LNN_t)-0.15\cdot\Delta\log(LGN_t)\right)/(1-0.15)=-0.041\cdot\left[\log\left(LNN_{t-1}\right)-\log\left(LSTAR_{t-1}\right)\right]$$
$$+0.669\cdot\Delta\log(LNN_{t-1})+0.131\cdot\Delta\log(WLR_t)+0.049\cdot\Delta\log(WLR_{t-1})$$
$$-0.088\cdot\Delta\log(WUN_t/YFD_t)-0.092\cdot\Delta\log(WUN_{t-1}/YFD_{t-1})$$

$R^2=0.99 \qquad DW=1.91 \qquad SE=0.003 \qquad t-ECM=-3.22$

where

LGN	= government employment
LSTAR	= equilibrium level of employment
WLR	= labour demand indicator (weighted labour contents from Input-Output table)
WUN	= compensation per employee

GDP Deflator at Factor Cost

Starting with the central price dynamic equation, it is noteworthy that the GDP deflator adjusts in reaction to two error-correction terms. The first error-correction term relates to the deviation of real wages from its long-run target level. Its estimated coefficient is relatively small, which implies that the role of prices in the real wage adjustment towards its equilibrium is rather limited (also compared to other MCM blocks). The second error-correction term relates to the output gap which represents the disequilibria on the goods market. The inclusion of the output gap provides a second transmission channel from demand and/or supply effects stemming from the real side. The motivation for including this second error-correction term is that, as mentioned above, the adjustment to long-run equilibrium through the first channel is rather weak[15].

Furthermore, the output price is characterised by a significant inertia indicated by significant large coefficients on its lags. The negative contemporaneous effect of imports growth on the output price change is due to the accounting effect from imports to GDP. The importance of other variable dynamics appears to be rather weak.

GDP deflator at factor cost (YFD):

$$\Delta \log(YFD_t) = -0.051 \cdot \left(\log\left(YFD_{t-4}\right) - \log\left(WUN_{t-4}\right) + \log\left(RWUNSTAR_{t-4}\right)\right)$$

$$+0.060 \cdot \log\left(YGA_{t-3}\right) + 0.136 \cdot \Delta \log(YFD_{t-2}) + 0.522 \cdot \Delta \log(YFD_{t-4}) + 0.048 \cdot \Delta \log\left(\frac{WUN_{t-2}}{PCD_{t-2}}\right)$$

$$-0.030 \cdot \Delta \log\left(PRO_t\right) - 0.124 \cdot \Delta \log\left(MTD_t\right) + 0.076 \cdot \Delta \log\left(MTD_{t-1}\right) + 0.089 \cdot \Delta \log\left(MTD_{t-4}\right)$$

$$R^2 = 0.58 \qquad DW = 2.43 \qquad SE = 0.005 \qquad t - ECM = -1.51$$

where

WUN	= compensation per employee
RWUNSTAR	= equilibrium level of real wages
YGA	= output gap
PCD	= private consumption deflator
PRO	= productivity
MTD	= import deflator

Wages

The deflator used for real wages is the consumption deflator rather than the GDP deflator, reflecting the relative importance of consumption price inflation in the wage negotiating process. Contrary to the output price above, nominal wages are estimated to be rather responsive to deviation of the actual real wage rate from its equilibrium level. In addition, wage growth is strongly influenced by labour productivity growth and changes in indirect taxation. Similar to the GDP deflator, in the case of wages there is a second level term entering the dynamic equation. This second error-correction term is the deviation of the unemployment rate from its long-run level, thus, representing the Phillips-curve effect. The impact from the unemployment gap, however, is estimated to be relatively small. Furthermore, compared to the GDP deflator nominal wages appear to be more responsive to disequilibrium conditions as evidenced through the relatively high estimated adjustment coefficient of real wage deviations from its target level. A dynamic homogeneity restriction on the equation coefficients has been supported by the data.

[15] As pointed out by other economists (see for example Nautz and Scharff (2005)) it is not easy to model German inflation. This is especially true for the period after German unification.

Compensation per head (WUN):

$$\Delta\log(WUN_t) = \Delta\log(PCD_t) + \gamma\cdot(1-0.243+0.113)$$
$$-0.198\cdot(\log(WUN_{t-1})-\log(YFD_{t-1})-\log(RWUNSTAR_{t-1})) + 0.243\cdot\Delta\log(PRO_t)$$
$$-0.113\cdot\Delta\log\left(\frac{WUN_t}{PCD_t}\right)-0.012\cdot(\log(URX_t)-\log(URT_t))-0.686\cdot\Delta\log\left(\frac{PCD_t}{YFD_t}\right)$$

$R^2 = 0.82$ $DW = 1.90$ $SE = 0.007$ $t-ECM = -3.31$

Where
PCD = private consumption deflator
YFD = GDP deflator at factor cost
RWUNSTAR = equilibrium level of real wages
PRO = productivity
URX = unemployment rate
URT = trend unemployment rate

3.2 Demand side

3.2.1 Long run

The long run targets of the demand side are represented by the GDP expenditure components, which are equilibrium private consumption, optimal inventory stock, exports and imports. Targets for investment components are given by the respective optimal capital stock levels discussed above.

Private Consumption

The long run consumption function specification corresponds to the theoretical equation [2.5]. Consumption is in the long-run determined by real disposable income and real wealth. The inclusion of the wealth variable provides a stock-flow equilibrating mechanism, as wealth is calculated as the sum of total capital, government debt and net foreign assets. The estimated coefficient of disposable income is close to 0.9, which is somewhat higher than the estimates reported for the Dutch and French MCM country blocks, but comparable to the Spanish one. In Germany housing and financial wealth have traditionally played a relatively small role[16] for consumption behaviour, which is reflected in the relatively low coefficient on wealth and thus a low tendency to consume out of wealth[17].

The inclusion of the real interest rate was tested and turned out to be insignificant. This may be a reflection of a relatively low share of credit-financed consumption.

[16] Hamburg *et al.* (2005) come to a similar conclusion regarding the role of wealth for German consumption.
[17] It should be noted that the relatively high coefficient on real disposable income is not necessarily a reflection of a low savings ratio.

Equilibrium level of private real consumption (CSTAR):

$$\log\left(CSTAR_t\right) = -0.505 + 0.874 \cdot \log(PYR_t) + 0.126 \cdot FWR_t$$

where
PYR = real disposable income
FWR = real financial wealth

Inventories

Modelling inventories is always a difficult task. This is primarily because the data for inventories includes not only actual inventories, but also statistical discrepancies that arise mainly due to differences in compiled GDP figures based on production and expenditure approaches. As a result, the data for inventories is very noisy[18]. Another difficulty in modelling inventories lies in the fact that there are no clear determinants of this variable coming out of economic theory. Finally, with regard to model specification, a log-difference specification of inventory investment is not possible since this variable can be positive or negative.

We apply for the long-run inventory equation a rather simple approach, which is basically to estimate the long-run level of stocks as a fixed proportion of GDP[19]. The inclusion of the real interest rate in the inventory equation, representing the opportunity cost of holding stocks, was tested but turned out to be insignificant. The estimation of the simple share equation does not produce a stationary residual, i.e. there is no cointegrating relationship. The equation requires the inclusion of a declining trend until the end of 1993 and a growing trend thereafter.

Equilibrium level of real inventory stocks (LSRSTAR):

$$\log\left(\frac{LSRSTAR}{YER}\right) = 0.054 - 0.005 \cdot TIME + 0.013 \cdot TIME94$$

where
YER = GDP
TIME = linear time trend
TIME94 = liner time trend starting in 1994Q1.

[18] Knetsch (2004) also argues that the national account data for inventory investment in Germany has particularly poor quality. For modelling inventory investment, the author draws on alternative data sources to get meaningful results. This approach, however, is not feasible in the context of DE-MCM, as the inventory equation has to fit into the national account based framework, not least for the purpose of producing projections.

[19] This resembles an approach used in the Spanish MCM block, i.e. the long run target is specified in terms of stock of inventories rather than change in inventories (as in French and Dutch models).

Exports

The two key explanatory variables for exports are world demand and price competitiveness. World demand is an index variable that is derived from the weighted average of Germany's trading partners' imports. The weights correspond to German export shares[20]. Given that the elasticity of exports with respect to world demand has to be restricted to be equal to one, the export equation resembles a trade share equation. Trade shares are modelled as a function of price competitiveness, which is the ratio between German export prices and foreign export prices[21]. As shown in the estimation results below, the elasticity of export market shares with respect to competitiveness is -0.42. However, modelling export market shares solely as a function of competitiveness turns out to be insufficient to establish a cointegrating relationship. A trend variable is also needed which imposes a deterministic loss of market shares amounting to about a quarter of a per cent each year[22].

Equilibrium level of real export for goods and services (XSTAR):

$$\log\left(\frac{XSTAR_t}{WDR_t}\right) = 5.271 - 0.0006 \cdot TIME_t - 0.421 \cdot \log(XTD_t / CXD_t)$$

where

WDR	= world demand indicator
TIME	= linear time trend
XTD	= export deflator
CXD	= competitor's export price in domestic currency

Imports

The specification of the long-run import equation is, analogously to the export equation, a function of a demand indicator and competitiveness. The import demand indicator is calculated as a weighted average of the final demand components. The weights are determined by the import content of the final demand components, as given by the Input-Output table. These weights are 0.21 for private consumption, 0.06 for government consumption, 0.26 for investment, 0.51 for inventory investment, and 0.39 for exports[23]. The high import content of inventories is a familiar feature[24].

Modelling long-run imports as a function of import demand, with an elasticity of one, and competitiveness does not establish a cointegrating relationship. It is a commonly found

[20] The trade shares are taken from the IMF's Direction of Trade Statistics (Yearbook 1998), referring to the years 1995-97.
[21] Foreign export prices are calculated from the weighted average of German trading partners' export prices (see previous footnote for trade shares).
[22] Given the fixed weights in the world demand indicator, the trend variable could also be due to trade composition effects.
[23] The weights are taken from the German Input-Output tables for 1995. The calculation follows the approach in Francq (1990). These import contents are slightly higher than those calculated by the Federal Office for Statistics in Germany (Statistisches Bundesamt, 1994).
[24] This strong relation between imports and stocks is also found in Knetsch (2004).

feature in most countries that imports have been growing at a much higher rate than domestic demand, and this can not be accounted for by competitiveness effects. This rapid rise in imports is particularly strong since the mid-nineties.

The relatively high import growth can be to a large extent attributed to a particular globalisation effect, namely, the globalisation of production. As more production takes place internationally, more intermediate products used for production are imported. In addition, the imports of final products are also increasing due to the relocation of production sites abroad. The latter would at the same time push up the exports of intermediate products. Sinn (2005) labels this phenomenon the "bazar-economy" and argues that the soaring German export performance in recent years is mainly due to the imports of intermediate goods.

The relatively high import growth needs to be reflected in the import equation. The most commonly used approaches are either to allow an elasticity of imports with respect to the import demand indicator which is higher than one, or to include a deterministic trend. Given that the key factor for the high import growth seems to be that of globalisation, a deterministic trend would more accurately reflect such an effect which is clearly coming from outside the model. This is why the first approach of using a non-unitary elasticity seems questionable, particularly when using the model for variant or policy simulations, as the crowding-out effect through imports would be exaggerated.

Against the background of the discussion on globalisation in production in the previous paragraph, the rise in the import share is mainly due to a rising import content of exports. For this reason in DE-MCM the trend has been applied to the import content of exports. Globalisation in production implies also a growing import content of investment, although to a lesser extent compared to exports. As a result, the import content of investment is gradually rising from 0.26 to 0.31, and the import content of exports from 0.39 to 0.58. These trends have been calibrated with the aim of establishing a cointegrating relationship in the long-run import equation. The trend increase in import contents is imposed in the period from 1995 to 2000.

Price competitiveness on the import side is expressed as the ratio between import prices and domestic prices. There is a potential problem with this specification which is most evident in the case of an oil price shock. Assuming a rise in the price of oil, there would be also a rise in the import deflator (see specification further below), and as a consequence imports would be reduced. It could be the case that the positive effect on GDP resulting from the lower impact would outweigh in the short-run the dampening effect on GDP through real income. This would result in a spurious positive effect on GDP. The spurious effect comes about through treating demand for oil and non-oil imports as equally elastic. The elasticity of oil imports with respect to the price of oil, however, is much lower (close to zero) than the elasticity of other imports with respect to their associated import price. In order to reflect this fact, the import deflator used in the import equation is adjusted for the impact from oil prices. This approximates a non-oil import deflator.

It is important for the stability of the model that the elasticities of exports and imports with respect to price competitiveness are roughly the same. In the case of DE-MCM this feature was found in the data anyhow.

Equilibrium level of real imports (MSTAR):

$$\log(\frac{MSTAR_t}{WER_t}) = -0.324 - 0.424 \cdot \left[\left(\log(MTD_t) - 0.076 \cdot \log(PEI_t) \right) / (1 - 0.076) - \log(YFD_t) \right]$$

where

WER = import demand indicator

MTD = import (goods and services) deflator

PEI = price index of imported energy in domestic currency (coefficient from import deflator equation)

YFD = GDP deflator at factor cost

3.2.2 Short run

Private Consumption

A notable feature of the dynamic consumption equation in DE-MCM, in particular when compared to other MCM country blocks, is the high impact of contemporaneous disposable income growth on private consumption growth. This feature is very robust across various samples and estimation methods. Its impact, however, is slightly offset by a negative coefficient on the lagged endogenous variable. The relative size of the dynamic impacts of income and wealth on consumption growth are roughly similar to those in the long-run equation. Regarding the coefficient on the error correction term, the adjustment to long-run equilibrium is relatively fast. The point estimate is within the range reported for other MCM country blocks.

Private real consumption (PCR):

$$\Delta \log(PCR_t) = -0.325 \cdot (LOG(PCR_{t-1}) - \log(CSTAR_{t-1})) - 0.118 \cdot \Delta \log(PCR_{t-1})$$
$$+ 0.905 \cdot \Delta \log(PYR_t) + 0.121 \cdot \Delta \log(FWR_t) + 0.091 \cdot \Delta \log(FWR_{t-1})$$

$R^2 = 0.92 \quad DW = 2.09 \quad SE = 0.005 \quad t-ECM = -4.03$

where

CSTAR = equilibrium level of consumption

PYR = real disposable income

FWR = real financial wealth

A high value of the coefficient on contemporaneous income has strong implications for the model properties, both in the context of projections as well as for policy simulations. In particular in the latter case it tends to accelerate the speed of transmission of shocks.

One possible explanation of the strong disposable income impact on consumption growth could be given by the fact that compared to other European countries inflation was on average relatively low and stable in Germany. The latter had a stabilising effect on current real income implying that changes in current income was perceived by consumers as being the permanent ones.

A further explanation for a relatively large contemporaneous income effect in DE-MCM is due to the fact that in the model, wealth generates substantial streams of households' income (for instance through housing rents) which, following the model accounting framework, are reflected in disposable income via the other personal income variable. As a result, the importance of disposable income may tend to be overestimated in DE-MCM.

Investment

Following the capital structure presented above, all three investment components are modelled explicitly, which allows for a more detailed analysis, in particular in the context of projections. In each case, investment adjusts to ensure that the actual capital stock approaches its optimal level. In principle, the error-correction term can be specified in terms of either investment or the actual capital stock relative to the target level of the capital stock. Here we choose a slightly richer specification which includes investment relative to actual capital, and actual capital relative to its target level[25]. The reason for that specification is that this has produced the best performance of the equation in terms of the fit.

Regarding non-residential private investment, we find a relatively strong short-run accelerator effect from real sector activity. The elasticity of private investment with respect to GDP is restricted to be equal to one over the first two quarters because otherwise the accelerator effect would lead to instability in the model. The interest rate has not been found to be significant in the dynamic equation for private investment, which means that it only enters through the long-run equation.

Private sector non-residential investment (IPR):

$$\Delta\log(IPR_t) = -0.604 - 0.143\cdot(\log(IPR_{t-1}) - \log(KRP_{t-1})) - 0.151\cdot(\log(KRP_{t-2}) - \log(KPSTAR_{t-2}))$$
$$+ 2.166\cdot\Delta\log(YFR_t) + (1-2.166)\cdot\Delta\log(YFR_{t-1}) + 0.341\cdot\Delta\log(IPR_{t-2}) - 0.132\cdot\Delta\log(IPR_{t-3})$$

$R^2 = 0.964 \quad DW = 2.14 \qquad SE = 0.036 \qquad t-ECM_1 = -3.01 \qquad t-ECM_2 = -1.90$

where
KPSTAR = equilibrium level of private non-residential capital stock
YFR = GDP at factor cost

[25] This is equivalent to the specification investment relative to the target capital stock in case the coefficients of the two error-correction terms would be the same.

In the case of housing investment, the two error-correction coefficients have been restricted to be equal. The estimated impact of contemporaneous GDP was not significantly different from one, so that this restriction has been imposed. In addition, the retail mortgage rate has a significant dampening impact on housing investment.

Housing investment (IHR):

$$\Delta\log(IHR_t) = -0.224 - 0.070\cdot(\log(IHR_{t-1}) - \log(KHR_{t-1})) - 0.070\cdot(\log(KHR_{t-4}) - \log(KHSTAR_{t-4})) + \Delta\log(YFR_t) - 0.123\cdot\Delta\log(RMT_{t-2})$$

$R^2 = 0.70 \quad DW = 2.09 \qquad SE = 0.027 \qquad t-ECM = -2.39$

where
KHSTAR = equilibrium level of housing capital stock
YFR = GDP at factor cost
RMT = retail mortgage rate

As regards government investment, the coefficient on contemporaneous GDP is larger than one, but this is offset by negative coefficients on the lagged endogenous variables.

Government investment (GIR):

$$\Delta\log(GIR_t) = -0.080 - 0.016\cdot(\log(GIR_{t-3}) - \log(KGR_{t-3})) - 0.181\cdot(\log(KGR_{t-2}) - \log(KGSTAR_{t-2})) + 1.382\cdot\Delta\log(YFR_t) - 0.219\cdot\Delta\log(GIR_{t-1}) - 0.361\cdot\Delta\log(GIR_{t-2})$$

$R^2 = 0.62 \quad DW = 2.07 \qquad SE = 0.044 \qquad t-ECM_1 = -0.63 \qquad t-ECM_2 = -1.95$

where
KGSTAR = equilibrium level of government capital stock
YFR = GDP at factor cost

Inventories

The estimated dynamic equation of the inventory stock reveals substantial inertia in inventory changes as well as its relatively slow speed of adjustment to the equilibrium level. In addition, growth in inventories is found to be dependent on changes in the real interest rate and domestic output growth.

Level of real inventories (LSR):

$$\Delta\log(LSR_t) = -0.176\cdot\left(LSR_{t-1} - LSRSTAR_{t-1}\right) + 0.451\cdot\Delta\log(LSR_{t-1}) - 0.001\cdot\Delta(REALI_{t-1}) + 0.323\cdot\Delta\log(YER_t)$$

$R^2 = 0.73 \quad DW = 2.55 \qquad SE = 0.011 \qquad t-ECM = -1.28$

where
LSRSTAR = long-run equilibrium level of real stocks
REALI =real interest rate for inventories
YER = GDP

Exports

Growth in real exports is largely driven by the error-correction term. The intra-euro area component of foreign demand enters with a relatively large coefficient. In addition, we find that there is a significant impact from the acceleration in German export prices.

Real exports of goods and services (XTR):

$$\Delta\log(XTR)_t = -0.667\cdot(\log(XTR_{t-1}) - \log(XSTAR_{t-1})) + 1.748\cdot\Delta\log(WDR\_IN_t)$$
$$-0.449\cdot\Delta^2\log(XTD_{t-2})$$

$R^2 = 0.77 \quad DW = 2.13 \quad SE = 0.016 \quad t-ECM = -7.72$

where

XSTAR	= equilibrium level of exports for goods and services
WDR_IN	= world demand indicator for imports from within the euro area
XTD	= export deflator

Imports

The speed of adjustment of real imports towards equilibrium level is slower compared to real exports. The impact from domestic activity is clearly larger than one, but this is largely compensated by the negative impact from the lagged endogenous variable. The unit elasticity imposed in the long run is therefore also approximately true for the short-run equation, which is a further indication that the trend in imports is deterministic.

Real imports of goods and services (MTR):

$$\Delta\log(MTR_t) = -0.175\cdot(\log(MTR_{t-1}) - \log(MSTAR_{t-1})) - 0.292\cdot\Delta\log(MTR_{t-1})$$
$$+0.993\cdot\Delta\log(WER_t) + 0.401\cdot\Delta\log(WER_{t-1}) - 0.160\cdot\Delta\log(MTDNO_t)$$

$R^2 = 0.77 \quad DW = 2.08 \quad SE = 0.011 \quad t-ECM = -2.26$

where

MSTAR	= equilibrium level of imports
WER	= import demand indicator
MTDNO	= simplified notation for the non-oil import deflator[26]. overall import deflator)

3.3 Interest rate term structure

The interest rate term structure in the DE-MCM is richer than in other MCM country blocks. Apart from an equation for the long term interest rate, there are also explicit equations for the credit interest rates for the corporate and households sectors and the retail mortgage rate. One of the reasons for the somewhat richer specification is due to the fact that capital and investment is modelled in a disaggregated way, and different interest rates may be relevant for

[26] MTDNO is approximated by taking out the long-run impact from oil-price on the import deflator. See the equation for the long-run import deflator or the equation coding in the appendix for details.

different components. It also opens up the possibility to conduct simulations with regard to changes in specific interest rates in case such an issue would arise. However, it should be noted that the more detailed specification of the interest rate term structures in DE-MCM is not related to the possibility of a different structure of financial markets in Germany.

All interest rate equations share a common specification approach, i.e. each equation is constructed as a weighted average of an autoregressive component and the short term interest rate. The latter is treated either as an exogenous variable (when the model is used to forecast) or determined by the monetary policy rule (in case of policy simulation exercises). In each equation a constant is included as a proxy for the risk premium. All parameters are estimated freely except for a restriction on weights which are required to sum to one.

The risk premia implied by this estimation range from 0.51 percentage points for the long-term interest rate to 6.1 percentage points for the household-sector credit interest rate. The level of the risk premia, however, does not play a role for the dynamics of the model. They can be interpreted in a similar way as constants employed in other equations.

Interest rates:

$$LTI_t = 0.893 \cdot (LTI_{t-1} + LTI_{t-2} + LTI_{t-3} + LTI_{t-4})/4$$
$$+ 0.107 \cdot \left(0.510 + 5.029 \cdot STI_t - 2.727 \cdot STI_{t-1} - 0.489 \cdot STI_{t-2} - 1.136 \cdot STI_{t-3} + 0.323 \cdot STI_{t-4}\right)$$

$R^2 = 0.99 \qquad DW = 0.53 \qquad SE = 0.498$

$$RCC_t = 0.747 \cdot (RCC_{t-1} + RCC_{t-2} + RCC_{t-3} + RCC_{t-4})/4$$
$$+ 0.253 \cdot \left(2.758 + 1.950 \cdot STI_t + 0.252 \cdot STI_{t-1} - 0.178 \cdot STI_{t-2} - 0.234 \cdot STI_{t-3} - 0.790 \cdot STI_{t-4}\right)$$

$R^2 = 0.99 \qquad DW = 0.43 \qquad SE = 0.448$

$$RCH_t = 0.840 \cdot (RCH_{t-1} + RCH_{t-2} + RCH_{t-3} + RCH_{t-4})/4$$
$$+ 0.160 \cdot \left(6.130 + 2.545 \cdot STI_t + 0.659 \cdot STI_{t-1} - 0.426 \cdot STI_{t-2} - 0.337 \cdot STI_{t-3} - 1.441 \cdot STI_{t-4}\right)$$

$R^2 = 0.99 \qquad DW = 0.44 \qquad SE = 0.464$

$$RMT_t = 0.859 \cdot (RMT_{t-1} + RMT_{t-2} + RMT_{t-3} + RMT_{t-4})/4$$
$$+ 0.141 \cdot \left(2.014 + 3.937 \cdot STI_t - 1.336 \cdot STI_{t-1} - 0.468 \cdot STI_{t-2} - 1.292 \cdot STI_{t-3} + 0.159 \cdot STI_{t-4}\right)$$

$R^2 = 0.99 \qquad DW = 0.50 \qquad SE = 0.531$

where
LTI = long-term nominal interest rate
STI = short-term nominal interest rate
RCC = credit interest rate for corporate sector
RCH = credit interest rate for household sector
RMT = retail mortgage rate

3.4 Policy rules

Policy rules are required to close the model, which is a prerequisite for achieving overall model stability over a long-run horizon, implying convergence to a steady-state. Although monetary conditions in Germany have been set since 1999 by the European Central Bank, for the purpose of model simulation we need to apply a monetary policy rule along with a fiscal policy rule.

Monetary Policy Rule

The monetary policy rule in DE-MCM follows a simple Taylor specification in which a change in the short term interest rate is determined by three "gaps": The nominal interest rate gap, the inflation gap and the output gap. The interest rate gap measures the difference between the actual nominal interest rate and its equilibrium level. The latter is defined in the spirit of the Fischer equation, i.e. a sum of real interest rate and inflation. Similar to other MCM blocks, the equilibrium real interest rate in the German model is calibrated to be equal to a sum of productivity and population growth rates. The inflation gap measures the distance between the actual inflation rate and its target level. For the purpose of the simulations reported below this target level of inflation is set to 2 per cent per annum, but it could in principle be set to any other *reasonable* level. The output gap gauges actual output deviation from its potential level as defined above. The interest rate parameter determines the speed of equilibrium adjustment (or reciprocal of level of policy response smoothness) whereas the inflation and output gap parameters show the reaction strength and relative importance of inflation and output stabilization in the policymakers' considerations.

Monetary policy rule:

$$\Delta STI_t = \lambda_1 \cdot \left(STI_{t-1} - 100 \cdot \left(4 \cdot \left(\gamma + n + \frac{PCD_{t-1}}{PCD_{t-2}} - 1 \right) \right) \right)$$

$$+ \lambda_2 \left(\Delta \log(PCD_t) - \pi^T \right) + \lambda_3 \log(YGA_{t-1})$$

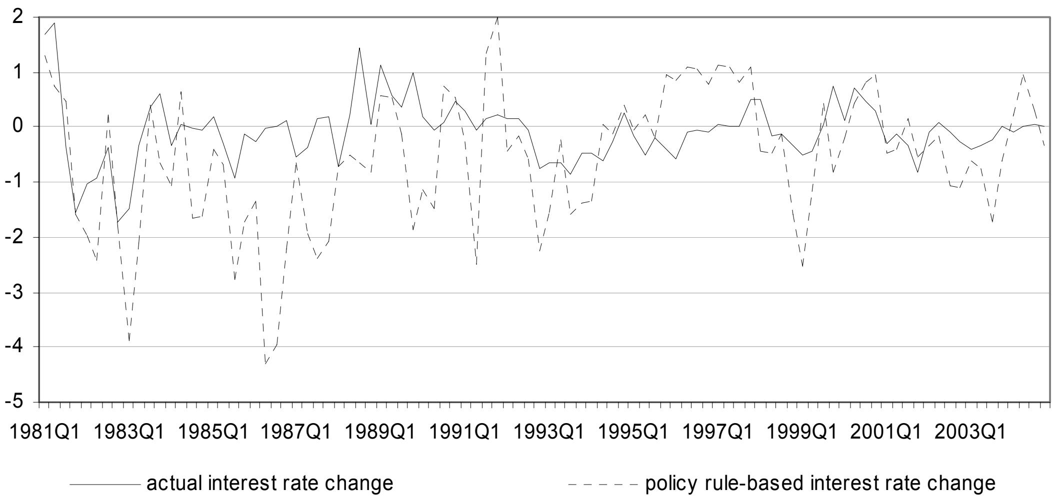
where

STI	= short-term nominal interest rate
PCD	= private consumption deflator
YGA	= output gap
π^T	= target inflation rate (default = 2% per annum)
λ_1	= adjustment parameter to long-run equilibrium nominal interest rate (default = -0.5)
λ_2	= reaction parameter to deviations of past inflation from target (default = 100)
λ_3	= reaction parameter to output gap (default = 50)

As regards the choice of parameters, they are calibrated on the basis of available relevant estimates in the literature and with the view of ensuring a sensible profile of the model's dynamic behaviour. More specifically, the parameter governing the speed of reaction to the interest rate gap is set to 0.5. The inflation gap and output gap parameters are set to 100 and 50 respectively. This setting corresponds to a central bank interest rate reaction which is one-to-one to inflation and only half a percentage point reaction to 1 percentage point of the output gap. The exact setting of the parameters can be chosen to reflect the relative strength of reactions to inflation and income stabilisation.

For the purpose of illustration, we report below the performance of the calibrated monetary policy rule over the whole sample. Prior to the German unification the monetary policy rule performs relatively poorly in explaining the actual short term interest rate changes. Since 1993 the policy rule-based interest rate changes match closer the actual ones, although a small negative bias remains. In addition, compared to the actual interest rate changes the rate changes implied by the policy rule are more volatile. As noted above, the policy rule cannot be interpreted as a behavioural equation, as its main purpose is not to fit the data as well as possible. The monetary policy rule for out-of-sample simulations is calibrated in a way that ensures a stable convergence to steady-state and reasonable simulation properties. When linking DE-MCM to the ESCB MCM, the national monetary policy rule is replaced by one for the euro area as a whole.

Figure 3: Actual and monetary policy rule-based changes in the short term interest rates (in percentage points)



Fiscal Policy Rule

The fiscal policy rule is based on a reaction of taxes to the deviation of the Government's debt to GDP ratio and budget deficit to GDP ratio from their predetermined targets. The default target values correspond to those of the stability and growth pact.

The fiscal rule determines in the first place the path of the personal income tax rate. In addition, the fiscal rule affects also other direct taxes, which correspond approximately to corporate taxes. Corporate taxes are included in order to avoid possible income distortions between the household and the corporate sectors in the economy. For simplicity, the path of the tax rate for other direct is modelled such that it follows closely the path for the tax rate of personal income.

Fiscal policy rules:

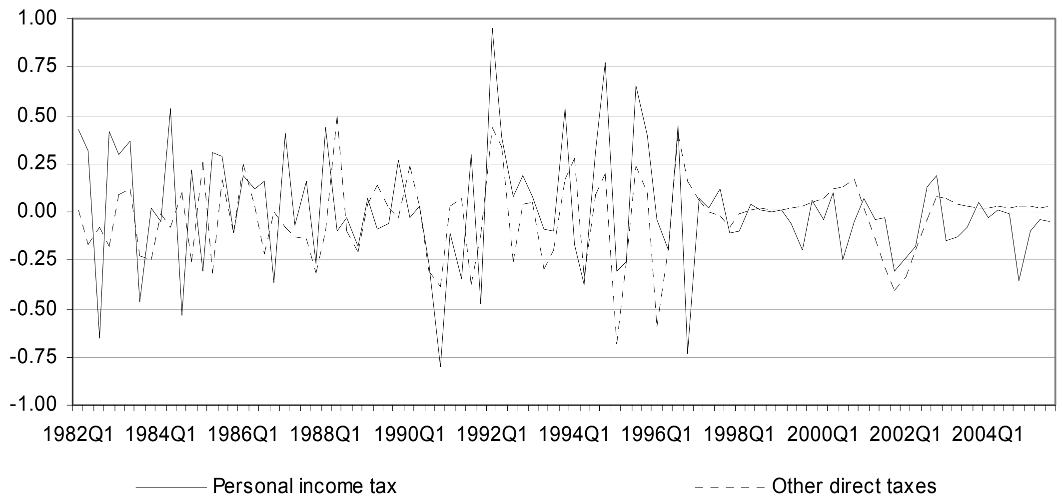
$$\Delta PDX_t = \mu_1 \cdot \left(\frac{GDN_t}{4 \cdot YEN_t} - GDNRATIO_t^T \right) + \mu_2 \cdot \left(GLNRATIO_t^T - \frac{\sum_{i=1}^{i=4} GLN_{t-i}}{\sum_{i=1}^{i=4} YEN_{t-i}} \right)$$

$$\Delta ODX_t = \mu_3 \cdot \Delta PDX_t$$

where

PDX	= direct tax to tax base ratio
ODX	= other direct taxes (predominantly corporate taxes) to tax base ratio
GDN	= government net debt
YEN	= nominal GDP
$GDNRATIO_t^T$	= target debt to GDP ratio (out of sample = 0.6)
$GLNRATIO_t^T$	= target deficit to GDP ratio (default = 0.0)
μ_1	= adjustment parameter to deviation of debt ratio from target (default = 0.01)
μ_2	= adjustment parameter to deviation of annual public sector deficit ratio from target (default = 0.1)
μ_3	= co-movement parameter to fiscal rule (default = 0.8)

Figure 4: Actual changes in personal income and other direct tax rates (in percentage points)



A visual inspection of historical developments of direct tax rates in Figure 4 reveals substantial co-movement of both types of tax rates at quarterly frequency. Our modelling approach is based on the belief that this sample regularity can be carried over the long run as well.

4. Steady state baseline and model simulations

In this section we discuss the construction of the steady-state baseline and report results for several diagnostic shock simulations.

4.1 Steady state baseline

The purpose of constructing a steady-state baseline is twofold. First, it is important *per se* to check that a model is compatible with a steady-state. It was emphasised throughout the paper that the specifications of the equations need to be consistent with such a steady-state of the model. Key examples are the homogeneity restrictions in the long-run equations, or the relevance of some key elasticities. Against this background, the main purpose of the steady-state compatibility is to ensure that the model is not explosive.

The second purpose of constructing the steady state is to have a clean and sufficiently long environment to conduct diagnostic simulations. A long-run time horizon is required in case simulations need to be conducted over a longer horizon than is available within the historical sample. More importantly, however, a clean environment ensures that simulation results are independent from a given baseline[27].

A key element of such a clean environment is that all variables grow at their steady-state growth rate. In addition, there are also some implications for the coefficients of the model equations. Within a steady-state environment it should always be possible to have static and dynamic homogeneity. The fact that these restrictions are often not compatible with the data is a reflection of the fact that the sample period used to estimate the model is obviously not a steady-state environment. In DE-MCM the steady-state compatible coefficient restrictions are imposed in two steps. First, all trends in the equations are "stopped" in steady state, which means that their value is kept constant. For instance in the case of the export equation, the trend loss in market shares will be stopped in steady state, and market share developments are only a function of trade competitiveness. The second step is to adjust the intercepts in the equations. This is done by extending the dataset with the steady-state growth rates of each variable[28], and then inverting the model to get the steady-state residuals of each equation. These steady-state residuals are kept in the steady-state environment where they act as

[27] Simulations depend on a given baseline in the case of non-linearities. Non-linearities are very limited in the model, but they do exist in some places such as for instance zero lower bounds of interest and unemployment rates. Baseline dependence also exists due to varying shares of GDP components, which are constant in steady-state. For example the impact of a world demand shock depends *inter alia* on the export share in GDP.

[28] The last column in the variable table of the appendix shows the steady-state growth rates for each variable. Variables are either kept constant (C), grow at the rate of total factor productivity growth (TFP), at the rate of labour force growth (L), real growth (R = TFP + L), price variables grow at the rate of long-run inflation (P), wage growth (W = TFP + P), and nominal variables increase at the nominal growth rate (N = R + P).

intercept adjustments[29]. These intercept adjustments have no impact on the elasticities or general properties of the model.

In this approach the convergence to steady-state is not tested from the in-sample environment. The convergence path to a steady-state is not very informative as such, because it largely depends on the choice of how for instance trend variables are treated. For the same reason the transition to steady-state could also not be interpreted as a long-term forecast. However, convergence to steady-state is an important property of a model. The general convergence properties of the DE-MCM are demonstrated by conducting simulations of permanent shocks to the model. These shocks are reported in the section below.

4.2 Shock analysis

As indicated above, simulations of permanent shocks are needed to show that the model finds a steady-state solution. In other words, there are no explosive forces in the model which would prevent the model from returning to steady state. A steady state is defined in terms of the growth rates of all the variables in the model. Imposing a permanent shock implies permanent level effects not only to the variable which is shocked, but also to all the endogenous variables in the model, whereas the growth rates of all variables will return to their steady-state rate of growth. Another important motivation for this simulation exercise is to demonstrate the dynamic properties of the model. The chosen simulations represent some typical economic shocks that may be analysed in DE-MCM.

The sub-sections below report the results of seven diagnostic simulations. In line with the objectives of this exercise stated above, results are shown in quarterly terms for the first three years, whereas annual results are also shown for longer horizons. The tables summarising the simulation results are in the appendix. In the text below we only show graphs that illustrate the reaction of the model's key real and nominal variables as well as operation of the policy rules.

Before discussing the actual simulation results it is instructive to highlight some features that are common to most of the simulations reported below. First, in most of the simulations there is a pronounced, though short-lived, supply side effect on domestic prices via apparent productivity over about two quarters following a shock. Second, the monetary policy rule plays an important role in explaining short to medium term dynamics of the model. The fiscal policy rule is more visible over the long run horizon when it serves to stabilize the stock variables, and serves to attain stock-flow equilibrium in the model. Third, various model equations embody a relatively rich and complex lag structure in order to improve the fit to the

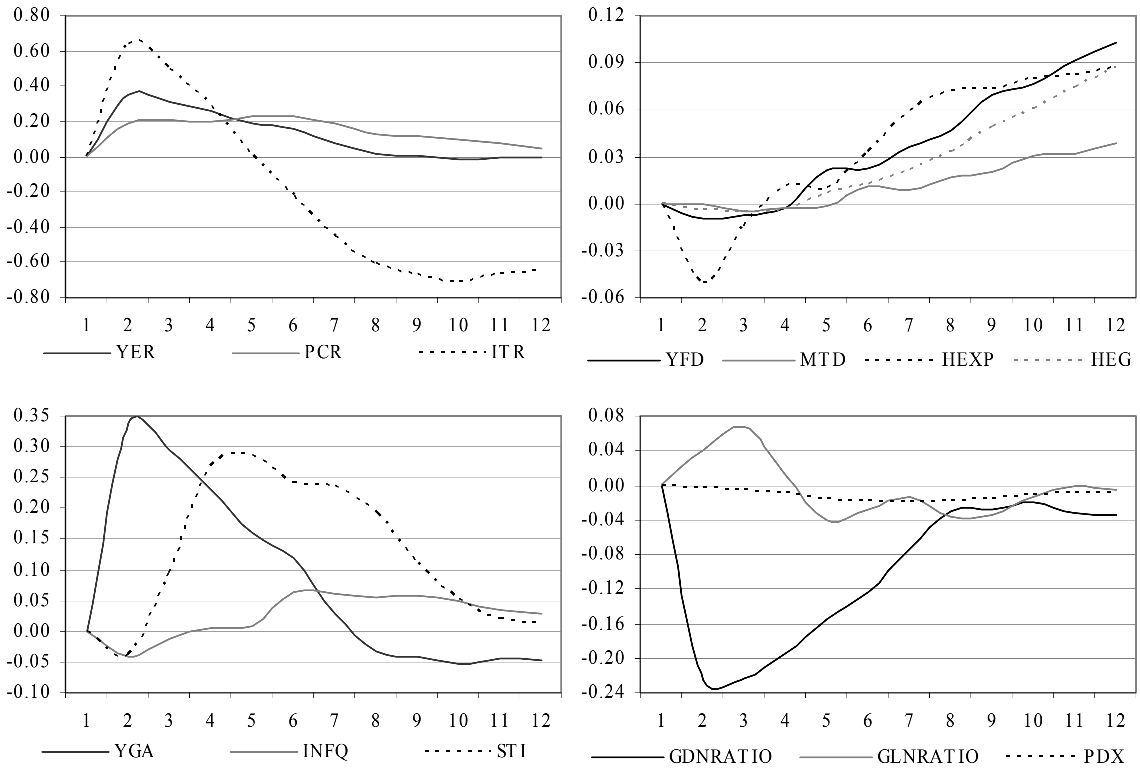
[29] The approach of inverting the model is a powerful tool when deriving the steady-state of a model. The inverted model residuals converge after a few quarters to a constant. All equations which are not consistent with a steady-state can be detected because they would display non-converging residual terms.

data. This leads in some cases to cyclical fluctuations in variable responses over a short to medium term horizon. This feature, however, does not undermine the overall stability of the model. Finally, the long-run effects of the shocks on the levels of DE-MCM variables should not be over-interpreted, because the steady-state is defined in growth rates rather than levels. These long-run results are reported to show that the model actually converges to a new steady state.

4.2.1. World demand shock

The simulation entails a permanent shock to extra-area world demand (WDR_ex) by 1% compared to its baseline value. World demand only enters the model as a lagged term in the export equation. As Figure 5 and Table A2 in the appendix show, there is therefore no contemporaneous impact of this shock. Extra-area trade constitutes about half of German total trade. The maximum impact of this shock on exports is reached after about one year. The impact on GDP is in the short-run boosted by the accelerator effect from investment and the income effect on consumption. Given the relatively high import content in exports, however, there is also a strong crowding-out effect from imports.

Figure 5: Reaction to a permanent world demand shock (deviation from the baseline in %)



From the second year onwards, the impact on GDP is declining and turns even negative. This is due to the policy rules, in particular the monetary policy rule which starts tightening.

This has a positive effect on the user cost of capital, which in turn has a negative impact on investment. The price effects from this shock are negligible in the short-run. The substantial increase in the short term interest rate is due to the monetary policy reaction to the positive output gap.

The long-run impact of this shock depends on the relative elasticities in the model and the calibration of the policy rules. As mentioned above, the long-run levels are not fixed as such; convergence to a new steady state is defined in terms of growth rates. This implies for instance that the asset positions are in the new steady state different to the baseline. In the case at hand, there is a negative impact on the capital stock, which lowers the levels of potential output and income generated by capital, so that there is overall a negative long-term impact on the level of GDP, while the level of private consumption remains slightly positive.

4.2.2. Oil price shock

This simulation entails a permanent shock to the oil price by 20%. The oil price has a direct impact on the energy component of the HICP (HEG) and the price index for imported energy (PEI), which in turn has an impact on the import deflator.

Figure 6 and Table A3 in the appendix show the results from this simulation[30]. The most direct impact of this shock on the real side is on consumption due to the reduction in real disposable income. The latter can be related both to an initial rise in consumer prices and an adjustment of real wages. Firstly, there is an impact of the shock on the energy component of the HICP which reaches a maximum of about 3% by the end of the first year. The building up of the impact on the import deflator takes a little bit longer; the maximum impact is about 1.2%. The overall impact on the level of the HICP is about 0.3 percentage point in the first two years and 0.2 percentage point in the third year. These roughly correspond to reaction in the private consumption deflator. Secondly, loss in productivity in the first year leads to surging unit labour costs. Adjustment of the real wages is take place primarily due to fall in nominal wages as opposed to rising output price inflation. The latter also leads to lower real disposable income and hence lower private consumption. There is also a small negative accelerator effect through investment and some crowding out through a reduction in imports. The maximum impact on GDP is -0.6% at the beginning of the second year.

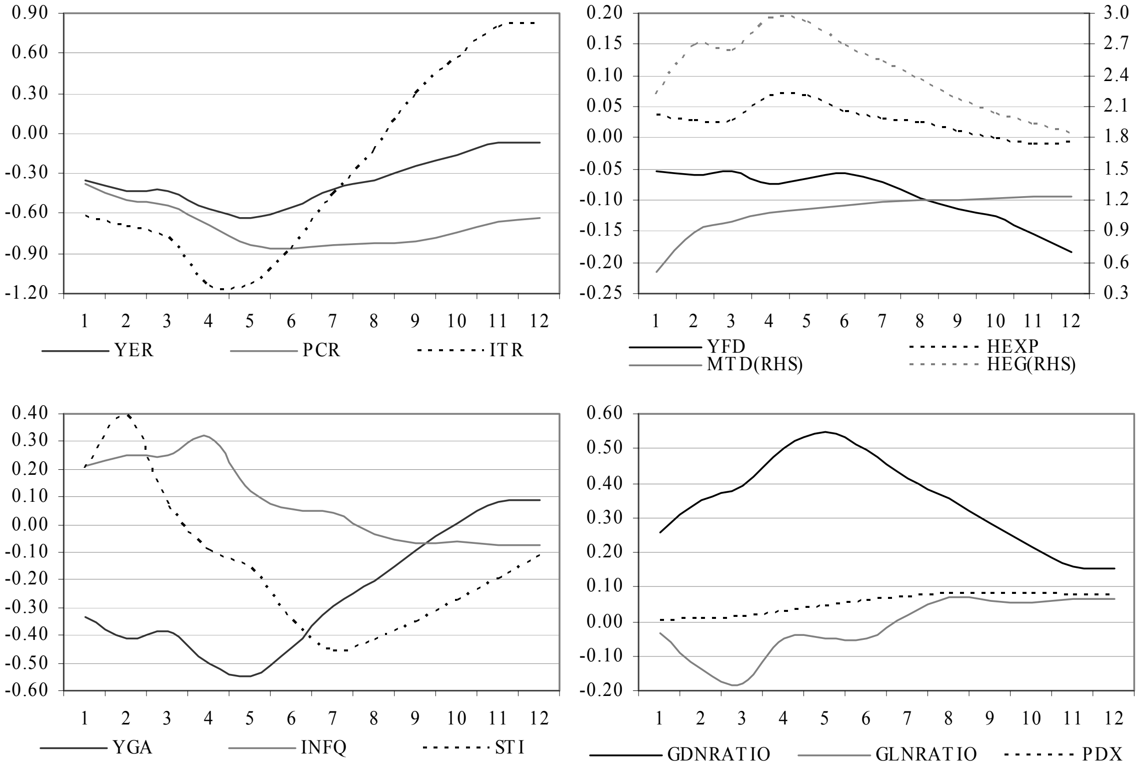
Although reacting strongly to higher consumer inflation in the first two quarters, the short term interest rate is set significantly below the baseline level in the beginning of the second

[30] In the current simulation we do not account for possible supply side effects of the oil price shock, i.e. its direct impact on producers' marginal costs. The latter feature could be introduced, for example, by augmenting the production function with oil products as the third factor of production. In this regard our results may well underestimate the true negative impact of oil price rise on the domestic economy.

year with the view of correcting the negative output gap. The lower cost of capital helps to boost private investment and thus reverse the initial negative trend in GDP.

Over the longer run the build up of the capital capacity allows for a higher potential output. Permanently lower domestic prices supported by enhanced productivity and lower nominal wages contribute to large competitiveness gains and result in a positive foreign trade contribution in the long run. Thus, overall the impact of GDP is positive, although the impact on private consumption remains negative in the long run. The latter is because of permanently higher income tax rate which is due to fiscal policy rule as well as lower real households' wealth stemming from significant deterioration of the terms of trade.

Figure 6: Reaction to a permanent oil price shock (deviation from the baseline in %)



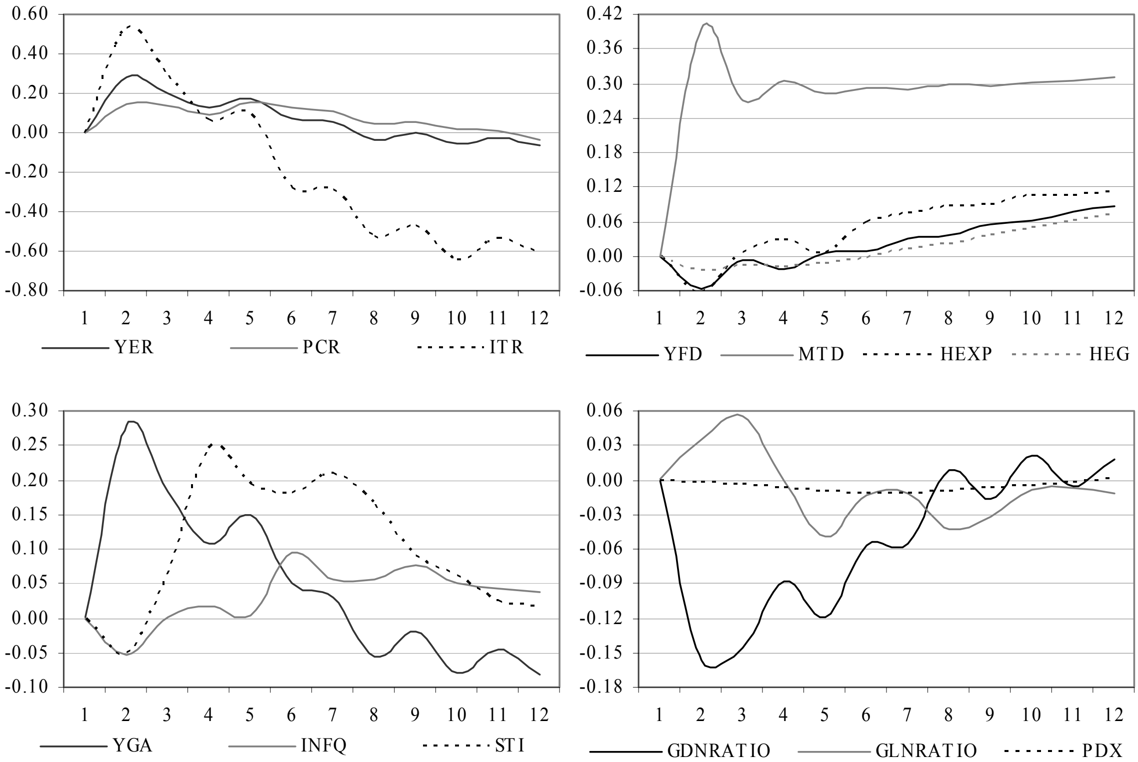
4.2.3. Competitors' price shock

The simulation entails a permanent shock to foreign prices (CXD and CMD) by 1%. It can be seen in Figure 7 and Table A4 of the appendix that the shock has a positive though rather transitory impact on the German economy. An increase in foreign prices implies competitiveness gains for German exporters. As a result GDP rises also supported by investment and private consumption. The impact from this shock on domestic prices is relatively small since a bulk of the real wage adjustment is on the nominal wages.

In the medium and long run competitiveness gains are gradually eroded as domestic price increase in excess of the foreign prices. This translates into deterioration of trade contribution. At the same time the terms of trade improve thus contributing to higher private consumption via higher wealth.

Tight monetary policy over the second and third years yielded lower capital accumulation and implying negative impact on potential output in the economy. Together with the deterioration in foreign trade it explains the lower level of GDP in the long run.

Figure 7: Reaction to a permanent competitor's price shock (deviation from the baseline in %)



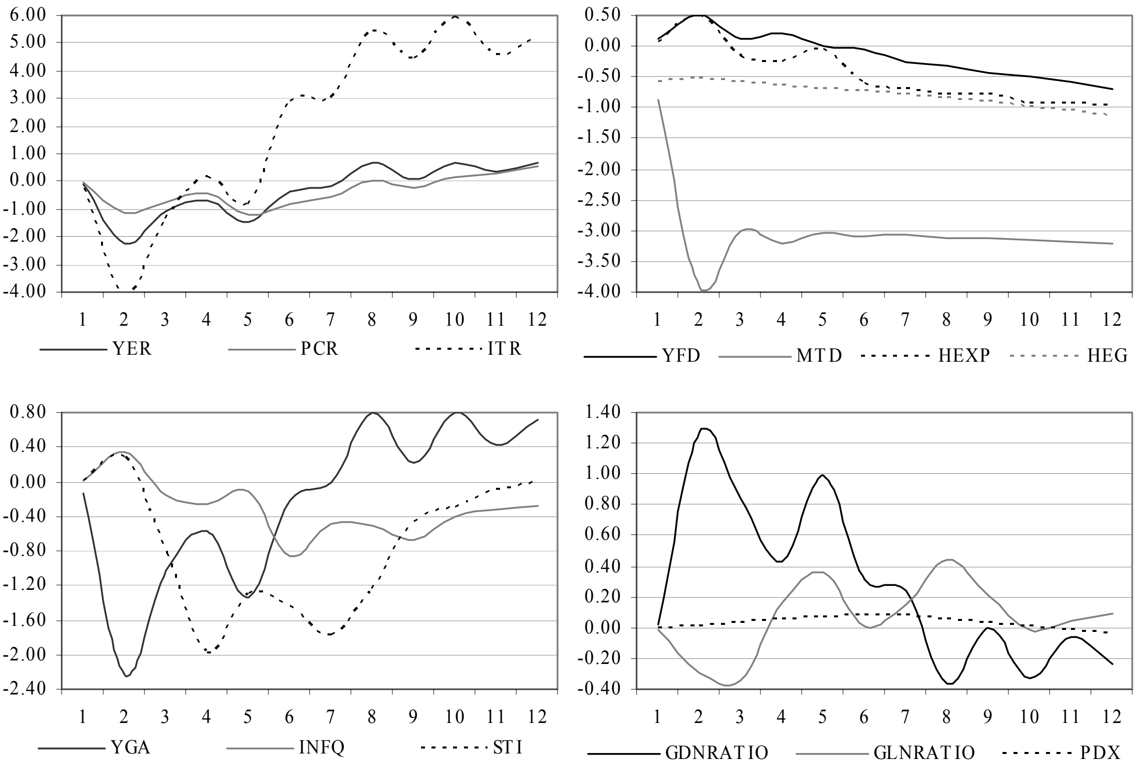
4.2.4. Exchange rate shock

The simulation entails a permanent appreciation of the euro by 5 % in effective terms. The direct impact of this shock is on the nominal side mainly through the trade deflators, to a lesser extent also on the energy component of the HICP, because oil prices are expressed in US dollars. The main impact on the real side is through export and import competitiveness. Apart from the shock size and speed of the model response, in many respects this shock is just a reverse of the shock to competitiveness described above.

Figure 8 and Table A5 in the appendix show that there is initially a positive impact on the GDP deflator, which is due to the supply side effect from the fall in apparent productivity. This positive impact fades away after about one year, in the longer run there is a rather large negative effect on prices, as could be expected.

The impact on the real side is negative, because the loss in competitiveness implies lower exports and higher imports. The negative effect on GDP is further exacerbated through the accelerator effect on investment. The negative impact fades gradually away, and there is only a small effect on GDP in the long-run.

Figure 8: Reaction to a permanent euro appreciation (deviation from the baseline in %)

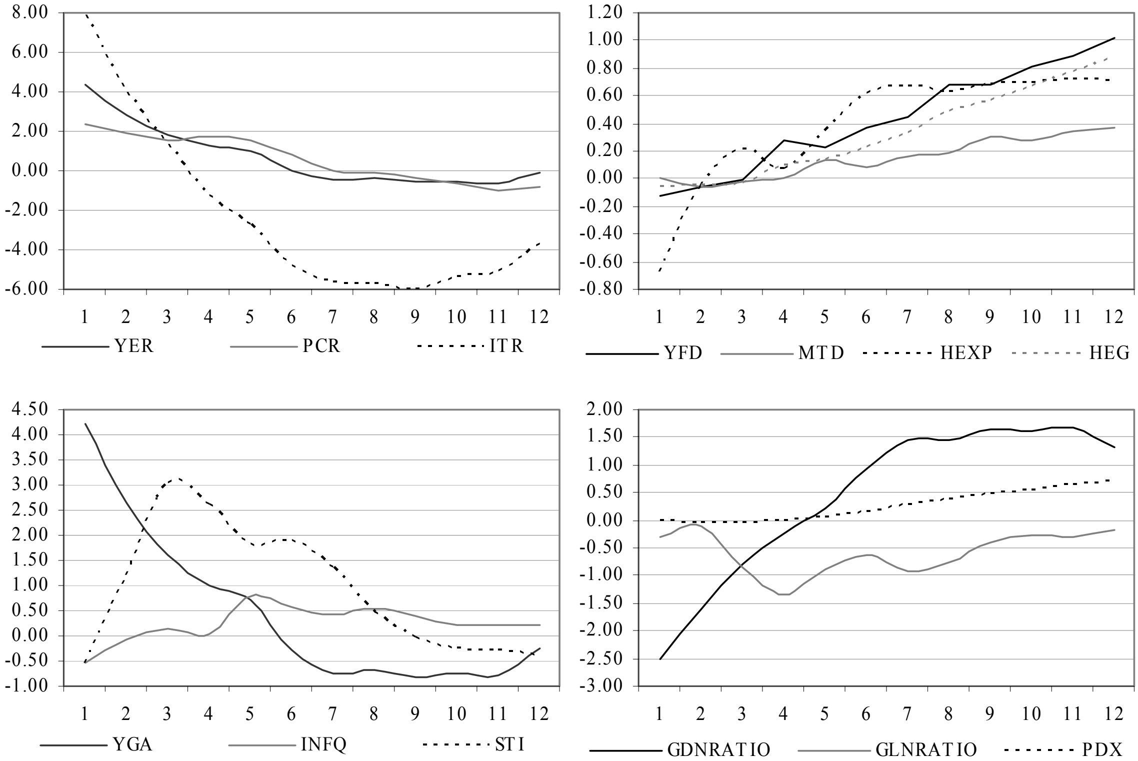


4.2.5. Government consumption shock

The simulation entails a permanent shock to government expenditures by 1% of baseline GDP. The main impact from this shock is on income. Given the high short-run elasticity of private consumption with respect to income, the shock builds up very quickly. The high short-run multiplier effect is also due to the accelerator effect on investment.

After the strong impact on GDP already in the first quarter, the impact of the shock fades away relatively quickly, and already turns negative in the second year. The negative impact results mainly from a crowding-out effect through imports and a tightening of monetary policy. In the long run, permanently higher government expenditure results in permanently lower exports and other domestic expenditures. In particular, lower exports are brought about by permanent losses in price competitiveness, while investment is lowered on the back of permanently higher cost of capital. Private consumption is brought down by both lower wealth and lower disposable income. The latter primarily stems from a reduction in real labour compensation and permanently higher income taxes implied by tighter fiscal policy.

Figure 9: Reaction to a permanent government consumption shock (deviation from the baseline in %)

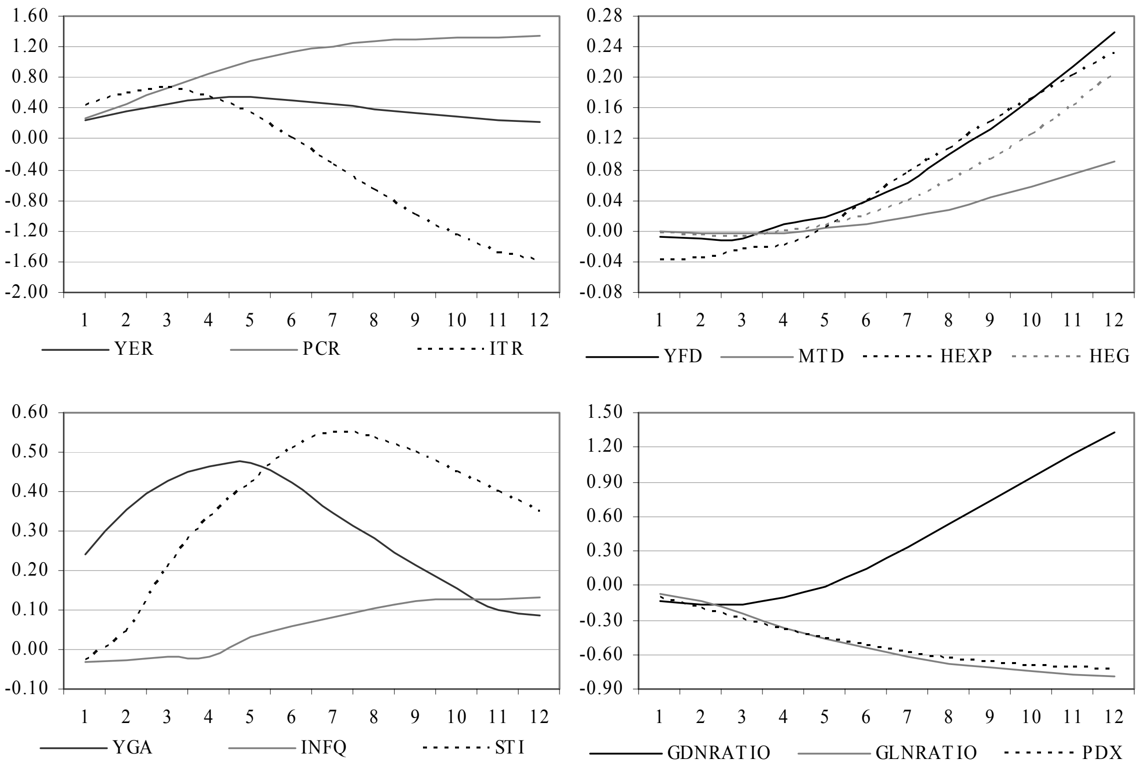


4.2.6. Government debt target shock

This simulation entails a permanent shock to the target ratio of public sector debt to GDP by 10 percentage points. The higher debt ratio leads to a relaxation of fiscal policy. This has in the short-run a positive impact on income and GDP. The positive impact prevails for a relatively sustained period, before monetary policy tightens and the positive impact disappears.

In the long-run there is an overall negative impact on GDP which stems from a downward adjustment of investment, capital and potential output as well as negative trade contribution implied by loss of price competitiveness. Private consumption on the other hand remains significantly above the baseline level supported by permanently higher disposable income due to lower labour income taxes.

Figure 10: Reaction to a permanent government debt target shock (deviation from the baseline in %)

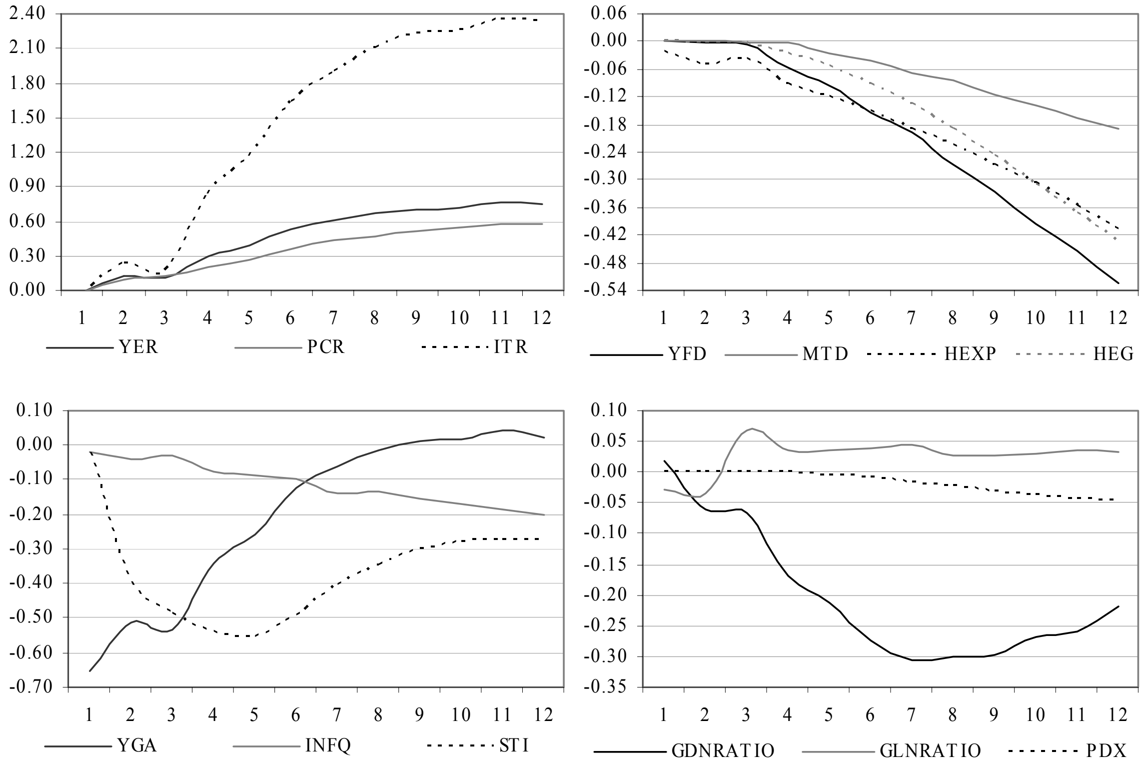


4.2.7. Labour supply shock

This simulation entails a permanent shock to the labour supply by 1 %. The direct impact of this shock has a positive effect on potential output and causes an increase in the unemployment rate. The potential output effect feeds through the model mainly through the output gap influence on the GDP deflator and the monetary policy reaction. As can be seen in Figure 11 and Table A8 in the appendix, the largest acceleration in investment is in the second year of the shock. Clearly, the surge in investment is strongly supported by loosening the monetary policy which reacts to a negative output gap. The reaction of prices is very sluggish due to the estimated long lag response to the output gap.

The higher unemployment rate has an immediate negative impact on nominal wages which, due to a sluggish price adjustment, implies a fall in real wages. The latter contributes to a gradual absorption of the excess labour force and thus to a reduction in the unemployment rate. The unemployment rate recovers to its baseline level after about 10 years. In the long run as both the output and unemployment gaps are closed virtually all GDP expenditure components are above their baseline levels.

Figure 11: Reaction to a permanent labour supply shock (deviation from the baseline in %)



5. Conclusions

The general aim of this paper is to outline the key features of the German MCM model block (DE-MCM). Since model building is always an ongoing work, the paper documents the current state of the modelling work on the German MCM block.

The main purpose of DE-MCM is to serve as a tool for the analysis of the German economy. The model was built with the view of preserving the theoretical foundation of the MCM while meeting certain requirements stemming from the use of the model in projections and in policy analysis exercises. In the context of the projections, the main emphasis is not necessarily on the creation of a baseline projection, but rather on ensuring full consistency of the forecast. For the purpose of the projections, the model needs to be as close to the data as possible, and it needs to comprise a rich set of variables. Moreover, the model needs to have suitable properties to analyse the impact from changes in assumptions and from new data, or, more generally, to produce robust results for variant simulations from a given baseline. Apart from its use in the context of projections, DE-MCM is used for policy simulations, both as a stand-alone model and together with other country blocks as part of the ECB multi-country model. This implies that the model needs to incorporate the key transmission mechanisms for a variety of shocks. At the same time, the model needs to be consistent with a theoretical framework of analysis.

Addressing the requirements outlined above has a number of implications for the modelling strategy. First, the consistency of the DE-MCM with a theoretical framework is achieved through keeping the MCM theoretical foundation for the production technology and the supply side in general. In addition, there are restrictions in place for the long-run specifications of the equations which ensure that the model converges in the long-run to a steady-state equilibrium. Second, the mapping of the data is achieved by imposing only very few restrictions on the dynamic specification of the model. In particular, in DE-MCM there are usually no coefficient restrictions in the short run equations, the lag structures of the lagged endogenous and the exogenous variables are fully determined by the data, and additional (stationary) variables are included in the short-run dynamics to improve the fit of the equation. Third, DE-MCM features a number of extensions that allow for a more detailed analysis, for instance, the disaggregated investment components, disaggregated HICP components, or additional equations such as the one for other personal income. Finally, in order to make the model useful for diagnostic or variant simulations, some specific features have been included in DE-MCM. One example is the use of a labour demand indicator in the employment equation, which allows for employment reactions that are specific to the type of shock imposed on the model.

The DE-MCM model has been in use at the ECB for some period of time and has proved to be a very effective tool for projections and the analysis of the German economy. Future modelling work is envisaged in various areas. The properties of the DE-MCM need to be reassessed in terms of steady-state levels and in the context of the linked MCM. The importance of policy rules will be studied further. The model will be used in shock transmission comparison exercises in the context of other MCM country models. Finally an explicit treatment of model parameter uncertainty is envisaged.

References

Angelini, E., F. Boissay and M. Ciccareli (2006a): “The Dutch Block of the ESCB Multi-Country Model,” ECB Working Paper, forthcoming.

Angelini, E., A. D’Agostino and P. McAdam (2006b): “The Italian Block of the ESCB Multi-Country Model,” ECB Working Paper, forthcoming.

Banerjee, A., J. Dolado and R. Mestre (1998): Error-correction mechanism tests for cointegration in single-equation framework”, Journal of Time Series Analysis Vol. 19, pp. 267-283.

Boissay, F. and J.P. Villetelle (2005): “The French Block of the ESCB Multi-Country Model,” ECB Working Paper, No. 456.

Deutsche Bundesbank (2000): “Macro-Econometric Multi-Country Model: MEMMOD”, publication by Deutsche Bundesbank.

Engle, R.F. and C.W.J. Granger. (1987), "Co-integration and error-correction: representation, estimation and testing", Econometrica, Vol. 55, pp. 251-276.

European Central Bank (2001): “A Guide to Eurosystem Staff Macroeconomic Projection Exercises”, European Central Bank, June 2001.

Fagan, G., J. Henry and R. Mestre (2001): “An Area-Wide Model (AWM) for the Euro Area,” ECB Working Paper, No. 42.

Francq, T. (1990) “Contenus en importations et contrainte extérieure”, Economie et Prévision, 94-95, pp. 171-177.

Franz, W. (2005): “Will the (German) NAIRU Please Stand Up?”, *German Economic Review*, 6, pp. 131–153.

Hamburg, B., M. Hoffmann and J. Keller (2005): “Consumption, Wealth and Business Cycles in Germany”, CESIFO Working Paper No. 1443.

Knetsch, T.A. (2004): “The Inventory Cycle of the German Economy”, Deutsche Bundesbank Discussion Paper No 09/2004.

Laubach, T. (2001): “Measuring the NAIRU: Evidence from Seven Economies”, *The Review of Economics and Statistics*, 83, pp. 218–231.

McGuire M. and M. Ryan (2000): “Macroeconomic Modelling Developments in the Central Bank,” Spring Bulletin, Central Bank of Ireland, pp. 77–90.

Nautz, D. and J. Scharff (2005): “Inflation and Relative Price Variability in a Low Inflation Country: Empirical Evidence for Germany”, *German Economic Review*, 6, pp. 507–523.

Sinn, Hans-Werner (2005): “Die Basar-Ökonomie Deutschland: Exportweltmeister oder Schlusslicht?“, Econ Verlag 2005.

Statistisches Bundesamt (1994): Volkswirtschaftliche Gesamtrechnungen – Input-Output-Rechnung: Importabhängigkeit der deutschen Exporte 1991, 1995, 1998, 2000 und 2002, Statistisches Bundesamt, 2004.

Statistisches Bundesamt (1995): “VGR des Bundes – Input-Output-Rechnung – Fachserie 18 Reihe 2“, Statistisches Bundesamt, 1995.

Tödter, K.-H. (1992): “Modelling the German Economy after Unification”, in Bank of Finland “Economic Policy Coordination in an Integrating Europe”, Helsinki, 1992.

Willman, A. and A. Estrada (2002): “The Spanish Block of the ESCB-Multi-Country Model,” ECB Working Paper, No. 149.

Annex

Table A1: List of variables in DE-MCM and their steady-state growth rates

The column on the righ shows the steady-state growth rate of each variable. The acronyms and their meaning are as follows:

	Quarterly growth (%)	Annual growth (%)
C: Constant	0	0
T: Time trend	-	-
TFP: Total factor productivity growth rate, equal to γ	0.29	1.17
L: Growth rate of labour force	0.25	1.00
R = **L** + **TFP**: Growth rate of real variables	0.54	2.17
R_ex = **R** · **extra-share**: Growth rate of extra-area world demand	0.29	1.16
R_in = **R** · **intra-share**: Growth rate of intra-area world demand	0.25	1.01
P: Growth rate of prices (steady-state inflation)	0.50	2.00
P_ex: Growth rate of extra-area competitors' prices	0.25	0.50
P_in: Growth rate of intra-area competitors' prices	0.25	0.50
W = **P** + **TFP**: Growth rate of compensation per head.	0.54	2.18
N = **P** + **R**: Nominal growth rate (also total compensation)	0.79	3.20
D are definition variables, typically used for the long-run equilibrium values of the variables. They grow in steady-state at the same as the variable they are referring to. This growth rate is given in brackets.		

Acronym	Description	Steady-state
de_BTN	Balance of trade of goods and services	N
de_CAN	Current account	N
de_CC0	User cost of capital, average of LTI and RCC, nominal	P
de_CEX	Labour compensation per employee, WIN / LEN	W
de_CMD	Competitor's import price in domestic currency	P
de_CMD_EX	External competitor's import price in domestic currency	P_ex
de_CMD_IN	Internal competitor's import price in domestic currency	P_in
de_CMUD	Competitor's import price in US dollar	P
de_CMUD_EX	External competitor's import price in US dollar	P_ex
de_CMUD_IN	Internal competitor's import price in US dollar	P_in
de_CSTAR	Long-run equilibrium level of private consumption	D (R)
de_CXD	Competitor's export price in domestic currency	P
de_CXD_EX	External competitor's export price in domestic currency	P_ex
de_CXD_IN	Internal competitor's export price in domestic currency	P_in
de_CXUD	Competitor's export price in US dollar	P
de_CXUD_EX	External competitor's export price in US dollar	P_ex
de_CXUD_IN	Internal competitor's export price in US dollar	P_in
de_D001P	step dummy variable equal to one as of 2000:1	C
de_D004	impulse dummy variable equal to one in 2000:4	C
de_D011	impulse dummy variable equal to one in 2001:1	C
de_D801824	step dummy variable equal to one as of 1980:1 to 1982:4	C
de_D813	impulse dummy variable equal to one in 1981:3	C
de_D822	impulse dummy variable equal to one in 1982:2	C
de_D823	impulse dummy variable equal to one in 1982:3	C
de_D824	impulse dummy variable equal to one in 1981:6	C
de_D831P	step dummy variable equal to one as of 1983:1	C
de_D832	impulse dummy variable equal to one in 1983:2	C
de_D841	impulse dummy variable equal to one in 1984:1	C
de_D842	impulse dummy variable equal to one in 1984:2	C
de_D851	impulse dummy variable equal to one in 1985:1	C
de_D852	impulse dummy variable equal to one in 1985:2	C
de_D853	impulse dummy variable equal to one in 1985:3	C
de_D861	impulse dummy variable equal to one in 1986:1	C
de_D861P	step dummy variable equal to one as of 1986:1	C
de_D863	impulse dummy variable equal to one in 1986:3	C
de_D864	impulse dummy variable equal to one in 1986:4	C
de_D871	impulse dummy variable equal to one in 1987:1	C
de_D872	impulse dummy variable equal to one in 1987:2	C
de_D891924	step dummy variable equal to one as of 1989:1 to 1992:4	C
de_D894	impulse dummy variable equal to one in 1989:4	C
de_D901	impulse dummy variable equal to one in 1990:1	C
de_D901P	step dummy variable equal to one as of 1990:1	C
de_D903	impulse dummy variable equal to one in 1990:3	C
de_D903924	step dummy variable equal to one as of 1990:3 to 1992:4	C
de_D904	impulse dummy variable equal to one in 1990:4	C
de_D904P	step dummy variable equal to one as of 1990:4	C
de_D911	impulse dummy variable equal to one in 1991:1	C
de_D911964	step dummy variable equal to one as of 1991:1 to 1996:4	C
de_D911P	step dummy variable equal to one as of 1991:1	C
de_D912	impulse dummy variable equal to one in 1991:2	C
de_D913	impulse dummy variable equal to one in 1991:3	C
de_D914	impulse dummy variable equal to one in 1991:4	C
de_D921	impulse dummy variable equal to one in 1992:1	C
de_D923	impulse dummy variable equal to one in 1992:3	C
de_D924	impulse dummy variable equal to one in 1992:4	C
de_D931	impulse dummy variable equal to one in 1993:1	C
de_D931P	step dummy variable equal to one as of 1993:1	C
de_D934	impulse dummy variable equal to one in 1993:4	C
de_D941	impulse dummy variable equal to one in 1994:1	C

de_D941P	step dummy variable equal to one as of 1994:1	C
de_D961	impulse dummy variable equal to one in 1996:1	C
de_D961P	step dummy variable equal to one as of 1996:1	C
de_D962	impulse dummy variable equal to one in 1996:2	C
de_D971	impulse dummy variable equal to one in 1997:1	C
de_D971P	step dummy variable equal to one as of 1997:1	C
de_D974	impulse dummy variable equal to one in 1997:4	C
de_D991P	step dummy variable equal to one as of 1999:1	C
de_D993	impulse dummy variable equal to one in 1999:3	C
de_D993P	step dummy variable equal to one as of 1999:3	C
de_DSS	step dummy variable equal to one out of sample (steady state)	C
de_EEN	Nominal effective exchange rate on the export side	C
de_EEN_EX	Nominal effective exchange rate on the export side, non-euro area	C
de_EEN_IN	Nominal effective exchange rate on the export side, euro area	C
de_EEN0	Nominal effective exchange rate on the import side	C
de_EEN0_EX	Nominal effective exchange rate on the import side, non-euro area	C
de_EEN0_IN	Nominal effective exchange rate on the import side, euro area	C
de_EXR	Nominal exchange rate of euro against US dollar	C
de_FWN	Financial wealth, nominal	N
de_FWR	Financial wealth, real	R
de_GCD	Government consumption deflator	P
de_GCN	Government consumption, nominal	N
de_GCP	Government consumption deflator, pre-tax	P
de_GCPSTAR	Long-run equilibrium level of Government consumption deflator	D (P)
de_GCR	Government consumption, real	R
de_GDN	Government debt, gross	N
de_GDNRATIO	Government debt to GDP ratio	C
de_GID	Government investment deflator	P
de_GIN	Government investment, nominal	N
de_GIP	Government investment deflator, pre-tax	P
de_GIR	Government investment, real	R
de_GLN	Government net lending	N
de_GON	Gross operating surplus	N
de_GSN	Government gross savings	N
de_GYN	Government disposable income	N
de_HEG	HIC - energy	P
de_HEGSTAR	Long-run level of HICP energy, behavioural, definition	D (P)
de_HEX	HIC - non-energy	P
de_HEXP	HIC - non-energy, pre-tax	P
de_HEXPSTAR	Long-run level of HICP excluding energy, behavioural, definition	D (P)
de_HIC	Harmonised index of consumption prices	P
de_IHD	Housing investment deflator, identity	P
de_IHN	Housing investment, nominal, identity	N
de_IHP	Housing investment deflator, pre-tax, behavioural	P
de_IHPSTAR	Long-run level of housing investment deflator, pre-tax, behavioural definition	D (P)
de_IHR	Housing investment, real	R
de_INFA	Annual inflation rate, identity	C
de_INFQ	Quarterly inflation rate, identity	C
de_INN	Interest payments on government debt	N
de_INNSTAR	Long-run level of public interest payments	D (N)
de_IPD	Private non-residential investment deflator, identity	P
de_IPN	Private sector non-residential investment, nominal	N
de_IPP	Private non-residential investment deflator, pre-tax, behavioural	P
de_IPPSTAR	Long-run level of private investment deflator, pre-tax, behavioural, definition	D (P)
de_IPR	Private non-residential investment, real	R
de_IPX	Industrial production to GDP ratio	C
de_ITD	Total investment deflator	P
de_ITN	Total investment, nominal	N

de_ITR	Total investment, real	R
de_KGR	Government capital stock	R
de_KGSTAR	Long-run equilibrium level of government capital stock	D (R)
de_KHR	Housing capital stock	R
de_KHSTAR	Long-run equilibrium level of housing capital stock	D (R)
de_KPSTAR	Long-run equilibrium level of private non-residential capital stock	D (R)
de_KRP	Private non-residential capital stock	R
de_KSR	Total capital stock	R
de_KSTAR	Long-run equilibrium level of total capital stock	D (R)
de_LEN	Employees	L
de_LEX	Employees to employment ratio	C
de_LFN	Total labour force	L
de_LFNSTAR	Long-run equilibrium level of labour force, behavioural	D (L)
de_LGN	Government employment	L
de_LINFSTARQ	Log of target inflation rate	C
de_LNN	Total employment	L
de_LNT	Trend employment	L
de_LSR	Stock of inventories	R
de_LSRSTAR	Long-run equilibrium level of real stocks	D (R)
de_LSTAR	Long-run equilibrium level of employment, behavioural	D (L)
de_LTI	Long-term nominal interest rate	C
de_LTR	Long-term real interest rate	C
de_MDSTAR	Long-run equilibrium level of import deflator, behavioural	D (P)
de_MSTAR	Long-run equilibrium level of imports, behavioural	D (R)
de_MTD	Import deflator	P
de_MTN	Imports, nominal	N
de_MTR	Imports, real	R
de_NFA	Net foreign assets	N
de_NFN	Net factor income	N
de_ODN	Direct taxes paid by the other private sector	N
de_ODNB	Tax base for direct taxes paid by the other private sector	N
de_ODX	Direct tax rate paid by the other private sector	C
de_OGN	Other sector transfers to/from government	N
de_OLN	Net lending by other private sector	N
de_OPN	Other personal income	N
de_OPNSTAR	Long-run level of OPN	D (N)
de_OWN	Private compensation to employees	W
de_OYN	Other disposable income	N
de_PCD	Private consumption deflator	P
de_PCDSTAR	Long-run level of Price/unit value index for import of energy	D (P)
de_PCN	Private consumption, nominal	N
de_PCP	Private consumption deflator, pre-tax	P
de_PCR	Private consumption, real	R
de_PDN	Income tax and social security contributions, paid by households	N
de_PDNB	Tax base for direct taxes	N
de_PDX	Ratio between direct taxes and its tax base	C
de_PEI	Price of imported energy and raw materials, domestic currency	P
de_PEISTAR	Long-run level of Private consumption deflator, behavioural/identity	D (P)
de_PLN	Net lending by private sector	N
de_POIL	Oil price in domestic currency	P
de_POILU	Oil price in US dollar	P
de_PRO	Average labour productivity	TFP
de_PSN	Private sector savings	N
de_PYN	Private sector disposable income, nominal	N
de_PYR	Private sector disposable income, real	R
de_RCC	Credit interest rate, corporate sector	C
de_RCH	Credit interest rate, households	C
de_REALI	The real interest rate for inventories	C
de_RMT	Retail mortgage rate	C
de_RWUNSTAR	Long-run level of compensation per employee, behavioural, definition	D (TFP)

de_SALE	Sales of storable goods (PCR + XTR)	R
de_SCR	Changes in inventories, real	R
de_SDUM1	Seasonal Dummy Q1	C
de_SDUM2	Seasonal Dummy 2	C
de_SDUM3	Seasonal Dummy Q3	C
de_SGLN	Cumulated government net lending	N
de_SMC	Short-run marginal cost of production	P
de_STI	Short-term nominal interest rate	C
de_SZD	Inventories and statistical discrepancies deflator	P
de_SZN	Inventories and statistical discrepancies, nominal	N
de_T801904	linear time trend from 1980:1 to 1990:4	C
de_T801904	linear time trend from 1980:1 to 1990:4	C
de_T801994P	linear time trend from 1980:1 to 1999:4	C
de_T911964	linear time trend from 1991:1 to 1996:4	C
de_T911984	linear time trend from 1991:1 to 1998:4	C
de_T941P	linear time trend from 1994:1 onwards	C
de_T951P	linear time trend from 1995:1 onwards	C
de_TCI	Apparent indirect tax rate on private consumption	C
de_TCIR	Apparent real indirect tax rate on private consumption	C
de_TGI	Apparent indirect tax rate on government consumption	C
de_TGIR	Apparent real indirect tax rate on government consumption	C
de_TII	Apparent indirect tax rate on investment	C
de_TIIR	Apparent real indirect tax rate on investment	C
de_TIME	Linear time trend, 1980Q1 = 1	T
de_TIMESS	Linear time trend, 1980Q1 = 1, out of the sample = 0	C
de_TIN	Indirect taxes less subsidies, total	N
de_TIR	Indirect taxes less subsidies, real	R
de_TIX	Ratio between TIN and YEN	C
de_TRN	Transfers from government to households	N
de_TRX	Ratio between TRN and YEN	C
de_TWN	Transfer from rest of the world	N
de_ULA	ULC adjusted (employees)	P
de_UNN	Total unemployment	L
de_URT	Trend unemployment rate	C
de_URX	Unemployment rate	C
de_WDR	World demand indicator	R
de_WDR_EX	World demand indicator, non-euro area	R_ex
de_WDR_IN	World demand indicator, euro area	R_in
de_WE	Energy share in HICP	C
de_WER	Import demand indicator	R
de_WGN	Compensations to employees, government	N
de_WIN	Total compensation to employees	N
de_WLR	Labour demand indicator	R
de_WUG	Compensation per government employee	W
de_WUN	Compensation per employee	W
de_XDSTAR	Long-run equilibrium level of export deflator, behavioural	D (P)
de_XSTAR	Long-run equilibrium level of exports, behavioural	D (R)
de_XTD	Exports deflator	P
de_XTN	Exports, nominal	N
de_XTR	Exports, real	R
de_YED	GDP expenditure deflator	P
de_YEN	GDP expenditure, nominal	N
de_YER	GDP expenditure, real	R
de_YFD	GDP at factor cost deflator	P
de_YFN	GDP at factor cost, nominal	N
de_YFR	GDP at factor cost, real	R
de_YFT	Potential output	R
de_YGA	Output gap	C
de_Z_HIC	Statistical discrepancy in harmonised index of consumer prices	C
de_ZER	Statistical discrepancy on GDP expenditure	C

de_ZGDN	Statistical discrepancy on government debt	C
de_ZIN	Statistical discrepancy on GDP income	C
de_ZKGR	Statistical discrepancy on public capital stock	R
de_ZKHR	Statistical discrepancy on residential capital stock	R
de_ZKRP	Statistical discrepancy on private non-residential capital stock	R
de_ZNFA	Statistical discrepancy on net foreign assets	C
de_ZNFN	Statistical discrepancy on net factor income	C
de_ZODN	Statistical discrepancy on ODN	C
de_ZPDN	Statistical discrepancy on PDN	C
de_ZTIN	Statistical discrepancy on TIN	C
de_ZWERITR	Trend of ITR weight in WER	C
de_ZWERXTR	Trend of XTR weight in WER	C
de_ZZINX	Ratio between INN and YEN, exogenous in forecast	C
de_ZZODX	Ratio between ODN and YEN, exogenous in forecast	C
de_ZZOPX	Ratio between OPN and YEN, exogenous in forecast	C
de_ZZPDX	Ratio between PDN and YEN, exogenous in forecast	C
de_ZZTIX	Ratio between TIN and YEN, exogenous in forecast	C

The equations of the DE-MCM

ENDOGENOUS VARIABLES:

DE_BTN DE_CAN DE_CC0 DE_CEX DE_CMD DE_CMD_EX DE_CMD_IN DE_CMUD DE_CXD DE_CXD_EX DE_CXD_IN DE_CXUD DE_EEN DE_EEN0 DE_FWN DE_FWR DE_GCD DE_GCN DE_GCP DE_GDN DE_GID DE_GIN DE_GIP DE_GIR DE_GLN DE_GON DE_GSN DE_GYN DE_HEG DE_HEX DE_HEXP DE_HIC DE_IHD DE_IHN DE_IHP DE_IHR DE_INN DE_IPD DE_IPN DE_IPP DE_IPR DE_ITD DE_ITN DE_ITR DE_KGR DE_KHR DE_KRP DE_KSR DE_LEN DE_LFN DE_LNN DE_LNT DE_LSR DE_LTI DE_LTR DE_MTD DE_MTN DE_MTR DE_NFA DE_NFN DE_ODN DE_ODNB DE_ODX DE_OLN DE_OPN DE_OWN DE_OYN DE_PCD DE_PCN DE_PCP DE_PCR DE_PDN DE_PDNB DE_PDX DE_PEI DE_PLN DE_POIL DE_PRO DE_PSN DE_PYN DE_PYR DE_RCC DE_RCH DE_REALI DE_RMT DE_SALE DE_SCR DE_SGLN DE_SMC DE_STI DE_SZD DE_SZN DE_TIN DE_TIR DE_TIX DE_TRN DE_TRX DE_ULA DE_UNN DE_URT DE_URX DE_WDR DE_WER DE_WGN DE_WIN DE_WLR DE_WUN DE_XTD DE_XTN DE_XTR DE_YED DE_YEN DE_YER DE_YFD DE_YFN DE_YFR DE_YFT DE_YGA

DEFINITIONS:

DE_CSTAR DE_GCPSTAR DE_HEGSTAR DE_HEXPSTAR DE_IHPSTAR DE_INFA DE_INFQ DE_INNSTAR DE_IPPSTAR DE_KGSTAR DE_KHSTAR DE_KPSTAR DE_KSTAR DE_LFNSTAR DE_LSRSTAR DE_LSTAR DE_MDSTAR DE_MSTAR DE_OPNSTAR DE_PCDSTAR DE_PEISTAR DE_RWUNSTAR DE_XDSTAR DE_XSTAR

EXOGENOUS VARIABLES:

DE_CMUD_EX DE_CMUD_IN DE_CXUD_EX DE_CXUD_IN DE_D001P DE_D004 DE_D011 DE_D813 DE_D822 DE_D823 DE_D824 DE_D831P DE_D832 DE_D841 DE_D842 DE_D851 DE_D852 DE_D853 DE_D861 DE_D861P DE_D871 DE_D872 DE_D891924 DE_D894 DE_D901 DE_D901P DE_D903 DE_D903924 DE_D904 DE_D904P DE_D911 DE_D911P DE_D912 DE_D913 DE_D914 DE_D921 DE_D923 DE_D924 DE_D931 DE_D931P DE_D934 DE_D941 DE_D961 DE_D961P DE_D962 DE_D971 DE_D971P DE_D974 DE_D991P DE_D993 DE_D993P DE_DSS DE_EEN0_EX DE_EEN0_IN DE_EEN_EX DE_EEN_IN DE_EXR DE_GCR DE_GDNRATIO DE_IPX DE_LEX DE_LGN DE_OGN DE_POILU DE_SDUM1 DE_SDUM2 DE_SDUM3 DE_T951P DE_TCI DE_TCIR DE_TGI DE_TGIR DE_TII DE_TIIR DE_TIME DE_TIMESS DE_TWN DE_WDR_EX DE_WDR_IN DE_WE DE_WUG DE_ZER DE_ZGDN DE_ZIN DE_ZKGR DE_ZKHR DE_ZKRP DE_ZNFA DE_ZNFN DE_ZODN DE_ZPDN DE_ZTIN DE_ZWERITR DE_ZWERXTR DE_ZZINX DE_ZZODX DE_ZZOPX DE_ZZPDX DE_ZZTIX DE_Z_HIC RES_DE_BTN RES_DE_CAN RES_DE_CC0 RES_DE_CEX RES_DE_CMD RES_DE_CMD_EX RES_DE_CMD_IN RES_DE_CMUD RES_DE_CXD RES_DE_CXD_EX RES_DE_CXD_IN RES_DE_CXUD RES_DE_EEN RES_DE_EEN0 RES_DE_FWN RES_DE_FWR RES_DE_GCD RES_DE_GCN RES_DE_GCP RES_DE_GDN RES_DE_GID RES_DE_GIN RES_DE_GIP RES_DE_GIR RES_DE_GLN RES_DE_GON RES_DE_GSN RES_DE_GYN RES_DE_HEG RES_DE_HEX RES_DE_HEXP RES_DE_HIC RES_DE_IHD RES_DE_IHN RES_DE_IHP RES_DE_IHR RES_DE_INN RES_DE_IPD RES_DE_IPN RES_DE_IPP RES_DE_IPR RES_DE_ITD RES_DE_ITN RES_DE_ITR RES_DE_KGR RES_DE_KHR RES_DE_KRP RES_DE_KSR RES_DE_LEN RES_DE_LFN RES_DE_LNN RES_DE_LNT RES_DE_LSR RES_DE_LTI RES_DE_LTR RES_DE_MTD RES_DE_MTN RES_DE_MTR RES_DE_NFA RES_DE_NFN RES_DE_ODN RES_DE_ODNB RES_DE_ODX RES_DE_OLN RES_DE_OPN RES_DE_OWN RES_DE_OYN RES_DE_PCD RES_DE_PCN RES_DE_PCP RES_DE_PCR RES_DE_PDN RES_DE_PDNB RES_DE_PDX RES_DE_PEI RES_DE_PLN RES_DE_POIL RES_DE_PRO RES_DE_PSN RES_DE_PYN RES_DE_PYR RES_DE_RCC RES_DE_RCH RES_DE_REALI RES_DE_RMT RES_DE_SALE RES_DE_SCR RES_DE_SGLN RES_DE_SMC RES_DE_STI RES_DE_SZD RES_DE_SZN RES_DE_TIN RES_DE_TIR RES_DE_TIX RES_DE_TRN RES_DE_TRX RES_DE_ULA RES_DE_UNN RES_DE_URT RES_DE_URX RES_DE_WDR RES_DE_WER RES_DE_WGN RES_DE_WIN RES_DE_WLR RES_DE_WUN RES_DE_XTD RES_DE_XTN RES_DE_XTR RES_DE_YED RES_DE_YEN RES_DE_YER RES_DE_YFD RES_DE_YFN RES_DE_YFR RES_DE_YFT RES_DE_YGA

COEFFICIENTS:

DE_GCP.EC DE_GIP.CST DE_GIP.D901 DE_GIP.D911P DE_GIP.GIP1 DE_GIPSTAR.MTD DE_GIR.CST DE_GIR.D851 DE_GIR.D871 DE_GIR.D913 DE_GIR.D971 DE_GIR.D974 DE_GIR.DGIR1 DE_GIR.DGIR2 DE_GIR.DYFR DE_GIR.EC1 DE_GIR.EC2 DE_HEG.D913 DE_HEG.D941 DE_HEG.DHEG1 DE_HEG.DHEG3 DE_HEG.DPOIL DE_HEG.DYFD DE_HEG.EC DE_HEXP.CST DE_HEXP.D1 DE_HEXP.D2 DE_HEXP.D3 DE_HEXP.D903 DE_HEXP.D911 DE_HEXP.DMRKUP DE_HEXP.DMRKUP3 DE_HEXP.DULC DE_HEXP.DULC3 DE_HEXP.EC DE_IHP.D911 DE_IHP.DYFD DE_IHP.DYFD1 DE_IHP.EC DE_IHR.CST DE_IHR.D851 DE_IHR.D861 DE_IHR.D871 DE_IHR.D872 DE_IHR.D901 DE_IHR.D911P DE_IHR.D962 DE_IHR.DRMT2 DE_IHR.EC DE_INN.D923 DE_INN.DLTI4 DE_INN.DSTI DE_INN.EC DE_IPP.EC DE_IPP.IPP1 DE_IPP.MTD DE_IPP.YFD DE_IPR.CST DE_IPR.D872 DE_IPR.DIPR2 DE_IPR.DIPR3 DE_IPR.DYFR DE_IPR.EC1 DE_IPR.EC2 DE_LFN.CST DE_LFN.D901 DE_LFN.D911 DE_LFN.D911P DE_LFN.DLNN DE_LFN.EC DE_LFN.UGAP3 DE_LNN.D911 DE_LNN.D912 DE_LNN.D993 DE_LNN.DWLR DE_LNN.DWLR1 DE_LNN.DWUR DE_LNN.EC DE_LSR.D911 DE_LSR.D912 DE_LSR.D914P DE_LSR.DREALI DE_LSR.DYER DE_LSR.DLSR1 DE_LSR.EC DE_LTI.CST DE_LTI.LTI DE_LTI.STI DE_LTI.STI1 DE_LTI.STI2 DE_LTI.STI3 DE_LTR.INF DE_LTR.LTI DE_MTD.DCMUDEX1 DE_MTD.DCMUDIN1 DE_MTD.DEXR DE_MTD.DEXR1 DE_MTD.DMTD1 DE_MTD.DPEI DE_MTD.DPEI1 DE_MTD.DYFD1 DE_MTD.EC DE_MTR.D924 DE_MTR.D931 DE_MTR.DMTDNO DE_MTR.DMTR1 DE_MTR.DWER DE_MTR.DWER1 DE_MTR.EC DE_NFN.CST DE_NFN.D901P DE_NFN.NFN DE_ODN.CST DE_ODN.D911 DE_ODN.D911P DE_ODN.ODNB DE_OPN.DGON DE_OPN.DOPN1 DE_OPN.DOPN4 DE_OPN.EC DE_PCD.D4HIC DE_PCD.D4PCD1 DE_PCD.D914 DE_PCD.D924 DE_PCD.EC DE_PCR.D911 DE_PCR.DFWR DE_PCR.DPCR1 DE_PCR.DPYR DE_PCR.EC DE_PEI.CST DE_PEI.DPEI1 DE_PEI.DPOIL DE_PEI.EC DE_RCC.CST DE_RCC.RCC DE_RCC.STI DE_RCC.STI1 DE_RCC.STI2 DE_RCC.STI3 DE_RCH.CST DE_RCH.RCH DE_RCH.STI DE_RCH.STI1 DE_RCH.STI2 DE_RCH.STI3 DE_REALI.INF DE_REALI.STI DE_RMT.CST DE_RMT.RMT DE_RMT.STI DE_RMT.STI1 DE_RMT.STI2 DE_RMT.STI3 DE_STI.EC DE_STI.INF DE_STI.YGA DE_TRX.CST DE_TRX.D911P DE_TRX.TRX1 DE_TRX.URX DE_TRX.URX1 DE_URT.CST DE_URT.D911P DE_URT.DSS DE_WUN.D842 DE_WUN.D911 DE_WUN.DPCDYFD DE_WUN.DPRO

DE_WUN.DRWUN1 DE_WUN.EC DE_WUN.UGAP DE_XTD.CXDEX DE_XTD.CXDIN DE_XTD.CXDIN1 DE_XTD.EC DE_XTD.XTD3 DE_XTD.XTD4 DE_XTD.YFD DE_XTD.YFD1 DE_XTR.D894 DE_XTR.D903 DE_XTR.D904 DE_XTR.D911 DE_XTR.DDXTD DE_XTR.EC DE_XTR.WDRIN DE_YFD.D912 DE_YFD.DMTD DE_YFD.DMTD1 DE_YFD.DMTD4 DE_YFD.DPRO DE_YFD.DRWUN2 DE_YFD.DYFD2 DE_YFD.DYFD4 DE_YFD.EC4 DE_YFD.YGA3

PARAMETERS:

DE_ALPHA DE_BETA DE_BETADEEX DE_BETADEIN DE_CSTAR.CST DE_CSTAR.D912 DE_CSTAR.PYR DE_CSTAR.T801904 DE_DEPKGR DE_DEPKHR DE_DEPKRP DE_DEPKSR DE_DFOR DE_EPS DE_FISC1 DE_FISC2 DE_FISC3 DE_GAMMA DE_GCPSTAR.CST DE_HEGSTAR.CST DE_HEGSTAR.D001P DE_HEGSTAR.D861P DE_HEGSTAR.POIL DE_HEXPSTAR.CST DE_HEXPSTAR.D911P DE_HEXPSTAR.D971P DE_HEXPSTAR.MTD DE_IHPSTAR.CST DE_IHPSTAR.D911P DE_IHPSTAR.IPP DE_IPPSTAR.CST DE_IPPSTAR.MTD DE_KGSTAR.CST DE_KGSTAR.D801824 DE_KGSTAR.D911964 DE_KGSTAR.D911964T DE_KGSTAR.D971P DE_KGSTAR.KSTAR DE_KHSTAR.CST DE_KHSTAR.D801904T DE_KHSTAR.D911984T DE_KHSTAR.D911P DE_KHSTAR.KSTAR DE_KPSTAR.CST DE_KPSTAR.D801824 DE_KPSTAR.D911964 DE_KPSTAR.D911964T DE_KPSTAR.D971P DE_KPSTAR.KSTAR DE_LFNSTAR.CST DE_LFNSTAR.D911P DE_LFNSTAR.TIME1 DE_LFNSTAR.TIME2 DE_LFNSTAR.TIME3 DE_LINFSTARQ DE_LSRSTAR.CST DE_LSRSTAR.D911P DE_LSRSTAR.TIME DE_LSRSTAR.T941P DE_LSTAR.CST DE_LSTAR.D001P DE_LSTAR.D801994T DE_LSTAR.D904 DE_LSTAR.D911P DE_M2DEEX DE_M2DEIN DE_MDSTAR.CMD DE_MDSTAR.CST DE_MDSTAR.PEI DE_MDSTAR.T911004 DE_MDSTAR.YFD DE_MSTAR.CMF DE_MSTAR.CST DE_MSTAR.D863 DE_MSTAR.D864 DE_MSTAR.D871 DE_MSTAR.D931P DE_OPNSTAR.CST DE_OPNSTAR.D911P DE_OPNSTAR.D911T DE_OPNSTAR.GON DE_OPNSTAR.INN DE_PCDSTAR.CST DE_PCDSTAR.D911P DE_PCDSTAR.D971P DE_PCDSTAR.SDUM1 DE_PCDSTAR.SDUM2 DE_PCDSTAR.SDUM3 DE_PCDSTAR.TIME1 DE_PCDSTAR.TIME2 DE_PDNB.WIN DE_PEISTAR.CST DE_RWUNSTAR.CST DE_RWUNSTAR.D001P DE_RWUNSTAR.D801994T DE_RWUNSTAR.D911 DE_RWUNSTAR.D911P DE_WER.GCR DE_WER.ITR DE_WER.PCR DE_WER.SCR DE_WER.XTR DE_WLR.GCR DE_WLR.ITR DE_WLR.PCR DE_WLR.SCR DE_WLR.XTR DE_XDSTAR.CST DE_XDSTAR.CXD DE_XDSTAR.D871P DE_XDSTAR.T871004 DE_XSTAR.CST DE_XSTAR.CXX DE_XSTAR.D903924 DE_XSTAR.D911P DE_XSTAR.D971P DE_XSTAR.TREND DE_YFTSTAR.CST DE_YFTSTAR.D001P DE_YFTSTAR.D801994T DE_YFTSTAR.D911P DE_YGA.LNMEAN

MONETARY POLICY RULE

```
de_STI:   del(de_STI) =
            de_sti.ec * (de_sti(-1) - (
            100 * (4 * (de_GAMMA + de_lfnstar.time3 + (de_PCD(-1)/de_PCD(-2) - 1) ) )  ))
          + de_sti.inf * (del(log(de_PCD)) - de_linfstarq)
          + de_sti.yga * log(de_YGA(-1))
          + res_de_STI ,
```

INTEREST RATE BLOCK

```
de_LTI:  de_LTI =
            de_lti.lti * 0.25 * (de_LTI(-1) + de_LTI(-2) + de_LTI(-3) + de_LTI(-4))
          + (1 - de_lti.lti) * (
                     de_lti.cst
              + de_lti.sti * de_STI
              + de_lti.sti1 * de_STI(-1)
              + de_lti.sti2 * de_STI(-2)
              + de_lti.sti3 * de_STI(-3)
              + (1 - de_lti.sti  - de_lti.sti1  - de_lti.sti2  - de_lti.sti3) * de_STI(-4) )
          + res_de_lti ,

de_RCC:  de_RCC =
            de_rcc.rcc * 0.25 * (de_RCC(-1) + de_RCC(-2) + de_RCC(-3) + de_RCC(-4))
          + (1 - de_rcc.rcc) * (
                     de_rcc.cst
              + de_rcc.sti * de_STI
              + de_rcc.sti1 * de_STI(-1)
              + de_rcc.sti2 * de_STI(-2)
              + de_rcc.sti3 * de_STI(-3)
              + (1 - de_rcc.sti  - de_rcc.sti1  - de_rcc.sti2  - de_rcc.sti3) * de_STI(-4) )
          + res_de_rcc ,

de_RCH:  de_RCH =
            0.25 * de_rch.rch * (de_RCH(-1) + de_RCH(-2) + de_RCH(-3) + de_RCH(-4))
          + (1 - de_rch.rch) * (
                     de_rch.cst
              + de_rch.sti * de_STI
              + de_rch.sti1 * de_STI(-1)
              + de_rch.sti2 * de_STI(-2)
              + de_rch.sti3 * de_STI(-3)
              + (1 - de_rch.sti  - de_rch.sti1  - de_rch.sti2  - de_rch.sti3) * de_STI(-4) )
          + res_de_rch ,
```

de_RMT: de_rmt =
0.25 * de_rmt.rmt * (de_RMT(-1) + de_RMT(-2) + de_RMT(-3) + de_RMT(-4))
+ (1 - de_rmt.rmt) * (
de_rmt.cst
+ de_rmt.sti * de_STI
+ de_rmt.sti1 * de_STI(-1)
+ de_rmt.sti2 * de_STI(-2)
+ de_rmt.sti3 * de_STI(-3)
+ (1 - de_rmt.sti - de_rmt.sti1 - de_rmt.sti2 - de_rmt.sti3) * de_STI(-4))
+ res_de_rmt ,

de_INFQ: de_INFQ = 100 * (de_PCD / de_PCD(-1) - 1) ,

de_INFA: de_INFA = 100 * (de_PCD / de_PCD(-4) - 1) ,

de_LTR: de_LTR = (
de_ltr.lti * de_LTI
+ (1 - de_ltr.lti) * de_STI
- de_ltr.inf * 4 * de_INFQ
- (1 - de_ltr.inf) * de_INFA) / 400
+ res_de_ltr ,

de_REALI: de_REALI =
de_reali.sti * de_STI
+ (1 - de_reali.sti) * de_LTI
- de_reali.inf * 4 * de_INFQ
- (1 - de_reali.inf) * de_INFA
+ res_de_reali ,

de_CC0: de_CC0 = de_YFD / 400 * (
(0.85 * (de_RCC + de_LTI) / 2 + 0.15 * de_RMT)
+ 4 - 100 * (de_YFD / de_YFD(-1) - 1))
+ res_de_cc0,

FISCAL RULE

de_PDX: del(de_PDX) =
(1 - de_fisc1) * del(de_PDX(-1))
+ de_fisc1 * (
de_fisc2 * 0.5 * (1 * (
de_GDN(0) / (4 * de_YEN(0)))- de_GDNRATIO)
+ de_fisc2 * 0.5 * (10 * (0.0 -
(sum(i = -1 to -4: (de_GLN(i)))) / (sum(i = -1 to -4: (de_YEN(i)))))))
+ res_de_pdx ,

de_ODX: del(de_ODX) =
(1 - de_fisc1) * del(de_ODX(-1))
+ de_fisc1
* de_fisc3 * (del(de_PDX))
+ res_de_odx ,

POTENTIAL OUTPUT AND OUTPUT GAP

de_URT: de_URT = de_urt.cst * (1 - de_D911P)
+ de_urt.d911P * (de_D911P - de_DSS)
+ de_urt.dss * de_DSS
+ res_de_URT ,

de_LNT: de_LNT = (1 - 0.01 * de_URT) * de_LFN + res_de_lnt ,

de_YFT: de_YFT = exp(
log(de_alpha)
+ de_beta * log(de_KSR)
+ (1 - de_beta) * de_gamma * de_TIME
+ (1 - de_beta) * log(de_LNT)
+ (de_yftstar.cst
+ de_yftstar.d911p * de_D911p
+ de_yftstar.d801994t * (1 - de_D001p) * de_TIME
+ de_yftstar.d001p * de_D001p)
+ res_de_yft
),

de_YGA: de_YGA = (de_YER / de_YFT) / 1.069689 + res_de_yga ,

PRICE BLOCK

DOMESTIC PRICES

```
de_RWUNSTAR:   de_RWUNSTAR = exp(
                  log(((de_eps - 1) / de_eps) * (1 - de_beta) * de_YFR / de_LNN)
                + (de_rwunstar.cst
                + de_rwunstar.D911 * de_D911
                + de_rwunstar.D911P * de_D911P
                + de_rwunstar.D801994t * (1) * de_TIME
                + de_rwunstar.D001P * de_D001P*0 ) * (1 - 0.05) ** (de_TIMESS)
                        ) ,

de_WUN:   del( log(de_WUN)) =
                  del(log(de_PCD))
                + de_gamma * (1 - de_wun.dpro - de_wun.drwun1)
                + de_wun.ec * (log(de_WUN(-1)) - log(de_YFD(-1)) - log(de_RWUNSTAR(-1)) )
                + de_wun.dpro * del(log(de_PRO))
                + de_wun.drwun1 * del(log(de_WUN(-1)/de_PCD(-1)))
                + de_wun.ugap * (log(de_URX) - log(de_URT))
                + de_wun.dpcdyfd * del(log(de_PCD/de_YFD))
                + de_wun.D842 * de_D842
                + de_wun.D911 * de_D911
                + res_de_wun ,

de_WIN:   de_WIN = de_WUN * de_LNN + res_de_win ,

de_YFD:   del(log(de_YFD)) =
                + de_yfd.EC4 * (log(de_YFD(-4)) - log(de_WUN(-4)) + log(de_RWUNSTAR(-4)))
                + de_yfd.yga3 * (log(de_yga(-3)) - de_yga.lnmean * (1 - 0.05) ** (de_TIMESS) )
                + de_yfd.DYFD2 * del(log(de_YFD(-2)))
                + de_yfd.DYFD4 * del(log(de_YFD(-4)))
                + de_yfd.DRWUN2 * del( log(de_WUN(-2)/de_YFD(-2)))
                + de_yfd.dpro * del( log(de_PRO))
                + de_yfd.dmtd * del( log(de_MTD))
                + de_yfd.dmtd1 * del( log(de_MTD(-1)))
                + de_yfd.dmtd4 * del( log(de_MTD(-4)))
                + de_yfd.D912 * de_D912
                + res_de_yfd ,

de_YED:   de_YED = de_YEN / de_YER + res_de_yed ,

de_HEGSTAR:   de_HEGSTAR = exp(
                          de_hegstar.cst
                        + de_hegstar.poil * log(de_POIL)
                        + (1 - de_hegstar.poil) * log(de_YFD)
                        + de_hegstar.d861p * de_D861P
                        + de_hegstar.d001p * de_D001P
                        ) ,

de_HEG:   del(log(de_HEG)) =
                + de_heg.ec * ( log(de_HEG(-1)/de_HEGSTAR(-1)) )
                + de_heg.dheg1 * del(log(de_HEG(-1)))
                + de_heg.dheg3 * del(log(de_HEG(-3)))
                + de_heg.dpoil * del(log(de_POIL))
                + de_heg.dyfd * del(log(de_YFD))
                + de_heg.d913 * de_D913
                + de_heg.d941 * de_D941
                + res_de_HEG,

de_HEXPSTAR:   de_HEXPSTAR = exp(
                          de_hexpstar.cst
                        + de_hexpstar.mtd * log(de_MTD)
                        +(1 - de_hexpstar.mtd) * log(de_YFD)
                        + de_hexpstar.d911p * de_D911P
                        + de_hexpstar.d971p * de_D971P
                                        ) ,
```

```
de_HEXP:  del(log(de_HEXP)) =
          + de_hexp.cst
          + de_hexp.ec * ( log(de_HEXP(-1)) - log(de_HEXPSTAR(-1)) )
          + de_hexp.dulc * del(log((de_WUN / de_PRO)))
          + de_hexp.dulc3 * del(log((de_WUN(-3) / de_PRO(-3))))
          + de_hexp.dmrkup * del(1-(de_WUN * de_LNN) / de_YFN)
          + de_hexp.dmrkup3 * del(1-(de_WUN(-3) * de_LNN(-3)) / de_YFN(-3))
          + de_hexp.D1 * de_SDUM1
          + de_hexp.D2 * de_SDUM2
          + de_hexp.D3 * de_SDUM3
          + de_hexp.d903 * de_D903
          + de_hexp.d911 * de_D911
          + res_de_HEXP,

de_HEX:  de_HEX = de_HEXP * (1 - de_TCIR) / (1 - de_TCI) + res_de_HEX ,

de_HIC:  del(4: log(de_HIC)) =
     de_WE * del(4: log(de_HEG)) + (1 - de_WE) * del(4: log(de_HEX)) + de_Z_HIC
    + res_de_HIC ,

de_PCDSTAR:  de_PCDSTAR = exp(
           log(de_HIC)
          + de_pcdstar.cst
          + de_pcdstar.D911p * de_D911P
          + de_pcdstar.D971p * de_D971P
          + de_pcdstar.sdum1 * de_SDUM1
          + de_pcdstar.sdum2 * de_SDUM2
          + de_pcdstar.sdum3 * de_SDUM3
          + de_pcdstar.time1 * de_TIME * (1 - de_D911P)
          + de_pcdstar.time2 * de_TIME * (de_D911P - de_D971P)
                  ),

de_PCD:  del(4:log(de_PCD)) =
           de_pcd.ec * (log(de_PCD(-4)) - log(de_PCDSTAR(-4)))
          + de_pcd.d4pcd1 * del(4:log(de_PCD(-1)))
          + de_pcd.d4hic * del(4:log(de_HIC))
          + (1 - de_pcd.d4pcd1 - de_pcd.d4hic) * del(4:log(de_HIC(-1)))
          + de_pcd.d914 * de_D914
          + de_pcd.d924 * de_D924
          - de_pcd.d924 * de_D924(-1)
          + res_de_pcd ,

de_PCP:  de_PCP = de_PCD * (1 - de_TCI) / (1-de_TCIR)        + res_de_pcp,

de_ITD:  de_ITD = de_ITN / de_ITR + res_de_itd ,

de_IPPSTAR:  de_IPPSTAR = exp(
           de_ippstar.cst
          + de_ippstar.mtd * log(de_MTD(-1))
          + (1 - de_ippstar.mtd) * log(de_YFD(-1))
           ) ,

de_IPP:  del(log(de_IPP)) =
           de_ipp.ipp1 * del(log(de_IPP(-1)))
          + de_ipp.mtd * del(log(de_MTD))
          + de_ipp.yfd * del(log(de_YFD))
          + de_ipp.ec * (          log(de_IPP(-1)) - log(de_IPPSTAR(-1)) )
          + res_de_ipp,

de_IPD:  de_IPD = de_IPP * (1 - de_TIIR) / (1 - de_TII) + res_de_ipd ,

de_IHPSTAR:  de_IHPSTAR = exp(
           de_ihpstar.cst
          + de_ihpstar.ipp * log(de_IPP)
          + (1 - de_ihpstar.ipp) * log(de_YFD)
          + de_ihpstar.d911p * de_D911P
           ) ,

de_IHP:  del(log(de_IHP)) =
     de_ihp.ec * (     log(de_IHP(-1)) - log(de_IHPSTAR(-1)) )
    + (1 - de_ihp.dyfd - de_ihp.dyfd1) * del(log(de_IPP(-1)))
    + de_ihp.dyfd  * del(log(de_YFD))
    + de_ihp.dyfd1 * del(log(de_YFD(-1)))
    + de_ihp.d911  * de_D911
    + res_de_IHP ,
```

```
de_IHD:  de_IHD = de_IHP * (1 - de_TIIR) / (1 - de_TII) + res_de_ihd ,

de_GIP:  log(de_GIP) =
           de_gip.cst
         + de_gip.gip1 * log(de_GIP(-1))
         + (1 - de_gip.gip1) * (de_gipstar.mtd * log(de_MTD) + (1 - de_gipstar.mtd) * log(de_YFD))
         + de_gip.d901 * de_D901
         + de_gip.d911P * de_D911P
         + res_de_gip,

de_GID:  de_GID = de_GIP * (1 - de_TIIR) / (1 - de_TII) + res_de_gid ,

de_GCPSTAR:  de_GCPSTAR = exp(
           de_gcpstar.cst
         + log(de_YFD)
           ) ,

de_GCP:  del(log(de_GCP)) =
           del(log(de_YFD))
         + de_gcp.ec * (log(de_GCP(-1)) - log(de_GCPSTAR(-1)))
         + res_de_gcp ,

de_GCD:  de_GCD =
         de_GCP * (1 - de_TGIR) / (1 - de_TGI) + res_de_gcd ,

de_SZD:  de_SZD = ABSV(de_SZN) / MAX(ABSV(de_SCR + de_ZER), 0.001) + res_de_szd ,

de_SMC:  de_SMC = exp(
           log(de_WIN / de_LNN)
         + log(1 / (1 - de_beta))
         + (1 / (1 - de_beta)) * (
                   de_beta * log(de_YER/de_KSR)
                   - log(de_alpha) )
         - de_gamma * de_TIME )
         + res_de_smc ,
```

TRADE AND ENERGY PRICES

```
de_CMD:  de_CMD = de_CMUD * de_EXR + res_de_cmd ,

de_CMD_EX:  de_CMD_EX = de_CMUD_EX * (de_EXR ** de_m2deex) + res_de_cmd_ex ,

de_CMD_IN:  de_CMD_IN = de_CMUD_IN * (de_EXR ** de_m2dein) + res_de_cmd_in ,

de_CMUD:  de_CMUD = de_CMUD_IN * de_CMUD_EX + res_de_cmud ,

de_CXD:  de_CXD = de_CXUD * de_EXR + res_de_cxd ,

de_CXD_EX:  de_CXD_EX = de_CXUD_EX * (de_EXR ** de_betadeex) + res_de_cxd_ex ,

de_CXD_IN:  de_CXD_IN = de_CXUD_IN * (de_EXR ** de_betadein) + res_de_cxd_in ,

de_CXUD:  de_CXUD = de_CXUD_IN * de_CXUD_EX + res_de_cxud ,

de_XDSTAR:  de_XDSTAR = exp(
           de_xdstar.cst
         + de_xdstar.cxd * log(de_CXD)
         + (1 - de_xdstar.cxd) * log(de_YFD)
         + de_xdstar.t871004 * (de_D861P(-4) * (de_TIME - 28) * (1 - de_D001P(-4)) + de_D001P(-4) * 57)
         + de_xdstar.d871p * de_D861P(-4)
           ),

de_XTD:  del(log(de_XTD)) =
           de_xtd.ec   * log(de_XTD(-1) / de_XDSTAR(-1))
         + de_xtd.xtd3 * del(log(de_XTD(-3)))
         + de_xtd.xtd4 * del(log(de_XTD(-4)))
         + de_xtd.cxdin  * del(log(de_CXD_IN))
         + de_xtd.cxdin1 * del(log(de_CXD_IN(-1)))
         + de_xtd.cxdex  * del(log(de_CXD_EX))
         + de_xtd.yfd  * del(log(de_YFD))
         + de_xtd.yfd1  * del(log(de_YFD(-1)))
         + res_de_xtd ,
```

de_MDSTAR: de_MDSTAR = exp(
de_mdstar.cst
+ de_mdstar.cmd * log(de_CMD)
+ de_mdstar.yfd * log(de_YFD)
+ de_mdstar.pei * log(de_PEI)
+ de_mdstar.t911004 * ((de_TIME - 44) * (de_D911p - de_D001p(-4)) + 40 * de_D001P(-4))
) ,

de_MTD: del(log(de_MTD)) =
de_mtd.ec * log(de_MTD(-1) / de_MDSTAR(-1))
+ de_mtd.dmtd1 * del(log(de_MTD(-1)))
+ de_mtd.dcmudin1 * del(log(de_CMUD_IN(-1)))
+ de_mtd.dcmudex1 * del(log(de_CMUD_EX(-1)))
+ de_mtd.dexr * del(log(de_EXR))
+ de_mtd.dexr1 * del(log(de_EXR(-1)))
+ de_mtd.dyfd1 * del(log(de_YFD(-1)))
+ de_mtd.dpei * del(log(de_PEI))
+ de_mtd.dpei1 * del(log(de_PEI(-1)))
+ res_de_MTD ,

de_POIL: de_POIL = de_POILU * de_EXR + res_de_poil ,

de_PEISTAR: de_PEISTAR = exp(
de_peistar.cst
+ log(de_POIL)
) ,

de_PEI: del(log(de_PEI)) =
de_pei.cst
+ de_pei.dpei1 * del(log(de_PEI(-1)))
+ de_pei.dpoil * del(log(de_POIL))
+ de_pei.ec * (log(de_PEI(-1)) - log(de_PEISTAR(-1)))
+ res_de_PEI ,

INCOME

HOUSEHOLD SECTOR INCOME

de_OPNSTAR: de_OPNSTAR = exp(
de_opnstar.cst
+ de_opnstar.gon * log(de_GON)
+ de_opnstar.inn * log(de_INN)
+ (1 - de_opnstar.gon - de_opnstar.inn) * log(de_ITD * de_KSR)
+ de_opnstar.d911p * de_D911P
+ de_opnstar.d911t * ((de_D911P - de_d001p(-4)) * (de_TIME) + de_d001p(-4) * 80)
) ,

de_OPN: del(log(de_OPN)) =
de_opn.ec * (log(de_OPN(-1) / de_OPNSTAR(-1)))
+ de_opn.dopn1 * del(log(de_OPN(-1)))
+ de_opn.dopn4 * del(log(de_OPN(-4)))
+ de_opn.dgon * del(log(de_GON))
+ (1 - de_opn.dopn1 - de_opn.dopn4 - de_opn.dgon) * del(log(de_ITD * de_KSR))
+ res_de_OPN ,

de_GON: de_GON = de_YEN - de_WIN - de_TIN - de_ZIN + res_de_gon ,

OTHER PRIVATE SECTOR INCOME BLOCK

de_OYN: de_OYN = de_GON + de_TWN + de_NFN + de_INN - de_ODN - de_OPN - de_OGN + res_de_oyn ,

de_OWN: de_OWN = de_WIN - de_WGN + res_de_own ,

de_OLN: de_OLN = de_CAN - de_PSN - de_GLN + de_IHN + de_IPN + res_de_oln ,

de_PYN: de_PYN = de_WIN + de_TRN + de_OPN - de_PDN + res_de_pyn ,

de_PYR: de_PYR = de_PYN / de_PCD + res_de_pyr ,

SAVINGS

de_PSN: de_PSN = de_PYN - de_PCN + res_de_psn ,

de_PLN: de_PLN = de_PSN - de_IHN - de_IPN + res_de_pln ,

WEALTH

de_FWN: de_FWN = de_IPP * de_KRP + de_IHP * de_KHR+ de_GDN+ de_NFA + res_de_fwn ,

de_FWR: de_FWR = de_FWN / de_PCD + res_de_fwr ,

GDP COMPONENTS

CONSUMPTION

de_CSTAR: de_CSTAR = exp(
de_cstar.cst
+ de_cstar.pyr * log(de_PYR)
+ (1 - de_cstar.pyr) * log(de_FWR)
+ de_cstar.d912 * de_D912
+ de_cstar.t801904 * de_TIME * (1 - de_D911P)
) ,

de_PCR: del(log(de_PCR)) =
de_pcr.ec * (log(de_PCR(-1)) - log(de_CSTAR(-1)))
+ de_pcr.dpcr1 * del(log(de_PCR(-1)))
+ de_pcr.dpyr * del(log(de_PYR))
+ de_pcr.dfwr * del(log(de_FWR))
+ (1 - de_pcr.dpcr1 - de_pcr.dpyr - de_pcr.dfwr) * del(log(de_FWR(-1)))
+ de_pcr.d911 * de_D911
+ res_de_pcr ,

de_PCN:. de_PCN = de_PCD * de_PCR + res_de_pcn ,

INVESTMENT

de_KSTAR: de_KSTAR = exp(
(1 - de_beta) * (
log(de_beta / (1 - de_beta))
+ log(de_WUN)
- log(de_CC0)
- de_gamma * de_TIME)
+ log(de_YFR)
- log(de_alpha)
) ,

de_KSR: de_KSR = de_KRP + de_KGR + de_KHR + res_de_ksr ,

de_ITR: de_ITR = de_IPR + de_GIR + de_IHR + res_de_ITR ,

de_ITN: de_ITN = de_IPN + de_GIN + de_IHN + res_de_itn ,

de_KPSTAR: de_KPSTAR = exp(
log(de_kpstar.kstar * de_KSTAR)
+ (de_kpstar.cst
+ de_kpstar.d801824 * (1 - de_D831P)
+ de_kpstar.d911964 * (de_D911P - de_D971P)
+ de_kpstar.d911964T * (de_D911P - de_D971P) * (de_TIME - 45)
+ de_kpstar.d971p * de_D971P) * (1 - 0.001) ** (de_TIMESS)
),

de_KRP: de_KRP = de_IPR+ (1 - de_depkrp) * de_KRP(-1) + de_ZKRP + res_de_krp ,

de_IPR: del(log(de_IPR)) =
de_ipr.cst
+ de_ipr.ec1 * (log(de_IPR(-1)) - log(de_KRP(-1)))
+ de_ipr.ec2 * (log(de_KRP(-2)) - log(de_KPSTAR(-2)))
+ de_ipr.dyfr * del(log(de_YFR))
+ (1 - de_ipr.dyfr) * del(log(de_YFR(-2)))
+ de_ipr.dipr2 * del(log(de_IPR(-2)))
+ de_ipr.dipr3 * del(log(de_IPR(-3)))
+ de_ipr.d872 * de_D872
+ res_de_ipr ,

de_IPN: de_IPN = de_IPR * de_IPD + res_de_ipn ,

de_KGSTAR: de_KGSTAR = exp(
 log(de_kgstar.kstar * de_KSTAR)
+ (de_kgstar.cst
+ de_kgstar.d801824 * (1 - de_D931P)
+ de_kgstar.d911964 * (de_D911P - de_D971P)
+ de_kgstar.d911964T * (de_D911P - de_D971P) * (de_TIME - 45)
+ de_kgstar.d971p * de_D971P) * (1 - 0.001) ** (de_TIMESS)
) ,

de_KGR: de_KGR = de_GIR + (1 - de_depkgr) * de_KGR(-1) + de_ZKGR + res_de_kgr ,

de_GIR: del(log(de_GIR)) =
 de_gir.cst
+ de_gir.ec1 * (log(de_GIR(-3)) - log(de_KGR(-3)))
+ de_gir.ec2 * (log(de_KGR(-2)) - log(de_KGSTAR(-2)))
+ de_gir.dyfr * del(log(de_YFR))
+ de_gir.dgir1 * del(log(de_GIR(-1)))
+ de_gir.dgir2 * del(log(de_GIR(-2)))
+ de_gir.d851 * de_D851
- de_gir.d851 * de_D851(-1)
+ de_gir.d871 * de_D871
- de_gir.d871 * de_D871(-1)
+ de_gir.d913 * de_D913
+ de_gir.d971 * de_D971
+ de_gir.d974 * de_D974
+ res_de_GIR ,

de_GIN: de_GIN = de_GID * de_GIR + res_de_gin ,

de_KHSTAR: de_KHSTAR = exp(
 log(de_khstar.kstar * de_KSTAR)
+ (de_khstar.cst
+ de_khstar.d801904T * (1 - de_D911P) * (de_TIME)
+ de_khstar.d911984T * (de_D911P - de_D991P) * (de_TIME - 45)
+ de_khstar.d911p * de_D911P) * (1 - 0.001) ** (de_TIMESS)
) ,

de_KHR: de_KHR = de_IHR + (1-de_depkhr) * de_KHR(-1) + de_ZKHR + res_de_khr ,

de_IHR: del(log(de_IHR)) =
 de_ihr.cst
+ de_ihr.ec * (log(de_IHR(-1)) - log(de_KHR(-1)))
+ de_ihr.ec * (log(de_KHR(-4)) - log(de_KHSTAR(-4)))
+ del(log(de_YFR))
+ de_ihr.drmt2 * del(log(max(de_RMT(-2),0.01)))
+ de_ihr.d851 * de_D851
+ de_ihr.d861 * de_D861
+ de_ihr.d871 * de_D871
+ de_ihr.d872 * de_D872
+ de_ihr.d901 * de_D901
+ de_ihr.d962 * de_D962
+ de_ihr.d911P * de_D911P
+ res_de_IHR ,

de_IHN: de_IHN = de_IHR * de_IHD + res_de_IHN ,

de_SALE: de_SALE = de_PCR + de_XTR + res_de_sale ,

de_LSRSTAR: de_LSRSTAR =
exp(de_lsrstar.cst + de_lsrstar.TREND * de_TIME + de_lsrstar.T941P * de_T941P + log(de_YER)) ,

de_LSR: del(log(de_LSR)) =
 de_lsr.ec * log(de_LSR(-1) / de_LSRSTAR(-1))
+ de_lsr.dlsr1 * del(log(de_LSR(-1)))
+ de_lsr.dreali * del(de_REALI)
+ de_lsr.dyer * del(log(de_YER))
+ de_lsr.d911 *de_D911
+ de_lsr.d912 *de_D912
+ de_lsr.d941P *de_D941P
+ res_de_lsr ,

de_SCR: de_SCR = del(de_LSR) + res_de_SCR ,

FOREIGN TRADE

```
de_WDR:  de_WDR = de_WDR_IN * de_WDR_EX + res_de_wdr ,

de_EEN0:  de_EEN0 = de_EEN0_in * de_EEN0_ex + res_de_EEN0 ,

de_EEN:  de_EEN = de_EEN_in * de_EEN_ex + res_de_EEN ,

de_XSTAR:  de_XSTAR =  exp(log(de_WDR)
        + de_XSTAR.cst
        + de_XSTAR.trend * de_TIME
        - de_XSTAR.trend * de_TIMESS
        + de_XSTAR.cxx * log(de_XTD / de_CXD)
        + de_XSTAR.d911p * de_D911P
        + de_XSTAR.d903924 * de_D903924
        + de_XSTAR.d971p * de_D971P
                ) ,

de_XTR:  del(log(de_XTR)) =
          de_XTR.ec * log(de_XTR(-1)/de_XSTAR(-1))
        + de_XTR.WDRIN * del(log(de_WDR_IN))
        + de_XTR.DDXTD * del(1:del(1:log(de_XTD(-2))))
        + de_XTR.D894 * de_D894
        + de_XTR.D903 * de_D903
        + de_XTR.D904 * de_D904
        + de_XTR.D911 * de_D911
        + res_de_xtr ,

de_XTN:  de_XTN = de_XTD * de_XTR + res_de_xtn ,

de_MSTAR:  de_MSTAR = exp(log(de_WER)
        + de_mstar.cst
        + de_mstar.cmf *
          ((log(de_MTD) - de_mdstar.pei * log(de_PEI)) / (1 - de_mdstar.pei) - log(de_YfD))
        + de_mstar.d931P * de_D931P
        + de_mstar.d863 * de_D861(-2)
        + de_mstar.d864 * de_D861(-3)
        + de_mstar.d871 * de_D861(-4)
          ) ,

de_MTR:  del(log(de_MTR)) =
          de_mtr.ec * log(de_mtr(-1)/de_MSTAR(-1))
        + de_mtr.dmtr1 * del(log(de_MTR(-1)))
        + de_mtr.dwer * del(log(de_WER))
        + de_mtr.dwer1 * del(log(de_WER(-1)))
        + de_mtr.dmtdno * del(((log(de_MTD) - de_mdstar.pei * log(de_PEI)) / (1 - de_mdstar.pei) - log(de_YfD)))
        + de_mtr.d924 * de_D924
        + de_mtr.d931 * de_D931
        + res_de_mtr ,

de_WER:  de_WER =
          de_wer.pcr * de_PCR
        + de_wer.gcr * de_GCR
        + de_wer.itr * de_ZWERITR * de_ITR
        + de_wer.scr * de_SCR
        + de_wer.xtr * de_ZWERXTR * de_XTR
        + res_de_wer ,

de_MTN:  de_MTN = de_MTD * de_MTR + res_de_mtn ,
```

PRODUCTION BLOCK

```
de_YER:  de_YER = de_PCR + de_GCR + de_ITR + de_SCR + de_XTR - de_MTR + de_ZER + res_de_yer ,

de_YEN:  de_YEN = de_YFD * de_YFR + de_TIN + res_de_yen ,

de_YFR:  de_YFR = de_YER - de_TIR + res_de_yfr ,

de_YFN:  de_YFN = de_YFD * de_YFR + res_de_yfn ,

de_SZN:  de_SZN = de_YEN - de_PCN - de_GCN - de_ITN - de_XTN + de_MTN + res_de_szn ,
```

LABOUR MARKET BLOCK

```
de_LFNSTAR:   de_LFNSTAR = exp(
                 de_lfnstar.cst
               + de_lfnstar.d911p * de_D911P
               + de_lfnstar.time1 * de_TIME * (1 - de_D911P)
               + de_lfnstar.time2 * de_TIME * (de_D911P - de_DSS)
               + de_lfnstar.time3 * de_TIME * de_DSS
                ) ,

de_LFN:   del(log(de_LFN)) =
                 de_lfn.cst
               + de_lfn.ec * (log(de_LFN(-1)) - log(de_LFNSTAR(-1)))
               + de_lfn.dlnn * del(log(de_LNN))
               + de_lfn.ugap3 * (de_URX(-3) - de_URT(-3))
               + de_lfn.d901 * de_D901
               + de_lfn.d911 * de_D911
               + de_lfn.d911p * de_D911P
               + res_de_lfn ,

de_WLR:   de_WLR =
                 de_wlr.pcr * de_PCR
               + de_wlr.gcr * de_GCR
               + de_wlr.itr * de_ITR
               + de_wlr.scr * de_SCR
               + de_wlr.xtr * de_XTR
               + res_de_wlr ,

de_LSTAR:   de_LSTAR =   exp(
                 log(de_YFR) / (1 - de_beta)
               - log(de_alpha) / (1 - de_beta)
               - de_beta * log(de_KSR) / (1 - de_beta)
               - de_gamma * de_TIME
               + (de_lstar.cst
               + de_lstar.d911P * de_D911P
               + de_lstar.d904 * de_D904
               + de_lstar.d801994t * (1 - de_D001P) * de_TIME
               + de_lstar.d001p * de_D001P) * (1 - 0.001) ** (de_TIMESS)
                 ) ,

de_LNN:   (del( log(de_LNN)) - 0.15 * del( log(de_LGN))) / (1 - 0.15) =
                 de_LNN.EC * (log(de_LNN(-1)) - log(de_LSTAR(-1)))
               + (1 - 0.15 - de_LNN.DWLR - de_LNN.DWLR1) * del(log(de_LNN(-1)))
               + de_LNN.DWLR * del(log(de_WLR))
               + de_LNN.DWLR1 * del(log(de_WLR(-1)))
               + de_LNN.DWUR * del(log(de_WUN / de_yfd))
               + (0 - de_LNN.DWLR - de_LNN.DWLR1 - de_LNN.DWUR) * del(log(de_WUN(-1)/ de_yfd(-1)))
               + de_LNN.D911 * de_D911
               + de_LNN.D912 * de_D912
               + de_LNN.D993 * de_D993
               + res_de_lnn ,

de_UNN:   de_UNN = de_LFN - de_LNN + res_de_unn ,

de_URX:   de_URX = MAX(0.5,100 * (de_UNN / de_LFN)) + res_de_urx ,

de_LEN:   de_LEN = de_LEX * de_LNN + res_de_len ,

de_PRO:   de_PRO = de_YER / de_LNN + res_de_pro ,

de_WGN:   de_WGN = de_WUG * de_LGN + res_de_wgn ,

de_CEX:   de_CEX =  de_WIN / de_LEN  + res_de_CEX ,

de_ULA:   de_ULA = (de_LNN * (de_WIN / de_YER) ) / de_LEN + res_de_ULA ,
```

GENERAL GOVERNMENT INCOME BLOCK

```
de_GYN:   de_GYN = de_PDN + de_ODN + de_TIN + de_OGN - de_TRN - de_INN + res_de_gyn ,

de_PDNB:   de_PDNB = (1 + de_pdnb.win) * de_WIN + de_TRN + de_OPN + res_de_pdnb ,

de_PDN:   de_PDN = de_dfor * (de_ZZPDX * de_YEN) + (1 - de_dfor) * de_ZPDN * (de_PDX * de_PDNB) + res_de_pdn ,

de_ODNB:   de_ODNB = de_GON - de_depksr * de_ITD * de_KSR  + res_de_odnb ,
```

de_ODN: de_ODN = de_dfor * (de_ZZODX * de_YEN) + (1 - de_dfor) * de_ZODN * (de_ODX * de_ODNB) + res_de_odn ,

de_TIN: de_TIN = de_dfor * (de_ZZTIX * de_YEN) + (1 - de_dfor) * de_ZTIN *
(de_TCI * de_PCN + de_TGI * de_GCN + de_TII * de_ITN)
+ res_de_tin ,

de_TIR: de_TIR = de_TIIR * de_ITR + de_TCIR * de_PCR + de_TGIR * de_GCR + res_de_tir ,

de_TIX: de_TIX = de_TIN / de_YEN + res_de_tix ,

de_INNSTAR: de_INNSTAR = exp(log((1/400) * de_LTI * de_GDN(-1))),

de_INN: de_INN = de_dfor * (de_ZZINX * de_YEN)+ (1 - de_dfor) * ((1/400) * de_LTI(-1) * de_GDN(-1)) + res_de_inn ,

de_TRX: de_TRX =
de_trx.cst
+ de_trx.trx1 * de_TRX(-1)
+ de_trx.urx * 0.25 * (de_URX + de_URX(-1) + de_URX(-2) + de_URX(-3))
+ de_trx.d911p * de_D911P
+ res_de_trx ,

de_TRN: de_TRN = de_TRX * de_YEN + res_de_trn ,

de_GCN: de_GCN = de_GCD * de_GCR + res_de_gcn ,

de_GSN: de_GSN = de_GYN - de_GCN + res_de_gsn ,

de_GLN: de_GLN = de_GSN - de_GIN + res_de_gln ,

de_SGLN: de_SGLN = de_SGLN(-1) + de_GLN + res_de_sgln ,

de_GDN: de_GDN = -de_SGLN * de_ZGDN + res_de_gdn ,

BALANCE OF PAYMENTS BLOCK

de_BTN: de_BTN = de_XTN - de_MTN + res_de_btn,

de_CAN: de_CAN = de_XTN - de_MTN + de_NFN + de_TWN + res_de_can ,

de_NFN: de_NFN = (1 / 400) * de_LTI(-1) * de_NFA(-1) + de_ZNFN + res_de_nfn ,

de_NFA: de_NFA = de_NFA(-1) + de_CAN + de_ZNFA + res_de_nfa ,

;

Dynamic simulation results

Table A2: Permanent shock to world demand by 1 per cent
(deviations from baseline, in percentage points unless otherwise indicated)

Key macroeconomic variables	Acronyms	Year 1				Year 2				Year 3				Year 1	Year 2	Year 3	Year 5	Year 10	Year 250
		1q	2q	3q	4q	1q	2q	3q	4q	1q	2q	3q	4q						
Economic Activity*(constant prices)*																			
GDP	DE_YER	0.00	0.35	0.31	0.26	0.19	0.16	0.07	0.01	0.00	-0.01	0.00	-0.01	0.23	0.11	-0.01	0.03	-0.04	-0.17
Private consumption	DE_PCR	0.00	0.19	0.21	0.20	0.22	0.23	0.19	0.13	0.12	0.09	0.08	0.05	0.15	0.19	0.08	0.10	0.05	0.04
Government consumption	DE_GCR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gross fixed capital formation	DE_ITR	0.00	0.64	0.49	0.29	0.00	-0.22	-0.46	-0.61	-0.67	-0.71	-0.66	-0.64	0.36	-0.32	-0.67	-0.52	-0.63	-0.48
Contribution of inventories (% of GDP)	DE_SCRRATIO	0.00	0.12	0.09	0.03	-0.01	-0.01	-0.05	-0.06	-0.05	-0.04	-0.02	-0.02	0.06	-0.03	-0.03	0.00	0.00	0.00
Exports	DE_XTR	0.00	0.33	0.44	0.48	0.50	0.50	0.49	0.49	0.50	0.49	0.49	0.49	0.32	0.50	0.49	0.47	0.43	0.22
Imports	DE_MTR	0.00	0.47	0.54	0.43	0.35	0.29	0.20	0.13	0.13	0.13	0.15	0.16	0.36	0.24	0.14	0.22	0.22	0.39
Price Developments																			
GDP deflator at factor cost	DE_YFD	0.00	-0.01	-0.01	0.00	0.02	0.02	0.04	0.05	0.07	0.08	0.09	0.10	-0.01	0.03	0.09	0.18	0.38	1.49
Private consumption deflator	DE_PCD	0.00	-0.04	-0.01	0.01	0.01	0.02	0.05	0.06	0.06	0.07	0.08	0.09	-0.01	0.03	0.08	0.16	0.34	1.36
HICP	DE_HIC	0.00	-0.05	-0.01	0.01	0.01	0.03	0.06	0.07	0.07	0.08	0.08	0.09	-0.01	0.04	0.08	0.16	0.34	1.36
HICP energy	DE_HEG	0.00	0.00	-0.01	0.00	0.01	0.01	0.02	0.03	0.05	0.06	0.07	0.09	0.00	0.02	0.07	0.16	0.33	1.32
HICP non-energy	DE_HEX	0.00	-0.05	-0.01	0.01	0.01	0.03	0.06	0.07	0.07	0.08	0.08	0.09	-0.01	0.04	0.08	0.16	0.34	1.37
Exports deflator	DE_XTD	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.00	0.01	0.03	0.07	0.16	0.67
Imports deflator	DE_MTD	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.00	0.01	0.03	0.07	0.15	0.61
Labour Market and Cost Developments																			
Compensation per employee (nominal)	DE_WUN	0.00	0.06	0.10	0.13	0.14	0.14	0.13	0.11	0.10	0.09	0.08	0.08	0.07	0.13	0.09	0.15	0.29	1.32
Compensation per employee (real, YED based)	DE_WUNY	0.00	0.07	0.11	0.13	0.12	0.11	0.09	0.06	0.03	0.01	-0.01	-0.02	0.08	0.10	0.00	-0.03	-0.09	-0.16
Compensation per employee (real, PCD based)	DE_WUNC	0.00	0.10	0.11	0.12	0.13	0.11	0.08	0.05	0.04	0.01	0.00	-0.01	0.08	0.09	0.01	-0.01	-0.05	-0.04
Productivity	DE_PRO	0.00	0.32	0.26	0.17	0.08	0.03	-0.07	-0.13	-0.14	-0.15	-0.13	-0.13	0.19	-0.02	-0.14	-0.10	-0.13	-0.15
ULC, whole economy	DE_ULC	0.00	-0.26	-0.16	-0.05	0.06	0.11	0.20	0.24	0.24	0.23	0.22	0.21	-0.12	0.15	0.23	0.25	0.42	1.48
Labour force	DE_LFN	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.07	0.08	0.08	0.08	0.02	0.06	0.08	0.08	0.06	-0.01
Employment	DE_LNN	0.00	0.02	0.06	0.09	0.11	0.13	0.14	0.14	0.14	0.13	0.13	0.13	0.04	0.13	0.13	0.13	0.10	-0.01
Unemployment rate	DE_URX	0.00	-0.01	-0.03	-0.05	-0.06	-0.07	-0.07	-0.07	-0.06	-0.05	-0.05	-0.04	-0.02	-0.07	-0.05	-0.05	-0.03	0.01
Disposable Income and Total Wealth																			
Disposable income	DE_PYN	0.00	0.17	0.24	0.25	0.27	0.30	0.28	0.22	0.20	0.18	0.17	0.15	0.17	0.27	0.17	0.28	0.41	1.41
Compensation of employees	DE_WIN	0.00	0.08	0.16	0.21	0.25	0.27	0.27	0.25	0.24	0.22	0.21	0.21	0.11	0.26	0.22	0.28	0.38	1.31
Transfers from public sector	DE_TRN	0.00	0.33	0.29	0.23	0.17	0.11	0.02	-0.05	-0.05	-0.06	-0.03	-0.02	0.21	0.06	-0.04	0.12	0.27	1.32
Other personal income	DE_OPN	0.00	0.22	0.32	0.28	0.29	0.37	0.33	0.21	0.17	0.17	0.14	0.09	0.21	0.30	0.14	0.28	0.38	1.30
Direct taxes (inc. SSC)	DE_PDN	0.00	0.15	0.20	0.19	0.19	0.20	0.17	0.12	0.12	0.12	0.11	0.10	0.14	0.17	0.11	0.21	0.23	1.00
Saving ratio	DE_SRATIO	0.00	0.10	0.06	0.03	-0.01	-0.04	-0.07	-0.07	-0.06	-0.06	-0.04	-0.03	0.05	-0.05	-0.05	-0.03	-0.03	-0.06
Disposable income (real)	DE_PYR	0.00	0.21	0.25	0.25	0.26	0.28	0.23	0.16	0.13	0.11	0.09	0.06	0.18	0.23	0.10	0.12	0.07	0.04
Total wealth (real)	DE_FWR	0.00	0.03	0.02	0.00	0.02	-0.01	-0.03	-0.04	-0.03	-0.04	-0.03	-0.03	0.02	-0.01	-0.03	-0.03	-0.04	0.04
Firms and Interest Rate																			
Capital stock	DE_KSR	0.00	0.01	0.02	0.02	0.02	0.02	0.01	0.00	-0.01	-0.02	-0.03	-0.04	0.01	0.01	-0.03	-0.08	-0.24	-0.46
Short-term nominal interest rate	DE_STI	0.00	-0.04	0.10	0.27	0.29	0.24	0.24	0.19	0.11	0.05	0.02	0.01	0.08	0.24	0.05	0.09	0.05	0.00
Long-term nominal interest rate	DE_LTI	0.00	-0.02	0.06	0.13	0.11	0.08	0.10	0.09	0.06	0.04	0.04	0.04	0.04	0.09	0.04	0.07	0.05	0.00
Cost of capital (nominal)	DE_CC0	0.00	-0.18	0.74	2.05	1.97	2.10	2.00	1.82	1.10	0.92	0.58	0.57	0.66	1.97	0.79	1.21	1.09	1.80
Public Sector																			
Direct tax rate (inc. ssc)	DE_PDX	0.00	0.00	-0.01	-0.01	-0.01	-0.02	-0.02	-0.02	-0.01	-0.01	-0.01	-0.01	0.00	-0.02	-0.01	-0.01	-0.03	-0.07
Other direct tax rate	DE_ODX	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	0.00	-0.01	-0.01	-0.01	-0.03	-0.06
Tranfers to households rate	DE_TIX	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02	-0.02	-0.01	0.00	-0.01	-0.02	-0.01	-0.01	0.00
Public sector net debt (% of GDP)	DE_GDNRATIO	0.00	-0.23	-0.22	-0.19	-0.15	-0.12	-0.07	-0.03	-0.03	-0.02	-0.03	-0.03	-0.16	-0.10	-0.03	-0.11	-0.13	-0.01
Public sector net lending (% of GDP)	DE_GLNRATIO	0.00	0.04	0.07	0.01	-0.04	-0.03	-0.01	-0.04	-0.03	-0.01	0.00	-0.01	0.03	-0.03	-0.01	-0.01	-0.01	0.00

Table A3: Permanent shock to oil price by 20 per cents

(deviations from baseline, in percentage points unless otherwise indicated)

Key macroeconomic variables	Acronyms	Year 1				Year 2				Year 3				Year 1	Year 2	Year 3	Year 5	Year 10	Year 250
		1q	2q	3q	4q	1q	2q	3q	4q	1q	2q	3q	4q						
Economic Activity*(constant prices)*																			
GDP	DE_YER	-0.35	-0.44	-0.43	-0.56	-0.63	-0.55	-0.42	-0.35	-0.25	-0.16	-0.08	-0.07	-0.44	-0.49	-0.14	-0.10	0.03	0.82
Private consumption	DE_PCR	-0.38	-0.50	-0.54	-0.69	-0.84	-0.86	-0.83	-0.83	-0.81	-0.74	-0.66	-0.63	-0.53	-0.84	-0.71	-0.60	-0.62	-0.74
Government consumption	DE_GCR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gross fixed capital formation	DE_ITR	-0.62	-0.70	-0.78	-1.15	-1.13	-0.87	-0.46	-0.12	0.29	0.57	0.79	0.82	-0.81	-0.64	0.62	0.66	1.10	2.34
Contribution of inventories (% of GDP)	DE_SCRRATIO	-0.09	-0.17	-0.09	-0.09	-0.11	-0.04	0.04	0.06	0.08	0.09	0.10	0.07	-0.11	-0.01	0.09	0.00	0.00	-0.01
Exports	DE_XTR	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.02	0.05	0.12	0.96
Imports	DE_MTR	-0.26	-0.45	-0.38	-0.48	-0.55	-0.43	-0.25	-0.15	-0.05	0.04	0.11	0.09	-0.39	-0.34	0.05	-0.05	-0.03	-0.42
Price Developments																			
GDP deflator at factor cost	DE_YFD	-0.05	-0.06	-0.05	-0.08	-0.07	-0.06	-0.07	-0.10	-0.11	-0.13	-0.15	-0.18	-0.06	-0.07	-0.14	-0.33	-0.67	-4.90
Private consumption deflator	DE_PCD	0.21	0.25	0.25	0.31	0.32	0.30	0.29	0.28	0.26	0.24	0.22	0.20	0.25	0.30	0.23	0.06	-0.25	-4.15
HICP	DE_HIC	0.24	0.28	0.27	0.34	0.34	0.29	0.27	0.25	0.21	0.19	0.17	0.17	0.28	0.29	0.19	0.08	-0.24	-4.15
HICP energy	DE_HEG	2.23	2.68	2.64	2.95	2.91	2.69	2.54	2.36	2.17	2.04	1.93	1.84	2.63	2.62	1.99	1.70	1.42	-2.44
HICP non-energy	DE_HEX	0.04	0.03	0.03	0.07	0.07	0.04	0.03	0.02	0.01	0.00	-0.01	-0.01	0.04	0.04	0.00	-0.09	-0.41	-4.33
Exports deflator	DE_XTD	-0.01	-0.02	-0.02	-0.02	-0.03	-0.03	-0.03	-0.03	-0.04	-0.05	-0.06	-0.07	-0.02	-0.03	-0.05	-0.13	-0.28	-2.23
Imports deflator	DE_MTD	0.50	0.89	1.00	1.07	1.11	1.15	1.18	1.20	1.21	1.22	1.23	1.23	0.87	1.16	1.22	1.22	1.12	-0.66
Labour Market and Cost Developments																			
Compensation per employee (nominal)	DE_WUN	-0.05	-0.09	-0.14	-0.21	-0.25	-0.27	-0.28	-0.27	-0.25	-0.22	-0.19	-0.17	-0.12	-0.27	-0.21	-0.23	-0.52	-4.15
Compensation per employee (real, YED based)	DE_WUNY	0.00	-0.03	-0.09	-0.13	-0.18	-0.22	-0.21	-0.18	-0.14	-0.09	-0.03	0.01	-0.06	-0.20	-0.06	0.10	0.14	0.79
Compensation per employee (real, PCD based)	DE_WUNC	-0.26	-0.34	-0.39	-0.51	-0.57	-0.57	-0.56	-0.55	-0.51	-0.45	-0.40	-0.37	-0.37	-0.56	-0.43	-0.29	-0.28	0.01
Productivity	DE_PRO	-0.31	-0.35	-0.29	-0.37	-0.38	-0.25	-0.08	0.02	0.14	0.23	0.30	0.29	-0.33	-0.17	0.24	0.19	0.17	0.69
ULC, whole economy	DE_ULC	0.27	0.26	0.15	0.17	0.14	-0.02	-0.19	-0.29	-0.38	-0.44	-0.49	-0.46	0.21	-0.09	-0.44	-0.42	-0.69	-4.80
Labour force	DE_LFN	-0.01	-0.04	-0.05	-0.07	-0.10	-0.13	-0.15	-0.17	-0.19	-0.21	-0.22	-0.22	-0.04	-0.14	-0.21	-0.19	-0.09	0.08
Employment	DE_LNN	-0.03	-0.09	-0.14	-0.19	-0.25	-0.30	-0.34	-0.37	-0.38	-0.38	-0.38	-0.36	-0.11	-0.32	-0.38	-0.29	-0.14	0.14
Unemployment rate	DE_URX	0.02	0.05	0.08	0.11	0.14	0.16	0.18	0.18	0.17	0.16	0.15	0.13	0.06	0.16	0.15	0.09	0.04	-0.05
Disposable Income and Total Wealth																			
Disposable income	DE_PYN	-0.18	-0.32	-0.36	-0.45	-0.59	-0.66	-0.63	-0.62	-0.61	-0.55	-0.47	-0.43	-0.33	-0.62	-0.51	-0.50	-0.73	-4.30
Compensation of employees	DE_WIN	-0.08	-0.18	-0.28	-0.40	-0.50	-0.57	-0.62	-0.64	-0.63	-0.60	-0.56	-0.53	-0.23	-0.58	-0.58	-0.52	-0.67	-4.01
Transfers from public sector	DE_TRN	-0.37	-0.46	-0.42	-0.54	-0.56	-0.42	-0.26	-0.17	-0.05	0.05	0.11	0.08	-0.45	-0.35	0.05	-0.19	-0.51	-4.16
Other personal income	DE_OPN	-0.26	-0.46	-0.41	-0.36	-0.57	-0.64	-0.51	-0.44	-0.47	-0.38	-0.23	-0.17	-0.37	-0.54	-0.31	-0.37	-0.65	-3.94
Direct taxes (inc. SSC)	DE_PDN	-0.16	-0.27	-0.27	-0.28	-0.34	-0.32	-0.23	-0.19	-0.16	-0.11	-0.05	-0.04	-0.25	-0.27	-0.09	-0.20	-0.38	-3.14
Saving ratio	DE_SRATIO	-0.12	-0.12	-0.09	-0.13	-0.09	-0.01	0.04	0.07	0.12	0.14	0.14	0.12	-0.11	0.00	0.13	0.08	0.15	0.47
Disposable income (real)	DE_PYR	-0.39	-0.56	-0.61	-0.75	-0.92	-0.96	-0.91	-0.89	-0.86	-0.79	-0.68	-0.64	-0.58	-0.92	-0.74	-0.56	-0.48	-0.16
Total wealth (real)	DE_FWR	-0.17	-0.20	-0.25	-0.36	-0.38	-0.37	-0.40	-0.43	-0.43	-0.45	-0.48	-0.52	-0.25	-0.39	-0.47	-0.75	-1.53	-4.70
Firms and Interest Rate																			
Capital stock	DE_KSR	-0.01	-0.02	-0.03	-0.05	-0.07	-0.08	-0.08	-0.08	-0.08	-0.07	-0.05	-0.04	-0.03	-0.08	-0.06	0.03	0.30	2.24
Short-term nominal interest rate	DE_STI	0.21	0.39	0.07	-0.09	-0.16	-0.35	-0.46	-0.42	-0.35	-0.28	-0.20	-0.11	0.14	-0.34	-0.23	-0.13	-0.07	-0.03
Long-term nominal interest rate	DE_LTI	0.11	0.17	-0.02	-0.06	-0.06	-0.12	-0.18	-0.15	-0.12	-0.11	-0.10	-0.07	0.05	-0.13	-0.10	-0.09	-0.08	-0.03
Cost of capital (nominal)	DE_CC0	2.46	3.20	0.46	-0.20	-1.23	-2.75	-3.39	-3.07	-2.98	-2.58	-1.96	-1.35	1.47	-2.61	-2.21	-1.68	-1.83	-6.22
Public Sector																			
Direct tax rate (inc. ssc)	DE_PDX	0.00	0.01	0.02	0.03	0.04	0.06	0.07	0.08	0.08	0.08	0.08	0.07	0.01	0.06	0.08	0.06	0.06	0.22
Other direct tax rate	DE_ODX	0.00	0.01	0.01	0.02	0.04	0.05	0.06	0.06	0.07	0.06	0.06	0.06	0.01	0.05	0.06	0.04	0.05	0.17
Tranfers to households rate	DE_TIX	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.03	0.04	0.04	0.04	0.04	0.00	0.02	0.04	0.03	0.01	-0.01
Public sector net debt (% of GDP)	DE_GDNRATIO	0.26	0.35	0.39	0.50	0.55	0.50	0.41	0.36	0.28	0.21	0.16	0.15	0.37	0.45	0.20	0.19	0.19	0.03
Public sector net lending (% of GDP)	DE_GLNRATIO	-0.04	-0.14	-0.18	-0.05	-0.05	-0.05	0.02	0.07	0.06	0.05	0.06	0.06	-0.10	0.00	0.06	0.03	0.01	0.00

Table A4: Permanent shock to competitors' price by 1 per cent
(deviations from baseline, in percentage points unless otherwise indicated)

Key macroeconomic variables	Acronyms	Year 1				Year 2				Year 3				Year 1	Year 2	Year 3	Year 5	Year 10	Year 250
		1q	2q	3q	4q	1q	2q	3q	4q	1q	2q	3q	4q						
Economic Activity *(constant prices)*																			
GDP	DE_YER	0.00	0.29	0.20	0.12	0.17	0.07	0.05	-0.03	0.00	-0.06	-0.03	-0.07	0.15	0.07	-0.04	0.00	-0.03	-0.16
Private consumption	DE_PCR	0.00	0.15	0.13	0.09	0.16	0.13	0.11	0.04	0.05	0.01	0.01	-0.03	0.09	0.11	0.01	0.00	0.01	0.07
Government consumption	DE_GCR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gross fixed capital formation	DE_ITR	0.00	0.53	0.29	0.06	0.09	-0.28	-0.29	-0.53	-0.48	-0.65	-0.53	-0.61	0.22	-0.25	-0.57	-0.38	-0.41	-0.46
Contribution of inventories (% of GDP)	DE_SCRRATIO	0.00	0.09	0.06	-0.01	0.01	-0.01	-0.03	-0.05	-0.03	-0.04	-0.02	-0.02	0.04	-0.02	-0.03	0.00	0.00	0.00
Exports	DE_XTR	0.00	0.16	0.19	0.23	0.22	0.22	0.20	0.20	0.19	0.19	0.18	0.17	0.15	0.21	0.18	0.14	0.08	-0.13
Imports	DE_MTR	0.00	0.24	0.25	0.09	0.12	0.01	-0.04	-0.13	-0.10	-0.15	-0.12	-0.15	0.14	-0.01	-0.13	-0.08	-0.10	0.04
Price Developments																			
GDP deflator at factor cost	DE_YFD	0.00	-0.06	-0.01	-0.02	0.00	0.01	0.03	0.04	0.05	0.06	0.08	0.09	-0.02	0.02	0.07	0.14	0.24	1.32
Private consumption deflator	DE_PCD	0.00	-0.05	0.00	0.02	0.00	0.04	0.06	0.07	0.08	0.09	0.10	0.11	-0.01	0.04	0.09	0.16	0.25	1.24
HICP	DE_HIC	0.00	-0.06	0.00	0.02	0.00	0.05	0.07	0.08	0.08	0.10	0.10	0.11	-0.01	0.05	0.10	0.15	0.25	1.24
HICP energy	DE_HEG	0.00	-0.03	-0.02	-0.02	-0.01	0.00	0.01	0.02	0.04	0.05	0.06	0.07	-0.01	0.00	0.06	0.12	0.21	1.17
HICP non-energy	DE_HEX	0.00	-0.06	0.01	0.03	0.01	0.06	0.07	0.09	0.09	0.10	0.10	0.11	-0.01	0.06	0.10	0.15	0.26	1.25
Exports deflator	DE_XTD	0.05	0.05	0.07	0.08	0.10	0.12	0.14	0.16	0.18	0.19	0.21	0.22	0.06	0.13	0.20	0.29	0.42	0.93
Imports deflator	DE_MTD	0.00	0.39	0.27	0.31	0.28	0.29	0.29	0.30	0.30	0.30	0.30	0.31	0.24	0.29	0.30	0.33	0.37	0.81
Labour Market and Cost Developments																			
Compensation per employee (nominal)	DE_WUN	0.00	0.01	0.07	0.07	0.09	0.09	0.10	0.08	0.08	0.06	0.07	0.06	0.04	0.09	0.07	0.11	0.18	1.16
Compensation per employee (real, YED based)	DE_WUNY	0.00	0.07	0.08	0.09	0.09	0.08	0.07	0.04	0.03	0.00	-0.01	-0.03	0.06	0.07	0.00	-0.03	-0.06	-0.16
Compensation per employee (real, PCD based)	DE_WUNC	0.00	0.06	0.07	0.05	0.09	0.05	0.04	0.01	0.00	-0.03	-0.03	-0.05	0.05	0.05	-0.03	-0.05	-0.07	-0.08
Productivity	DE_PRO	0.00	0.27	0.16	0.07	0.10	0.00	-0.03	-0.11	-0.07	-0.13	-0.09	-0.13	0.13	-0.01	-0.11	-0.05	-0.08	-0.14
ULC, whole economy	DE_ULC	0.00	-0.26	-0.09	-0.01	-0.01	0.09	0.13	0.19	0.16	0.20	0.16	0.19	-0.09	0.10	0.18	0.16	0.27	1.31
Labour force	DE_LFN	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.01	0.03	0.04	0.03	0.04	-0.01
Employment	DE_LNN	0.00	0.01	0.04	0.05	0.07	0.08	0.08	0.08	0.08	0.07	0.07	0.06	0.03	0.08	0.07	0.05	0.06	-0.02
Unemployment rate	DE_URX	0.00	-0.01	-0.02	-0.03	-0.04	-0.04	-0.04	-0.04	-0.03	-0.03	-0.02	-0.02	-0.01	-0.04	-0.02	-0.02	-0.02	0.01
Disposable Income and Total Wealth																			
Disposable income	DE_PYN	0.00	0.10	0.16	0.13	0.18	0.20	0.20	0.13	0.14	0.12	0.11	0.08	0.10	0.18	0.11	0.16	0.26	1.24
Compensation of employees	DE_WIN	0.00	0.03	0.11	0.12	0.16	0.17	0.18	0.16	0.16	0.14	0.14	0.12	0.06	0.17	0.14	0.16	0.24	1.14
Transfers from public sector	DE_TRN	0.00	0.23	0.18	0.09	0.15	0.04	0.03	-0.06	-0.01	-0.06	-0.01	-0.04	0.12	0.04	-0.03	0.10	0.18	1.16
Other personal income	DE_OPN	0.00	0.17	0.22	0.14	0.19	0.27	0.24	0.13	0.16	0.15	0.11	0.06	0.13	0.21	0.12	0.20	0.24	1.14
Direct taxes (inc. SSC)	DE_PDN	0.00	0.09	0.14	0.09	0.12	0.13	0.13	0.08	0.10	0.09	0.10	0.08	0.08	0.12	0.09	0.16	0.15	0.87
Saving ratio	DE_SRATIO	0.00	0.07	0.03	0.00	0.01	-0.05	-0.05	-0.06	-0.04	-0.06	-0.03	-0.03	0.03	-0.04	-0.04	-0.01	-0.03	-0.09
Disposable income (real)	DE_PYR	0.00	0.16	0.16	0.11	0.18	0.16	0.14	0.06	0.07	0.03	0.01	-0.03	0.11	0.13	0.02	0.01	0.01	-0.01
Total wealth (real)	DE_FWR	0.00	0.07	0.03	-0.01	0.03	-0.03	-0.02	-0.05	-0.05	-0.06	-0.06	-0.06	0.02	-0.02	-0.06	-0.06	0.01	0.60
Firms and Interest Rate																			
Capital stock	DE_KSR	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00	-0.01	-0.02	-0.03	-0.04	0.01	0.01	-0.02	-0.07	-0.17	-0.44
Short-term nominal interest rate	DE_STI	0.00	-0.05	0.06	0.25	0.19	0.18	0.21	0.17	0.09	0.06	0.03	0.02	0.06	0.19	0.05	0.04	0.03	0.00
Long-term nominal interest rate	DE_LTI	0.00	-0.03	0.04	0.12	0.07	0.06	0.09	0.08	0.04	0.04	0.03	0.03	0.03	0.07	0.04	0.04	0.03	0.00
Cost of capital (nominal)	DE_CC0	0.00	0.41	-0.24	2.17	1.12	1.54	1.55	1.59	0.88	0.83	0.52	0.51	0.59	1.45	0.68	0.70	0.69	1.61
Public Sector																			
Direct tax rate (inc. ssc)	DE_PDX	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	-0.02	-0.07
Other direct tax rate	DE_ODX	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	-0.02	-0.05
Tranfers to households rate	DE_TIX	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.00	-0.01	-0.01	0.00	-0.01	0.00
Public sector net debt (% of GDP)	DE_GDNRATIO	0.00	-0.16	-0.15	-0.09	-0.12	-0.06	-0.06	0.01	-0.02	0.02	-0.01	0.02	-0.10	-0.06	0.00	-0.06	-0.09	-0.01
Public sector net lending (% of GDP)	DE_GLNRATIO	0.00	0.03	0.05	0.00	-0.05	-0.01	-0.01	-0.04	-0.03	-0.01	-0.01	-0.01	0.02	-0.03	-0.01	0.00	0.00	0.00

Table A5: Permanent appreciation of the euro by 5 per cents
(deviations from baseline, in percentage points unless otherwise indicated)

Key macroeconomic variables	Acronyms	Year 1				Year 2				Year 3				Year 1	Year 2	Year 3	Year 5	Year 10	Year 250
		1q	2q	3q	4q	1q	2q	3q	4q	1q	2q	3q	4q						
Economic Activity*(constant prices)*																			
GDP	DE_YER	-0.14	-2.28	-1.11	-0.66	-1.47	-0.38	-0.17	0.67	0.11	0.70	0.36	0.69	-1.05	-0.33	0.47	0.00	0.23	1.17
Private consumption	DE_PCR	-0.01	-1.15	-0.74	-0.41	-1.22	-0.80	-0.58	0.01	-0.25	0.16	0.29	0.57	-0.58	-0.65	0.20	0.14	0.10	-0.25
Government consumption	DE_GCR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gross fixed capital formation	DE_ITR	-0.26	-4.12	-1.31	0.19	-0.79	2.91	3.03	5.42	4.46	5.94	4.59	5.23	-1.37	2.66	5.06	3.02	3.51	3.39
Contribution of inventories (% of GDP)	DE_SCRRATIO	-0.05	-0.77	-0.32	0.16	-0.18	0.10	0.34	0.51	0.16	0.30	0.12	0.17	-0.25	0.19	0.19	-0.03	-0.01	-0.01
Exports	DE_XTR	0.00	-1.25	-1.17	-1.38	-1.78	-1.63	-1.44	-1.28	-1.36	-1.32	-1.29	-1.19	-0.95	-1.53	-1.29	-1.03	-0.69	0.87
Imports	DE_MTR	0.03	-1.84	-1.17	0.09	-0.89	0.26	0.90	1.80	1.22	1.68	1.39	1.60	-0.72	0.52	1.47	0.95	1.07	-0.06
Price Developments																			
GDP deflator at factor cost	DE_YFD	0.11	0.50	0.11	0.21	-0.01	-0.07	-0.25	-0.33	-0.42	-0.50	-0.59	-0.69	0.23	-0.16	-0.55	-0.99	-1.86	-9.22
Private consumption deflator	DE_PCD	0.00	0.33	-0.16	-0.24	-0.11	-0.51	-0.63	-0.74	-0.76	-0.90	-0.95	-1.02	-0.02	-0.50	-0.91	-1.32	-2.09	-8.88
HICP	DE_HIC	0.00	0.39	-0.20	-0.29	-0.12	-0.62	-0.71	-0.80	-0.81	-0.94	-0.94	-0.98	-0.03	-0.56	-0.92	-1.28	-2.09	-8.88
HICP energy	DE_HEG	-0.57	-0.51	-0.58	-0.65	-0.69	-0.71	-0.79	-0.85	-0.91	-0.98	-1.06	-1.14	-0.58	-0.76	-1.02	-1.44	-2.20	-8.77
HICP non-energy	DE_HEX	0.07	0.49	-0.16	-0.25	-0.06	-0.61	-0.70	-0.80	-0.80	-0.94	-0.93	-0.96	0.03	-0.54	-0.91	-1.26	-2.08	-8.89
Exports deflator	DE_XTD	-0.65	-1.38	-1.44	-1.44	-1.51	-1.78	-1.90	-2.00	-2.04	-2.16	-2.25	-2.34	-1.23	-1.80	-2.20	-2.71	-3.46	-6.93
Imports deflator	DE_MTD	-0.89	-3.92	-2.99	-3.22	-3.03	-3.10	-3.07	-3.13	-3.13	-3.17	-3.19	-3.22	-2.76	-3.08	-3.18	-3.36	-3.71	-6.75
Labour Market and Cost Developments																			
Compensation per employee (nominal)	DE_WUN	0.05	-0.12	-0.50	-0.43	-0.72	-0.67	-0.74	-0.52	-0.55	-0.42	-0.45	-0.40	-0.25	-0.66	-0.46	-0.84	-1.37	-8.18
Compensation per employee (real, YED based)	DE_WUNY	-0.07	-0.61	-0.61	-0.64	-0.71	-0.60	-0.49	-0.19	-0.13	0.08	0.14	0.29	-0.48	-0.50	0.10	0.15	0.49	1.15
Compensation per employee (real, PCD based)	DE_WUNC	0.04	-0.45	-0.34	-0.18	-0.61	-0.16	-0.11	0.22	0.21	0.48	0.50	0.63	-0.23	-0.16	0.45	0.48	0.73	0.76
Productivity	DE_PRO	-0.14	-2.17	-0.86	-0.35	-1.04	0.14	0.38	1.18	0.58	1.13	0.73	0.99	-0.88	0.17	0.86	0.31	0.73	1.08
ULC, whole economy	DE_ULC	0.18	2.10	0.36	-0.08	0.33	-0.81	-1.11	-1.68	-1.12	-1.53	-1.17	-1.38	0.64	-0.82	-1.30	-1.15	-2.08	-9.16
Labour force	DE_LFN	0.00	-0.05	-0.10	-0.12	-0.17	-0.21	-0.24	-0.24	-0.26	-0.27	-0.26	-0.24	-0.07	-0.22	-0.26	-0.18	-0.30	0.06
Employment	DE_LNN	0.00	-0.11	-0.25	-0.32	-0.44	-0.52	-0.55	-0.50	-0.47	-0.42	-0.36	-0.30	-0.17	-0.50	-0.39	-0.31	-0.50	0.09
Unemployment rate	DE_URX	0.00	0.06	0.14	0.18	0.25	0.29	0.29	0.24	0.19	0.14	0.09	0.05	0.09	0.27	0.12	0.12	0.19	-0.03
Disposable Income and Total Wealth																			
Disposable income	DE_PYN	0.00	-0.85	-1.05	-0.78	-1.45	-1.53	-1.38	-0.81	-1.04	-0.80	-0.65	-0.40	-0.67	-1.29	-0.72	-1.25	-2.02	-8.79
Compensation of employees	DE_WIN	0.05	-0.23	-0.75	-0.74	-1.15	-1.19	-1.28	-1.02	-1.02	-0.84	-0.81	-0.70	-0.42	-1.16	-0.84	-1.15	-1.86	-8.10
Transfers from public sector	DE_TRN	-0.03	-1.78	-0.97	-0.39	-1.31	-0.21	-0.10	0.73	0.11	0.61	0.15	0.31	-0.79	-0.21	0.29	-0.85	-1.32	-8.20
Other personal income	DE_OPN	-0.05	-1.40	-1.46	-0.78	-1.69	-2.38	-1.79	-0.90	-1.48	-1.34	-0.80	-0.37	-0.93	-1.69	-0.99	-1.62	-1.91	-8.14
Direct taxes (inc. SSC)	DE_PDN	0.01	-0.74	-0.87	-0.50	-1.03	-1.09	-0.96	-0.52	-0.87	-0.76	-0.73	-0.60	-0.53	-0.90	-0.74	-1.27	-1.15	-6.12
Saving ratio	DE_SRATIO	-0.01	-0.56	-0.07	0.10	-0.09	0.47	0.43	0.58	0.38	0.51	0.23	0.24	-0.14	0.35	0.34	0.10	0.20	0.59
Disposable income (real)	DE_PYR	0.00	-1.18	-0.89	-0.53	-1.34	-1.03	-0.75	-0.07	-0.29	0.10	0.30	0.62	-0.65	-0.79	0.18	0.08	0.07	0.09
Total wealth (real)	DE_FWR	-0.08	-0.62	-0.18	0.04	-0.27	0.22	0.19	0.36	0.36	0.47	0.46	0.44	-0.21	0.12	0.43	0.50	0.29	-2.60
Firms and Interest Rate																			
Capital stock	DE_KSR	0.00	-0.07	-0.09	-0.08	-0.09	-0.05	0.00	0.08	0.15	0.24	0.31	0.38	-0.06	-0.01	0.27	0.64	1.51	3.24
Short-term nominal interest rate	DE_STI	0.00	0.27	-0.82	-1.99	-1.31	-1.45	-1.77	-1.24	-0.47	-0.31	-0.09	0.00	-0.63	-1.44	-0.22	-0.39	-0.26	-0.01
Long-term nominal interest rate	DE_LTI	0.00	0.14	-0.49	-0.92	-0.39	-0.56	-0.77	-0.57	-0.18	-0.26	-0.25	-0.23	-0.31	-0.57	-0.23	-0.31	-0.26	-0.01
Cost of capital (nominal)	DE_CC0	-1.64	-3.22	-0.59	-17.24	-7.25	-12.20	-13.25	-11.67	-5.66	-5.18	-3.50	-2.57	-5.70	-11.10	-4.22	-5.84	-5.58	-11.11
Public Sector																			
Direct tax rate (inc. ssc)	DE_PDX	0.00	0.01	0.03	0.05	0.07	0.08	0.08	0.06	0.03	0.01	-0.01	-0.03	0.02	0.07	0.00	-0.01	0.16	0.52
Other direct tax rate	DE_ODX	0.00	0.01	0.02	0.04	0.06	0.06	0.06	0.04	0.02	0.01	-0.01	-0.03	0.02	0.06	0.00	-0.01	0.13	0.42
Tranfers to households rate	DE_TIX	0.00	0.00	0.01	0.01	0.02	0.04	0.05	0.06	0.06	0.06	0.05	0.04	0.01	0.04	0.05	0.02	0.04	-0.01
Public sector net debt (% of GDP)	DE_GDNRATIO	0.03	1.27	0.83	0.43	0.99	0.31	0.25	-0.37	0.00	-0.32	-0.07	-0.24	0.64	0.30	-0.16	0.47	0.77	0.06
Public sector net lending (% of GDP)	DE_GLNRATIO	-0.02	-0.29	-0.34	0.16	0.37	0.01	0.15	0.44	0.21	-0.02	0.05	0.10	-0.12	0.24	0.08	-0.02	0.02	0.01

Table A6: Permanent shock to government consumption by 1 p.p. of GDP
(deviations from baseline, in percentage points unless otherwise indicated)

Key macroeconomic variables	Acronyms	Year 1				Year 2				Year 3				Year 1	Year 2	Year 3	Year 5	Year 10	Year 250
		1q	2q	3q	4q	1q	2q	3q	4q	1q	2q	3q	4q						
Economic Activity *(constant prices)*																			
GDP	DE_YER	4.33	2.84	1.85	1.28	1.02	0.04	-0.46	-0.39	-0.55	-0.51	-0.60	-0.11	2.57	0.05	-0.44	-0.28	-0.27	-0.39
Private consumption	DE_PCR	2.36	1.91	1.50	1.69	1.55	0.79	0.04	-0.05	-0.37	-0.66	-1.00	-0.78	1.86	0.58	-0.70	-1.03	-1.34	-1.67
Government consumption	DE_GCR	6.20	6.20	6.20	6.20	6.20	6.20	6.20	6.20	6.20	6.20	6.20	6.20	6.20	6.20	6.20	6.20	6.20	6.20
Gross fixed capital formation	DE_ITR	7.91	4.04	1.35	-1.28	-2.75	-4.78	-5.67	-5.72	-5.99	-5.35	-5.09	-3.68	2.99	-4.74	-5.02	-3.25	-2.32	-1.13
Contribution of inventories (% of GDP)	DE_SCRRATIO	1.37	0.77	-0.01	-0.27	-0.17	-0.58	-0.67	-0.42	-0.32	-0.22	-0.17	0.07	0.47	-0.46	-0.16	-0.05	0.01	0.00
Exports	DE_XTR	0.00	0.01	0.02	0.01	-0.03	-0.06	-0.05	-0.03	-0.08	-0.12	-0.12	-0.11	0.01	-0.04	-0.11	-0.22	-0.29	-0.57
Imports	DE_MTR	3.69	2.63	0.80	0.06	-0.23	-1.21	-1.74	-1.45	-1.45	-1.27	-1.22	-0.61	1.79	-1.16	-1.14	-0.64	-0.40	-0.08
Price Developments																			
GDP deflator at factor cost	DE_YFD	-0.12	-0.06	-0.01	0.28	0.22	0.36	0.45	0.68	0.68	0.81	0.89	1.02	0.02	0.43	0.85	1.36	1.61	3.08
Private consumption deflator	DE_PCD	-0.52	-0.06	0.14	0.05	0.24	0.48	0.56	0.56	0.62	0.69	0.76	0.77	-0.10	0.46	0.71	1.23	1.46	2.82
HICP	DE_HIC	-0.61	-0.05	0.19	0.07	0.33	0.58	0.64	0.61	0.67	0.70	0.73	0.72	-0.10	0.54	0.71	1.21	1.47	2.82
HICP energy	DE_HEG	-0.05	-0.05	-0.03	0.10	0.14	0.22	0.33	0.48	0.56	0.67	0.77	0.88	-0.01	0.29	0.72	1.23	1.43	2.74
HICP non-energy	DE_HEX	-0.67	-0.05	0.21	0.07	0.35	0.62	0.67	0.63	0.69	0.70	0.73	0.70	-0.11	0.57	0.70	1.20	1.47	2.83
Exports deflator	DE_XTD	-0.02	-0.04	-0.02	0.05	0.11	0.11	0.15	0.21	0.27	0.29	0.33	0.37	-0.01	0.14	0.32	0.55	0.70	1.38
Imports deflator	DE_MTD	0.00	-0.06	-0.02	0.00	0.14	0.08	0.16	0.19	0.30	0.28	0.34	0.37	-0.02	0.14	0.32	0.54	0.65	1.25
Labour Market and Cost Developments																			
Compensation per employee (nominal)	DE_WUN	0.74	1.03	1.15	1.22	1.10	0.97	0.74	0.69	0.48	0.46	0.39	0.52	1.04	0.88	0.46	0.90	1.24	2.69
Compensation per employee (real, YED based)	DE_WUNY	0.87	1.09	1.16	0.94	0.88	0.61	0.29	0.01	-0.20	-0.35	-0.49	-0.50	1.01	0.45	-0.39	-0.45	-0.36	-0.38
Compensation per employee (real, PCD based)	DE_WUNC	1.27	1.09	1.01	1.17	0.86	0.49	0.18	0.12	-0.14	-0.23	-0.36	-0.25	1.13	0.41	-0.25	-0.32	-0.22	-0.13
Productivity	DE_PRO	4.06	2.25	1.06	0.34	-0.01	-1.00	-1.42	-1.27	-1.35	-1.22	-1.21	-0.66	1.92	-0.93	-1.11	-0.63	-0.41	-0.34
ULC, whole economy	DE_ULC	-3.19	-1.20	0.10	0.87	1.11	1.99	2.19	1.99	1.85	1.70	1.63	1.19	-0.85	1.82	1.59	1.54	1.66	3.05
Labour force	DE_LFN	0.11	0.24	0.29	0.35	0.42	0.47	0.50	0.52	0.54	0.53	0.49	0.46	0.25	0.48	0.50	0.24	0.07	-0.03
Employment	DE_LNN	0.26	0.58	0.78	0.93	1.03	1.04	0.97	0.90	0.81	0.72	0.62	0.56	0.64	0.99	0.68	0.35	0.14	-0.05
Unemployment rate	DE_URX	-0.14	-0.32	-0.45	-0.53	-0.56	-0.53	-0.44	-0.34	-0.25	-0.18	-0.12	-0.09	-0.36	-0.47	-0.16	-0.10	-0.06	0.02
Disposable Income and Total Wealth																			
Disposable income	DE_PYN	2.01	2.32	2.00	2.00	2.10	1.52	0.68	0.47	0.20	-0.06	-0.40	-0.18	2.08	1.18	-0.11	0.18	0.25	1.62
Compensation of employees	DE_WIN	1.00	1.61	1.94	2.16	2.14	2.03	1.73	1.59	1.30	1.18	1.02	1.07	1.68	1.87	1.14	1.26	1.39	2.64
Transfers from public sector	DE_TRN	4.12	2.68	1.62	1.14	0.65	-0.34	-0.85	-0.60	-0.71	-0.46	-0.36	0.37	2.38	-0.29	-0.29	0.84	1.23	2.68
Other personal income	DE_OPN	2.64	3.19	2.13	2.13	2.97	2.22	0.78	0.72	0.84	0.48	-0.02	0.51	2.52	1.66	0.45	1.82	1.46	2.63
Direct taxes (inc. SSC)	DE_PDN	1.81	2.09	1.83	2.01	2.48	2.44	2.22	2.62	2.88	3.09	3.18	3.71	1.94	2.44	3.22	4.96	4.79	5.71
Saving ratio	DE_SRATIO	1.25	0.51	0.12	-0.10	-0.30	-0.47	-0.33	-0.13	-0.07	0.14	0.29	0.50	0.45	-0.31	0.22	0.49	0.67	0.84
Disposable income (real)	DE_PYR	2.54	2.38	1.85	1.95	1.85	1.04	0.11	-0.09	-0.42	-0.75	-1.15	-0.94	2.18	0.72	-0.82	-1.04	-1.20	-1.17
Total wealth (real)	DE_FWR	0.46	0.19	-0.02	0.27	-0.23	-0.33	-0.45	-0.29	-0.49	-0.41	-0.46	-0.36	0.22	-0.33	-0.43	-0.91	-2.20	-5.00
Firms and Interest Rate																			
Capital stock	DE_KSR	0.12	0.18	0.20	0.18	0.13	0.06	-0.03	-0.12	-0.21	-0.29	-0.36	-0.42	0.17	0.01	-0.32	-0.66	-1.23	-1.07
Short-term nominal interest rate	DE_STI	-0.52	1.21	3.03	2.62	1.81	1.88	1.35	0.46	-0.05	-0.25	-0.29	-0.39	1.58	1.38	-0.24	0.26	0.16	0.01
Long-term nominal interest rate	DE_LTI	-0.28	0.74	1.40	0.94	0.51	0.82	0.69	0.29	0.12	0.19	0.20	0.09	0.70	0.58	0.15	0.27	0.15	0.01
Cost of capital (nominal)	DE_CC0	-2.50	8.99	23.16	17.28	17.50	16.31	13.83	5.23	4.93	1.43	1.70	-0.41	11.78	13.19	1.90	5.52	4.00	3.82
Public Sector																			
Direct tax rate (inc. ssc)	DE_PDX	-0.03	-0.03	-0.03	0.00	0.07	0.16	0.26	0.37	0.47	0.55	0.63	0.69	-0.02	0.22	0.59	0.84	0.80	0.71
Other direct tax rate	DE_ODX	-0.02	-0.03	-0.02	0.00	0.05	0.13	0.21	0.30	0.38	0.44	0.50	0.55	-0.02	0.17	0.47	0.68	0.64	0.57
Tranfers to households rate	DE_TIX	0.00	-0.01	-0.03	-0.05	-0.08	-0.10	-0.11	-0.12	-0.11	-0.10	-0.08	-0.07	-0.03	-0.10	-0.09	-0.03	-0.01	0.00
Public sector net debt (% of GDP)	DE_GDNRATIO	-2.50	-1.62	-0.79	-0.23	0.21	0.92	1.44	1.45	1.65	1.60	1.68	1.31	-1.29	1.00	1.56	1.16	0.23	-0.02
Public sector net lending (% of GDP)	DE_GLNRATIO	-0.32	-0.11	-0.86	-1.33	-0.90	-0.64	-0.92	-0.76	-0.41	-0.27	-0.31	-0.19	-0.65	-0.80	-0.30	0.01	0.06	0.00

Table A7: Permanent shock to government debt to GDP target by 10 p.p.
(deviations from baseline, in percentage points unless otherwise indicated)

Key macroeconomic variables	Acronyms	Year 1				Year 2				Year 3				Year 1	Year 2	Year 3	Year 5	Year 10	Year 250
		1q	2q	3q	4q	1q	2q	3q	4q	1q	2q	3q	4q						
Economic Activity *(constant prices)*																			
GDP	DE_YER	0.25	0.37	0.46	0.51	0.54	0.51	0.45	0.40	0.34	0.29	0.24	0.23	0.40	0.47	0.27	0.11	-0.24	-0.18
Private consumption	DE_PCR	0.26	0.47	0.66	0.85	1.02	1.14	1.21	1.27	1.31	1.32	1.32	1.33	0.56	1.16	1.32	1.32	0.72	0.18
Government consumption	DE_GCR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gross fixed capital formation	DE_ITR	0.44	0.60	0.66	0.55	0.34	0.02	-0.34	-0.68	-1.01	-1.26	-1.48	-1.59	0.56	-0.17	-1.33	-2.02	-2.06	-0.53
Contribution of inventories (% of GDP)	DE_SCRRATIO	0.08	0.12	0.11	0.09	0.08	0.04	0.00	-0.03	-0.04	-0.05	-0.06	-0.05	0.10	0.02	-0.05	-0.03	0.00	0.00
Exports	DE_XTR	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.02	-0.02	-0.03	0.00	0.00	-0.02	-0.08	-0.21	-0.22
Imports	DE_MTR	0.23	0.38	0.43	0.44	0.42	0.35	0.25	0.17	0.10	0.04	0.00	0.00	0.37	0.30	0.03	-0.03	-0.06	0.10
Price Developments																			
GDP deflator at factor cost	DE_YFD	-0.01	-0.01	-0.01	0.01	0.02	0.04	0.06	0.10	0.13	0.17	0.21	0.26	0.00	0.06	0.19	0.57	1.21	1.18
Private consumption deflator	DE_PCD	-0.03	-0.03	-0.02	-0.02	0.00	0.03	0.06	0.09	0.12	0.15	0.19	0.22	-0.02	0.04	0.17	0.49	1.10	1.08
HICP	DE_HIC	-0.03	-0.03	-0.02	-0.02	0.01	0.04	0.07	0.10	0.14	0.17	0.20	0.23	-0.03	0.06	0.18	0.48	1.10	1.08
HICP energy	DE_HEG	0.00	-0.01	-0.01	0.00	0.01	0.02	0.04	0.06	0.09	0.13	0.16	0.20	0.00	0.03	0.15	0.50	1.08	1.05
HICP non-energy	DE_HEX	-0.04	-0.03	-0.02	-0.02	0.01	0.04	0.08	0.11	0.14	0.17	0.20	0.23	-0.03	0.06	0.19	0.48	1.10	1.08
Exports deflator	DE_XTD	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.06	0.07	0.09	0.00	0.02	0.07	0.22	0.52	0.53
Imports deflator	DE_MTD	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.04	0.06	0.07	0.09	0.00	0.01	0.07	0.22	0.49	0.48
Labour Market and Cost Developments																			
Compensation per employee (nominal)	DE_WUN	0.04	0.09	0.15	0.21	0.25	0.29	0.31	0.32	0.32	0.33	0.32	0.33	0.12	0.29	0.33	0.45	0.86	1.00
Compensation per employee (real, YED based)	DE_WUNY	0.05	0.10	0.16	0.20	0.24	0.25	0.25	0.22	0.19	0.15	0.11	0.07	0.13	0.24	0.13	-0.12	-0.34	-0.18
Compensation per employee (real, PCD based)	DE_WUNC	0.07	0.12	0.17	0.23	0.25	0.26	0.25	0.24	0.21	0.17	0.14	0.11	0.15	0.25	0.16	-0.04	-0.23	-0.08
Productivity	DE_PRO	0.23	0.32	0.36	0.35	0.32	0.23	0.12	0.03	-0.06	-0.14	-0.20	-0.23	0.31	0.17	-0.16	-0.35	-0.35	-0.15
ULC, whole economy	DE_ULC	-0.18	-0.22	-0.20	-0.14	-0.06	0.06	0.19	0.30	0.39	0.46	0.53	0.56	-0.19	0.12	0.48	0.80	1.22	1.15
Labour force	DE_LFN	0.01	0.02	0.04	0.06	0.09	0.11	0.14	0.17	0.19	0.22	0.24	0.26	0.03	0.13	0.23	0.29	0.08	-0.02
Employment	DE_LNN	0.02	0.06	0.11	0.16	0.22	0.28	0.33	0.37	0.40	0.43	0.44	0.46	0.09	0.30	0.43	0.47	0.11	-0.03
Unemployment rate	DE_URX	-0.01	-0.03	-0.06	-0.09	-0.12	-0.15	-0.17	-0.19	-0.19	-0.19	-0.19	-0.18	-0.05	-0.16	-0.19	-0.16	-0.03	0.01
Disposable Income and Total Wealth																			
Disposable income	DE_PYN	0.26	0.51	0.75	0.97	1.19	1.36	1.46	1.55	1.61	1.65	1.67	1.70	0.63	1.39	1.66	1.92	1.80	1.43
Compensation of employees	DE_WIN	0.06	0.15	0.26	0.37	0.48	0.57	0.64	0.69	0.73	0.75	0.77	0.79	0.21	0.60	0.76	0.92	0.97	0.97
Transfers from public sector	DE_TRN	0.24	0.35	0.43	0.47	0.48	0.42	0.33	0.27	0.20	0.16	0.13	0.15	0.37	0.37	0.16	0.35	0.89	1.01
Other personal income	DE_OPN	0.15	0.31	0.41	0.51	0.66	0.75	0.76	0.77	0.78	0.77	0.73	0.74	0.35	0.74	0.76	1.08	1.69	1.75
Direct taxes (inc. SSC)	DE_PDN	-0.31	-0.62	-0.93	-1.20	-1.43	-1.65	-1.86	-2.02	-2.16	-2.26	-2.35	-2.40	-0.77	-1.74	-2.29	-2.20	-0.66	0.57
Saving ratio	DE_SRATIO	0.00	-0.04	-0.10	-0.17	-0.26	-0.34	-0.42	-0.48	-0.53	-0.56	-0.58	-0.59	-0.08	-0.37	-0.57	-0.63	-0.48	-0.15
Disposable income (real)	DE_PYR	0.29	0.54	0.77	0.99	1.19	1.33	1.40	1.46	1.49	1.50	1.48	1.48	0.65	1.35	1.49	1.42	0.69	0.35
Total wealth (real)	DE_FWR	0.03	0.05	0.07	0.11	0.13	0.15	0.16	0.19	0.22	0.25	0.28	0.33	0.07	0.16	0.27	0.56	0.85	-0.97
Firms and Interest Rate																			
Capital stock	DE_KSR	0.01	0.02	0.03	0.03	0.04	0.04	0.03	0.02	0.01	-0.01	-0.04	-0.06	0.02	0.03	-0.03	-0.23	-0.84	-0.50
Short-term nominal interest rate	DE_STI	-0.03	0.05	0.21	0.34	0.42	0.51	0.55	0.54	0.50	0.45	0.40	0.35	0.14	0.50	0.42	0.30	0.06	0.01
Long-term nominal interest rate	DE_LTI	-0.02	0.03	0.10	0.15	0.17	0.21	0.23	0.23	0.22	0.22	0.21	0.20	0.07	0.21	0.22	0.22	0.12	0.01
Cost of capital (nominal)	DE_CC0	-0.14	0.41	1.66	2.48	3.36	4.07	4.58	4.56	4.54	4.28	4.08	3.78	1.11	4.15	4.17	4.05	2.83	1.51
Public Sector																			
Direct tax rate (inc. ssc)	DE_PDX	-0.10	-0.20	-0.30	-0.39	-0.47	-0.53	-0.59	-0.63	-0.67	-0.70	-0.72	-0.73	-0.25	-0.56	-0.70	-0.73	-0.43	-0.15
Other direct tax rate	DE_ODX	-0.08	-0.16	-0.24	-0.31	-0.37	-0.43	-0.47	-0.51	-0.54	-0.56	-0.57	-0.58	-0.20	-0.44	-0.56	-0.58	-0.35	-0.12
Tranfers to households rate	DE_TIX	0.00	0.00	0.00	-0.01	-0.01	-0.02	-0.02	-0.03	-0.04	-0.04	-0.04	-0.05	0.00	-0.02	-0.04	-4.46	-0.93	0.29
Public sector net debt (% of GDP)	DE_GDNRATIO	-0.13	-0.17	-0.16	-0.11	-0.01	0.15	0.34	0.53	0.74	0.94	1.15	1.33	-0.15	0.25	1.04	2.52	5.62	7.26
Public sector net lending (% of GDP)	DE_GLNRATIO	-0.07	-0.14	-0.25	-0.37	-0.46	-0.54	-0.62	-0.68	-0.72	-0.75	-0.78	-0.79	-0.21	-0.57	-0.76	-0.81	-0.51	-0.27

Table A8: Permanent shock to labour supply by 1 per cent
(deviations from baseline, in percentage points unless otherwise indicated)

Key macroeconomic variables	Acronyms	Year 1				Year 2				Year 3				Year 1	Year 2	Year 3	Year 5	Year 10	Year 250
		1q	2q	3q	4q	1q	2q	3q	4q	1q	2q	3q	4q						
Economic Activity *(constant prices)*																			
GDP	DE_YER	-0.02	0.13	0.11	0.30	0.39	0.54	0.61	0.67	0.71	0.72	0.76	0.75	0.13	0.55	0.74	1.05	0.92	1.25
Private consumption	DE_PCR	-0.01	0.09	0.12	0.21	0.27	0.36	0.43	0.47	0.52	0.54	0.58	0.58	0.10	0.38	0.56	0.85	0.93	1.24
Government consumption	DE_GCR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gross fixed capital formation	DE_ITR	-0.03	0.23	0.18	0.85	1.18	1.64	1.90	2.11	2.23	2.27	2.36	2.34	0.31	1.71	2.30	2.98	1.96	1.81
Contribution of inventories (% of GDP)	DE_SCRRATIO	-0.01	0.07	0.05	0.08	0.10	0.11	0.10	0.09	0.07	0.05	0.04	0.02	0.05	0.10	0.05	0.04	0.00	-0.01
Exports	DE_XTR	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.04	0.06	0.07	0.00	0.02	0.05	0.13	0.19	0.51
Imports	DE_MTR	-0.02	0.14	0.13	0.29	0.41	0.52	0.58	0.60	0.61	0.60	0.60	0.57	0.14	0.53	0.60	0.73	0.44	0.27
Price Developments																			
GDP deflator at factor cost	DE_YFD	0.00	0.00	-0.01	-0.06	-0.09	-0.15	-0.20	-0.27	-0.32	-0.40	-0.45	-0.52	-0.02	-0.18	-0.42	-0.89	-1.04	-2.65
Private consumption deflator	DE_PCD	-0.02	-0.04	-0.03	-0.07	-0.10	-0.13	-0.17	-0.21	-0.25	-0.30	-0.35	-0.40	-0.04	-0.15	-0.33	-0.77	-0.96	-2.43
HICP	DE_HIC	-0.02	-0.05	-0.03	-0.09	-0.11	-0.14	-0.18	-0.22	-0.26	-0.31	-0.36	-0.41	-0.05	-0.17	-0.34	-0.77	-0.96	-2.43
HICP energy	DE_HEG	0.00	0.00	0.00	-0.03	-0.05	-0.09	-0.14	-0.19	-0.25	-0.31	-0.37	-0.44	-0.01	-0.12	-0.34	-0.79	-0.92	-2.36
HICP non-energy	DE_HEX	-0.02	-0.05	-0.04	-0.09	-0.12	-0.15	-0.19	-0.22	-0.27	-0.31	-0.36	-0.41	-0.05	-0.17	-0.34	-0.76	-0.96	-2.44
Exports deflator	DE_XTD	0.00	0.00	0.00	-0.01	-0.03	-0.05	-0.07	-0.09	-0.11	-0.14	-0.17	-0.19	0.00	-0.06	-0.15	-0.35	-0.46	-1.20
Imports deflator	DE_MTD	0.00	0.00	0.00	0.00	-0.03	-0.04	-0.07	-0.08	-0.12	-0.14	-0.17	-0.19	0.00	-0.05	-0.15	-0.35	-0.42	-1.09
Labour Market and Cost Developments																			
Compensation per employee (nominal)	DE_WUN	-0.15	-0.22	-0.29	-0.35	-0.39	-0.43	-0.45	-0.49	-0.53	-0.58	-0.62	-0.69	-0.25	-0.44	-0.61	-0.93	-1.13	-2.40
Compensation per employee (real, YED based)	DE_WUNY	-0.15	-0.22	-0.29	-0.30	-0.30	-0.27	-0.25	-0.23	-0.20	-0.19	-0.17	-0.16	-0.24	-0.26	-0.18	-0.04	-0.10	0.25
Compensation per employee (real, PCD based)	DE_WUNC	-0.13	-0.18	-0.26	-0.28	-0.29	-0.29	-0.28	-0.29	-0.28	-0.28	-0.28	-0.29	-0.21	-0.29	-0.28	-0.16	-0.17	0.03
Productivity	DE_PRO	-0.03	0.09	0.03	0.18	0.22	0.30	0.32	0.31	0.30	0.26	0.25	0.19	0.07	0.29	0.25	0.20	-0.04	0.24
ULC, whole economy	DE_ULC	-0.12	-0.30	-0.32	-0.53	-0.61	-0.73	-0.76	-0.80	-0.82	-0.84	-0.87	-0.88	-0.32	-0.73	-0.85	-1.13	-1.09	-2.64
Labour force	DE_LFN	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Employment	DE_LNN	0.01	0.04	0.08	0.12	0.18	0.23	0.29	0.35	0.41	0.46	0.51	0.56	0.06	0.26	0.49	0.85	0.96	1.01
Unemployment rate	DE_URX	0.91	0.88	0.85	0.80	0.76	0.70	0.65	0.59	0.54	0.49	0.45	0.40	0.86	0.68	0.47	0.14	0.03	-0.01
Disposable Income and Total Wealth																			
Disposable income	DE_PYN	-0.04	0.05	0.10	0.15	0.20	0.26	0.31	0.30	0.31	0.29	0.27	0.21	0.07	0.27	0.27	0.09	-0.08	-1.31
Compensation of employees	DE_WIN	-0.14	-0.18	-0.21	-0.23	-0.22	-0.19	-0.16	-0.14	-0.12	-0.12	-0.11	-0.13	-0.19	-0.18	-0.12	-0.10	-0.18	-1.42
Transfers from public sector	DE_TRN	0.15	0.56	0.87	1.37	1.62	1.78	1.83	1.78	1.71	1.58	1.47	1.31	0.75	1.75	1.51	0.69	-0.11	-1.42
Other personal income	DE_OPN	0.05	0.21	0.29	0.23	0.24	0.29	0.33	0.28	0.27	0.24	0.20	0.09	0.19	0.28	0.20	-0.24	-0.22	-1.36
Direct taxes (inc. SSC)	DE_PDN	-0.04	0.04	0.09	0.12	0.15	0.18	0.19	0.14	0.12	0.06	0.02	-0.07	0.05	0.16	0.03	-0.40	-0.48	-1.65
Saving ratio	DE_SRATIO	0.01	0.04	0.01	0.06	0.07	0.09	0.09	0.08	0.07	0.05	0.05	0.03	0.03	0.08	0.05	0.05	-0.04	-0.11
Disposable income (real)	DE_PYR	-0.02	0.09	0.13	0.23	0.30	0.39	0.48	0.51	0.56	0.59	0.62	0.62	0.11	0.42	0.60	0.88	0.89	1.14
Total wealth (real)	DE_FWR	0.02	0.05	0.07	0.10	0.14	0.16	0.21	0.22	0.26	0.28	0.32	0.34	0.06	0.18	0.30	0.64	1.21	1.93
Firms and Interest Rate																			
Capital stock	DE_KSR	0.00	0.00	0.01	0.02	0.04	0.06	0.09	0.12	0.15	0.19	0.22	0.25	0.01	0.08	0.20	0.49	1.00	1.71
Short-term nominal interest rate	DE_STI	-0.02	-0.39	-0.49	-0.54	-0.55	-0.49	-0.41	-0.34	-0.30	-0.28	-0.28	-0.28	-0.36	-0.45	-0.28	-0.15	-0.08	0.00
Long-term nominal interest rate	DE_LTI	-0.01	-0.21	-0.20	-0.22	-0.21	-0.21	-0.18	-0.18	-0.17	-0.18	-0.18	-0.19	-0.16	-0.20	-0.18	-0.16	-0.07	0.00
Cost of capital (nominal)	DE_CC0	-0.15	-3.14	-3.83	-3.88	-4.33	-3.89	-3.68	-3.01	-3.07	-2.86	-3.13	-3.05	-2.76	-3.72	-3.02	-3.10	-2.25	-3.18
Public Sector																			
Direct tax rate (inc. ssc)	DE_PDX	0.00	0.00	0.00	0.00	0.00	-0.01	-0.02	-0.02	-0.03	-0.04	-0.04	-0.05	0.00	-0.01	-0.04	-0.09	-0.07	-0.06
Other direct tax rate	DE_ODX	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.02	-0.02	-0.03	-0.03	-0.04	0.00	-0.01	-0.03	-0.07	-0.06	-0.05
Tranfers to households rate	DE_TIX	0.02	0.06	0.10	0.15	0.17	0.18	0.19	0.18	0.17	0.16	0.15	0.14	0.08	0.18	0.16	0.07	0.00	0.00
Public sector net debt (% of GDP)	DE_GDNRATIO	0.02	-0.06	-0.07	-0.17	-0.21	-0.27	-0.31	-0.30	-0.30	-0.27	-0.26	-0.22	-0.07	-0.27	-0.26	-0.23	0.05	0.01
Public sector net lending (% of GDP)	DE_GLNRATIO	-0.03	-0.03	0.07	0.04	0.03	0.04	0.05	0.03	0.03	0.03	0.04	0.03	0.01	0.04	0.03	0.04	0.00	0.00

European Central Bank Working Paper Series

For a complete list of Working Papers published by the ECB, please visit the ECB's website (http://www.ecb.int)

600 "A speed limit monetary policy rule for the euro area" by L. Stracca, April 2006.

601 "Excess burden and the cost of inefficiency in public services provision" by A. Afonso and V. Gaspar, April 2006.

602 "Job flow dynamics and firing restrictions: evidence from Europe" by J. Messina and G. Vallanti, April 2006.

603 "Estimating multi-country VAR models" by F. Canova and M. Ciccarelli, April 2006.

604 "A dynamic model of settlement" by T. Koeppl, C. Monnet and T. Temzelides, April 2006.

605 "(Un)Predictability and macroeconomic stability" by A. D'Agostino, D. Giannone and P. Surico, April 2006.

606 "Measuring the importance of the uniform nonsynchronization hypothesis" by D. A. Dias, C. Robalo Marques and J. M. C. Santos Silva, April 2006.

607 "Price setting behaviour in the Netherlands: results of a survey" by M. Hoeberichts and A. Stokman, April 2006.

608 "How does information affect the comovement between interest rates and exchange rates?" by M. Sánchez, April 2006.

609 "The elusive welfare economics of price stability as a monetary policy objective: why New Keynesian central bankers should validate core inflation" by W. H. Buiter, April 2006.

610 "Real-time model uncertainty in the United States: the Fed from 1996-2003" by R. J. Tetlow and B. Ironside, April 2006.

611 "Monetary policy, determinacy, and learnability in the open economy" by J. Bullard and E. Schaling, April 2006.

612 "Optimal fiscal and monetary policy in a medium-scale macroeconomic model" by S. Schmitt-Grohé and M. Uribe, April 2006.

613 "Welfare-based monetary policy rules in an estimated DSGE model of the US economy" by M. Juillard, P. Karam, D. Laxton and P. Pesenti, April 2006.

614 "Expenditure switching vs. real exchange rate stabilization: competing objectives for exchange rate policy" by M. B. Devereux and C. Engel, April 2006.

615 "Quantitative goals for monetary policy" by A. Fatás, I. Mihov and A. K. Rose, April 2006.

616 "Global financial transmission of monetary policy shocks" by M. Ehrmann and M. Fratzscher, April 2006.

617 "New survey evidence on the pricing behaviour of Luxembourg firms" by P. Lünnemann and T. Y. Mathä, May 2006.

618 "The patterns and determinants of price setting in the Belgian industry" by D. Cornille and M. Dossche, May 2006.

619 "Cyclical inflation divergence and different labor market institutions in the EMU" by A. Campolmi and E. Faia, May 2006.

620 "Does fiscal policy matter for the trade account? A panel cointegration study" by K. Funke and C. Nickel, May 2006.

621 "Assessing predetermined expectations in the standard sticky-price model: a Bayesian approach" by P. Welz, May 2006.

622 "Short-term forecasts of euro area real GDP growth: an assessment of real-time performance based on vintage data" by M. Diron, May 2006.

623 "Human capital, the structure of production, and growth" by A. Ciccone and E. Papaioannou, May 2006.

624 "Foreign reserves management subject to a policy objective" by J. Coche, M. Koivu, K. Nyholm and V. Poikonen, May 2006.

625 "Sectoral explanations of employment in Europe: the role of services" by A. D'Agostino, R. Serafini and M. Ward-Warmedinger, May 2006.

626 "Financial integration, international portfolio choice and the European Monetary Union" by R. A. De Santis and B. Gérard, May 2006.

627 "Euro area banking sector integration: using hierarchical cluster analysis techniques" by C. Kok Sørensen, J. M. Puigvert Gutiérrez, May 2006.

628 "Long-run money demand in the new EU Member States with exchange rate effects" by C. Dreger, H.-E. Reimers and B. Roffia, May 2006.

629 "A market microstructure analysis of foreign exchange intervention" by P. Vitale, May 2006.

630 "Implications of monetary union for catching-up member states" by M. Sánchez, May 2006.

631 "Which news moves the euro area bond market?" by M. Andersson, L. J. Hansen and S. Sebestyén, May 2006.

632 "Does information help recovering structural shocks from past observations?" by D. Giannone and L. Reichlin, May 2006.

633 "Nowcasting GDP and inflation: the real-time informational content of macroeconomic data releases" by D. Giannone, L. Reichlin and D. H. Small, May 2006.

634 "Expenditure reform in industrialised countries: a case study approach" by S. Hauptmeier, M. Heipertz and L. Schuknecht, May 2006.

635 "Identifying the role of labor markets for monetary policy in an estimated DSGE model" by K. Christoffel, K. Kuester and T. Linzert, June 2006.

636 "Exchange rate stabilization in developed and underdeveloped capital markets" by V. Chmelarova and G. Schnabl, June 2006.

637 "Transparency, expectations, and forecasts" by A. Bauer, R. Eisenbeis, D. Waggoner and T. Zha, June 2006.

638 "Detecting and predicting forecast breakdowns" by R. Giacomini and B. Rossi, June 2006.

639 "Optimal monetary policy with uncertainty about financial frictions" by R. Moessner, June 2006.

640 "Employment stickiness in small manufacturing firms" by P. Vermeulen, June 2006.

641 "A factor risk model with reference returns for the US dollar and Japanese yen bond markets" by C. Bernadell, J. Coche and K. Nyholm, June 2006.

642 "Financing constraints and firms' cash policy in the euro area" by R. Pál and A. Ferrando, June 2006.

643 "Inflation forecast-based-rules and indeterminacy: a puzzle and a resolution" by P. Levine, P. McAdam and J. Pearlman, June 2006.

644 "Adaptive learning, persistence, and optimal monetary policy" by V. Gaspar, F. Smets and D. Vestin, June 2006.

645 "Are internet prices sticky?" by P. Lünnemann and L. Wintr, June 2006.

646 "The Dutch block of the ESCB multi-country model" by E. Angelini, F. Boissay and M. Ciccarelli, June 2006.

647 "The economic effects of exogenous fiscal shocks in Spain: a SVAR approach" by F. de Castro Fernández and P. Hernández de Cos, June 2006.

648 "Firm-specific production factors in a DSGE model with Taylor price setting" by G. de Walque, F. Smets and R. Wouters, June 2006.

649 "Monetary and fiscal policy interactions in a New Keynesian model with capital accumulation and non-Ricardian consumers" by C. Leith and L. von Thadden, June 2006.

650 "A structural break in the effects of Japanese foreign exchange intervention on yen/dollar exchange rate volatility" by E. Hillebrand and G. Schnabl, June 2006.

651 "On the determinants of external imbalances and net international portfolio flows: a global perspective" by R. A. De Santis and M. Lührmann, July 2006.

652 "Consumer price adjustment under the microscope: Germany in a period of low inflation" by J. Hoffmann and J.-R. Kurz-Kim, July 2006.

653 "Acquisition versus greenfield: the impact of the mode of foreign bank entry on information and bank lending rates" by S. Claeys and C. Hainz, July 2006.

654 "The German block of the ESCB multi-country model" by I. Vetlov and T. Warmedinger, July 2006.

ISSN 1561081-0
9 771561 081005