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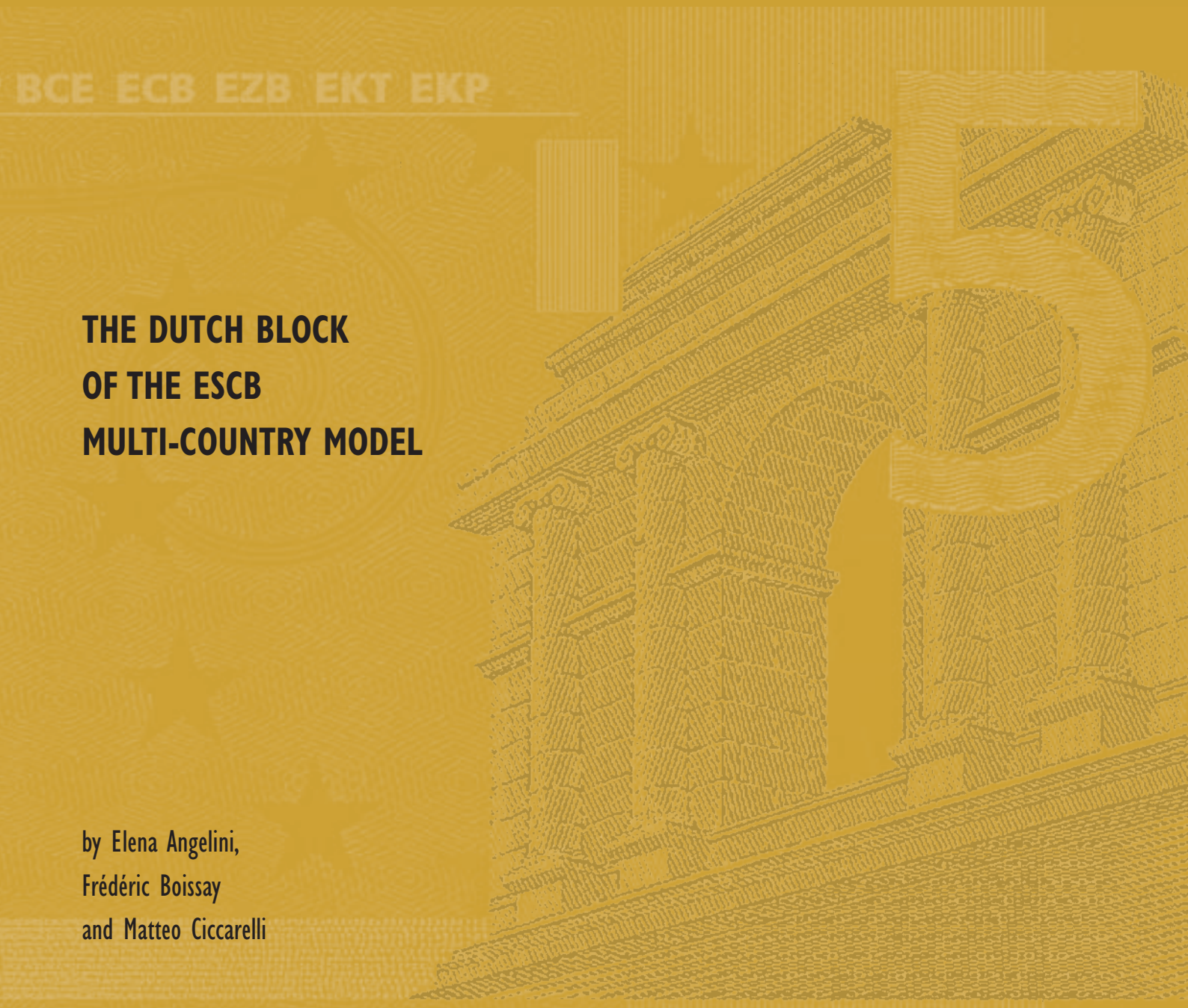

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CONTENTS

Abstract

The paper presents the Dutch country block of the ESCB Multi-Country Model (MCM) for the euro area. We show how a theoretical model is translated into an econometric specification and how this specification is in turn estimated and used in the projection exercises of the E(S)CB. The dynamic properties of the model are analyzed and the effects of six exogenous shocks to the economy discussed. The long run simulations performed deliver responses of the baseline economy in line with both macroeconomic theory and practice, from a quantitative and a qualitative point of view.

JEL: C3, C5, E1, E2

Key Words: Multi-country model, Forecast, Simulation, Netherlands

Non-technical Summary

This paper presents the Dutch country block of the ESCB Multi-Country Model (MCM) for the euro area. The model is standard in the tradition of the ECB Area-Wide Model and follows the specification of other MCM blocks (AWM, see Fagan et al. 2001, Boissay and Villetelle 2005, Willman and Estrada 2002). Given that the MCMs are mainly used in the quarterly Macroeconomic Projection Exercise of the ECB, having a common and standard theoretical structure was a way to ensure the comparability of the AWM and the MCM forecast figures. The theoretical structure of the Dutch MCM block is in line with most current macroeconometric models, i.e. the supply factors determine the long-run equilibrium, while in the short run aggregate demand determines aggregate output. The current version of the Dutch block is a traditional backward-looking model, in which expectations are treated implicitly by the inclusion of current and lagged values of the variables. The assumption by default concerning the policy regime is that of the monetary union, in which the interest rate, the exchange rate and foreign developments are exogenously given.

This paper includes a presentation of the model (i.e. its theoretical background and estimated equations), a presentation of the way the model is used in the context of the macroeconomic projection exercises of the ECB, as well as a discussion about the dynamic properties of the model. In particular, we analyze the effects of six exogenous shocks to the economy (prices, government consumption, oil price, exchange rate, world demand, and monetary policy shocks).

This presentation should be seen more as an intermediate report describing the current state of the work. The estimated equations of the model fit data reasonably well, and the adjustment paths to the long-run equilibrium are plausible. Among the problems that still need to be tackled is that the current model is backward-looking and thus eludes the treatment of expectations. In the current framework, notably, prices respond little to permanent shocks, and variations in wealth have no instantaneous effect on consumption. Another caveat of the current model is the absence of a financial block, which would probably allow for a finer analysis of the transmission of monetary policy.

1 Introduction

This paper describes the Dutch block of the ESCB Multi-Country Model (MCM) for the euro area. The model is standard in the tradition of the ECB Area-Wide Model and follows the specification of other MCM blocks (AWM, see Fagan et al. 2001, Boissay and Villetelle 2005, Willman and Estrada 2002). In these models, the supply-side determines the long run equilibrium, with long run prices fully adjusting, whereas the short run output is determined by the demand side, with a sluggish adjustment of prices and quantities towards equilibrium. The model has a total of 97 equations of which 18 are estimated behavioral equations. It is backward-looking and expectations are treated implicitly by the inclusion of current and lagged values of the variables in the equations. Nominal exchange rate and foreign developments are exogenous. The dynamics of short-term interest rates is described with a simple monetary rule. Since this model is part of the MCM modelling project of the ESCB Working Group on Econometric Modelling, some common features have been pre-defined within the working group (e.g. Phillips Curve, the choice of a Cobb Douglas production function). Moreover some features common to all five ECB MCM country blocks had to be maintained (especially in the trade equations) in order for the model to fit into the MCM-link model of the ECB, which links all five MCM country blocks together.

One of the main characteristics of the Dutch block (also present in the French block) is that the same model is used both for the projection exercises of the ESCB and for policy experiments. On the one hand, this feature has the advantage of making the model transparent. On the other hand, however, our specification is constrained by data availability: we are forced to use those variables that are needed to 'update' the model during the forecast.

The paper is organized as follows. In Section 2 we present an overview of the model equations after a brief introduction of the theoretical framework underlying the supply side. In Section 3 we describe the dynamic properties of the model, illustrating its uses in forecasting and in policy simulation analysis. Section 4 concludes.

2 The Model: theory and econometrics

As in most traditional macroeconometric models, only the supply side of the MCM is rigorously derived from optimizing neoclassical behavior. The supply side is of particular importance since labour and productivity drive aggregate output in the long run, while demand adjusts to supply through prices. The theoretical behavior underlying the specification of the supply side is that of a monopolistic firm. The latter faces a downward sloping demand function, and chooses the levels of labour, capital, and prices that maximize its profit. In what follows, we briefly describe the theoretical considerations behind the building of the model and illustrate the estimated equations for the supply and demand sides. A full description of the model equations can be found in the appendix.

2.1 Theoretical background: The Supply Side

2.1.1 The firm's programme

Firms maximize their profits given the technology and the demand addressed to them. The solution to the firms' profit maximization problem is given by individual prices P_i, labour demand L_i, capital demand K_i, and output Y_i which depend on the aggregate production level Y, the general price level P, real wages w/P (w being the nominal wage) and the nominal cost of capital c. By definition:

$$c \equiv P(r+\delta) \tag{2.1}$$

where r is the real rate of interest and δ is the physical depreciation rate of capital. We assume that there is no capital adjustment cost, so that the programme of the firm is static:

$$\begin{cases} \max\limits_{L_i,K_i} \Pi(Y_i) = P_i Y_i - wL_i - cK_i \\ s.t. \\ P_i = P\left(\frac{Y}{Y_i}\right)^{1/\varepsilon} \\ Y_i = AK_i^{\beta}\left(e^{\gamma t}L_i\right)^{1-\beta} \end{cases}$$

where $\varepsilon > 1$ is the elasticity of the demand for good i to its relative price and γ is the exogenous growth rate of technological progress. The new capital goods are homogenous to the consumption goods, and the price of new capital goods is P. Firms take the nominal capital cost and nominal wages as given, since the latter depend on the general level of price P.

$$\Leftrightarrow \begin{cases} \max\limits_{L_i,K_i} \Pi(Y_i) = PY^{1/\varepsilon} Y_i^{\frac{\varepsilon-1}{\varepsilon}} - wL_i - cK_i \\ s.t. \\ Y_i = AK_i^{\beta}\left(e^{\gamma t}L_i\right)^{1-\beta} \end{cases}$$

The solution of the programme is given by its first order conditions and, in the symmetric equilibrium (where $P_i = P$, $Y_i = Y$, $L_i = L$ and $K_i = K\ \forall i$), one obtains:

$$\begin{cases} (a): \quad L = e^{-\gamma t}\left[\frac{Y}{AK^{\beta}}\right]^{\frac{1}{1-\beta}} \\ (b): \quad K = \frac{Y}{Ae^{(1-\beta)\gamma t}}\left[\frac{\beta w}{(1-\beta)P(r+\delta)}\right]^{1-\beta} \\ (c): \quad \frac{w}{P} = \frac{(1-\beta)(\varepsilon-1)}{\varepsilon}\frac{Y}{L} \end{cases} \tag{2.2}$$

At this stage, given our assumption of constant returns to scale, the level of aggregate output is undetermined. These three relations determine the optimal capital to labour ratio, labour productivity, and real wages. To determine the levels of output, employment and capital, one more condition has to be met on the labour market side. In a frictionless economy where real wages adjust to labour productivity, the level of employment would adjust to the (exogenous) labour force and full employment would prevail. In equilibrium, aggregate output and the stock of capital would be determined by the level of the labour force. However, in an economy where firms and unions bargain on nominal wages, real wages are not only driven by labour

productivity, but also by the rate of unemployment. In this situation, real wages are set above their frictionless equilibrium level and unemployment arises. The equilibrium rate of unemployment and the exogenous labour force then determine the level of employment, the aggregate output and the stock of capital.

2.1.2 Phillips curve and NAIRU

Nominal wages are indexed to the level of prices, but also depend on the unions' bargaining power, which depends on the unemployment rate. This is modelled through the following general Phillips curve:

$$\Delta \log w = \Delta \log \widetilde{P} + \phi \left(\Delta \log Y - \Delta \log L \right) + \rho - \eta \log \left(u \right) \tag{2.3}$$

where ρ is a constant, η indicates the sensitivity of nominal wage increases to the unemployment rate (i.e. unions' bargaining power), u is the unemployment rate:

$$u \equiv \frac{\overline{L} - L}{\overline{L}} \tag{2.4}$$

and $\widetilde{P}$ is the price anticipations. ($\overline{L}$ denotes the active labour force.) In sum, this Phillips curve accounts for two types of rigidities. First, if inflation expectations are not perfect ($\Delta \log \widetilde{P} \neq \Delta \log P$) then nominal wages are not fully indexed on prices, thus meaning that *nominal wage rigidities* exist in the economy. Second, although nominal wages are flexible, real wages may not adjust perfectly to the marginal productivity of labour, unless $\phi = 1$ and $\eta = 0$. If $\phi < 1$ and $\eta > 0$, labour productivity is partly taken into account within the bargaining process, and wage developments depend on the unemployment rate.

The non-accelerating inflation rate of unemployment (NAIRU). From equation (c) of system (2.2) and considering a constant mark-up rate, one has:

$$\Delta \log P = \Delta \log w - \Delta \log Y + \Delta \log L \tag{2.5}$$

which, once substituted into the Phillips curve (2.3), gives the following relationship between inflation and unemployment:

$$\Delta \ln P = \Delta \ln \widetilde{P} + (\phi - 1) \left(\Delta \ln Y - \Delta \ln L \right) + \rho - \eta \log u$$

By definition, the $NAIRU$ is the unemployment rate which solves for $\Delta \ln P = \Delta \ln \widetilde{P}$ (i.e. foresights are perfect in the long run):

$$\log(NAIRU) = \frac{-(1-\phi)\left(\Delta \log Y - \Delta \log L \right) + \rho}{\eta} \tag{2.6}$$

The equilibrium rate of unemployment depends negatively on labour productivity growth (e.g. lower labour productivity growth requires higher unemployment to warrant constant inflation). To get the final expression for the $NAIRU$, we need to compute the long-term growth rates of Y and L. Assuming first that the $NAIRU$ is constant in the long run: $\Delta \log(NAIRU) = 0$ (to be checked *ex post*) then $\Delta \log L = \Delta \log \overline{L} = n$, where n is the growth rate of labour force. Moreover, relation (2.1) implies that $\Delta \log c = \Delta \log P$, and relation

(b) of system (2.2) implies that $\Delta \log K = \Delta \log w - \Delta \log P + \Delta \log L$, which, together with (2.5), yields $\Delta \log Y = \Delta \log K$. Finally, one obtains:

$$\Delta \log Y = \gamma + n$$

so that:

$$NAIRU = e^{\frac{-(1-\phi)\gamma+\rho}{\eta}} \tag{2.7}$$

which is constant. It is also positive, implying that $L^* < \overline{L}$.[1] As a result the growth rate of real wages is:

$$\Delta \log \left(\frac{w}{P}\right) = \gamma$$

A fundamental reason why the $NAIRU$ is constant in the long run is that we considered only one price in the model. Specifically, wages are indexed on the (domestic) firms' prices. In the estimation of the model, we will use a slightly different, more general specification that also includes the wedge between the consumer price and and the GDP deflator at factor cost in order to capture the effects of taxes and administered prices onto wages. As a consequence, the $NAIRU$ will also vary with this tax wedge.

2.1.3 Calibration of the Supply Side Parameters

The theoretical model contains 5 parameters (β, ε, γ, A, and n) and 5 real variables (Y, L, K, c/P, w/P). It is therefore possible to invert the model and solve it for the parameters. Denoting the sample mean operator by $\overline{(.)}$, and using system (2.2), we calibrated the parameters as follows:

- $\widehat{\beta} = \overline{\left(\frac{(r+\delta)K}{\frac{w}{P}L+(r+\delta)K}\right)}$ *(Elasticity of output to capital)*
- $\widehat{\varepsilon} = \overline{\left(\frac{PY}{PY-wL-cK}\right)}$ *(Elasticity of demand to prices)*
- $\widehat{\gamma} = \overline{\left(\Delta \log \left(\frac{w}{P}\right)\right)}$ *(Growth rate of labour productivity)*
- $\widehat{A} = \overline{\left(\frac{Y}{K^{\widehat{\beta}}(e^{\widehat{\gamma}t}L)^{1-\widehat{\beta}}}\right)}$ *(Scale factor in Cobb-Douglas production function)*
- $\widehat{n} = \overline{\left(\Delta \log(\overline{L})\right)}$ *(Growth rate of labour supply)*

2.1.4 Solving the model

The relations (2.3) and (2.4) close the model and enable the whole *real* side of the steady state of the economy to be solved. These two relations determine the $NAIRU$ and thereby the long run level of labour. The latter being given, the solution of system (2.2) provides the steady state levels of Y, K, and w/P as functions of the parameters of the model and the real cost of capital. The nominal variables of the model are not determined by the supply side and do not affect the real economy in the long run.

[1] Note that if $\phi = 1$ and $\rho = 0$ then $NAIRU = 1$.

Desired level of capital, long run real wages, and potential output. The desired level (or, equivalently, long run target) of capital, denoted by K^*, corresponds to the level of the capital stock that solves the maximization problem of the firm, for a given aggregate demand Y and a relative price of capital c/w (see equation (b) of system (2.2)):

$$K^* = \frac{Y}{Ae^{(1-\beta)\gamma t}} \left[\frac{\beta w}{(1-\beta)P(r+\delta)} \right]^{1-\beta} \tag{2.8}$$

In the MCM, the long run targets will appear in logarithms in the error correction term of the short run dynamic equations:

$$\log(K^*) = \log(Y) + (1-\widehat{\beta}) \left[\log \left(\frac{\widehat{\beta} w}{(1-\widehat{\beta})P(r+\delta)} \right) - \widehat{\gamma} t \right] - \log(\widehat{A}) \tag{2.9}$$

Basically, K^* depends on the (calibrated) elasticity of output to capital, $\widehat{\beta}$, and on labour productivity growth, $\widehat{\gamma}$. Experience shows that the gap $\log(K/K^*)$ between the current capital stock and its desired level may exhibit some drifts in-sample. In order to obtain a stationary gap, we have adjusted the latter with a deterministic term, denoted by t^a.[2] The gaps between the current values and the long run targets play a crucial role in the estimation of the short run dynamic behavioral equation as they serve to construct the error correction terms, which has to be mean stationary. Finally, the desired level of the capital stock that we used in the short run regressions of the model is in the form:

$$\log(K^*) = \log(Y) + (1-\widehat{\beta}) \left[\log \left(\frac{\widehat{\beta} w}{(1-\widehat{\beta})P(r+\delta)} \right) - \widehat{\gamma} t \right] + a_k + b_k t^a \tag{2.10}$$

where the coefficients a_k and b_k are estimated. In what follows, we will refer to these deterministic components as the "adjustment deterministic trends", as opposed to the usual *demographic* and *productivity* deterministic trends. The specificity of these adjustment trends is that they progressively go back to zero in the out-of-sample simulations (we will discuss this point later on). Using the standard capital accumulation equation[3]

$$K' = (1-\delta)K + I'$$

one can also derive the long run target for investment (I):

$$\log(I^*) = \log \left(\frac{\widehat{\gamma} + \widehat{n} + \delta}{1 + \widehat{\gamma} + \widehat{n}} \right) + \log(K^*) + a_i + b_i t^a \tag{2.11}$$

where K^* is defined by equation (2.10), so that I^* also depends on the real cost of capital. Similarly, potential output and the target value of real wages are respectively drawn from relations (a) and (c) of system (2.2):

$$\log \left(\frac{w^*}{P} \right) = \log \left(\frac{(1-\widehat{\beta})(\widehat{\varepsilon}-1)}{\widehat{\varepsilon}} \right) + \log \left(\frac{Y}{L} \right) + a_w + b_w t^a \tag{2.12}$$

[2] The superscript a stands for "adjustment". More precisely, the deterministic term t^a will be either a time trend or a dummy, according to what is necessary to have a good fit with the data.

[3] The prime refers to next period (quarter).

$$\log(Y^*) = \log(A) + \widehat{\beta}\log(K) + (1-\widehat{\beta})\log(L) + (1-\widehat{\beta})\widehat{\gamma}t + a_y + b_y t^a \tag{2.13}$$

Note that a standard feature of the MCMs is that the desired level of output is defined as a function of the *actual* levels of capital and employment in order to improve the statistical fit of the model.

The desired level of labour. As mentioned earlier, the Phillips curve is vertical in the long run. The long run unemployment rate, together with the exogenous labour force, determine the long run level of labour:

$$L^{**} = (1 - NAIRU)\overline{L} \tag{2.14}$$

With a constant $NAIRU$ and an exogenous labour force, this specification will however generally not provide a relevant target for the dynamics of actual employment. The reason is that the relevant information necessary to model the labour force and labour participation in a satisfactory way is not available in the MCM framework, where labour force is modelled as a simple autoregressive process. In order to have a good fit of the short run dynamic employment equation, we will therefore not use L^{**} in the definition of the error correction term. Instead, the common practice in the MCM framework is to define the latter as the difference between actual employment L and an ad hoc reference level L^*, which is derived from the production function (see equation (a) of system (2.2)):

$$\log(L^*) = \frac{1}{1-\widehat{\beta}}\left[\log(Y) - \widehat{\beta}\log(K) - \log(A)\right] - \widehat{\gamma}t + a_l + b_l t^a \tag{2.15}$$

Since this definition is a re-writing of relation (2.13)), the employment gap $L - L^*$ that we will use in the short run dynamic equation of labour is in fact a re-writing of the output gap $Y - Y^*$ (see Section (2.3.1)). In the long run, the convergence process of the supply side to its steady state takes place as follows. First, actual employment will converge toward the reference level L^*. Given equations (2.13) and (2.15), this ensures, by construction, that the output gap closes in the long run. Finally, employment adjusts to its long term level L^{**} thanks to the Phillips curve, whose verticality in the long run warrants that the unemployment rate converges toward the NAIRU and, therefore, that L converges toward L^{**} (see relations (2.4) and (2.14)).

2.2 Demand Side

In order to allow a flexible econometric estimation of GDP components, the specification of the demand side of the MCM is not formally derived from microeconomic theory and does not refer to one unique theory.

2.2.1 Households' behavior

The households sector only includes one behavioral equation for private consumption, which is a fairly standard specification (see e.g. Muellbauer (1994) for a survey of the currently used specification). We do not consider housing investment separately. Private consumption (PCR) is a function of real disposable income (PYR), comprising compensation, transfers of taxes and other income, and of real financial wealth (FWR), defined

as cumulated savings under the assumption that households own all of the assets in the economy (i.e. public debt, net foreign assets, and private capital stock):

$$\log(PCR^*) = a + b\log(PYR) + c\log(FWR) + \varepsilon \tag{2.16}$$

where a, b, c are coefficients and ε denotes all other factors, including relevant adjustments in terms of dummies or trends (e.g. Section 2.1.4, where an adjustment trend included whenever necessary.) This specification is a compromise between the life-cycle theory, which relates consumption to permanent income, and the basic Keynesian consumption theory, which relates consumption to current real disposable income.

2.2.2 Trade

Real exports (XTR) and imports (MTR) are modelled in a standard fashion, whereby market shares (in terms of world demand, WDR, and domestic demand, WER, respectively) are a function of a competitiveness indicator involving export and domestic prices (XTD and YFD respectively) and competitors' prices on the import and the export side (MTD and CMD respectively). The latter are computed as a weighted average of external and internal prices. This approach to modelling trade is in line with e.g. Goldstein & Kahn (1985). The external indicators for demand and prices as well as the effective exchange rate are based on weighted averages of indicators for the main trade partners of the Netherlands. Therefore, the export and import equations take the following form:

$$\begin{aligned} \log(XTR^*) - \log(WDR) &= c + \underset{(-)}{d}\log\left(\tfrac{XTD}{CMD}\right) + \varepsilon_{xtr} \\ \log(MTR^*) - \log(WER) &= e + \underset{(-)}{f}\log\left(\tfrac{MTD}{YFD}\right) + \varepsilon_{mtr} \end{aligned} \tag{2.17}$$

where the coefficients d and f are (expected to be) negative.

2.3 The estimated equations

Equations were estimated using ESA 79 seasonally adjusted quarterly macroeconomic aggregates on the sample 1980q1-2002-q4. The econometric methodology relies on a two-step cointegration approach: first we have estimated the long run relations, then we have estimated the dynamic model equation by equation. Dynamic homogeneity conditions have been imposed throughout the estimation process to guarantee that the supply side of the economy converges exactly to what theory predicts in the long run. All dynamic equations are backward-looking and expectation formation mechanism has not been explicitly modelled.

In order to understand how the supply side of the economy exactly converges to what theory predicts in the long run, the following general error correction model must be considered, with $\phi(.)$ and $\varphi(.)$ being lag-polynomials, y the endogenous variable, and x a vector of explanatory variables (in logarithm):

$$\phi(L)\Delta y_t = \varphi(L)\Delta x_t - \mu(y_{t-k} - \beta x_{t-k}) + \epsilon_t$$

The term in levels $y_{t-k} - \beta x_{t-k}$ is the error correction term and βx_{t-k} is what we called the long run target of y. Assuming that a balanced growth path exists and that x and y grow at the constant rates g_x and g_y in the long run, the steady state levels of x^* and y^* satisfy the relationship:

$$\phi(1)g_y = \varphi(1)g_x - \mu(y^* - \beta x^*)$$

Moreover, the long run relationship $y^* = \beta x^*$ implies that $g_y = \beta g_x$. Consequently, the long-term relationship and the short-term dynamic equation are both consistent with a balanced growth path if, and only if, $\beta\phi(1) = \varphi(1)$. We impose this dynamic homogeneity constraint when estimating the dynamic equations on the supply side. All such restrictions have been tested as to illustrate the rigidity of the theory in relation to the data considered. On the demand side no restrictions have been imposed. Thus, the steady state levels will be equal to the targets *modulo* a constant, which depends on the estimated coefficients of the short run equation, as well as on the growth rate of the explanatory variable, i.e.

$$y^* = \beta x^* - \left[\frac{\beta\phi(1) - \varphi(1)}{\mu}\right] g_x.$$

The following description of the estimated econometric model first, reports the most important long run targets of the model and then, illustrates the estimation of the short run dynamic equations. (The targets for the remaining variables can be easily derived from the appendix.) The notation used is standard in the MCM tradition. Specifically, the variable "$XSTAR$" will denote the long run target of the variable "X", unless stated differently. All the dynamic behavioral equations of the model are estimated as error correction models, where the error correction term is the differences between the actual data and the long run targets. The latter converges to the steady state of the model as all (price) adjustments operate. As repeatedly remarked, while targets on the supply side are rigorously derived from the theory, those on the demand side are not.

2.3.1 The Supply side

Targets The long run targets of the supply side are based on the four behavioral equations derived in the previous subsection, i.e., (2.10), (2.12), (2.13) and (2.15). However, for various practical reasons (e.g. national accounting consistency, realism of the model), the empirical model needs to be more detailed than its theoretical counterpart. It therefore includes various decompositions of the main aggregates. In particular, we make the distinction between the public and the private sectors (e.g. for capital, consumption, investment, labour, etc.). Other important refinements include the heterogeneity of goods and a specific treatment of consumption goods, housing investment, non-housing investment, inventories, foreign goods, etc. In terms of estimation, the theoretical model is translated into an econometric model by adding constants, trends and dummies that have the twofold objective of making the model fit the data in a better way and of having the error correction term behave properly.

The parameters used to compute the long run targets on the supply side are calibrated to match long run averages of the data, as described in section 2.1.3. Their values are reported in the table below.

Calibrated parameters		
factor share	$\widehat{\beta}$	0.336
growth rate of productivity	$\widehat{\gamma}$	0.002
growth rate of labour force	$\widehat{n}$	0.004
demand elasticity	$\widehat{\varepsilon}$	5.763
scale factor in C-D production	$\widehat{A}$	3.167
target inflation rate	π^*	0.005
depreciation of capital	$\widehat{\delta}$	0.010
NAIRU	$nairu$	0.063

Although these values are in line with those calibrated in other MCM blocks, it is important to point out to specific issues of the Dutch block. First, having calibrated the growth rate of productivity over the sample period 1985-2002, its value is higher than the one obtained over the period 1996-2002, given the productivity slowdown. Specifically, $\hat{\gamma}$ would be half of the one presented here, i.e., 0.3% on an annual basis or 0.001 on a quarterly basis (against 0.002 in our calibration). Nevertheless, we have decided to keep it equal to 0.002 for consistency within the model, in order to have the most homogeneous estimation period. Moreover, from an economic perspective, if the parameter is calibrated over the most recent period, one could make the debatable assumption that the recent productivity slowdown is permanent. Second, the factor share parameter value $\widehat{\beta}$ is calibrated to 0.336 whereas in MORKMON (DNB's quarterly model for the Netherlands model) the Nederlandsche Bank (DNB) applies a value of 0.15 which implies a labour share of income of more than 80 percent. The value that we set is consistent both with the specification of the production function as a Cobb-Douglas with two factors, and with the general literature on growth empirics. As for other parameters, we prefer to apply our own value in order to maintain a stronger coherence in the estimation sample so that all important empirical features of the model entail the same information set. Finally, a NAIRU set equal to 6.3% may appear somewhat high. However it has been computed using the theoretical supply side and calibrated to the long run mean of unemployment implied by the estimation of the equation over the same sample period used for the other parameters as above-mentioned.

The equations for the long run targets of the supply side are reported in the following tables.

$\log(YFT)$ - eq. (2.13)		
	coeff	t-stat
cst	1.153	–
$\log(KSR)$	0.336	–
$\log(LNN)$	0.664	–
$TIME$	0.001	–
$ONES$	−0.029	−10.84
$TREND$	0.001	11.99

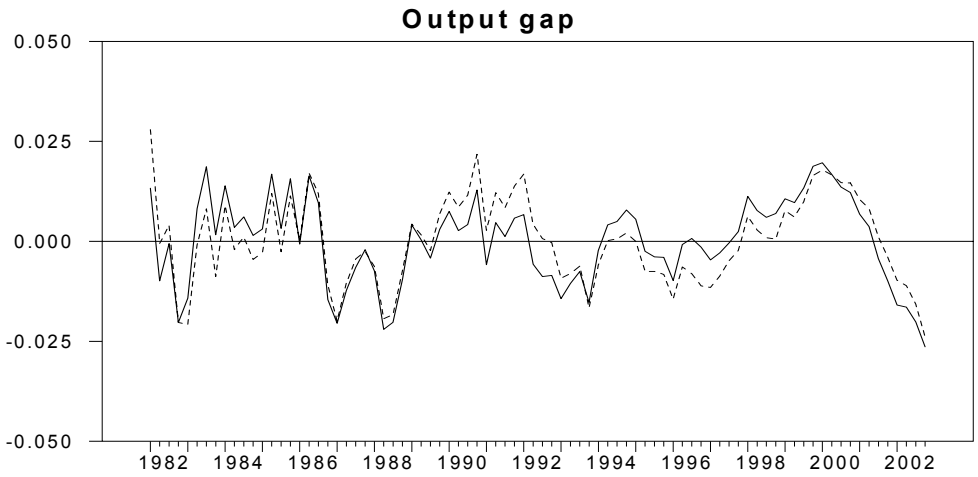
$\log(LSTAR)$ - eq. (2.15)		
	coeff	t-stat
cst	−1.796	–
$\log(KSR)$	−0.506	–
$\log(YER)$	1.506	–
$TIME$	−0.002	–
$ONES$	0.044	10.84
$TREND$	−0.001	11.99

$\log(KSTAR)$ - eq. (2.10)		
	coeff	t-stat
cst	−1.605	–
$\log(WUN/YFD)$	0.664	–
$\log(YER)$	1.000	–
$\log(CCR)$	−0.664	–
$TIME$	−0.001	–
$ONES$	0.102	4.91
$DUMT951_t$	−0.283	−8.38

$\log(RWUNSTAR)$ - eq. (2.12)		
	coeff	t-stat
cst	−0.600	–
$\log(PRO)$	1.000	–
$ONES$	−0.034	−16.7

The additional variables $ONES$, $TREND$ and $DUMT951_t$ correspond to the *ad hoc* adjustment terms mentioned above. The coefficients of these adjustment terms are the only estimated coefficients of the supply side. Their standard error is reported to check for significance. These terms play an important role in-sample as they improve the statistical fit of the model and make the error correction term behave more properly (i.e. they are mean stationary) than without the adjustment. However, in order for these adjustments not to distort the long run behavior of the model, they are progressively made return to zero in the out-of-sample exercises. (A detailed list of dummies and trends with the corresponding equations where they have been used is in the appendix.)

Two further remarks are in order here. First, the target of real wages ($RWUNSTAR$) is defined as the ratio of nominal wage to GDP deflator at factor cost. This variable, therefore, acts as a target for both the nominal wages and the GDP deflator and it will be present in both the Phillips curve and the dynamic equation of the GDP deflator. Second, we want to stress the importance of the long run target for the production function (potential output) YFT, which enters our definition of the output gap: $YGA \equiv YER/YFT$. In order to get an idea about the fit induced by the model for this variable, the following graph plots the (log of) output gap implied by our MCM equation for the potential output, together with the (log of) output gap implied by a simple Hodrick-Prescott filter of the same variable (dashed line).



The choice of the Phillips-Curve framework, which as afore-mentioned is a common feature of all MCM blocks of the ESCB models, is debatable and perhaps not completely suitable for the Dutch economy and its institutional set-up. "A right to manage" approach which allows for a very strong negotiations component could be more suitable. For example, the compensation per head equation could include: (i) a tax wedge to capture how differences in the real labour costs paid by the employer and the post-tax consumption wage faced by the worker might lead to real wage resistance; (ii) a price wedge, to capture the fact that negotiations on the part of the producer are based on producer prices, whereas on the part of the workers they are based on consumer prices; and finally, (iii) a replacement rate to reflect the choice that workers have between coming in and out of employment as captured by unemployment benefits and wages. Unfortunately such detailed data is missing from our MCM database as well as from our current forecasting infrastructure. These specifications could be introduced in future versions of the model.

Short run dynamics As said above, the dynamic specification is standard and homogenous across all the equations. It takes the form of an error correction mechanism, where the error correction term is the gap between the actual series and its long run target. The Phillips curve and the dynamic equations of the supply side are estimated under constraints in order to have the steady state satisfy its theoretical foundations. All restrictions have been tested. In some cases step dummies or seasonal dummies have been added to the specification to improve the in-sample fit.[4] The first estimated equation we report here is the Phillips curve, which plays a crucial role in the determination of the NAIRU and the steady state of the economy.

[4] The full equations are given in the appendix.

Phillips curve

Endogenous: $\Delta \log \left(\frac{WUN}{PCD}\right)$

Explanatory variables:	coefficient	t-stat
cst	0.002	7.24
$\Delta \log \left(\frac{WUN(-1)}{PCD(-1)}\right)$	−0.218	−2.43
$\Delta \log(PRO)$	0.138	1.38
$\log(URX/100) - \log(NAIRU)$	−0.004	−2.64
$\Delta \log \left(\frac{PCD}{YFD}\right)$	−0.545	−4.34
$\log \left(\frac{WUN(-1)}{YFD(-1)}\right) - \log(RWUNSTAR(-1))$	−0.099	−2.21

$R^2 = 0.41,\ DW = 1.54,\ \ \sigma_\varepsilon = 0.0063$

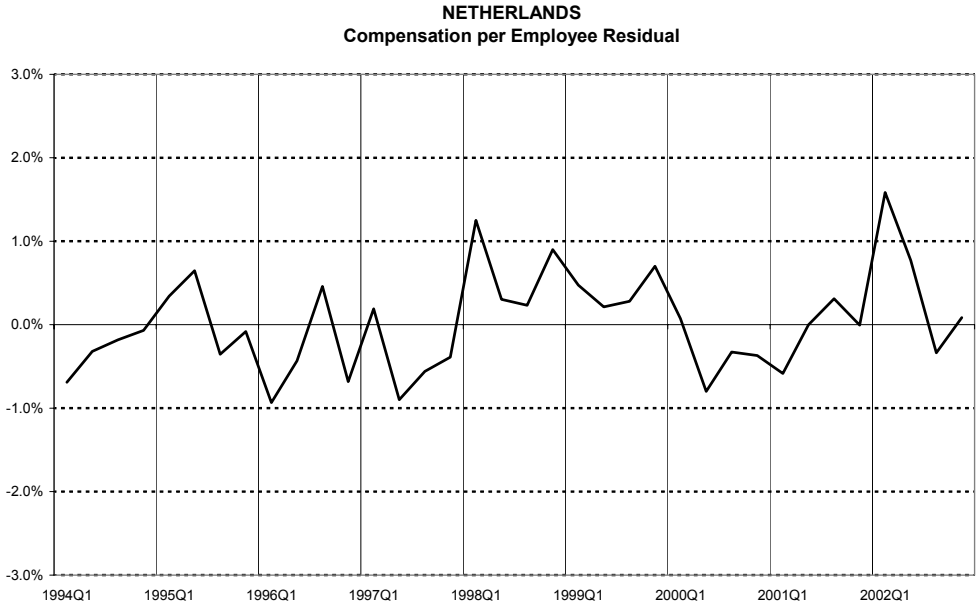
Nominal wages are indexed on the private consumption deflator in the short run and on the GDP deflator in the long run. The wedge between these two deflators PCD/YFD captures the effects of taxes, administered prices, as well as those of relative import and energy prices on wage bargaining.[5] The coefficient of this wedge is significantly negative, meaning that nominal wage increases do not fully offset non-domestic and tax inflation.[6] The equation also includes the rate of unemployment as an indicator for firms' bargaining power.

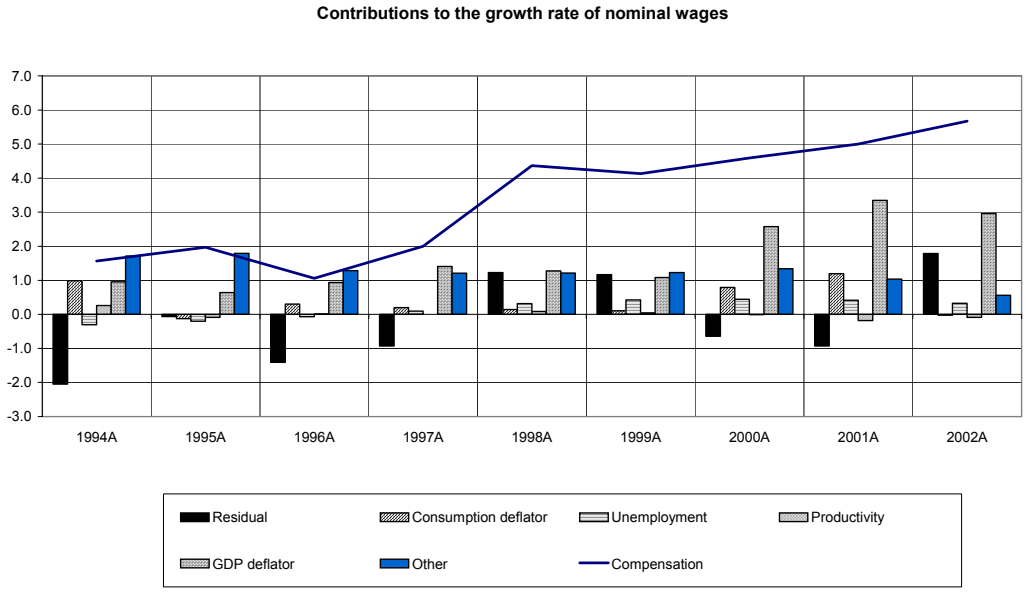
The Phillips curve has been estimated under some restrictions on the coefficients, in order to ensure its "dynamic homogeneity" as explained in section 2.3. Specifically, in accordance with the theory we impose that both productivity and real wages grow at rate $\widehat{\gamma}$ in the long run. On the other hand, unemployment rate is forced to converge to a constant $NAIRU$, whereas both consumers and producers deflators grow at the same rate in the long run. Consistently with these requirements, the coefficients of the equation satisfy the restriction $(1 + 0.218 - 0.138)\widehat{\gamma} \simeq 0.002$. The resulting Wald statistics for testing this restriction is 0.66, and its p-value is approximately 0.42. In words this means that the restriction is not rejected by the data according to the standard significance levels.

The following two charts report respectively the residual of nominal wages growth rate and a decomposition of its main contributing variables over the sample 1994-2002.

[5] Note that in the standard MCM framework WUN is the nominal compensation "per head" (not "per employee"). Therefore, variations in WUN are affected by the changes in the share of self-employed in total employment.

[6] One example of this imperfect indexation is that of the minimum wage increases, which are based on inflation *excluding* tobacco.





The most important price in the model is the GDP deflator at factor cost. All the other domestic prices present in the model are derived, explicitly or implicitly, from it. In the long run, the GDP deflator at factor cost is driven by the pricing behavior of firms modelled in Section 2.1. As shown there (Eq. 2.5), firms set their prices with respect to nominal wages and to labour productivity, and $RWUNSTAR$ acts as a long run target for the GDP deflator as well. Its short run dynamics is simply a function of the output gap and of the import deflator, as detailed in the table below.

Price Equation

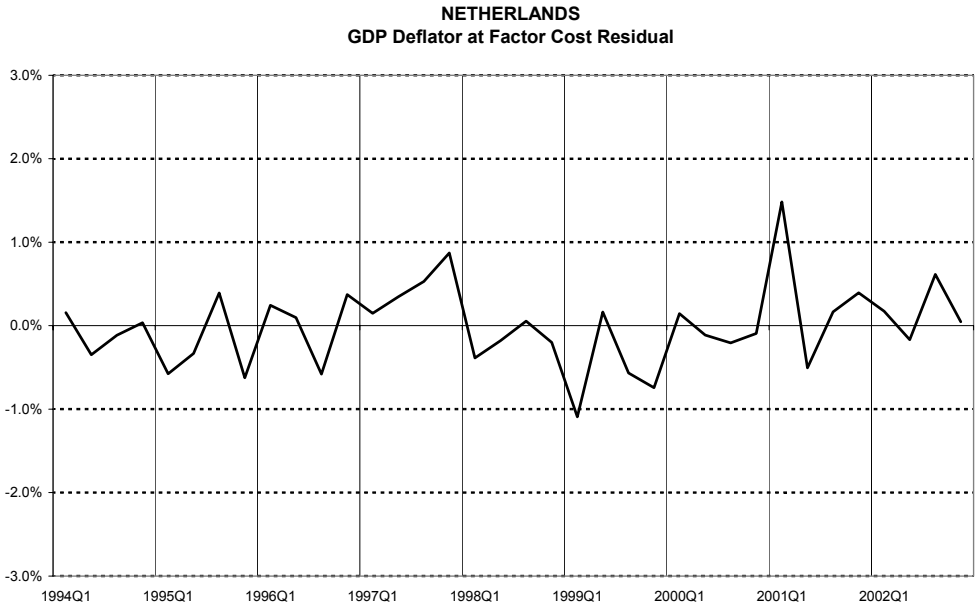
Endogenous: $\Delta \log (YFD)$

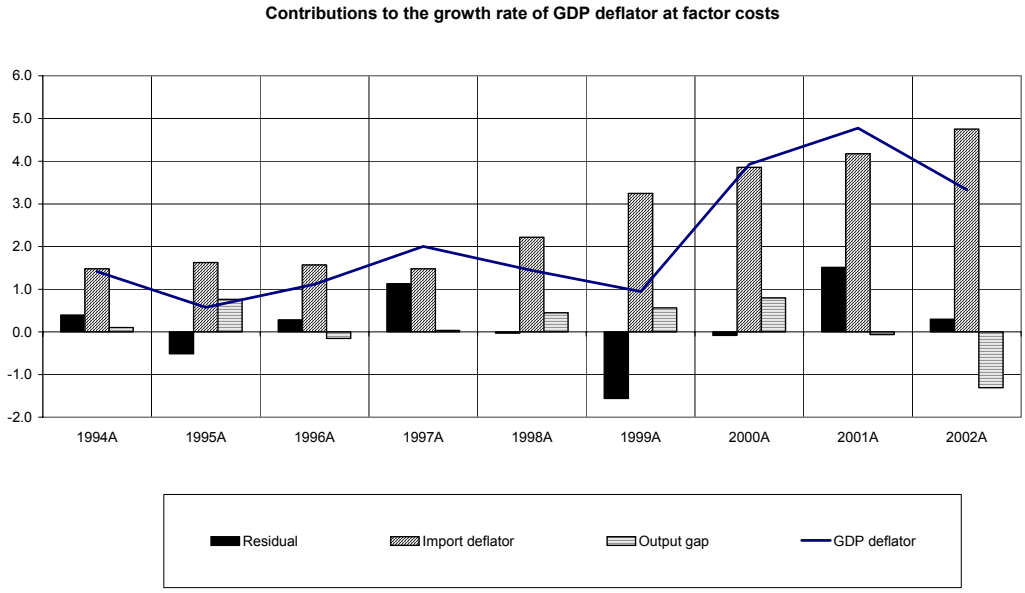
Explanatory variables:	coefficient	t-stat
cst	0.004	22.7
$\log (YGA(-1))$	0.108	2.76
$\Delta \log (MTD(-1))$	0.231	2.91
$\log(RWUNSTAR(-1)) - \log\left(\frac{WUN(-1)}{YFD(-1)}\right)$	-0.165	-2.90

$R^2 = 0.23,\ DW = 2.14,\quad \sigma_\varepsilon = 0.0060$

Similarly to the Phillips curve, we have estimated this equation with constraints on its coefficients in order to ensure its dynamic homogeneity. Concretely, the coefficients satisfy the relation $(1 - 0.231)\pi^* \simeq 0.004$. Such a restriction is not rejected at the 5% level by the Wald test. In fact, the numerical value of the Wald statistics is 0.48 and its significance level is around 0.49.

The contribution chart below shows that the import deflator has been contributing to GDP deflator growth relatively more than the output gap.





As a final equation for the supply side we report the one for employment. Total employment is a weighted sum of government (12.5%) and private employment (87.5%). In the MCM only the latter is modelled. Its variations are mainly due to variations in output, as reported in the following table and graphed by the contribution chart.

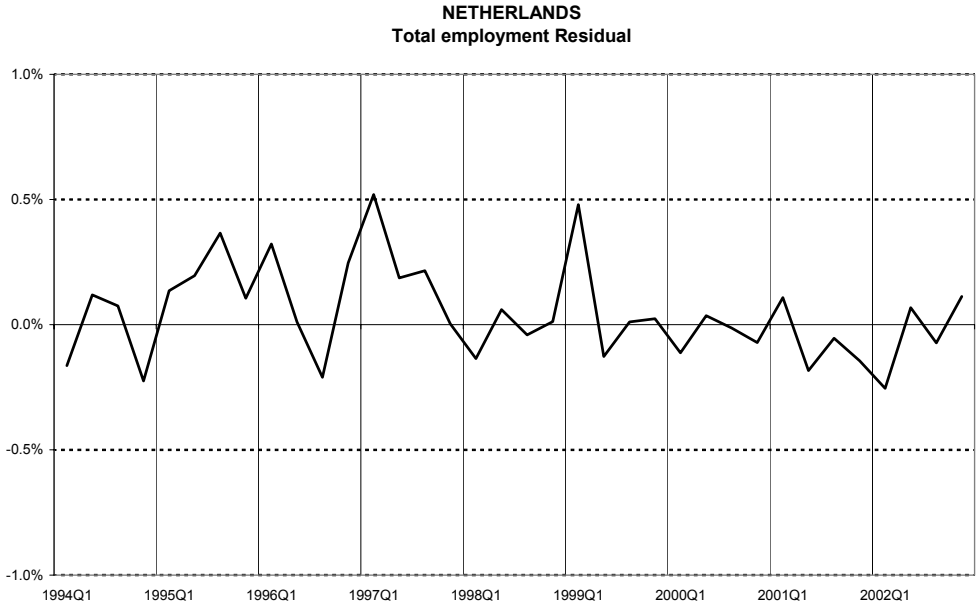
Employment

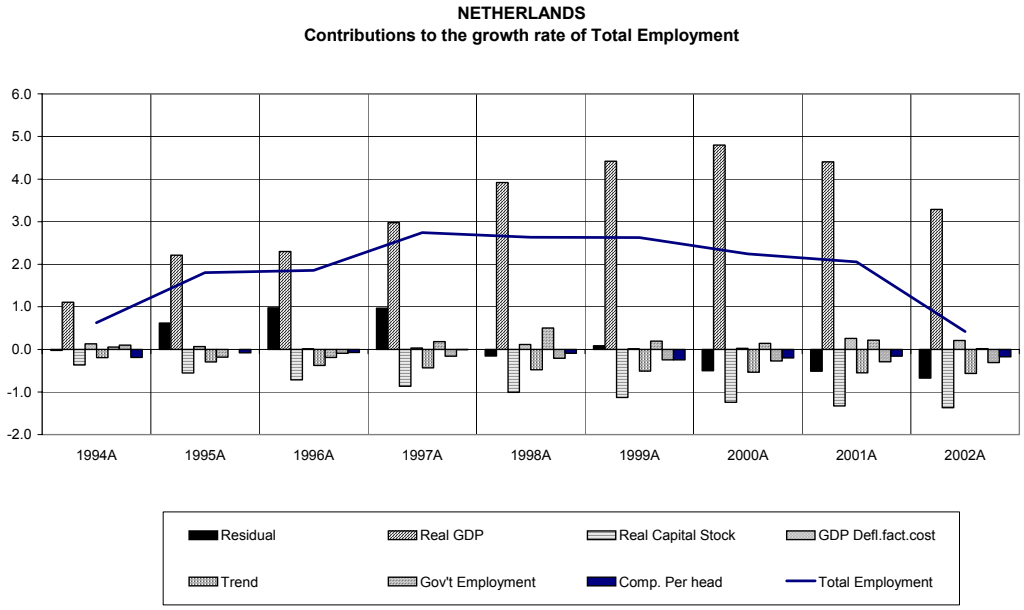
Endogenous: $\Delta \log (LNN)$

Explanatory variables:	coefficient	t-stat
cst	0.001	3.64
$\Delta \log (LNN(-1))$	0.436	4.85
$\Delta \log (YER)$	0.068	2.02
$\Delta \log (YER(-3))$	0.105	2.33
$\Delta \log (WUN(-3)/YFD(-3))$	−0.069	−2.06
$\log(LNN(-1)) - \log (LSTAR(-1))$	−0.048	−2.78

$R^2 = 0.40,\ DW = 2.27,\ \ \sigma_\varepsilon = 0.0021$

The coefficients of this equation satisfy the relation $\widehat{n} = 0.001 + 0.436\widehat{n} + (\widehat{n} + \hat{\gamma})\,(0.068 + 0.105) - 0.069\hat{\gamma}$. As for the other equations of the supply side, the restrictions is statistically not rejected by the data. The Wald test is equal to 2.39 with a significance level equal to 0.122.





Two final important remarks concerning the reported restrictions are in order here. First, the short run dynamic equations of nominal wages (Phillips curve) and the GDP deflator are restricted in order to make the unemployment rate converge to the $NAIRU$ in the long run. By constraining the GDP deflator we ensure that the error correction term converges to zero in the long run, i.e. that real wages (WUN/YFD) converge to their target value ($RWUNSTAR$). On the other hand, given that real wages converge to their steady state, the constraint on the Phillips curve implies that the unemployment rate converges to the $NAIRU$. Second, and similarly, the short run dynamic equation of employment is restricted to have the output gap close in the long run. This is easily seen in the expressions of YFT and $LSTAR$ in section 2.1, which both

stem from the Cobb-Douglas production function. YFT is defined with respect to LNN, while $LSTAR$ is defined with respect to YER. Therefore, by construction, when LNN converges to $LSTAR$, YER converges to YFT.

2.3.2 Demand side and prices

As already remarked, the econometric specification of the demand side is not formally derived from micro-economic fundamentals and combines instead several theories. In this section we describe both the long run and the short run dynamics of domestic demand, foreign demand and prices.

Targets For the households sector, the MCM contains only one behavioral equation for private consumption. In the AWM and the MCM tradition, private consumption (PCR) is a weighted average of total real net financial wealth (FWR) and real disposable income (PYR). The former is defined as cumulated savings under the assumption that households own all assets in the economy, i.e. public debt, net foreign assets and private capital stock. The latter includes compensation, transfers and other personal income. For investment, the long run target is derived from equation (2.11). Regarding prices we report below only the target for the HICP excluding energy, which is assumed to be a function of unit labor costs. The estimation of the long run of these variables is reported in the following tables.

$\log(PCRSTAR)$

	coeff	t-stat
cst	-1.445	-4.86
$\log(PYR + PYR(-1))$	1.000	–
$\log(FWR/PYR)$	0.191	2.09

$\log(IPRSTAR)$

	coeff	t-stat
cst	0.016	–
$\log(KSTAR)$	1.000	–
$ONES$	-0.009	-0.21
$TREND$	-0.007	-9.61

$\log(HEXPSTAR)$

	coeff	t-stat
cst	5.089	594.5
$\log(WUN/PRO)$	1.000	–
$TREND$	0.0004	2.44

Concerning the foreign demand side, in the long run real exports (XTR) and real imports (MTR) are modelled in terms of market shares. i.e. as ratios of world demand (WDR) and domestic demand (WER) respectively. They are functions of a competitiveness indicator comprising export prices and export competitors' prices (XTD and CXD) for exports, and import and domestic price (YFD and MTD) for imports. Competitor prices are computed as weighted averages of external and internal prices. As usual, the specification has been

adjusted to include trends and dummies which have proven to be useful to make the error correction term behave properly.

$\log(MTRSTAR)$		
	coeff	t-stat
cst	−0.351	−67.2
$\log(WER)$	1.000	–
$\log(MTD/YFD)$	−0.136	−4.61
$D891924$	0.031	5.65
$T931$	0.003	14.6
$DUMT951$	0.016	1.99

$\log(XTRSTAR)$		
	coeff	t-stat
cst	11.388	602.1
$\log(WDR)$	1.000	–
$\log(XTD/CXD)$	−0.118	−2.77
$TREND$	−0.002	−14.04
$D934$	0.070	30.0
$DUMT951$	0.023	5.17

One important remark is in order here. Although the price elasticity of the desired level of imports is, as expected, slightly higher than the one of the desired level of exports, the coefficient estimates do not satisfy the Marshall-Lerner conditions. For the simulation analysis (see Section 3) these elasticities are calibrated to higher levels for the model to converge toward its steady state. As the Netherlands is a small open economy, there is a great need to maintain a good level of competitiveness. Clearly, the estimated price elasticities are quite small for the long run relationship. In MORKMON, DNB has estimated their sum to be -1.1. Although our estimates may seem a bit low (and need to be calibrated to higher values in the long run simulations) they are supported by the data and the constraints of our specification. The values of our coefficients have been estimated on the largest possible sub-sample, in order for the estimates to incorporate information on the long run properties of the series used. Conditional on the data availability and the common setup for the MCM blocks, different specifications and sub-samples were tested. What we are reporting is the best possible estimated outcome we could achieve.

Finally, the following tables report the estimation for the long run import and export prices (MTD and XTD respectively), which depend not only on domestic and competitor prices, but also on oil prices. This is a peculiarity of the Dutch block due to the fact that the Netherlands is also an exporter of oil. PEI is the price of imported energy and POILU is the price of oil in US dollars. They are included in the equations to capture the evolution of energy prices in the import market.

Notice that the coefficients of the three main regressors sum up to one in the long run equations of both import and export prices. This implies that at the steady state of the economy these deflators will grow at the same rate π^*.

$\log(MTDSTAR)$		
	coeff	t-stat
cst	-0.508	-17.8
$\log(YFD)$	0.434	14.3
$\log(CMD)$	0.487	14.0
$\log(PEI)$	0.079	10.7
$TREND$	-0.002	-23.6

$\log(XTDSTAR)$		
	coeff	t-stat
cst	-0.301	-7.97
$\log(CXD)$	0.456	8.07
$\log(YFD)$	0.489	9.50
$\log(EXR \cdot POILU)$	0.054	5.71
$TREND$	-0.003	-16.7

Short run dynamics The short run dynamics of real private consumption is mainly driven by past consumption, real disposable income and the gap from the desired level of consumption $PCRSTAR$. We have included in the specification also past values of the unemployment and the long term real interest rates to capture both the influence of the labour market and the effects of monetary policy.

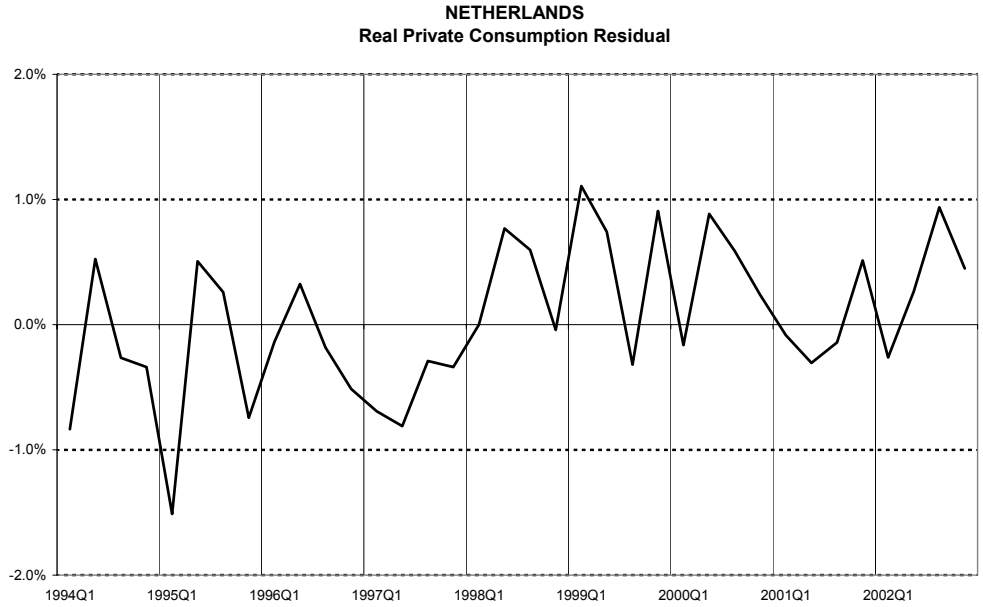
Real private consumption

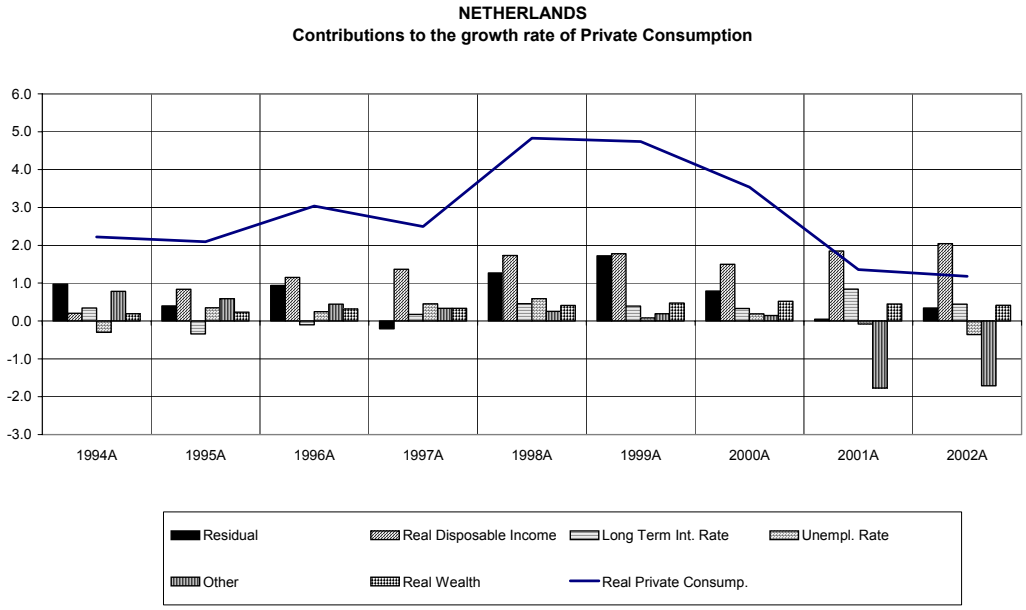
Endogenous: $\Delta \log(PCR)$

Explanatory variables:	coefficient	t-stat
cst	0.019	4.48
$\Delta \log(PCR(-1))$	-0.497	-3.46
$\Delta \log(PCR(-2))$	-0.311	-3.50
$\Delta \log(PYR(-1))$	0.092	2.33
$\Delta \log(1 + LTR(-1)/100)$	-0.161	-2.55
$\Delta \log(URX(-1)/100)$	-0.053	-3.42
$DUM01$	-0.012	-3.42
$\log(PCR(-1)) - \log(PCRSTAR(-1))$	-0.128	-3.44

$R^2 = 0.29,\ DW = 2.18,\ \ \sigma_\varepsilon = 0.0074$

Dum01 is a step dummy from 2001q1 onwards needed to capture some house market developments which affected markedly consumption and for which we don't dispose of data. The dummy (as captured by the "other " in the contribution chart below) proved to contribute extensively. It seems that it is capturing the levelling off of home equity withdrawal (capitalization) but not the build-up. We have also tried to estimate the equation including an explicit variable that would allow for house prices to play a role in the short run (e.g. change in house prices over the appropriate deflator). However, since this model is used also for forecasting we face a practical constraint concerning the availability and reliability of the update of this variable. Therefore we have preferred the use of a dummy to ensure more satisfactory results.





The specification used for investment is a very simple one. We model only the non-housing part of total investment and make it a function only of its past values and of real GDP, plus the evolution around its desired level $IPRSTAR$. However, other variables have considerable indirect effects, as it can be seen from the contribution chart. For instance the real cost of capital has got some impact on investment dynamics through the error correction term. In particular, the decrease in the real interest rate in the second half of the 1990s increased the desired level of capital and therefore had a positive effect on investment.

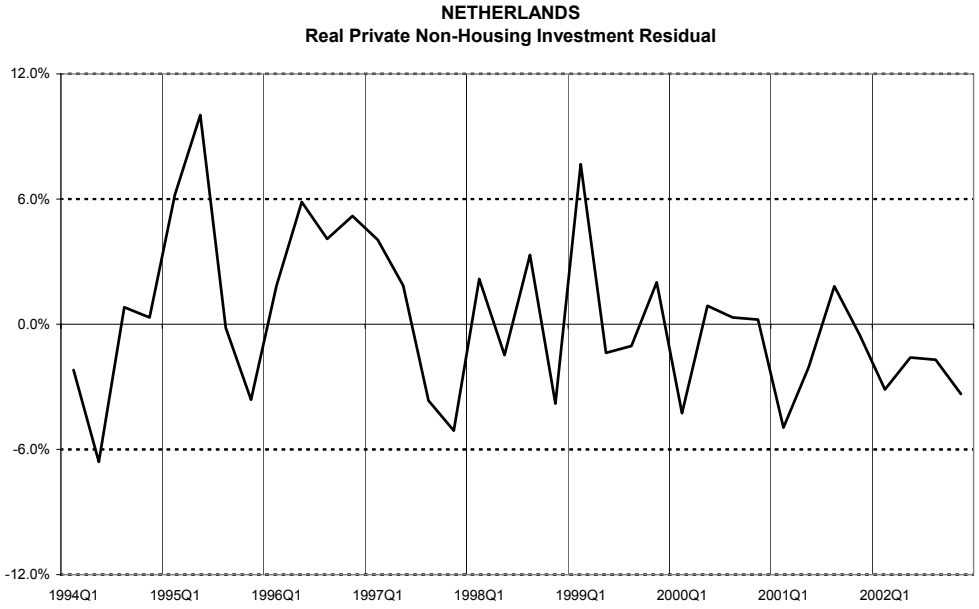
Real private non-housing investment

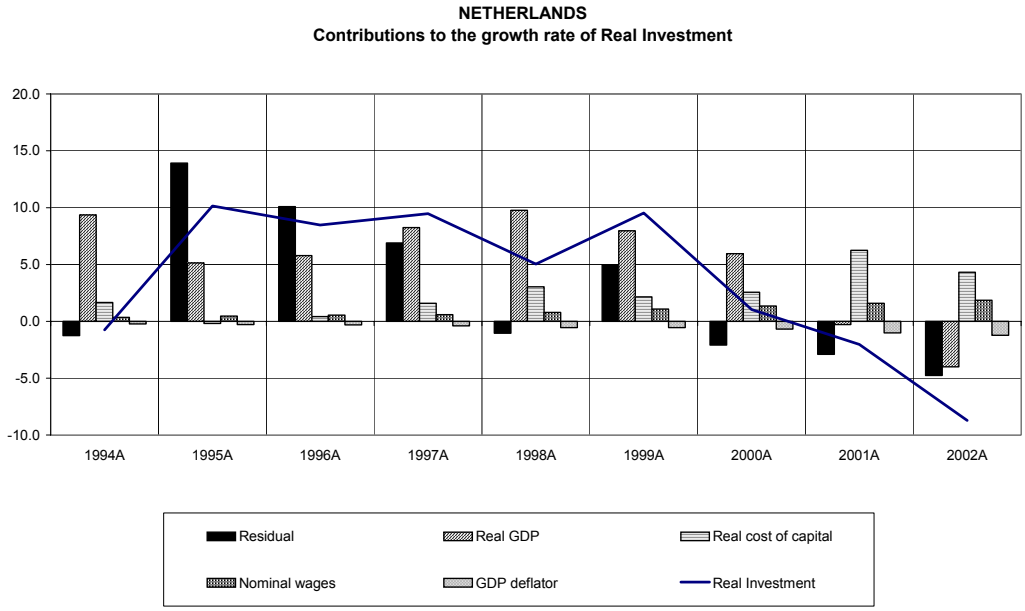
Endogenous: $\Delta \log (IPR)$

Explanatory variables:	coefficient	t-stat
cst	−0.018	−1.93
$\Delta \log (IPR(-1))$	−0.394	−3.33
$\Delta \log (YER)$	2.852	3.69
$\Delta \log (YER(-1))$	1.437	1.72
$\log(IPR(-1)) - \log (IPRSTAR(-1))$	−0.053	−1.10

$R^2 = 0.36,\ DW = 2.09,\ \ \sigma_\varepsilon = 0.0487$

As the theoretical relations derived in section 2.1. (Eq. 2.10) suggest, real wages also affect investment *via* capital/labour substitution effects.





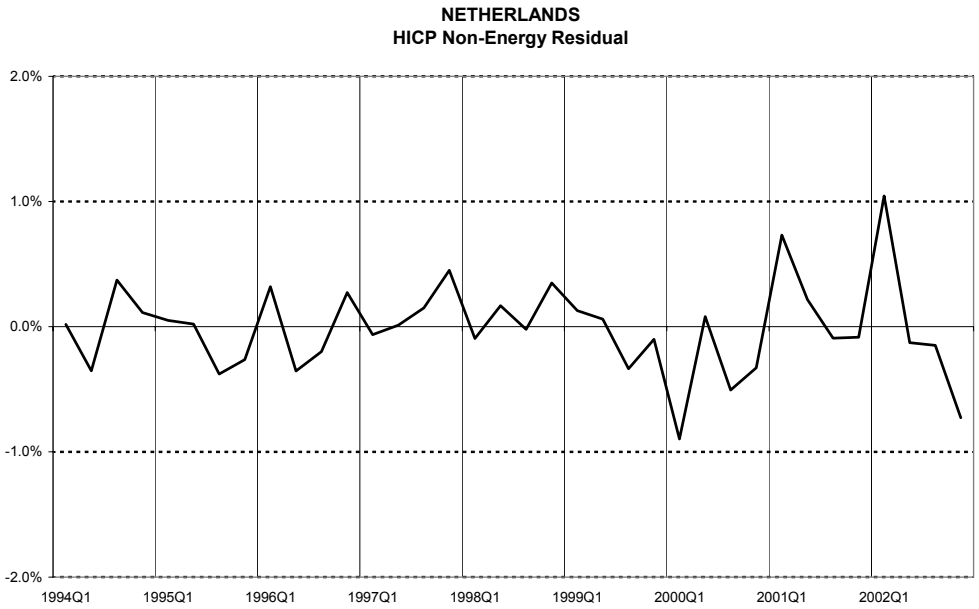
The HICP excluding energy is closely linked to domestic prices. Import prices in difference from unit labor costs have a positive instantaneous impact. DUMMYQ1, DUMMYQ2 and DUMMYQ3 are seasonal dummies. Their inclusion is motivated by the fact that HICP is the only non seasonally adjusted variable used in the Dutch block. Nominal wages are contributing the most over the sample under consideration in explaining variations of ex-energy inflation.

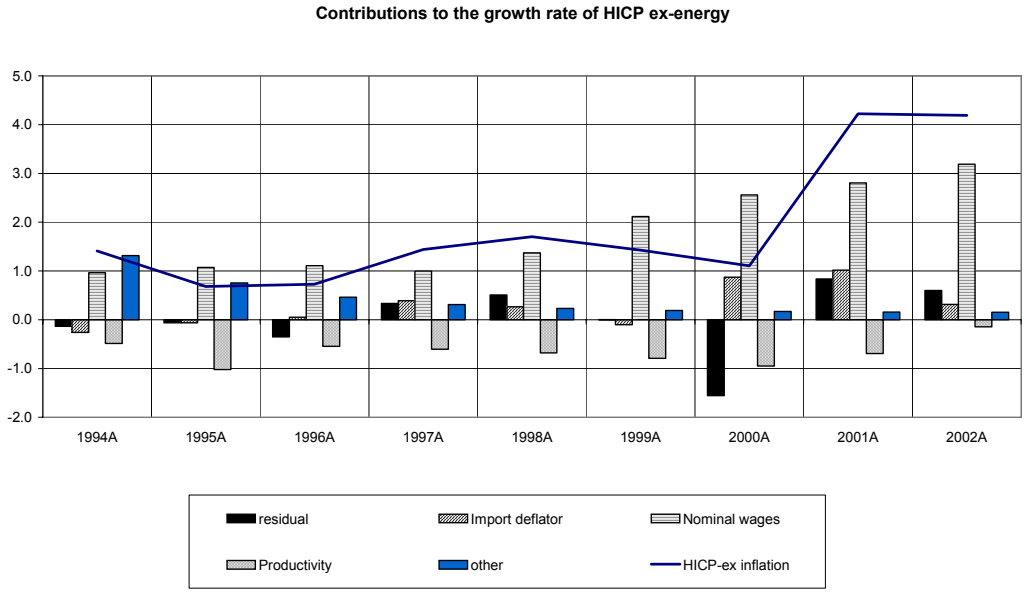
HICP excluding energy

Endogenous: $\Delta \log (HEXP)$

Explanatory variables:	coefficient	t-stat
cst	-0.013	-2.26
$\Delta \log (HEXP(-1))$	0.153	1.99
$\Delta \log (MTD) - \log(WUN/PRO)$	0.038	3.73
$DUMMYQ1$	-0.005	-2.54
$DUMMYQ2$	0.003	3.49
$DUMMYQ3$	-0.009	-5.06
$\log(HEXP(-1)) - \log (HEXPSTAR(-1))$	-0.125	-3.39

$R^2 = 0.62,\ DW = 1.97,\ \ \sigma_\varepsilon = 0.0037$





Finally we turn to the foreign demand side. The equations of real exports and imports are standard. Exports depend on world demand and price competitiveness. Given that the Netherlands exports most of the import volumes, for both world demand and price competitiveness we use their decomposition in extra euro area –WDR_EX and CXUD_EX– and intra euro area –WDR_IN and CXUD_IN.

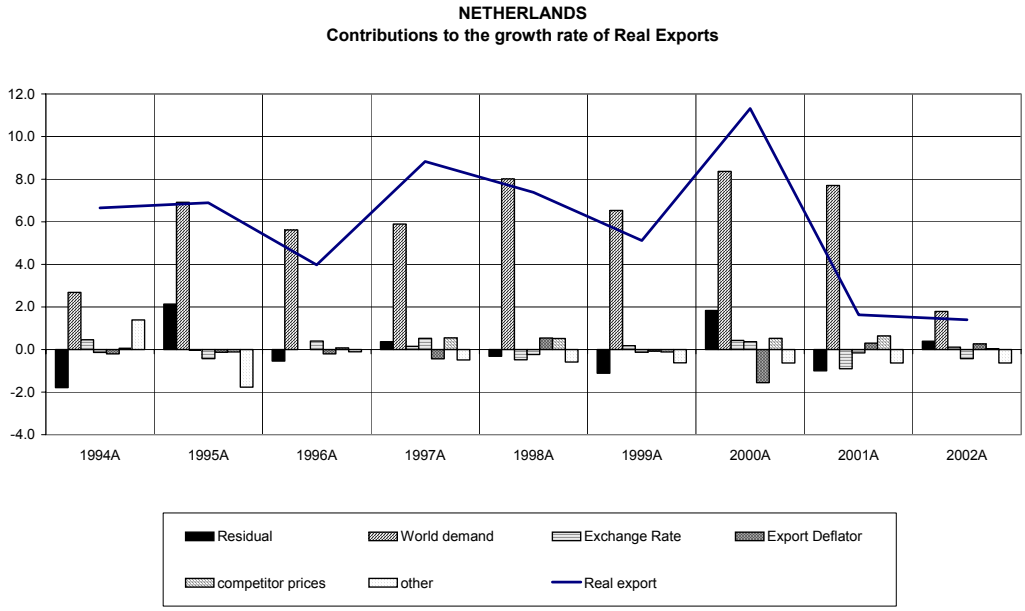
Real exports

Endogenous: $\Delta \log (XTR)$

Explanatory variables:	coefficient	t-stat
cst	0.002	2.00
$\Delta \log (XTR(-1))$	−0.131	−1.62
$\Delta \log (WDR\_EX)$	0.595	2.13
$\Delta \log (WDR\_IN)$	0.940	6.03
$\Delta \log (EXR(-1))$	0.061	3.02
$\Delta \log (XTD)$	−0.271	−2.27
$\Delta \log (CXUD\_EX)$	0.351	2.04
$\Delta \log (CXUD\_IN)$	−0.169	−2.36
$\log(XTR(-1)) - \log (XTRSTAR(-1))$	−0.316	−3.22

$R^2 = 0.55,\ DW = 1.84,\quad \sigma_\varepsilon = 0.0109$

The analysis of the contributions to export growth (see below) show that, as expected, the most important determinant of exports is world demand. To a lower extent, relative prices also contributed to real export growth, but it is not entirely clear whether the contribution stems from changes in competitors' or domestic exporters' prices.



The dynamics of real imports is described in the following table. Coefficients are precisely estimated and the in-sample fit is among the highest of all equations.

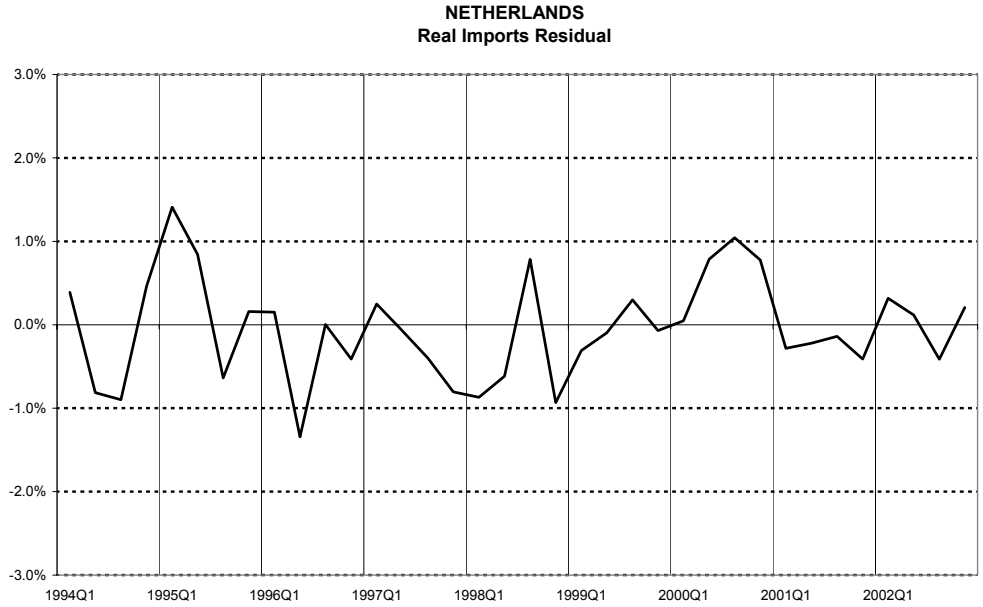
Real imports

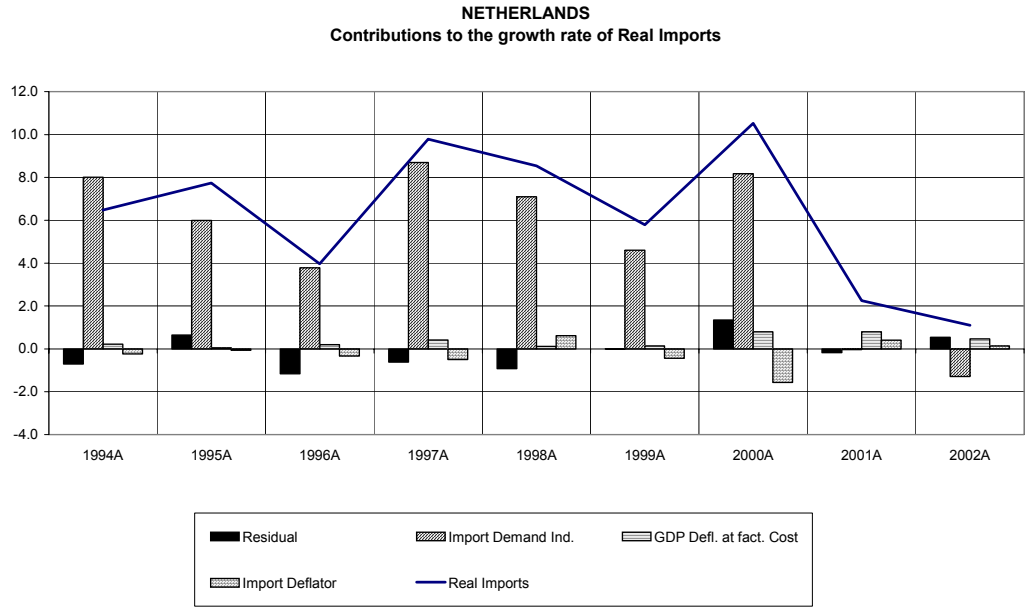
Endogenous: $\Delta \log (MTR)$

Explanatory variables:	coefficient	t-stat
cst	-0.008	-6.07
$\Delta \log (MTR(-1))$	-0.264	-2.65
$\Delta \log (MTR(-2))$	-0.383	-4.64
$\Delta \log (WER)$	1.431	30.48
$\Delta \log (WER(-1))$	0.517	2.89
$\Delta \log (WER(-2))$	0.492	3.27
$\Delta \log (MTD/YFD)$	-0.357	-4.73
$\log(MTR(-1)) - \log (MTRSTAR(-1))$	-0.139	-1.78

$R^2 = 0.87,\ DW = 1.96,\quad \sigma_\varepsilon = 0.0067$

Overall, taking into account both the long and the short run variables, the contribution of prices is relatively limited (see contribution chart below).





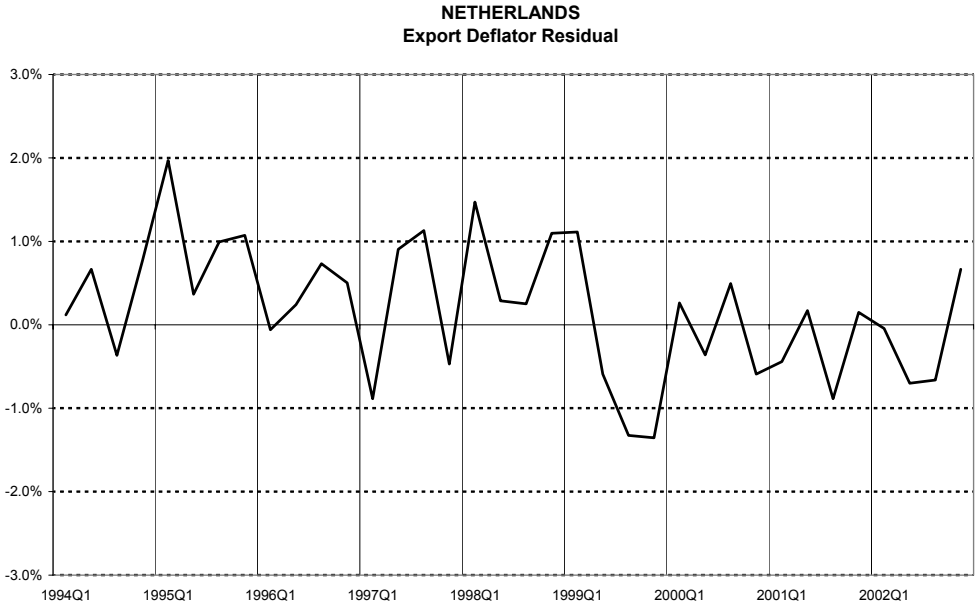
On the price side, the equations for export and import deflators are also quite standard, since both variables depend on domestic price developments, competitors' prices and oil price. Estimates, residuals and contribution charts are reported below.

Export deflator

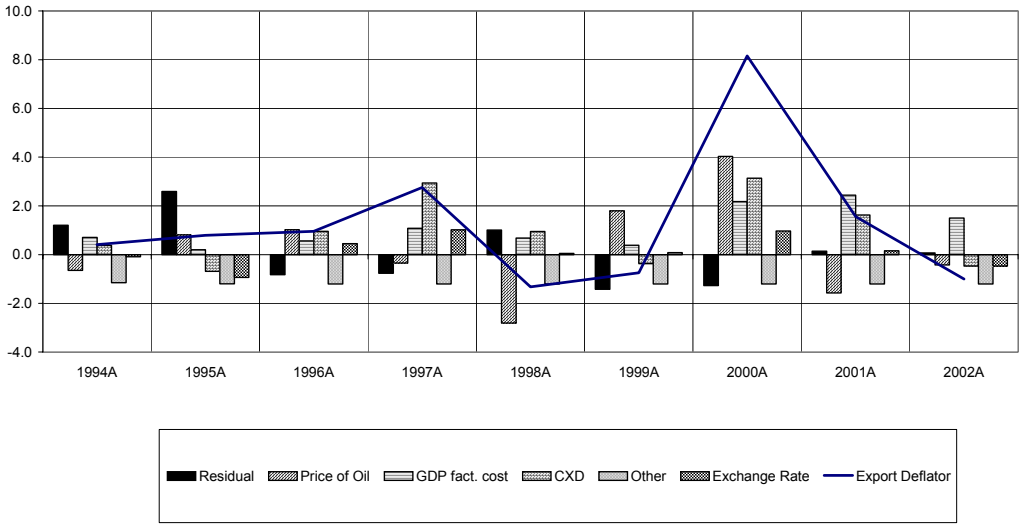
Endogenous: $\Delta \log (XTD)$

Explanatory variables:	coefficient	t-stat
cst	−0.003	−1.61
$\Delta \log (XTD(-1))$	0.152	2.16
$\Delta \log (CXD)$	0.169	5.37
$\Delta \log (YFD)$	0.566	2.16
$\Delta \log (EXR \cdot POILU)$	0.042	5.65
$\Delta \log (EXR(-1) \cdot POILU(-1))$	0.025	1.98
$\log \left(\frac{XTD_{(-1)}}{XTDSTAR_{(-1)}} \right)$	−0.279	−4.32

$R^2 = 0.67,\ DW = 2.21,\ \ \sigma_\varepsilon = 0.0108$



NETHERLANDS
Contributions to the growth rate of Private Consumption

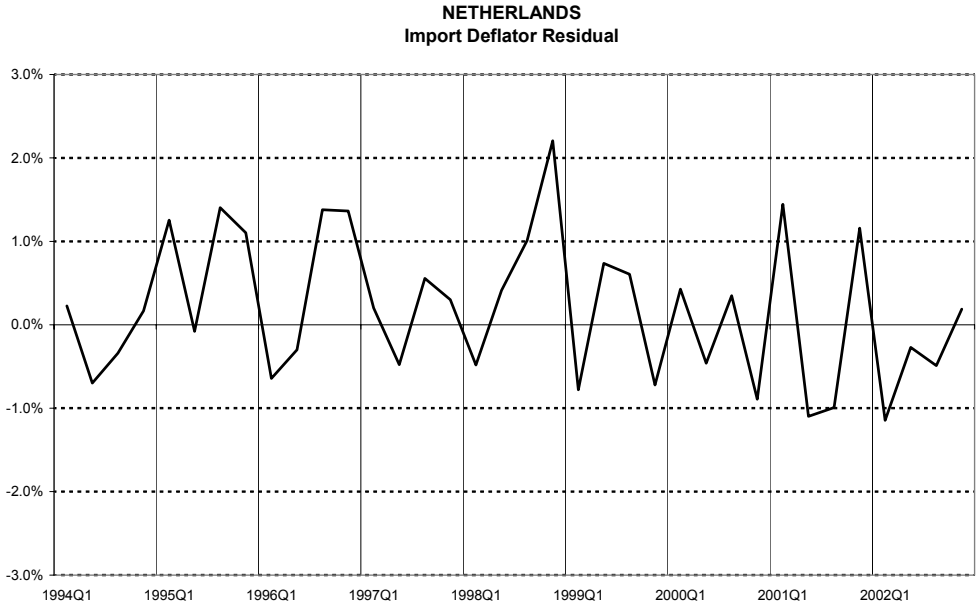


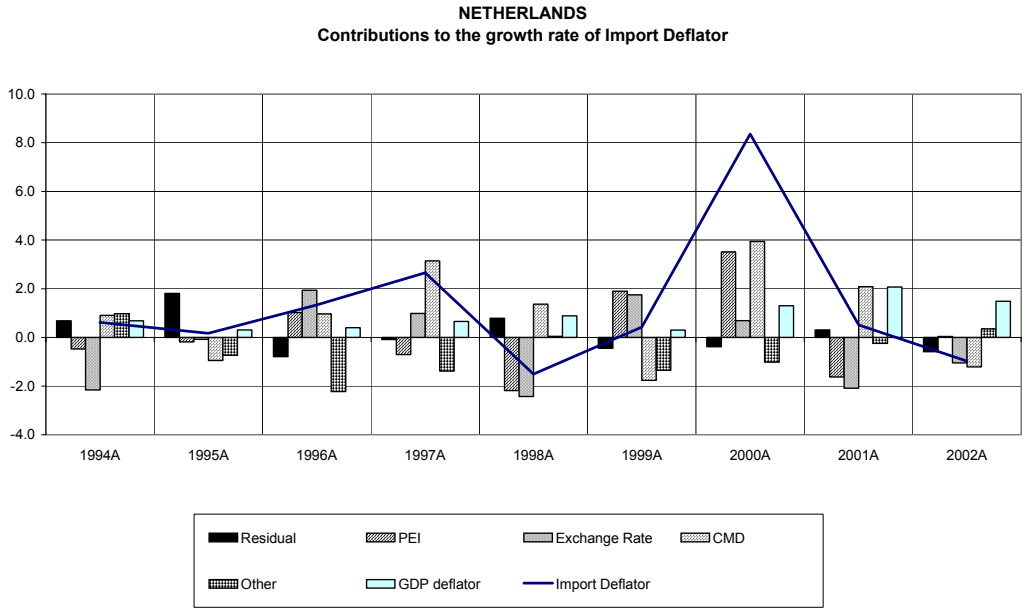
Import deflator

Endogenous: $\Delta \log (MTD)$

Explanatory variables:	coefficient	t-stat
$\Delta \log (MTD(-1))$	0.262	4.34
$\Delta \log (PEI)$	0.088	8.70
$\Delta \log (CMUD)$	0.263	1.98
$\Delta \log (EXR)$	0.266	3.15
$\Delta \log (YFD)$	0.045	0.35
$\log \left(\frac{MTD_{(-1)}}{MTDSTAR_{(-1)}} \right)$	−0.582	−6.75

$R^2 = 0.79,\ DW = 2.08,\quad \sigma_\varepsilon = 0.0088$





3 Uses of the model

The aim of this Section is to analyze the dynamic properties of the model. We first describe how the model is used internally at the ECB to make projections combining model features and judgemental expertise. Then we present the steady state analysis and we simulate the response of the baseline economy to several interesting shocks.

3.1 Forecasting with the MCM

The governing Council of the ECB has decided to publish the ECB staff macroeconomic projections (MPE) for the euro area on a biannual basis since September 2004. The projections are both published on the ECB web page and summarized in the March, and September issues of the Monthly Bulletin, in addition to the Eurosystem staff macroeconomic projections, published in the June and December issues of the Monthly bulletin. The published figures include band-projections of inflation in terms of the Harmonized Index of Consumer Prices (HICP), the growth of real GDP and its main expenditure components over a two-year horizon.

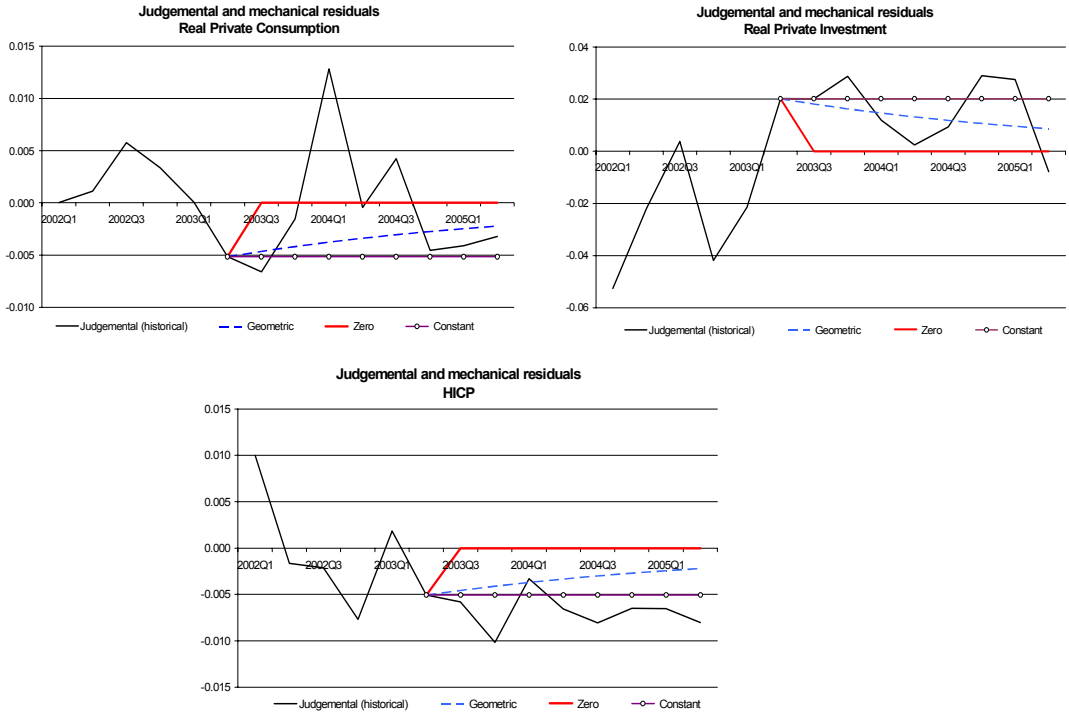
The projections are a convenient analytical tool which help bring together in a systematic manner a range of information on current and future economic developments. There are two main steps in the production of the MPEs. First, there is the setting of assumptions underlying the exercise; second, an agreement on a set of macroeconomic projection figures is reached which follows a process of overview at the area-wide level, of projection consistency checks, and of a peer review of the individual country projection figures.

At the beginning of the exercise, a set of provisional assumptions is agreed upon, covering interest rates, exchange rates, the international environment and fiscal variables. Given the set of assumptions, the projections combine judgemental assessments, made on the basis of expert knowledge, and the use of econometric models, namely the MCM at the country level. These two elements are complementary. While the MCM provides a detailed structure for the projections, ensuring that they are internally consistent, judgemental assessments are indispensable for taking into account the economic developments that the MCM does not account for. Indeed, given its relatively small size, the MCM obviously cannot describe all aspects of the economy and is therefore bound to discard some detailed economic elements like financial behaviors (e.g. banks' credit rationing), sector-specific behaviors, administered price changes, etc. Moreover, some economic developments are simply not easy to bring to models, like the effects of weather conditions on food prices or that of a long strike on labour productivity. Judgement is therefore important to preserve the flexibility and adaptability of the projection exercise, and to feature into the projections any events that models are not able to capture either because they are omitted or simply because it is not possible to model them.

Technically, experts' views are introduced into the MCM through the residuals of the behavioral equations. For example, the impact of the drought of the Summer 2002 in Europe onto food prices and, therefore, on the HICP was featured into the projection by adding a positive residual into the HICP equation. In forecasters' jargon, the practice of judgementally correcting macroeconometric forecasts from regression models is known as the use of "add-factors", i.e. "subjective changes to the forecast which depend on the forecaster's assessment of special circumstances that are not well summarized by the variables included in the econometric model" (Bullard et al. 2004). On the contrary, in absence of judgement the residuals of the behavioral equations would follow a mechanical pattern. Many arbitrary mechanical patterns can a priori be envisaged. One may set all the residuals equal to zero throughout the two year horizon of the projections, or assume that they

remain constant and equal to their last values, or that they decrease geometrically throughout the forecast horizon, etc. In any case, by definition, mechanical residuals do not feature any economic information or expert view and might be based only on a statistical analysis of the in-sample residuals of the model.

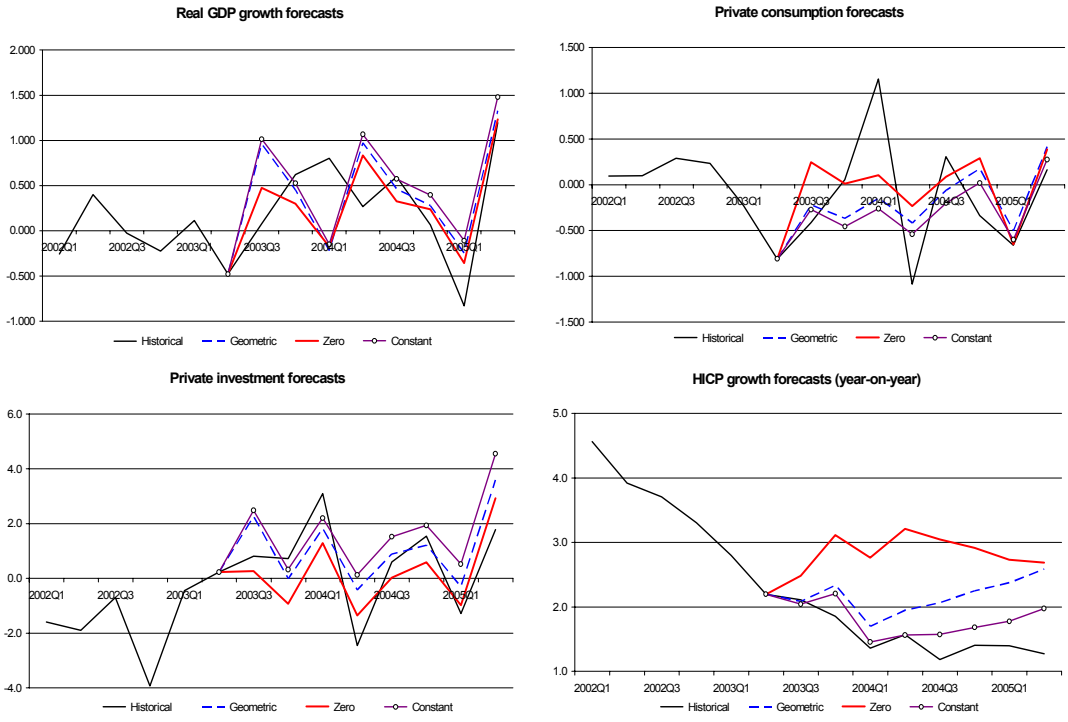
The aim of this Section is to illustrate the complementarity between expert judgements and the model. To do so we consider the historical period 2003Q3-2005Q2 as our forecast horizon, and take the observed interest rates, exchange rates, international environment and fiscal variables as assumptions. Given these "true" assumptions, we use the MCM to derive projections of HICP inflation, GDP growth, private consumption, and private investment growth, in the absence of judgement (i.e. using mechanical residuals). We then compare these projections with the realized values of HICP inflation, GDP growth, private consumption growth, and private investment growth.



We consider three purely model-based projections by using three types of mechanical residuals for the behavioral equations: (i) the residuals are set equal to zero; (ii) they all remain constant and equal to their last historical value; or (iii) they all geometrically return back to zero over the forecast horizon at a slow speed. The residuals for the HICP, private consumption and private investment equations are reported in the graphs above, together with the "true" judgemental residuals. The latter correspond to the add-factors that should have been featured into the model in order to forecast perfectly the HICP inflation, GDP growth, private consumption growth, and private investment growth. In that sense, these add-factors represent the best judgement possible. The graphs compared the projections of the model obtained by using such add-factor (i.e. the observed growth rate of consumption, investment, and HICP) together with the projection obtained by using the three mechanical add-factors.

A rapid comparison of residuals and projections seems to show that, among the three mechanical residuals envisaged, the constant residual has been the closest to the true residuals for private investment and HICP. In other words, HICP inflation and private investment broadly behaved as the model predicts when one assumes constant mechanical residuals. In such a case, experts' views could have refined but not changed fundamentally the model-based projections. Clearly this is just an example and is in general not a valid one. For instance, the model turns out to be unable to predict the spike in consumption growth in the first quarter of 2004 (see graphs below), whatever the type of mechanical residuals employed. The reason is that this spike is due to a health care reform implemented from the start of 2004. By requiring households to pay a larger share of the total health care bill, this reform implied a quasi-mechanical shift from public to private expenditures and resulted in a significant increase in private consumption, which is not featured into the model. In particular, the graph of the consumption residual above indicates that this reform increased the growth rate of consumption by about 1pp in 2004 above the rate that should have been observed in absence of the reform, while the model-based projection below suggests a 0% increase of consumption in the absence of reform. It is interesting to note how model and judgement can be used complementary, as the right forecast (consumption grew by about 1%) can be viewed as the sum of model-based projections and judgements.

Finally, notice also that the combination of the different sources of residual settings seems to imply a more reasonable projection, in the sense of representing more closely the realized observations, than each source taken in isolation.



3.2 Steady state and simulations

In this Section we simulate the model economy to make it converge to the steady state and then simulate the response of the baseline to six shocks, in order to check that the long-term properties of the model conform to what we expect and to assess the plausibility of the responses in case the model is used for policy analysis. In particular, after we have simulated the model in the neighborhood of the steady state, we check that the price level has no impact on the real long-term equilibrium (i.e. there is no monetary illusion in the long run) and that the output gap closes after a permanent government consumption shock with and without the fiscal rule. We also perform permanent shocks to oil prices, exchange rate, world demand, and to the labor force.

The exercise is a complement to the previous one, in the sense that all exogenous variables are extended for many periods so that they follow their target long run growth rate, whereas the endogenous variables of the model are simulated to get their steady state under a setting which make their residuals gradually going to zero.

3.2.1 Policy rules

The government and the central bank play an active role in the economy. Policy rules both depend and have an impact on the economy. Both a monetary and a fiscal rule are in place in the Dutch MCM. They are both used in the simulation mode of the model, whereas only the fiscal rule is used in the projection exercises, to make explicit the fact that the projections are based on a set of exogenous technical assumptions which include unchanged interest rates.

Monetary policy rule The main characteristic of the monetary rule in the Dutch block is that of being as neutral as possible on the long run properties of the model. The rule has the twofold characteristics of keeping the real short-term rate exogenous in the long run while leaving the central bank target it in the short run in such a way that the nominal rate remains below the equilibrium nominal growth rate of the economy. We need this condition in order for the economy to grow faster than the debt burden and for the debt to be sustainable in the long run.

For the short run the Central bank uses a Taylor rule[7] and adjusts nominal interest rates to inflation deviation form the target and to the output gap:

$$
\begin{aligned}
&STI_t = \rho STI_{t-1} + \\
&(1-\rho)400\left[\hat{\gamma} + \hat{n} + \pi^* + 1.5\left(PCD_t/PCD_{t-1} - \pi^*\right) + 0.5\left(YER_t/YER_{t-1} - \hat{\gamma} - \hat{n}\right)\right] \\
&-(1-\rho)
\end{aligned}
$$

where the degree of smoothness ρ is set equal to 0.5 in the simulation exercise. Clearly, in the long run,

[7] Clearly, the use of a monetary policy rule in the model is just a device needed to guarantee a well defined adjustment to the steady state.

when the growth rate of GDP is equal to its long run value and domestic inflation is equal to the target, the short-term rate is equal to the growth rate of the economy ($\hat{\gamma} + \widehat{n} + \pi^*$) minus an arbitrary 1% which technically ensures debt sustainability.

A consequence of our simple monetary policy rule is that foreign inflation acts as a nominal anchor. In other words, given that the wage-price block is homogeneous, it can be solved in terms of foreign prices only.

Fiscal rule The fiscal rule is also extremely simple. We assume that the ratio of public debt to GDP is equal to 56% in steady state (which is the average of the latest observed values). In the model the rule is stated as:

$$\Delta PDX = \lambda \left[(GDN/4 \cdot YEN) - 0.56 \right]$$

where PDX is the tax rate on income and the parameter λ measures the intensity of the reaction of fiscal authorities to deviations from their objective. In the simulation we have tried several values of λ and, apart from some more or less accentuated cyclicality of the responses to shocks, quantitative results do not seem to vary too much. The reported results are based on $\lambda = 0.1$.

It will be clear from some simulation exercises (section 3.2.4) that the absence of a fiscal rule may have permanent strong effects on the composition of output without precluding the classical crowding-out effects to take place. It is important to anticipate that independently of the rule, the output gap always closes because the real equilibrium is determined on the supply side as a function of real wages and the real cost of capital, which do not involve terms of trade.

3.2.2 Steady state

For the model to achieve its steady state, the first step is to specify the growth paths of the endogenous variables. All real variables in the long run grow at the same rate which is the sum of the growth rate of labour force ($\widehat{n}$) and the growth rate of productivity ($\widehat{\gamma}$). Exchange rates are kept constant. Interest rates are set according to the simple monetary rule described above. Domestic inflation is targeted to π^*. The growth of nominal variables is equal to the sum of the growth rate of inflation (π^*), productivity ($\widehat{\gamma}$) and of the labour force ($\widehat{n}$). Employment variables grow in line with the growth rate of the labour force ($\widehat{n}$). All exogenous variables, according to their type (e.g. real, nominal, demographic), are assumed to grow at that specific rate out-of-sample. Finally, all the residuals, dummies and ad hoc deterministic trends are set to geometrically decay to zero out-of-sample. The model has been simulated over a long period of time, until the economy reaches its balanced growth path. (Depending on the variable, on average it takes at most 200 years to converge). The values of the main ratios of the economy are given in the table below. These values are plausibly close to the long run mean of each variable and therefore they represent a good baseline to be shocked to analyze the response of the economy in the steady state.

One key element to achieve model convergence is that price elasticities of the trade equations have been set to higher values than the estimated ones as stated above. A feature of the MCM is that prices in the long

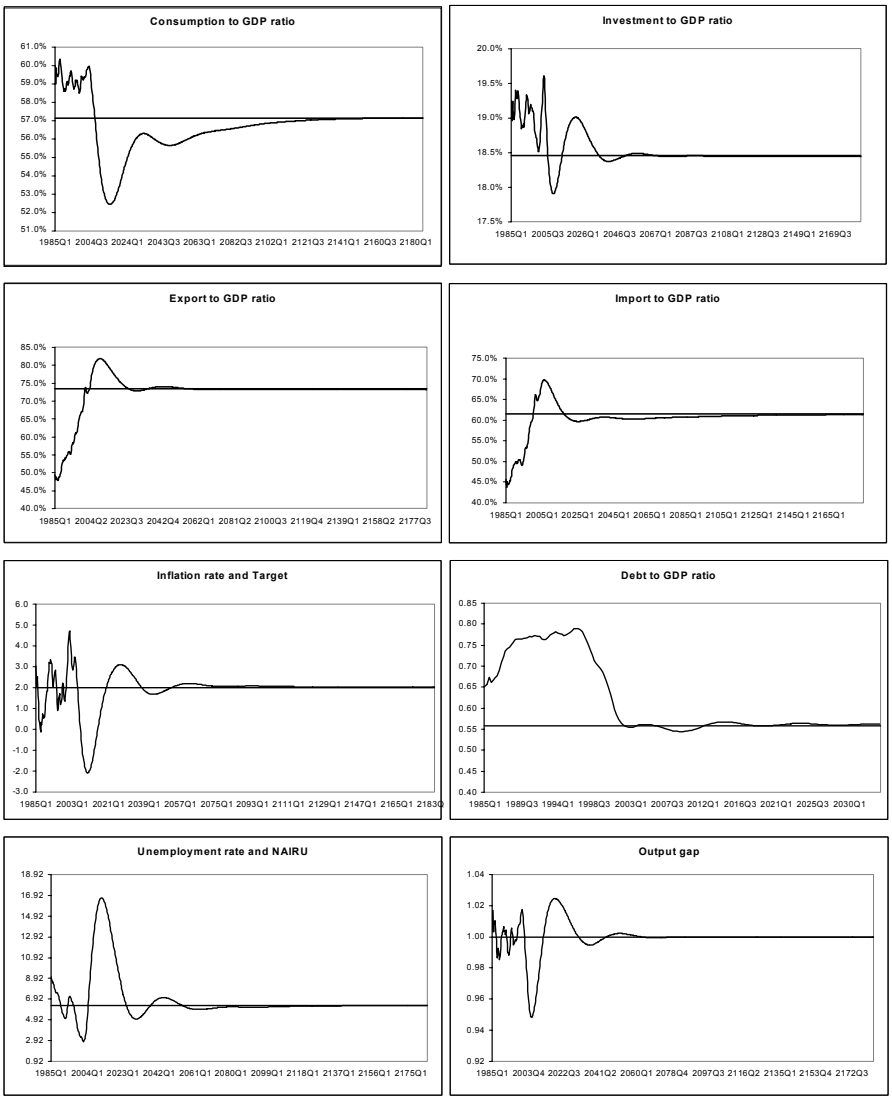
run are flexible and adjust to the transition path of the economy. The real side of the model converges as it responds to relative prices, therefore the higher price elasticities are the more likely it is to reach steady state.

Steady state. Selected variables

	P.Cons.	Inv.	Gov.Cons.	Exp.	Imp.
Average 1985-2003	59.3%	19.0%	14.2%	59.5%	53.6%
2003	59.7%	19.6%	14.4%	74.7%	66.9%
Steady State	57.1%	18.5%	13.8%	73.9%	62.0%

	Gov.Lend.	Gov. Debt	Unempl.	Infl.	Out. gap
Average 1985-2003	-2.4%	71.8%	5.7%	2.0%	1.0
2003	-2.0%	55.9%	4.8%	3.1%	1.0
Steady State	-2.5%	56.0%	6.3%	2.0%	1.0

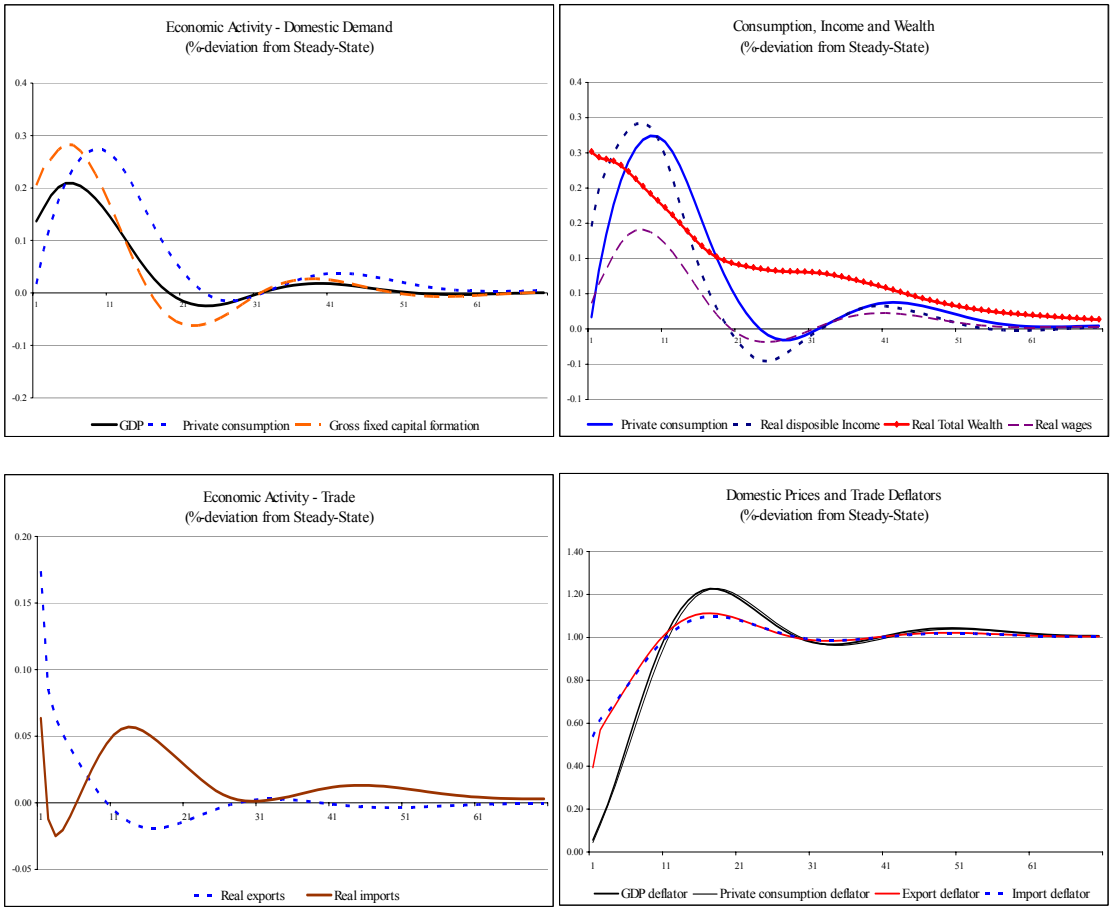
Transition to steady state



The chart above reports the transition to the steady state for several variables. A remark is necessary here. The out-of-sample simulation is entirely model based for it does not take into account all the available information (e.g. the empirical evidence, information of aging population, etc.). As a consequence, the transition phase from the last in-sample observation to the steady state must not be interpreted as a meaningful macroeconomic projection, but rather as the result of the complex shocks that occur when the exogenous variables "jump" to their steady state level. In other words, in our transition phase implausible values are admissible (see e.g. the "deflation" at the beginning of the simulation). Our purpose here is only to show that the model converges to the predetermined steady state. Once at the baseline, the economy can then be shocked and responses could be given a meaningful sense.

3.2.3 Shock to prices and nominal variables

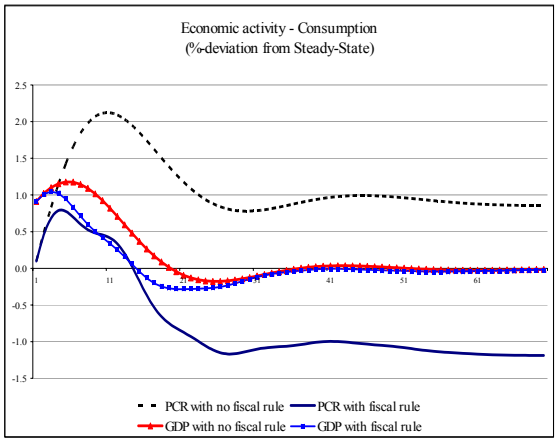
The purpose of this shock is to check that there are no anomalies on the nominal side. All exogenous and foreign prices of the model (e.g. oil, imported energy, competitors' prices, etc.) have been increased by 1% above the baseline. As expected, all of the endogenous prices react positively and converge to a higher steady state. The shock has an impact on the real economy in the short run, until all price adjustments are made. Following the shock, price competitiveness improves and GDP is stimulated. In particular, real trade variables keep on adjusting as long as relative prices (domestic/foreign) depart from their steady state. The initial effects vanish as domestic agents adjust their own prices. In the long run, all real variables of the economy go back to their baseline, as shown in the charts below.

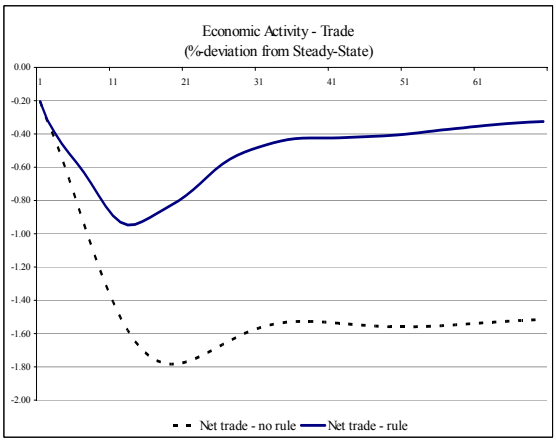


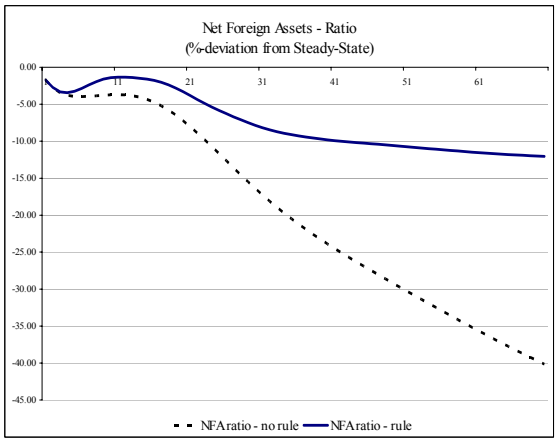
3.2.4 Permanent shock to government consumption (Fiscal shock)

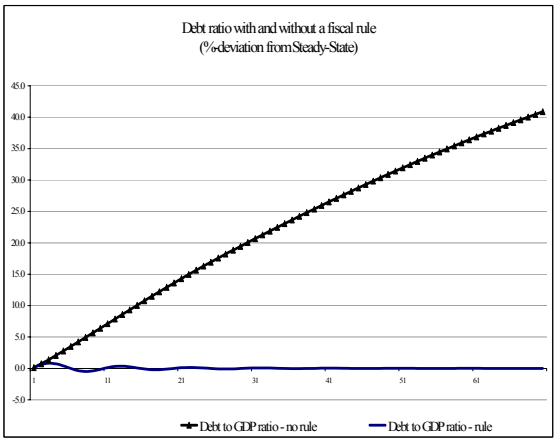
This exercise has been performed with and without the fiscal rule as mentioned in the fiscal policy section. Real government consumption has been increased permanently by 1% of GDP above baseline. In this simulation the nominal interest rate is driven by the monetary policy rule described above and, when the fiscal rule is activated, the tax rate adjusts in order to keep the debt-to GDP ratio close to 56%.

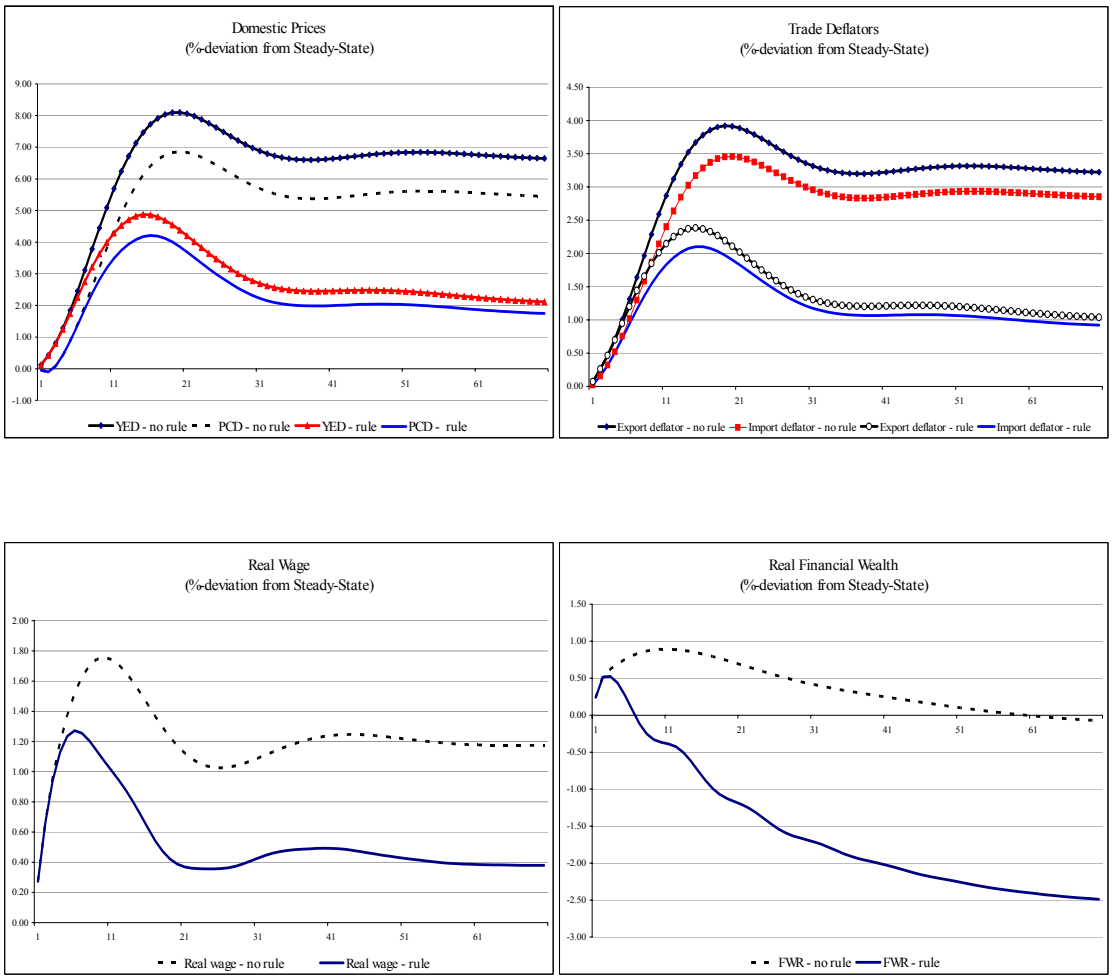
Three successive phases can be distinguished, the accelerator, the multiplier and the crowding-out phase. The overall results are both an interaction of the accelerator/multiplier effect and a permanent shift in the price level. The increase in public consumption has a direct impact on GDP due to an acceleration in investment. Moreover there is a deterioration of net trade, since output growth boosts import demand and adverse competitiveness effects – resulting from the excess demand – exert some downward pressure on export demand. There is an increase in private consumption through the multiplier effect. Income in real terms is increasing due to higher real wages and additional employment. Both of these elements account for the increase in private consumption. The subsequent deterioration in foreign trade gradually attenuates the initial beneficial effects on output. The output gap then closes and the unemployment rate returns back to the NAIRU, the permanent increase in government consumption is absorbed by a compositional effect through lower consumption and lower net trade. Without a fiscal rule in place, consumption remains above baseline due to continued indebtedness and to the strong deterioration of the trade balance.











Independently of the fiscal rule then, a permanent rise in government consumption pushes domestic prices up, generates losses in competitiveness and leads to lower exports and higher imports. Without a fiscal rule, however, effects on trade are magnified and therefore, in order for the output gap to close again, the effect on consumption is of opposite sign. Qualitative and quantitative results are reported in the charts above.

3.2.5 Permanent increase in oil prices (Oil price shock)

In this simulation exercise, oil prices are increased permanently by 20% above baseline. This results in an increase in the import deflator by 0.78% during the first year, and the increase feeds more into the private consumption deflator (the GDP deflator does not depend directly on import prices) which increase by 0.18% above baseline. The decline in real wages, 0.03% below baseline, causes the decline in real disposable income. This, with real financial wealth is the main determinant of private consumption, which also declines in the short to medium run. The increase in prices has a negative effect on investment which is also negatively affecting demand. The increase in import prices and the slowdown in demand cause imports to decrease. There is a small and negligible positive immediate effect on GDP. This can be partly explained by the fact

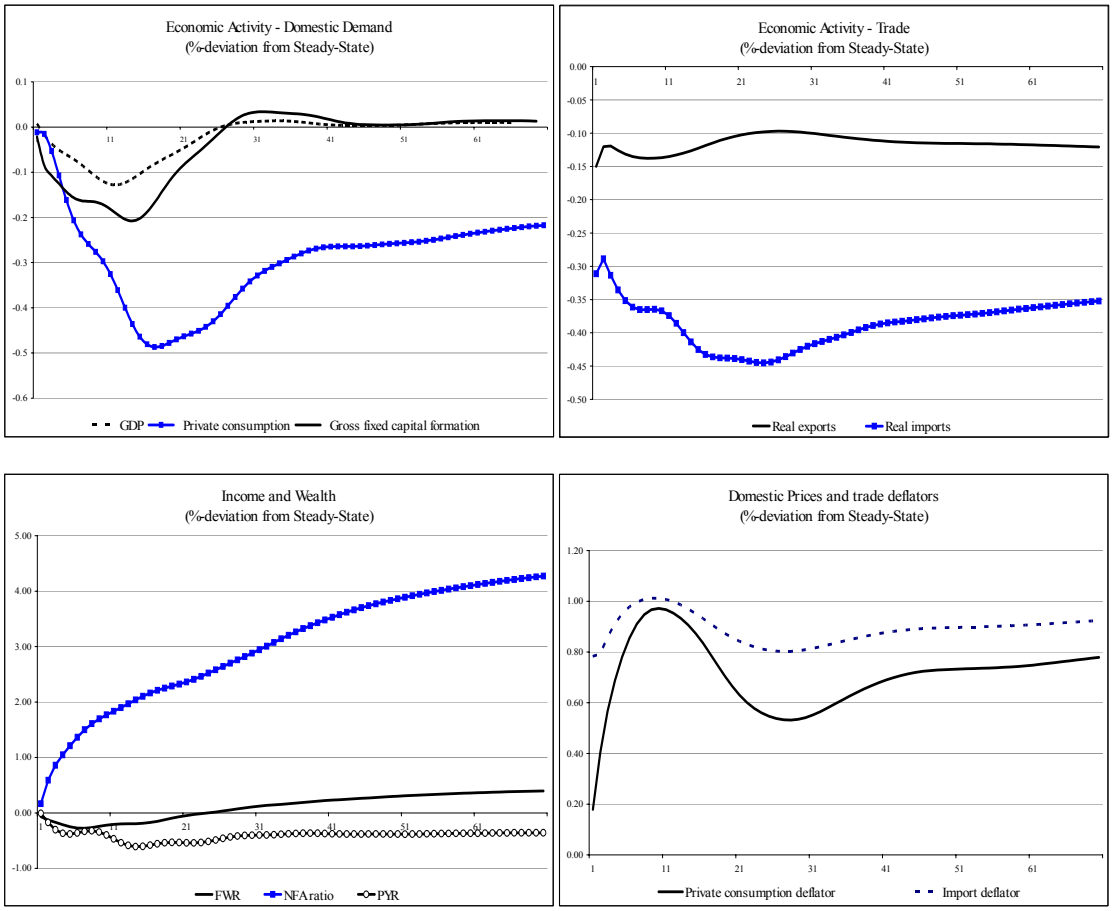
that there is no distinction made in terms of energy therefore the impact of an oil shock on import prices is quite big, followed by an equally big drop in the volume of imports. This explains the initial rise in GDP through the national identity. A solution to this feature would be that the import equations might benefit from an explicit distinction between energy and non-energy imports. However such a disaggregation between energy and non energy is not yet implemented across all MCM blocks. The implementation is currently under study.

(deviations from baseline, percentage unless otherwise indicated)

		1	2	3	4	5	6	7	8	9
Economic Activity										
(constant prices)										
GDP	E_NL_YER	0.09	0.08	0.06	0.04	0.01	-0.02	-0.04	-0.05	-0.06
Private consumption	E_NL_PCR	-0.01	-0.02	-0.05	-0.11	-0.16	-0.21	-0.24	-0.26	-0.28
Government consumption	E_NL_GCR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gross fixed capital formation	E_NL_ITR	0.07	-0.02	-0.08	-0.11	-0.13	-0.14	-0.16	-0.16	-0.16
Exports	E_NL_XTR	-0.15	-0.12	-0.12	-0.13	-0.13	-0.13	-0.14	-0.14	-0.14
Imports	E_NL_MTR	-0.31	-0.29	-0.31	-0.34	-0.35	-0.36	-0.37	-0.37	-0.36
of which :										
Contribution of trade	E_NL_TRADE	0.08	0.09	0.11	0.12	0.12	0.13	0.13	0.13	0.13
Contribution of inventories	E_NL_SCRRATIO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Price Developments										
HICP	E_NL_HIC	0.20	0.42	0.58	0.70	0.79	0.86	0.91	0.95	0.97
GDP deflator	E_NL_YED	0.09	0.20	0.31	0.41	0.49	0.55	0.59	0.61	0.62
Private Consumption deflator	E_NL_PCD	0.18	0.40	0.57	0.69	0.78	0.86	0.91	0.95	0.97
Exports deflator	E_NL_XTD	0.69	0.68	0.69	0.73	0.76	0.79	0.80	0.81	0.81
Imports deflator	E_NL_MTD	0.78	0.79	0.86	0.91	0.95	0.98	1.00	1.01	1.01
Competitors Prices on domestic market	E_NL_CMD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Competitors Prices on external markets	E_NL_CXD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nominal Exchange Rate	E_NL_EEN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Labour Market and Cost Developments										
Compensation per employee (nominal)	E_NL_WUN	0.15	0.31	0.42	0.50	0.55	0.59	0.61	0.61	0.60
Compensation per employee (real, GDP price)	E_NL_WUNY	0.06	0.11	0.11	0.09	0.06	0.04	0.02	0.00	-0.02
Compensation per employee (real, Consumption price)	E_NL_WUNC	-0.03	-0.09	-0.14	-0.18	-0.22	-0.26	-0.30	-0.33	-0.36
Productivity	E_NL_PRO	0.07	0.03	0.00	-0.02	-0.04	-0.06	-0.06	-0.05	-0.04
ULC, whole economy	E_NL_ULC	0.08	0.28	0.42	0.52	0.60	0.64	0.66	0.66	0.65
Total Labour Force	E_NL_LFN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total employment	E_NL_LNN	0.02	0.05	0.06	0.06	0.05	0.04	0.02	0.00	-0.02
Unemployment	E_NL_UNN	-0.32	-0.71	-0.84	-0.88	-0.77	-0.55	-0.28	-0.01	0.24
Unemployment rate (deviation from baseline)	E_NL_URX	-0.02	-0.04	-0.05	-0.06	-0.05	-0.04	-0.02	0.00	0.02

(deviations from baseline, percentage unless otherwise indicated)

		1	2	3	4	5	6	7	8	9
Disposable Income (nominal) & Total Wealth										
Disposable income	E_NL_PYN	0.17	0.23	0.26	0.31	0.40	0.49	0.57	0.62	0.62
Real disposible Income	E_NL_PYR	-0.01	-0.17	-0.30	-0.37	-0.38	-0.36	-0.33	-0.32	-0.34
Compensation of employees	E_NL_WIN	0.17	0.36	0.48	0.56	0.61	0.63	0.62	0.61	0.58
Transfers from Gal Gov.	E_NL_TRN	0.18	0.28	0.37	0.45	0.50	0.53	0.55	0.56	0.56
Other Personal income	E_NL_OPN	0.21	0.15	0.20	0.27	0.33	0.38	0.42	0.46	0.49
Direst Taxes (inc. SSC)	E_NL_PDN	0.21	0.48	0.76	0.90	0.87	0.72	0.56	0.44	0.42
Total Wealth	E_NL_FWN	0.11	0.27	0.40	0.47	0.53	0.58	0.63	0.68	0.72
Real Total Wealth	E_NL_FWR	-0.07	-0.13	-0.17	-0.21	-0.25	-0.27	-0.27	-0.26	-0.24
Saving ratio	E_NL_SRATIO	0.01	-0.07	-0.09	-0.08	-0.07	-0.07	-0.07	-0.08	-0.08
Net foreign asstes ratio	E_NL_NFARATIO	0.17	0.59	0.86	1.05	1.21	1.37	1.50	1.61	1.70
Firms and Interest Rate										
Capital Stock	E_NL_KSR	0.00	0.00	0.00	-0.01	-0.01	-0.02	-0.03	-0.04	-0.04
Real Cost of Capital (average)	E_NL_CCR	1.96	1.35	0.27	-0.13	-0.11	-0.02	0.04	0.05	0.04
3-month interest rate	E_NL_STI	0.39	0.33	0.22	0.15	0.12	0.09	0.07	0.04	0.02
10-year long-term interest rate	E_NL_LTI	0.23	0.20	0.13	0.09	0.07	0.06	0.04	0.02	0.01
Public Sector										
Gal Gov. Compensation of Employees	E_NL_PDN	0.21	0.48	0.76	0.90	0.87	0.72	0.56	0.44	0.42
Tranfers from gal Gov.	E_NL_TRN	0.18	0.28	0.37	0.45	0.50	0.53	0.55	0.56	0.56
Other Gov. Net Revenues	E_NL_OGN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Direst Taxes (inc. SSC)	E_NL_PDX	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Direct Taxes	E_NL_ODN	0.33	0.61	1.11	1.34	1.19	0.80	0.38	0.13	0.12
Indirect Taxes less Subsidies	E_NL_TIN	0.17	0.31	0.41	0.48	0.52	0.56	0.59	0.61	0.62
Gen. Gov. Net Debt	E_NL_GDN	0.26	0.51	0.55	0.46	0.35	0.31	0.35	0.46	0.59
Gen. Gov. Net Lending (% of GDP)	E_NL_GLNRATIO	-0.20	-0.11	0.01	0.06	0.06	0.01	-0.04	-0.07	-0.06
Gen. Gov. Net Debt (% of GDP)	E_NL_GDNRATIO	0.04	0.13	0.10	0.01	-0.08	-0.13	-0.11	-0.05	0.02



3.2.6 Permanent appreciation of the euro (Exchange rate shock)

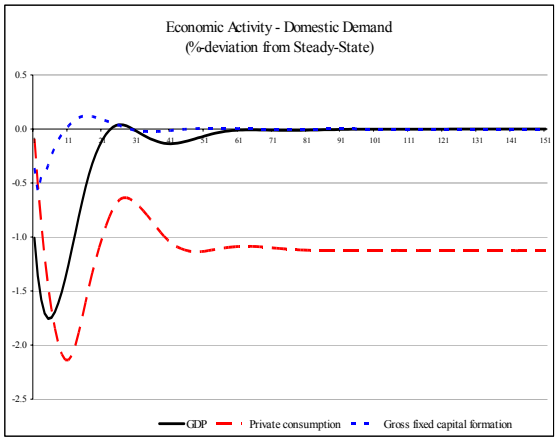
A permanent increase of the euro is an important shock for a small open economy like the Netherlands. In this exercise we assume that the euro appreciates permanently by 5% against all foreign currencies. Import prices are affected as well as export competitiveness. Real exports fall below baseline (-0.49% second year) following the appreciation of the euro and competitiveness losses dragging down investment and stock building through the accelerator mechanism. The decrease in activity determines the fall in imports through the multiplier effect and net trade becomes more favorable in the medium run. The fall in GDP and the rise in the unemployment rate cause private consumption to decrease. Private consumption is also affected by the decrease in real wealth, due to the decrease in capital stock. On the price side, there is a shift in all prices through imported inflation, in fact consumer prices decrease following the decline in import prices. In the long run the drop in domestic prices tends to offset the initial fall in competitiveness, quantitative and qualitative results are reported in the tables and charts below.

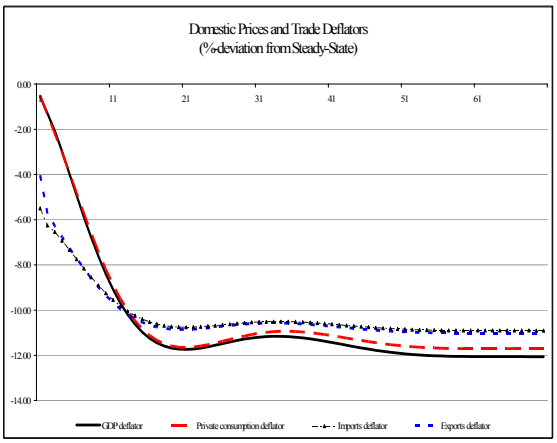
(deviations from baseline, percentage unless otherwise indicated)

		1	2	3	4	5	6	7	8	9
Economic Activity										
(constant prices)										
GDP	E_NL_YER	-1.01	-1.36	-1.58	-1.71	-1.76	-1.74	-1.69	-1.61	-1.51
Private consumption	E_NL_PCR	-0.09	-0.52	-0.88	-1.19	-1.45	-1.67	-1.85	-1.99	-2.08
Government consumption	E_NL_GCR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gross fixed capital formation	E_NL_ITR	-0.36	-0.58	-0.44	-0.42	-0.34	-0.25	-0.16	-0.10	-0.05
Exports	E_NL_XTR	-0.04	-0.49	-0.58	-0.54	-0.47	-0.39	-0.31	-0.23	-0.16
Imports	E_NL_MTR	1.27	0.84	0.78	0.75	0.70	0.62	0.50	0.37	0.23
of which :										
Contribution of trade	E_NL_TRADE	-0.91	-0.98	-1.01	-0.96	-0.87	-0.75	-0.60	-0.45	-0.29
Contribution of inventories	E_NL_SCRRATIO	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Price Developments										
HICP	E_NL_HIC	-0.54	-1.42	-2.25	-3.09	-3.97	-4.88	-5.79	-6.67	-7.49
GDP deflator	E_NL_YED	-0.55	-1.29	-2.06	-2.98	-3.95	-4.93	-5.88	-6.79	-7.63
Private Consumption deflator	E_NL_PCD	-0.48	-1.35	-2.18	-3.02	-3.90	-4.81	-5.72	-6.60	-7.43
Exports deflator	E_NL_XTD	-4.04	-5.73	-6.27	-6.76	-7.24	-7.71	-8.16	-8.59	-8.99
Imports deflator	E_NL_MTD	-5.50	-6.25	-6.54	-6.92	-7.33	-7.75	-8.16	-8.55	-8.91
Competitors Prices on domestic market	E_NL_CMD	-10.00	-10.00	-10.00	-10.00	-10.00	-10.00	-10.00	-10.00	-10.00
Competitors Prices on external markets	E_NL_CXD	-10.00	-10.00	-10.00	-10.00	-10.00	-10.00	-10.00	-10.00	-10.00
Nominal Exchange Rate	E_NL_EEN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Labour Market and Cost Developments										
Compensation per employee (nominal)	E_NL_WUN	-0.73	-1.76	-2.73	-3.71	-4.69	-5.65	-6.56	-7.41	-8.19
Compensation per employee (real, GDP price)	E_NL_WUNY	-0.19	-0.48	-0.68	-0.75	-0.77	-0.75	-0.72	-0.67	-0.60
Compensation per employee (real, Consumption price)	E_NL_WUNC	-0.25	-0.42	-0.56	-0.71	-0.82	-0.88	-0.89	-0.87	-0.82
Productivity	E_NL_PRO	-0.81	-0.66	-0.49	-0.26	-0.01	0.22	0.42	0.58	0.71
ULC, whole economy	E_NL_ULC	0.08	-1.11	-2.25	-3.46	-4.68	-5.85	-6.95	-7.95	-8.83
Total Labour Force	E_NL_LFN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total employment	E_NL_LNN	-0.20	-0.70	-1.10	-1.45	-1.75	-1.96	-2.11	-2.18	-2.20
Unemployment	E_NL_UNN	2.94	10.36	16.20	21.46	25.80	29.01	31.13	32.27	32.56
Unemployment rate (deviation from baseline)	E_NL_URX	0.19	0.66	1.03	1.36	1.63	1.84	1.97	2.04	2.06

(deviations from baseline, percentage unless otherwise indicated)

		1	2	3	4	5	6	7	8	9
Disposable Income (nominal) & Total Wealth										
Disposable income	E_NL_PYN	-1.56	-2.86	-3.88	-4.89	-5.91	-6.94	-7.92	-8.83	-9.62
Real disposible Income	E_NL_PYR	-1.07	-1.53	-1.73	-1.93	-2.10	-2.24	-2.34	-2.39	-2.37
Compensation of employees	E_NL_WIN	-0.93	-2.45	-3.79	-5.11	-6.35	-7.50	-8.53	-9.43	-10.21
Transfers from Gal Gov.	E_NL_TRN	-1.55	-2.63	-3.61	-4.64	-5.64	-6.59	-7.48	-8.29	-9.03
Other Personal income	E_NL_OPN	-2.75	-3.15	-3.60	-4.23	-4.87	-5.51	-6.16	-6.81	-7.44
Direst Taxes (inc. SSC)	E_NL_PDN	-1.10	-2.07	-3.32	-4.68	-5.87	-6.83	-7.60	-8.26	-8.88
Total Wealth	E_NL_FWN	-0.48	-1.47	-2.55	-3.60	-4.64	-5.67	-6.70	-7.69	-8.63
Real Total Wealth	E_NL_FWR	0.00	-0.12	-0.38	-0.60	-0.77	-0.91	-1.04	-1.17	-1.30
Saving ratio	E_NL_SRATIO	-0.61	-0.48	-0.36	-0.30	-0.22	-0.13	-0.01	0.11	0.22
Firms and Interest Rate										
Capital Stock	E_NL_KSR	-0.01	-0.04	-0.07	-0.09	-0.11	-0.12	-0.12	-0.12	-0.12
Real Cost of Capital (average)	E_NL_CCR	-3.51	-2.08	-0.53	2.07	2.62	2.56	2.37	2.19	2.03
3-month interest rate	E_NL_STI	-1.39	-1.50	-1.39	-1.37	-1.40	-1.43	-1.41	-1.36	-1.28
10-year long-term interest rate	E_NL_LTI	-0.84	-0.91	-0.84	-0.83	-0.84	-0.86	-0.85	-0.82	-0.77
Public Sector										
Gal Gov. Compensation of Employees	E_NL_PDN	-1.10	-2.07	-3.32	-4.68	-5.87	-6.83	-7.60	-8.26	-8.88
Tranfers from gal Gov.	E_NL_TRN	-1.55	-2.63	-3.61	-4.64	-5.64	-6.59	-7.48	-8.29	-9.03
Other Gov. Net Revenues	E_NL_OGN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Direst Taxes (inc. SSC)	E_NL_PDX	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Direct Taxes	E_NL_ODN	-2.81	-2.63	-3.44	-4.62	-5.50	-5.97	-6.17	-6.31	-6.56
Indirect Taxes less Subsidies	E_NL_TIN	-0.76	-1.83	-2.77	-3.74	-4.73	-5.72	-6.70	-7.62	-8.48
Gen. Gov. Net Debt	E_NL_GDN	-0.96	-2.55	-3.89	-4.89	-5.70	-6.46	-7.25	-8.07	-8.90
Gen. Gov. Net Lending (% of GDP)	E_NL_GLNRATIO	0.84	0.90	0.70	0.53	0.46	0.45	0.48	0.50	0.50
Gen. Gov. Net Debt (% of GDP)	E_NL_GDNRATIO	0.34	0.05	-0.16	-0.15	-0.04	0.08	0.14	0.13	0.08





3.2.7 Permanent increase in world demand (Foreign demand shock)

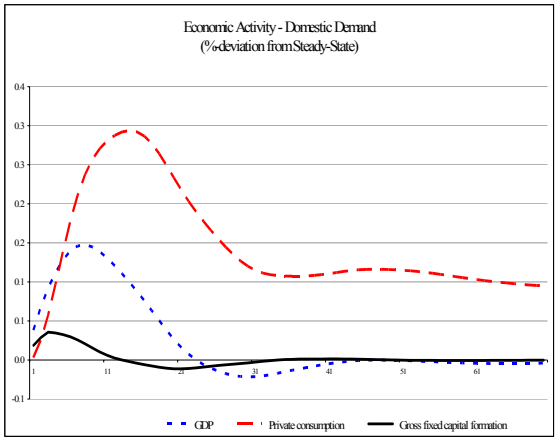
In this experiment we let world demand (excluding euro area) increase permanently by 1% above baseline. The increase in export demand (exports increase above baseline by 0.22% in the first year) triggers an increase in GDP due to increases in investment and consumption. The increase in export prices, through domestic inflation, leads to a deterioration of net trade initiated by the increase of imports resulting from the initial positive demand shock. In the long run this deterioration causes GDP to decline. Tables and charts below provide further qualitative and quantitative details.

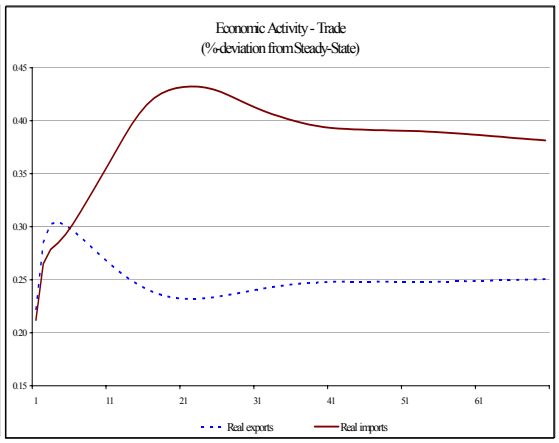
(deviations from baseline, percentage unless otherwise indicated)

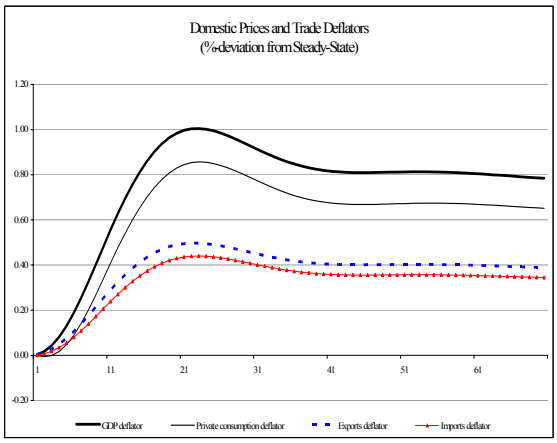
		1	2	3	4	5	6	7	8	9
Economic Activity										
(constant prices)										
GDP	E_NL_YER	0.04	0.07	0.09	0.11	0.13	0.14	0.15	0.15	0.14
Private consumption	E_NL_PCR	0.00	0.03	0.06	0.10	0.14	0.18	0.21	0.24	0.26
Government consumption	E_NL_GCR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gross fixed capital formation	E_NL_ITR	0.02	0.03	0.04	0.03	0.03	0.03	0.03	0.02	0.02
Exports	E_NL_XTR	0.22	0.29	0.30	0.30	0.30	0.30	0.29	0.28	0.28
Imports	E_NL_MTR	0.21	0.26	0.28	0.28	0.29	0.30	0.31	0.33	0.34
of which :										
Contribution of trade	E_NL_TRADE	0.03	0.05	0.05	0.05	0.04	0.03	0.02	0.01	-0.01
Contribution of inventories	E_NL_SCRRATIO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Price Developments										
HICP	E_NL_HIC	0.00	-0.01	0.00	0.02	0.05	0.09	0.15	0.21	0.27
GDP deflator	E_NL_YED	0.00	0.02	0.04	0.08	0.13	0.19	0.25	0.33	0.40
Private Consumption deflator	E_NL_PCD	0.00	-0.01	0.00	0.02	0.05	0.09	0.14	0.20	0.27
Exports deflator	E_NL_XTD	0.00	0.01	0.03	0.05	0.07	0.11	0.14	0.18	0.21
Imports deflator	E_NL_MTD	0.00	0.01	0.02	0.03	0.05	0.08	0.11	0.14	0.17
Competitors Prices on domestic market	E_NL_CMD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Competitors Prices on external markets	E_NL_CXD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nominal Exchange Rate	E_NL_EEN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Labour Market and Cost Developments										
Compensation per employee (nominal)	E_NL_WUN	0.01	0.03	0.06	0.11	0.17	0.23	0.31	0.38	0.46
Compensation per employee (real, GDP price)	E_NL_WUNY	0.01	0.01	0.02	0.03	0.04	0.05	0.05	0.06	0.06
Compensation per employee (real, Consumption price)	E_NL_WUNC	0.01	0.03	0.06	0.09	0.12	0.14	0.17	0.18	0.20
Productivity	E_NL_PRO	0.03	0.04	0.04	0.03	0.02	0.01	-0.01	-0.02	-0.04
ULC, whole economy	E_NL_ULC	-0.02	-0.01	0.03	0.08	0.15	0.23	0.31	0.41	0.50
Total Labour Force	E_NL_LFN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total employment	E_NL_LNN	0.01	0.03	0.06	0.08	0.11	0.13	0.15	0.17	0.18
Unemployment	E_NL_UNN	-0.10	-0.43	-0.83	-1.23	-1.61	-1.97	-2.27	-2.51	-2.68
Unemployment rate (deviation from baseline)	E_NL_URX	-0.01	-0.03	-0.05	-0.08	-0.10	-0.12	-0.14	-0.16	-0.17

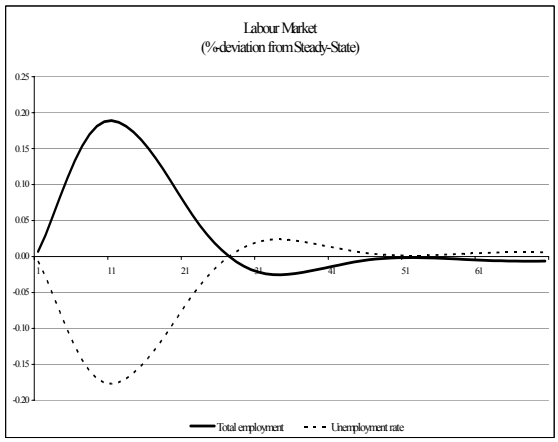
(deviations from baseline, percentage unless otherwise indicated)

		1	2	3	4	5	6	7	8	9
Disposable Income (nominal) & Total Wealth										
Disposable income	E_NL_PYN	0.04	0.10	0.18	0.25	0.33	0.40	0.47	0.53	0.60
Real disposible Income	E_NL_PYR	0.04	0.11	0.18	0.24	0.28	0.31	0.32	0.33	0.33
Compensation of employees	E_NL_WIN	0.02	0.06	0.12	0.19	0.28	0.37	0.46	0.56	0.65
Transfers from Gal Gov.	E_NL_TRN	0.04	0.09	0.14	0.19	0.26	0.33	0.40	0.48	0.55
Other Personal income	E_NL_OPN	0.09	0.15	0.19	0.23	0.26	0.30	0.34	0.39	0.43
Direst Taxes (inc. SSC)	E_NL_PDN	0.02	0.03	0.04	0.06	0.12	0.21	0.33	0.44	0.55
Total Wealth	E_NL_FWN	0.01	0.02	0.05	0.08	0.13	0.19	0.26	0.32	0.39
Real Total Wealth	E_NL_FWR	0.01	0.03	0.05	0.07	0.09	0.10	0.11	0.12	0.12
Saving ratio	E_NL_SRATIO	0.02	0.04	0.05	0.05	0.04	0.04	0.03	0.02	0.01
Firms and Interest Rate										
Capital Stock	E_NL_KSR	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Real Cost of Capital (average)	E_NL_CCR	0.13	-0.18	-0.19	-0.19	-0.21	-0.22	-0.24	-0.24	-0.24
3-month interest rate	E_NL_STI	0.02	0.01	0.03	0.04	0.06	0.07	0.09	0.09	0.10
10-year long-term interest rate	E_NL_LTI	0.01	0.00	0.02	0.03	0.04	0.04	0.05	0.06	0.06
Public Sector										
Gal Gov. Compensation of Employees	E_NL_PDN	0.02	0.03	0.04	0.06	0.12	0.21	0.33	0.44	0.55
Tranfers from gal Gov.	E_NL_TRN	0.04	0.09	0.14	0.19	0.26	0.33	0.40	0.48	0.55
Other Gov. Net Revenues	E_NL_OGN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Direst Taxes (inc. SSC)	E_NL_PDX	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Direct Taxes	E_NL_ODN	0.10	0.09	0.02	-0.03	-0.02	0.05	0.17	0.29	0.39
Indirect Taxes less Subsidies	E_NL_TIN	0.00	0.02	0.05	0.10	0.16	0.23	0.30	0.38	0.45
Gen. Gov. Net Debt	E_NL_GDN	0.02	0.03	0.07	0.15	0.25	0.36	0.45	0.52	0.57
Gen. Gov. Net Lending (% of GDP)	E_NL_GLNRATIO	-0.01	-0.01	-0.03	-0.05	-0.06	-0.06	-0.05	-0.04	-0.03
Gen. Gov. Net Debt (% of GDP)	E_NL_GDNRATIO	-0.01	-0.03	-0.03	-0.02	0.00	0.02	0.03	0.02	0.01









3.2.8 Permanent increase in labour supply

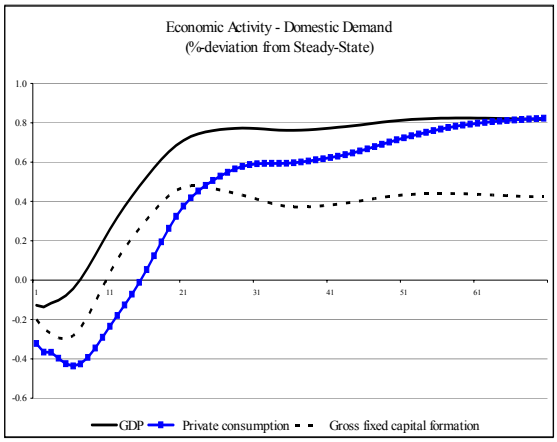
In the final experiment reported here we let labour supply increase permanently by 1% above baseline. As shown numerically and graphically below, the initial effect is a slow adjustment in output and employment. The shock on labour force however results in opposite effects. On the one hand, the jump in the unemployment rate, resulting from the sudden increase in the labour force causes a drop in real wages. On the other hand, the resulting drop in inflation and increased investment initiates a positive demand effect with a subsequent increase in employment. The net effect on consumption is the sum of these two different effects of opposite sign: the direct negative effect of real wages and the indirect positive effect of higher employment. In the long run, as expected, all real variables are permanently higher and all prices are permanently lower.

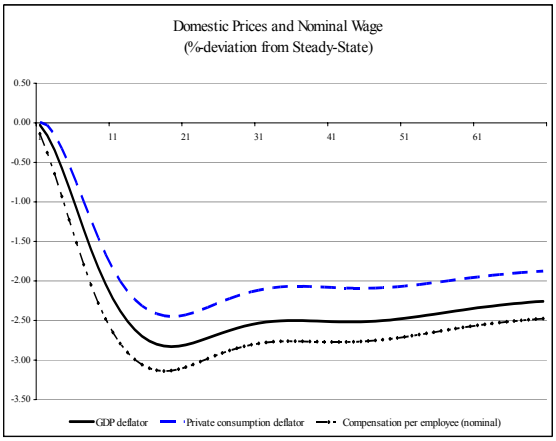
(deviations from baseline, percentage unless otherwise indicated)

		1	2	3	4	5	6	7	8	9
Economic Activity										
(constant prices)										
GDP	E_NL_YER	-0.13	-0.14	-0.12	-0.10	-0.08	-0.04	0.00	0.06	0.13
Private consumption	E_NL_PCR	-0.32	-0.37	-0.37	-0.40	-0.42	-0.44	-0.43	-0.39	-0.35
Government consumption	E_NL_GCR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gross fixed capital formation	E_NL_ITR	-0.20	-0.25	-0.27	-0.29	-0.30	-0.28	-0.24	-0.18	-0.11
Exports	E_NL_XTR	0.00	0.02	0.04	0.06	0.09	0.11	0.13	0.15	0.17
Imports	E_NL_MTR	-0.14	-0.16	-0.18	-0.21	-0.25	-0.28	-0.31	-0.33	-0.35
of which :										
Contribution of trade	E_NL_TRADE	0.09	0.12	0.14	0.18	0.22	0.26	0.29	0.32	0.35
Contribution of inventories	E_NL_SCRRATIO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Price Developments										
HICP	E_NL_HIC	0.00	-0.04	-0.17	-0.35	-0.56	-0.78	-1.02	-1.26	-1.48
GDP deflator	E_NL_YED	-0.03	-0.16	-0.35	-0.58	-0.83	-1.09	-1.35	-1.60	-1.84
Private Consumption deflator	E_NL_PCD	0.00	-0.04	-0.16	-0.33	-0.54	-0.77	-1.00	-1.24	-1.46
Exports deflator	E_NL_XTD	-0.02	-0.10	-0.20	-0.32	-0.45	-0.59	-0.72	-0.84	-0.95
Imports deflator	E_NL_MTD	-0.01	-0.06	-0.13	-0.23	-0.34	-0.46	-0.57	-0.69	-0.79
Competitors Prices on domestic market	E_NL_CMD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Competitors Prices on external markets	E_NL_CXD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nominal Exchange Rate	E_NL_EEN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Labour Market and Cost Developments										
Compensation per employee (nominal)	E_NL_WUN	-0.15	-0.38	-0.65	-0.94	-1.23	-1.52	-1.80	-2.06	-2.29
Compensation per employee (real, GDP price)	E_NL_WUNY	-0.11	-0.22	-0.30	-0.36	-0.41	-0.44	-0.45	-0.46	-0.46
Compensation per employee (real, Consumption price)	E_NL_WUNC	-0.15	-0.35	-0.50	-0.61	-0.70	-0.76	-0.81	-0.83	-0.84
Productivity	E_NL_PRO	-0.11	-0.06	-0.03	-0.01	0.01	0.03	0.05	0.07	0.07
ULC, whole economy	E_NL_ULC	-0.04	-0.32	-0.62	-0.93	-1.25	-1.56	-1.85	-2.12	-2.36
Total Labour Force	E_NL_LFN	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Total employment	E_NL_LNN	-0.02	-0.08	-0.09	-0.10	-0.09	-0.08	-0.05	-0.01	0.05
Unemployment	E_NL_UNN	16.10	16.90	17.13	17.22	17.17	16.94	16.51	15.86	15.01
Unemployment rate (deviation from baseline)	E_NL_URX	0.95	1.00	1.01	1.02	1.01	1.00	0.97	0.93	0.88

(deviations from baseline, percentage unless otherwise indicated)

		1	2	3	4	5	6	7	8	9
Disposable Income (nominal) & Total Wealth										
Disposable income	E_NL_PYN	-0.18	-0.43	-0.68	-0.93	-1.14	-1.31	-1.46	-1.61	-1.76
Real disposible Income	E_NL_PYR	-0.18	-0.39	-0.53	-0.60	-0.61	-0.55	-0.47	-0.38	-0.30
Compensation of employees	E_NL_WIN	-0.17	-0.46	-0.74	-1.04	-1.33	-1.60	-1.85	-2.06	-2.23
Transfers from Gal Gov.	E_NL_TRN	-0.16	-0.30	-0.47	-0.68	-0.91	-1.14	-1.35	-1.54	-1.71
Other Personal income	E_NL_OPN	-0.12	-0.05	-0.06	-0.16	-0.29	-0.45	-0.62	-0.78	-0.94
Direst Taxes (inc. SSC)	E_NL_PDN	-0.10	-0.13	-0.20	-0.41	-0.75	-1.17	-1.58	-1.91	-2.13
Total Wealth	E_NL_FWN	-0.02	-0.04	-0.14	-0.28	-0.46	-0.64	-0.82	-0.98	-1.13
Real Total Wealth	E_NL_FWR	-0.02	-0.01	0.02	0.05	0.08	0.13	0.19	0.26	0.34
Saving ratio	E_NL_SRATIO	0.10	0.06	0.03	0.03	0.03	0.04	0.05	0.05	0.06
Firms and Interest Rate										
Capital Stock	E_NL_KSR	-0.01	-0.02	-0.04	-0.05	-0.06	-0.08	-0.09	-0.10	-0.10
Real Cost of Capital (average)	E_NL_CCR	0.00	1.13	1.08	1.03	1.03	1.02	0.97	0.89	0.80
3-month interest rate	E_NL_STI	-0.06	-0.10	-0.20	-0.27	-0.31	-0.33	-0.33	-0.32	-0.30
10-year long-term interest rate	E_NL_LTI	-0.03	-0.06	-0.12	-0.16	-0.19	-0.20	-0.20	-0.20	-0.18
Public Sector										
Gal Gov. Compensation of Employees	E_NL_PDN	-0.10	-0.13	-0.20	-0.41	-0.75	-1.17	-1.58	-1.91	-2.13
Tranfers from gal Gov.	E_NL_TRN	-0.16	-0.30	-0.47	-0.68	-0.91	-1.14	-1.35	-1.54	-1.71
Other Gov. Net Revenues	E_NL_OGN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Direst Taxes (inc. SSC)	E_NL_PDX	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Direct Taxes	E_NL_ODN	-0.03	0.53	0.93	0.95	0.61	0.02	-0.59	-1.07	-1.32
Indirect Taxes less Subsidies	E_NL_TIN	-0.25	-0.34	-0.46	-0.65	-0.87	-1.10	-1.31	-1.51	-1.69
Gen. Gov. Net Debt	E_NL_GDN	-0.03	-0.10	-0.34	-0.70	-1.06	-1.36	-1.56	-1.67	-1.73
Gen. Gov. Net Lending (% of GDP)	E_NL_GLNRATIO	0.01	0.07	0.17	0.21	0.20	0.15	0.09	0.05	0.03
Gen. Gov. Net Debt (% of GDP)	E_NL_GDNRATIO	0.07	0.12	0.07	-0.01	-0.09	-0.13	-0.12	-0.07	-0.01





4 Conclusion

This paper has presented the Dutch block of the MCM used at the ECB. As in the other blocks of the MCM and in the AWM, the econometric specification relies on an ad hoc demand side and on a theoretically-based supply side. While the short run output is determined by the former –with a sluggish adjustment of prices and quantities towards equilibrium–, the long run equilibrium is based on the latter –with long run prices adjusting fully. The model is backward-looking and expectations are treated implicitly by the inclusion of current and lagged values of the variables in the equations. Nominal exchange rate and foreign developments are exogenous.

One of the main characteristics of the Dutch block is that the same model is used in the projection exercises of the ESCB and for policy experiments. Therefore we have described how the model can be used both for forecasting and for simulating interesting policy experiments. On the forecasting side, we have shown how to deal with the combination of judgmental and non-judgmental forecasts. On the simulation side, the paper illustrates how the long run simulations performed deliver responses of the baseline economy in line with both macroeconomic theory and practice, from a quantitative and a qualitative point of view.

In order to extend the model and include more realistic and up to date features of the Dutch economy, several issues have been postponed to our future research agenda. In particular, it will be useful (i) to build a time-varying measure of the NAIRU, which should reflect the change in the structure of the markets over time; (ii) to include other realistic co-variates in order to explain in a better way the behavior of the domestic demand side; (iii) to improve the estimates of the trade side, especially those related to the trade elasticities, whose values seem unreasonably low as compared to other studies; (iv) to choose a Phillips Curve more suited to the institutional set-up, e.g. using "a right to manage" approach which allows for important negotiation components.

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Appendix

A The Accounting Framework

The table below summarizes the main accounting relationships of the Dutch block. The names of the variables are given in the appendix B.

The main accounting relationships

EXPENDITURES					RECEIPTS			
Households	**Public sector**	**Firms**	**RoW**		**Households**	**Public Sector**	**Firms**	**RoW**
PCN+IHN	GCN+GIN	ITN+SCN	XTN	**I- Operations on Goods and Services**		GWN	YEN-GWN	MTN
				II- Distribution of Income				
			BTN	Value Added		GWN	YEN-GWN	
	GWN	WIN-GWN		Compensations	WIN			
		TIN		Net Indirect Taxes		TIN		
	TRN			Social contributions	TRN			
			NFN	Net Foreign Income			NFN	
			TWN	Net Transfers			TWN	
		OGN		Other Net Transfers to Public Sector		OGN		
		OPN		Other Net Transfers to Households	OPN			
	INN			Interests			INN	
TDN				Direct Taxes		TDN		
		ODN		Other Direct Taxes		ODN		
PYN	GYN	OYN		*Balance: Gross Disposable Income*				CAN
				III- Savings and Consumption				
			CAN	Gross Disposable Income	PYN	GYN	OYN	
PCN	GCN			Final Consumption				
PSN	GSN	OYN		*Balance: Gross Savings*				CAN
				IV- Capital Accumulation				
				Gross Savings	PSN	GSN	OYN	
IHN	GIN	IPN		Gross Fixed Capital Formation				
		SCN		Variations of Stocks				
			CAN	Foreign Trade				
PLN	GLN	OLN		*Balance: Net Lending*				CAN

In words: the purchases of goods and services by households, government, firms and foreign agents match the sales of goods and services by the government, firms and the rest of the world (block I in the table). The aggregate income thus generated is redistributed as compensations (to households) and gross operating surplus (to firms), and gives rise to a number of transfers among the domestic agents and the rest of the world (block II of the table). Once these transfers are made, domestic agents are left with a gross disposable income, which is allocated to consumption and gross savings (block III). The gap between gross aggregate savings and domestic capital formation is filled by the current account surplus, which can also be viewed as net (flow of) lending to the rest of the world (block IV).

B Names of the variables in the MCM

Here is the agreed list with the acronyms associated to all variables used in the model.

Names	Description
BTN	*Balance of Goods and Services*
CAN	Current Account Surplus
CC0	*User Cost of Capital (average LTI and RCC)*
CC1	*User Cost of Capital (LTI)*
CC2	*User Cost of Capital (RCC)*
CCR	*Real User Cost of Capital (deflated by GDP deflator)*
CMD	*Competitors' Import Price in Domestic Currency*
CXD	*Competitors' Export Price in Domestic Currency*
CMUD	*Competitors' Import Price in US$*
CXUD	*Competitors' Export Price in US$*
EEN	*Effective Exchange Rate, Export Side*
EEN0	*Effective Exchange Rate, Import Side*
EXR	*Exchange Rate vis-à-vis the US$*
FWN	*Financial Wealth*
FWR	*Financial Wealth (Real)*
GCD	Government Consumption (Deflator)
GCN	Government Consumption
GCP	*Government Consumption Pre-Tax (Deflator)*
GCR	Government Consumption (Real)
GDN	General Government Net Debt
GID	Gen. Govt Domestic Capital Formation (Deflator)
GIN	Gen. Govt Domestic Capital Formation
GIP	*Gen. Govt Domestic Capital Formation Pre-Tax (Deflator)*
GIR	Gen. Govt Domestic Capital Formation (Real)
GLN	Gen. Govt Net Lending
GON	Gross Operating Surplus
GOR	*Gross Operating Surplus (Real)*
GSN	Govt savings
GWN	General government compensation to employees
GYN	Govt disposable income
HE	*HICP Energy*
HEX	*HICP Excluding Energy*
HEXP	*HICP Excluding Energy Pre-Tax*
HICP	*HICP*
IHD	Housing Investment (Deflator)
IHN	Housing Investment
IHR	Housing Investment (Real)
INFA	*Inflation on PCD Deflator (Annuual)*
INFE	*Inflation on PCD Deflator (Expected)*
INFQ	*Inflation on PCD Deflator (Quarterly)*
INN	National Debt Interest
IPD	Private-sector Investment (Deflator)
IPN	Private-sector Investment
IPR	Private-sector Investment (Real)
IPX	*Industrail Production to GDP (Ratio)*
ITD	Investment (Deflator)
ITN	Investment
ITR	Investment (Real)
KGR	*General Government Capital Stock (Real)*
KSR	*Total Capital Stock (Real)*

Names	Description
KRP	Capital Stock, private sector (Real)
KRW	Capital Stock, whole economy (Real)
LEX	*Employees to Employment (Ratio)*
LEN	*Total Employees*
LFN	Total Labour Force
LGN	General government employment
LNN	Whole Economy Employment
LNT	*Trend Employment*
LSR	*Outstanding Inventories (Real)*
LTI	Long term interest Rate
LTR	*Long term interest Rate (Real)*
MTD	Imports of Goods and Services (Deflator)
MTN	Imports of Goods and Services
MTR	Imports of Goods and Services (Real)
NFA	Net foreign Assets
NFN	Net Factor Income
ODN	Other Direct Taxes
OGN	Other Govt. Net. Revenue
OID	Private Gross Domestic Capital Formation (Deflator)
OIN	Private Gross Domestic Capital Formation
OIP	*Private Gross Domestic Capital Formation Pre-Tax (Deflator)*
OIR	Private Gross Domestic Capital Formation (Real)
OLN	Other Domestic Net Lending
OPN	Other Personal Income
OWN	Other sector compensation of employees
OYN	Other sector disposable income
PCD	Personal Consumer Expenditure (Deflator)
PCN	Personal Consumer Expenditure
PCP	*Private Consumption Deflator Pre-Tax (Deflator)*
PCR	Personal Consumer Expenditure (Real)
PEI	Price/unit value index for imports of energy
POIL	*Price of Oil in US$*
PPYB	*Permanent Income(backward looking) (Real)*
PROD	*Productivity per Head*
PSN	Personal Sector Saving
PYN	Personal Disposable Income
PYR	Personal Disposable Income (Real)
RCC	Credit interest rate (corporate sector)
RCH	Credit interest rate (household sector)
RMT	Mortgage rate (representative)
SALE	*Consumption plus Exports (Real)*
SCD	Change in inventories (Deflator)
SCN	Change in inventories
SCR	Change in inventories (Real)
SGLN	*Cumulated Current Account*
SMC	*Short-Run Marginal Cost of Production*
STI	Short Term Interest Rate
SZD	*Inventories and Stat. Discrepancy (Deflator)*
SZN	*Inventories and Stat. Discrepancy*
TCI	*Apparent Tax Rate on Consumption*
TCIR	*Apparent Tax Rate on Consumption (Rebased)*

Names	Description
TDN	Direct Taxes incl. SSC
TDNB	*Tax Base for Direct Taxes*
TDX	*Direct Taxes to the Tax Base (Ratio)*
TGI	*Apparent Indirect Tax Rate on Government Consumption*
TGIR	*Apparent Indirect Tax Rate on Government Consumption (Rebased)*
TII	*Apparent Indirect Tax Rate on Investment*
TIIR	*Apparent Indirect Tax Rate on Investment (Rebased)*
TIN	Indirect Taxes less Subsidies
TIR	*Indirect Taxes less Subsidies (Real)*
TIX	*Indirect Taxes less Subsidies (Ratio)*
TRN	Transfers from Gen. Govt
TRX	*Transfers from Gen. Govt (Ratio)*
TWN	Transfers from ROW
ULA	*ULC Adjusted (employees)*
ULC	*ULC*
UNN	Unemployment (ILO concept)
URT	Equilibrium Unemployment Rate
URX	Unemployment Rate (ILO concept)
WED	*Foreign Output in Domestic Currency (Deflator)*
WEN	*Compensation per Employee*
WER	*Weighted Import Demand Indicator*
WEUD	*Foreign Output in US$ (Deflator)*
WIN	Compensation to Employees, Total
WUN	*Compensation to Employees, per Head*
WUG	*Government Compensation, per Head*
WUR	*Real Wage in terms of Consumption*
XTD	Exports of Goods and Services (Deflator)
XTN	Exports of Goods and Services
XTR	Exports of Goods and Services (Real)
YED	GDP BY EXPENDITURE/INCOME (Deflator)
YEN	GDP BY EXPENDITURE/INCOME
YER	GDP BY EXPENDITURE/INCOME (Real)
YFD	*GDP at Factor Cost (Deflator)*
YFN	*GDP at Factor Cost*
YFR	*GDP at Factor Cost (Real)*
YFT	*Potential Output*
YGA	*Output Gap*
YNR	*Production Using Available Inputs (Real)*
ZCC1	*Stat. Discrep. User Cost of Capital (LTI)*
ZCC2	*Stat. Discrep. User Cost of Capital (RCC)*
ZED	Statistical discrepancy, GDP Expenditure
ZEN	Statistical discrepancy, GDP Expenditure
ZER	Statistical discrepancy, GDP Expenditure
ZGDN	*Stat. Discrep. Government Net Debt*
ZGLN	*Stat. Discrep. Government Net Lending*
ZID	Statistical discrepancy, GDP Income
ZIN	Statistical discrepancy, GDP Income
ZIR	Statistical discrepancy, GDP Income
ZKSR	*Stat. Discrep. Total Real Capital Stock*
ZNFA	*Stat. Discrep. Net Foreign Assets*
ZOLN	*Stat. Discrep. Net Lending Other Private Sector*

C List of Dummies and trends

The following dummies and trends have been used in the following equations:

dummy/trend	description	equation
DUMT951	Step dummy from 95q1 onward	KSTAR XTRSTAR MTRSTAR $\Delta \log (MTR)$
DUMMYQ1 DUMMYQ2 DUMMYQ3	Seasonal dummies	$\Delta \log (OIP)$ $\Delta \log (HEG)$ $\Delta \log (HEXP)$
DUM01	Step dummy from 01q1 onward	$\Delta \log (PCR)$
D934	Dummy for 1993q4	XTRSTAR $\Delta \log (XTR)$
D891924	Step dummy from 89q1 to 92q4	MTRSTAR
T931	Trend form 93q1 onward	MTRSTAR
T	Trend	KSTAR IPRSTAR LSTAR SCRSTAR XTRSTAR XTDSTAR MTDSTAR HEGSTAR HEXPSTAR

For the forecast exercise, all dummies and trends are kept constant over the forecast horizon. In the simulation exercise, instead, their treatment may be different as long as their effect decays over the future to ensure that all variables grow, in the long run, at their target growth rate.

D The equations of the MCM

EXOGENOUS VARIABLES

nl_CMUD_EX nl_CMUD_IN nl_CXUD_EX nl_CXUD_IN nl_DUMMYQ1 nl_DUMMYQ2 nl_DUMMYQ3 nl_DUMT951 nl_T931P nl_D891924 nl_D934 nl_EEN0_EX nl_EEN0_IN nl_EEN_EX nl_EEN_IN nl_EXR nl_GCR nl_GIR nl_IHD nl_IHR nl_LEX nl_LGN
nl_OGN nl_POILU nl_TCI nl_TCIR nl_TGI nl_TGIR nl_TII nl_TIIR nl_TIME nl_TIME1 nl_TIME2 nl_ONES nl_TRX nl_TWN nl_WDR_EX nl_WDR_IN nl_WE nl_ZCAN nl_ZER nl_ZGDN nl_ZHIC nl_ZIN nl_ZINN nl_ZZLTI nl_ZNFA nl_ZNFN nl_ZZODX nl_ZZPDX nl_ZZOPX nl_ZZSTI

ENDOGENOUS VARIABLES

nl_YFT nl_YGA nl_STI nl_LTI nl_LTR nl_STR nl_CC0 nl_CCR nl_PDN nl_ODN nl_OPN nl_WUN nl_YFD nl_MTD nl_PEI nl_XTD nl_OIP nl_OIR nl_GIP nl_GCP nl_HEXP nl_HEG nl_PCD nl_PCR nl_IPR nl_XTR nl_MTR nl_LNN nl_LFN nl_SCR nl_INFQ nl_INFA nl_POIL nl_CMD nl_CXD nl_WDR nl_CXUD nl_CXD_IN nl_CXD_EX nl_CMUD nl_CMD_IN nl_CMD_EX nl_EEN0 nl_EEN nl_OID nl_GCD nl_GID nl_YED nl_ITD nl_PCP nl_HEX nl_HIC nl_OIN nl_GIN nl_ITN nl_PCN nl_GCN nl_XTN nl_MTN nl_YFN nl_YEN nl_ITR nl_YFR nl_MKUP nl_SZD nl_UNN nl_URX nl_PYR nl_KGR nl_KPR nl_KSR nl_KHR nl_FWR nl_FWRH nl_SALE nl_YER nl_SZN nl_LEN nl_PRO nl_WIN nl_CEX nl_ULA nl_WUG nl_GON nl_PYN nl_PSN nl_GYN nl_PDNB nl_INN nl_GSN nl_GLN nl_GDN nl_ODNB nl_OLN nl_BTN nl_CAN nl_NFN nl_NFA nl_OYN nl_PLN nl_TRN nl_WER nl_FWN nl_IHN nl_TIN nl_TIR nl_ODX nl_PDX

DEFINITIONS

nl_LSTAR nl_RWUNSTAR nl_KSTAR nl_MTDSTAR nl_PEISTAR nl_XTDSTAR nl_OIPSTAR nl_GIPSTAR nl_GCPSTAR nl_HEXPSTAR nl_HEGSTAR nl_PCRSTAR nl_IPRSTAR nl_XTRSTAR nl_MTRSTAR nl_LFNSTAR nl_SCRSTAR nl_GDNRATIO nl_GLNRATIO nl_DEBT_TARGET

PARAMETERS

nl_dfor nl_drir nl_fiscrule nl_nairu nl_infl nl_lambda nl_depksr nl_depkpr nl_depkgr nl_wer.pcr nl_wer.gcr nl_wer.itr nl_wer.scr nl_wer.xtr nl_pdnb.win nl_betain nl_betaex nl_m2in nl_m2ex

COEFFICIENTS

nl_taylor nl_demo nl_alpha nl_beta nl_gamma nl_eps nl_lti.cst nl_lti.sti nl_yft.cst nl_yft.time1 nl_rwunstar.cst nl_wun.cst nl_wun.rwun1 nl_wun.pro nl_wun.urx nl_wun.ecm1 nl_wun.pcyf nl_yfd.cst nl_yfd.mtd1 nl_yfd.yga1 nl_yfd.ecm1 nl_pcd.hic nl_pcd.dre1 nl_oipstar.cst nl_oipstar.yfd nl_oipstar.mtd nl_oip.cst nl_oip.yfd nl_oip.mtd nl_oip.ecm1 nl_oip.dumq1 nl_gipstar.cst nl_gipstar.yfd nl_gipstar.mtd nl_gip.cst nl_gip.gip1 nl_gip.mtd nl_gip.ecm1 nl_gip.dumq2 nl_gcpstar.cst nl_gcpstar.yfd nl_gcpstar.mtd nl_gcpstar.time1 nl_gcp.cst nl_gcp.yfd nl_gcp.mtd nl_gcp.ecm1 nl_mtdstar.cst nl_mtdstar.cmd nl_mtdstar.pei nl_mtdstar.yfd nl_mtdstar.time1 nl_mtd.mtd1 nl_mtd.pei nl_mtd.cmud nl_mtd.exr nl_mtd.yfd nl_mtd.ecm1 nl_xtdstar.cst nl_xtdstar.cxd nl_xtdstar.yfd nl_xtdstar.expoi nl_xtdstar.time1 nl_xtd.cst nl_xtd.xtd1 nl_xtd.cxd nl_xtd.yfd nl_xtd.expoi nl_xtd.expoil nl_xtd.ecm1 nl_peistar.cst nl_peistar.poil nl_peistar.time1 nl_peistar.time2 nl_pei.cst nl_pei.pei1 nl_pei.poil nl_pei.ecm1 nl_hegstar.cst nl_hegstar.yfd nl_hegstar.poil nl_hegstar.time1 nl_heg.cst nl_heg.heg4 nl_heg.poil nl_heg.ecm1 nl_heg.dumq1 nl_hexpstar.cst nl_hexpstar.ulc nl_hexpstar.time1 nl_hexp.cst nl_hexp.hexp1 nl_hexp.mg nl_hexp.ecm1 nl_hexp.dumq1 nl_hexp.dumq2 nl_hexp.dumq3 nl_pcrstar.cst nl_pcrstar.pyr nl_pcrstar.fwrpy nl_pcr.cst nl_pcr.pcr1 nl_pcr.pcr2 nl_pcr.pyr1 nl_pcr.urx1 nl_pcr.ltr nl_pcr.ecm1 nl_pcr.dum01 nl_kstar.cst nl_kstar.dumt951 nl_iprstar.cst nl_iprstar.time1 nl_ipr.cst nl_ipr.ipr1 nl_ipr.yer nl_ipr.yer1 nl_ipr.ecm1 nl_xtrstar.cst nl_xtrstar.wdr nl_xtrstar.xtd nl_xtrstar.cxd nl_xtrstar.time1 nl_xtrstar.d934 nl_xtrstar.dumt951 nl_xtr.cst nl_xtr.xtr1 nl_xtr.wdr.ex nl_xtr.wdr.in nl_xtr.exr1 nl_xtr.xtd nl_xtr.cxud.ex nl_xtr.cxud.in nl_xtr.ecm1 nl_xtr.d934 nl_mtrstar.cst nl_mtrstar.wer nl_mtrstar.mtd nl_mtrstar.yfd nl_mtrstar.d891924 nl_mtrstar.t931p nl_mtrstar.dumt951 nl_mtr.cst nl_mtr.ecm1 nl_mtr.mtr1 nl_mtr.mtr2 nl_mtr.wer nl_mtr.wer1 nl_mtr.wer2 nl_mtr.comp nl_mtr.dumt951 nl_lstar.cst nl_lstar.time1 nl_lnn.cst nl_lnn.lnn1 nl_lnn.yer nl_lnn.yer3 nl_lnn.rwun3 nl_lnn.ecm1 nl_lnn.lgn nl_lfnstar.cst nl_lfnstar.lfn1 nl_lfnstar.time nl_lfn.cst nl_lfn.ecm1 nl_lfn.lfn4 nl_scrstar.yer nl_scrstar.time1 nl_scryer.cst nl_scryer.ecm1 nl_scryer.scryer1 nl_scryer.scryer2 nl_scryer.scryer3 nl_scryer.scryer4 nl_fisc.smooth nl_fisc.exo nl_fisc.gdn nl_fisc.gln nl_debt.target

POTENTIAL OUTPUT AND OUTPUT GAP

```
nl_YFT:     nl_YFT   = exp( + log(nl_alpha)
                         + nl_beta*log(nl_KSR)
                         + (1-nl_beta)*log(nl_LNN)
                         + (1-nl_beta)*(nl_gamma*nl_TIME)
                         + nl_yft.cst*nl_ONES
                         + nl_yft.time1*nl_TIME1) +res_nl_yft,

nl_YGA:     nl_YGA    = nl_YER/nl_YFT + res_nl_yga,
```

MONETARY POLICY AND INTEREST RATES

NOMINAL INTEREST RATES

```
nl_STI:     nl_STI        = nl_dfor*nl_ZZSTI
                          +  (1-nl_dfor)*(nl_taylor*nl_STI(-1)
                               + (1-nl_taylor)*400*(nl_gamma+nl_demo+nl_infl-1.5*nl_infl
                               + 1.5*(nl_PCD/nl_PCD(-1)-1) + 0.5*(nl_YER/nl_YER(-1)-1-nl_gamma-nl_demo))
                                -(1-nl_taylor) )+ res_nl_sti,


nl_LTI:     nl_LTI = nl_dfor*nl_ZZLTI + (1-nl_dfor)*(nl_lti.cst+nl_lti.sti*nl_STI)+ res_nl_lti,
```

REAL INTEREST RATES

```
nl_LTR:     nl_LTR        = 100*((1 + nl_LTI/100)/(nl_PCD/nl_PCD(-4))-1) + res_nl_ltr,

nl_STR:     nl_STR        = 100*((1 + nl_STI/100)/(nl_PCD/nl_PCD(-4))-1) + res_nl_str,
```

NOMINAL USER COST OF CAPITAL

```
nl_CC0:     nl_CC0   = nl_OID*(nl_LTI/400 + nl_depkpr - (nl_YFD/nl_YFD(-4)-1)/4) + res_nl_cc0,
```

REAL USER COST OF CAPITAL

```
nl_CCR:     nl_CCR  = nl_CC0/nl_OID + res_nl_ccr,
```

FISCAL POLICY AND TAX RATES

DEFINITION OF PUBLIC DEBT-TO-GDP RATIO, PERCENT

```
nl_GDNRATIO = 100 * nl_GDN / (4*nl_YEN) ,
```

DEFINITION OF PUBLIC DEFICIT-TO-GDP RATIO, PERCENT

```
nl_GLNRATIO = 100 * nl_GLN / (nl_YEN) ,
```

DEFINITION OF DEBT TARGET

```
nl_DEBT_TARGET = nl_debt.target * (NL_YEN/NL_YEN) ,
```

```
nl_PDN:     nl_PDN  = nl_dfor*nl_ZZPDX*nl_YEN
              + (1-nl_dfor)* nl_PDX * nl_PDNB + res_nl_pdn,

nl_PDX:     nl_PDX =   nl_fiscrule * ( nl_fisc.smooth * nl_PDX(-1)
                                + nl_fisc.exo * nl_PDX
                                + nl_fisc.gdn * (nl_GDNRATIO - nl_DEBT_TARGET)/100
                                + nl_fisc.gln * ( nl_GLNRATIO(-1) - nl_GLNRATIO(-2) )/100  )
              + (1-nl_fiscrule)*nl_PDX
              + res_nl_PDX,

nl_ODN:     nl_ODN  = nl_dfor*nl_ZZODX*nl_YEN
              + (1-nl_dfor)*nl_ODX*nl_ODNB + res_nl_odn,


nl_ODX:     nl_ODX =   nl_fiscrule * ( nl_fisc.smooth * nl_ODX(-1)
                                + nl_fisc.exo * nl_ODX
                                + nl_fisc.gdn * (nl_GDNRATIO - nl_DEBT_TARGET)/100
                                + nl_fisc.gln * ( nl_GLNRATIO(-1) - nl_GLNRATIO(-2) )/100  )
              + (1-nl_fiscrule)*nl_ODX
              + res_nl_ODX,
```

PRICE BLOCK

DOMESTIC WAGE-PRICE BLOCK

```
nl_RWUNSTAR:  nl_RWUNSTAR = exp( log((1-nl_beta)*(nl_eps-1)/nl_eps)
                    + log(nl_YER/nl_LNN)
                    + nl_rwunstar.cst*nl_ONES ) ,

nl_WUN:   del(log(nl_WUN)) = del(log(nl_PCD))
                                + (1-nl_wun.rwun1-nl_wun.pro)*nl_gamma
                                + (nl_wun.cst-(1-nl_wun.rwun1-nl_wun.pro)*nl_gamma)*nl_ONES
              + nl_wun.rwun1*del(log(nl_WUN(-1)/nl_PCD(-1)))
              + nl_wun.pro*del(log(nl_PRO))
              + nl_wun.urx*(log(nl_URX/100)-log(nl_nairu))
              + nl_wun.ecm1*( log(nl_WUN(-1)/nl_YFD(-1))-log(nl_RWUNSTAR(-1)) )
              + nl_wun.pcyf*del(log(nl_PCD/nl_YFD))
              + res_nl_wun,


nl_YFD:   del(log(nl_YFD)) =  (1-nl_yfd.mtd1)*nl_infl + (nl_yfd.cst-(1-nl_yfd.mtd1)*nl_infl)*nl_ONES
              + nl_yfd.mtd1*del(log(nl_MTD(-1)))
                                + nl_yfd.yga1*log(nl_YGA(-1))
              + nl_yfd.ecm1*( log(nl_YFD(-1)/nl_WUN(-1))+log(nl_RWUNSTAR(-1)) )
              + res_nl_yfd,
```

IMPORT PRICES

```
nl_MTDSTAR:   nl_MTDSTAR  = exp( + nl_mtdstar.cst
                    + nl_mtdstar.cmd*log(nl_CMD)
                    + nl_mtdstar.pei*log(nl_PEI)
                    + nl_mtdstar.yfd*log(nl_YFD)
                    + nl_mtdstar.time1*nl_TIME1 ),
```

```
nl_MTD:   del(log(nl_MTD)) = nl_mtd.mtd1*del(log(nl_MTD(-1)))
                           + nl_mtd.pei*del(log(nl_PEI))
                           + nl_mtd.cmud*del(log(nl_CMUD))
                           + nl_mtd.exr*del(log(nl_EXR))
                           + nl_mtd.yfd*del(log(nl_YFD))
                           + nl_mtd.ecm1*log(nl_MTD(-1)/nl_MTDSTAR(-1))
                           + res_nl_mtd,
```

ENERGY PRICES

```
nl_PEISTAR:     nl_PEISTAR  = exp( + nl_peistar.cst
                                  + nl_peistar.poil*log(nl_POIL)
                                  + nl_peistar.time1*nl_TIME1
                                  + nl_peistar.time2*nl_TIME2 ),

nl_PEI:   del(log(nl_PEI)) =   nl_pei.cst
                           + nl_pei.pei1*del(log(nl_PEI(-1)))
                           + nl_pei.poil*del(log(nl_POIL))
                           + nl_pei.ecm1*log(nl_PEI(-1)/nl_PEISTAR(-1))
                           + res_nl_pei,
```

EXPORT PRICES

```
nl_XTDSTAR:     nl_XTDSTAR  = exp( + nl_xtdstar.cst
                                  + nl_xtdstar.cxd*log(nl_CXD)
                                  + nl_xtdstar.yfd*log(nl_YFD)
                                  + nl_xtdstar.expoi*log(nl_EXR*nl_POILU)
                                  + nl_xtdstar.time1*nl_TIME1 ),


nl_XTD:   del(log(nl_XTD)) =  nl_xtd.cst
                           + nl_xtd.xtd1*del(log(nl_XTD(-1)))
                           + nl_xtd.cxd*del(log(nl_CXD))
                           + nl_xtd.yfd*del(log(nl_YFD))
                           + nl_xtd.expoi*del(log(nl_EXR*nl_POILU))
                           + nl_xtd.expoi1*del(log(nl_EXR(-1)*nl_POILU(-1)))
                           + nl_xtd.ecm1*log(nl_XTD(-1)/nl_XTDSTAR(-1))
                           + res_nl_xtd,
```

PRIVATE INVESTMENT DEFLATOR (PRE-TAX)

```
nl_OIPSTAR:     nl_OIPSTAR  = exp(  + nl_oipstar.cst
                                   + nl_oipstar.yfd*log(nl_YFD)
                                   + nl_oipstar.mtd*log(nl_MTD) ),

nl_OIP:   del(log(nl_OIP)) =  nl_oip.cst
                           + nl_oip.yfd*del(log(nl_YFD))
                           + nl_oip.mtd*del(log(nl_MTD))
                           + nl_oip.ecm1*log(nl_OIP(-1)/nl_OIPSTAR(-1))
                           + nl_oip.dumq1*nl_DUMMYQ1
                           + res_nl_oip,
```

GOVERNMENT INVESTMENT DEFLATOR (PRE-TAX)

```
nl_GIPSTAR:   nl_GIPSTAR  = exp(  + nl_gipstar.cst
                              + nl_gipstar.yfd*log(nl_YFD)
                              + nl_gipstar.mtd*log(nl_MTD)),



nl_GIP:   del(log(nl_GIP)) =  nl_gip.cst
                          + nl_gip.gip1*del(log(nl_GIP(-1)))
                          + nl_gip.mtd*del(log(nl_MTD))
                        + nl_gip.ecm1*log(nl_GIP(-1)/nl_GIPSTAR(-1))
                          + nl_gip.dumq2*nl_DUMMYQ2
                          + res_nl_gip,
```

GOVERNMENT CONSUMPTION DEFLATOR (PRE-TAX)

```
nl_GCPSTAR:   nl_GCPSTAR  = exp(  + nl_gcpstar.cst
                              + nl_gcpstar.yfd*log(nl_YFD)
                              + nl_gcpstar.mtd*log(nl_MTD)
                              + nl_gcpstar.time1*nl_TIME1 ),


nl_GCP:   del(log(nl_GCP)) =  nl_gcp.cst
                          + nl_gcp.yfd*del(log(nl_YFD))
                          + nl_gcp.mtd*del(log(nl_MTD))
                          + nl_gcp.ecm1*log(nl_GCP(-1)/nl_GCPSTAR(-1))
                        + res_nl_gcp,
```

HICP EXCLUDING ENERGY

```
nl_HEXPSTAR:   nl_HEXPSTAR = exp(  + nl_hexpstar.cst
                              + nl_hexpstar.ulc*log(nl_WUN/nl_PRO)
                              + nl_hexpstar.time1*nl_TIME1 ),


nl_HEXP:   del(log(nl_HEXP)) =  nl_hexp.cst
                            + nl_hexp.hexp1*del(log(nl_HEXP(-1)))
                            + nl_hexp.mg*(log(nl_MTD)-log(nl_WUN/nl_PRO))
                            + nl_hexp.ecm1*log(nl_HEXP(-1)/nl_HEXPSTAR(-1))
                            + nl_hexp.dumq1*nl_DUMMYQ1
                            + nl_hexp.dumq2*nl_DUMMYQ2
                            + nl_hexp.dumq3*nl_DUMMYQ3
                            + res_nl_hexp,
```

HICP ENERGY

```
nl_HEGSTAR:   nl_HEGSTAR  = exp(  + nl_hegstar.cst
                              + nl_hegstar.yfd*log(nl_YFD)
                              + nl_hegstar.poil*log(nl_POIL)
                              + nl_hegstar.time1*nl_TIME1 ) ,


nl_HEG:   del(log(nl_HEG)) =   nl_heg.cst
                          + nl_heg.heg4*del(log(nl_HEG(-4)))
                          + nl_heg.poil*del(log(nl_POIL))
                          + nl_heg.ecm1*log(nl_HEG(-1)/nl_HEGSTAR(-1))
                          + nl_heg.dumq1*nl_DUMMYQ + res_nl_heg,
```

PRIVATE CONSUMPTION DEFLATOR

```
nl_PCD:          log(nl_PCD) = log(nl_PCD(-4)) + del(4:log(nl_PCD(-1)))
                                + nl_pcd.hic*del(del(4:log(nl_HIC)))
                                + nl_pcd.dre1*(del(4:log(nl_pcd(-1)))-del(4:log(nl_HIC(-1))))
                                +res_nl_pcd ,
```

REAL BLOCK

REAL PRIVATE CONSUMPTION

```
nl_PCRSTAR:   nl_PCRSTAR  = exp(  + nl_pcrstar.cst
                    + nl_pcrstar.pyr*log(nl_PYR+nl_PYR(-1))
                    + nl_pcrstar.fwrpy*log(nl_FWR/nl_PYR) ) ,


nl_PCR:   del(log(nl_PCR)) =  nl_pcr.cst
                  + nl_pcr.pcr1*del(log(nl_PCR(-1)))
                  + nl_pcr.pcr2*del(log(nl_PCR(-2)))
                  + nl_pcr.pyr1*del(log(nl_PYR(-1)))
                  + nl_pcr.ltr1*log(1+(nl_LTR(-1))/100)
                  + nl_pcr.urx1*del(log(nl_URX(-1)/100))
                  + nl_pcr.ecm1*log(nl_PCR(-1)/nl_PCRSTAR(-1))
                  + nl_pcr.dum01*nl_DUM01
                  + res_nl_pcr,
```

REAL NON-HOUSING PRIVATE INVESTMENT

```
nl_KSTAR:      nl_KSTAR    = exp( + log(nl_YER)
                        - log(nl_alpha)
                        + (1-nl_beta)*log(nl_WUN/nl_YFD)
                        - (1-nl_beta)*log(nl_CCR)
                        - (1-nl_beta)*(nl_gamma*nl_TIME)
                        + (1-nl_beta)*log(nl_beta/(1-nl_beta))
                        + nl_kstar.cst*nl_ONES
                        + nl_kstar.dumt951*nl_DUMT951 ),

nl_IPRSTAR:   nl_IPRSTAR  = exp( +log((nl_gamma + nl_demo+ nl_depkpr)/(1+nl_gamma+nl_demo))
                        + log(nl_YER)
                        - log(nl_alpha)
                        + (1-nl_beta)*log(nl_WUN/nl_YFD)
                        - (1-nl_beta)*log(nl_CCR)
                        - (1-nl_beta)*(nl_gamma*nl_TIME)
                        + (1-nl_beta)*log(nl_beta/(1-nl_beta))
                        + nl_iprstar.cst
                        + nl_iprstar.time1*nl_TIME1 ),


nl_IPR:   del(log(nl_IPR)) =  nl_ipr.cst
                  + nl_ipr.ipr1*del(log(nl_IPR(-1)))
                  + nl_ipr.yer*del(log(nl_YER))
                  + nl_ipr.yer1*del(log(nl_YER(-1)))
                 + nl_ipr.ecm1*log(nl_IPR(-1)/nl_IPRSTAR(-1))
                  + res_nl_ipr,
```

REAL EXPORTS

```
nl_XTRSTAR:     nl_XTRSTAR = exp(  + nl_xtrstar.cst
                                  + nl_xtrstar.wdr*log(nl_WDR)
                                  + nl_xtrstar.xtd*log(nl_XTD)
                                  + nl_xtrstar.cxd*log(nl_CXD)
                                  + nl_xtrstar.time1*nl_TIME1
                                  + nl_xtrstar.d934*nl_D934
                                  + nl_xtrstar.dumt951*nl_DUMT951 ),

nl_XTR:   del(log(nl_XTR)) =  nl_xtr.cst
                            + nl_xtr.xtr1*del(log(nl_XTR(-1)))
                            + nl_xtr.wdr.ex*del(log(nl_WDR_EX))
                            + nl_xtr.wdr.in*del(log(nl_WDR_IN))
                            + nl_xtr.exr1*del(log(nl_EXR(-1)))
                            + nl_xtr.xtd*del(log(nl_XTD))
                            + nl_xtr.cxud.ex*del(log(nl_CXUD_EX))
                            + nl_xtr.cxud.in*del(log(nl_CXUD_IN))
                            + nl_xtr.ecm1*log(nl_XTR(-1)/nl_XTRSTAR(-1))
                            + nl_xtr.d934*nl_D934
                          + res_nl_xtr,
```

REAL IMPORTS

```
nl_MTRSTAR:     nl_MTRSTAR = exp(  + nl_mtrstar.cst
                                  + nl_mtrstar.wer*log(nl_WER)
                                  + nl_mtrstar.mtd*log(nl_MTD)
                                  + nl_mtrstar.yfd*log(nl_YFD)
                                  + nl_mtrstar.d891924*nl_D891924
                                  + nl_mtrstar.t931p*nl_T931P
                                  + nl_mtrstar.dumt951*nl_DUMT951 ),

nl_MTR:   del(log(nl_MTR)) =  nl_mtr.cst
                            + nl_mtr.ecm1*log(nl_MTR(-1)/nl_MTRSTAR(-1))
                            + nl_mtr.mtr1*del(log(nl_MTR(-1)))
                            + nl_mtr.mtr2*del(log(nl_MTR(-2)))
                            + nl_mtr.wer*del(log(nl_WER))
                            + nl_mtr.wer1*del(log(nl_WER(-1)))
                            + nl_mtr.wer2*del(log(nl_WER(-2)))
                            + nl_mtr.comp*del(log(nl_MTD)  - log(nl_YFD) )
                            + nl_mtr.dumt951*nl_DUMT951
                            + res_nl_mtr,
```

TOTAL EMPLOYMENT

```
nl_LSTAR:      nl_LSTAR    = exp( + log(nl_YER)/(1-nl_beta)
                            - log(nl_alpha)/(1-nl_beta)
                            - nl_beta*log(nl_KSR)/(1-nl_beta)
                            - nl_gamma*nl_TIME
                            + nl_lstar.cst*nl_ONES
                            + nl_lstar.time1*nl_TIME1 ),

nl_LNN:   del(log(nl_LNN)) = nl_lnn.lgn*del(log(nl_LGN))
                           +(1-nl_lnn.lgn)*(nl_demo-nl_lnn.lnn1*nl_demo-(nl_lnn.yer+nl_lnn.yer3)*
                          (nl_gamma+nl_demo)-nl_lnn.rwun3*nl_gamma
                           +(nl_lnn.cst-(nl_demo-nl_lnn.lnn1*nl_demo-(nl_lnn.yer+nl_lnn.yer3)*(nl_gamma+nl_demo)-
                          nl_lnn.rwun3*nl_gamma))*nl_ONES
                       + nl_lnn.lnn1*del(log(nl_LNN(-1)))
                       + nl_lnn.yer*del(log(nl_YER))
                       + nl_lnn.yer3*del(log(nl_YER(-3)))
                       + nl_lnn.rwun3*del(log(nl_WUN(-3)/nl_YFD(-3)))
                       + nl_lnn.ecm1*log(nl_LNN(-1)/nl_LSTAR(-1)))+ res_nl_lnn,
```

TOTAL LABOUR FORCE

```
nl_LFNSTAR:    nl_LFNSTAR = exp(  + nl_lfnstar.cst
                                  + nl_lfnstar.lfn1*log(nl_LFN(-1))
                                  + nl_lfnstar.time*nl_TIME ),

nl_LFN:   del(log(nl_LFN)) =  nl_lfn.cst
                           + nl_lfn.ecm1*log(nl_LFN(-1)/nl_LFNSTAR(-1))
                           + nl_lfn.lfn4*del(log(nl_LFN(-4)))
                           + res_nl_lfn,
```

REAL INVENTORIES

```
nl_SCRSTAR:    nl_SCRSTAR = (nl_scrstar.yer+nl_scrstar.time1*nl_TIME1)*nl_YER,

nl_SCR:   del(nl_SCR/nl_YER) =  nl_scryer.cst
                             + nl_scryer.ecm1*( (nl_SCR(-1)-nl_SCRSTAR(-1))/nl_YER(-1) )
                             + nl_scryer.scryer1*del(nl_SCR(-1)/nl_YER(-1))
                             + nl_scryer.scryer2*del(nl_SCR(-2)/nl_YER(-2))
                             + nl_scryer.scryer3*del(nl_SCR(-3)/nl_YER(-3))
                             + nl_scryer.scryer4*del(nl_SCR(-4)/nl_YER(-4))
                             + res_nl_scr,
```

ACCOUNTING RELATIONSHIPS

```
nl_INFQ:       nl_INFQ = 100*(nl_PCD/nl_PCD(-1)-1) + res_nl_INFQ,

nl_INFA:       nl_INFA = 100*(nl_PCD/nl_PCD(-4)-1) + res_nl_INFA,

nl_POIL:       nl_POIL = nl_POILU*nl_EXR + res_nl_poil,
```

nl_CMD: nl_CMD = nl_CMUD * nl_EXR + res_nl_CMD,

nl_CXD: nl_CXD = nl_CXUD * nl_EXR + res_nl_CXD,

nl_WDR: nl_WDR = nl_WDR_in*nl_WDR_ex + res_nl_WDR,

nl_CXUD: nl_CXUD = nl_CXUD_in*nl_CXUD_ex + res_nl_CXUD,

nl_CXDIN: nl_CXD_IN = nl_CXUD_in*(nl_EXR**nl_betain) + res_nl_CXD_IN,

nl_CXDEX: nl_CXD_EX = nl_CXUD_ex*(nl_EXR**nl_betaex) + res_nl_CXD_EX,

nl_CMUD: nl_CMUD = nl_CMUD_in*nl_CMUD_ex + res_nl_CMUD,

nl_CMDIN: nl_CMD_IN = nl_CMUD_in*(nl_EXR**nl_m2in) + res_nl_CMD_IN,

nl_CMDEX: nl_CMD_EX = nl_CMUD_ex*(nl_EXR**nl_m2ex) + res_nl_CMD_EX,

nl_EEN0: nl_EEN0 = nl_EEN0_in*nl_EEN0_ex + res_nl_EEN0,

nl_EEN: nl_EEN = nl_EEN_in*nl_EEN_ex + res_nl_EEN,

nl_OID: nl_OID = nl_OIP*(1-nl_TIIR)/(1-nl_TII) + res_nl_oid,

nl_GCD: nl_GCD = nl_GCP*(1-nl_TGIR)/(1-nl_TGI) + res_nl_gcd,

nl_GID: nl_GID = nl_GIP*(1-nl_TIIR)/(1-nl_TII) + res_nl_gid,

nl_YED: nl_YED = nl_YEN/nl_YER + res_nl_yed,

nl_ITD: nl_ITD = nl_ITN/nl_ITR + res_nl_itd,

nl_PCP: nl_PCD = nl_PCP*(1-nl_TCIR)/(1-nl_TCI) + res_nl_pcp,

nl_HEX: nl_HEX = nl_HEXP*(1-nl_TCIR)/(1-nl_TCI) + res_nl_hex,

nl_HIC: nl_HIC = nl_WE*nl_HEG + (1-nl_WE)*nl_HEX + nl_ZHIC + res_nl_hic,

nl_OIN: nl_OIN = nl_OID*nl_OIR + res_nl_oin,

nl_GIN: nl_GIN = nl_GID*nl_GIR + res_nl_gin,

nl_ITN: nl_ITN = nl_OIN + nl_GIN + res_nl_itn,

nl_PCN: nl_PCN = nl_PCD*nl_PCR + res_nl_pcn,

nl_GCN: nl_GCN = nl_GCD*nl_GCR + res_nl_gcn,

nl_XTN: nl_XTN = nl_XTD*nl_XTR + res_nl_xtn,

nl_MTN: nl_MTN = nl_MTD*nl_MTR + res_nl_mtn,

nl_YFN: nl_YFN = nl_YFD*nl_YFR + res_nl_yfn,

nl_YEN: nl_YEN = nl_YFN + nl_TIN + res_nl_yen,

nl_ITR: nl_ITR = nl_IHR + nl_IPR + nl_GIR + res_nl_itr,

nl_OIR: nl_OIR = nl_IPR + nl_IHR + res_nl_oir,

nl_YFR: nl_YFR = nl_YER - nl_TIR + res_nl_yfr,

nl_MKUP: nl_MKUP = 100*(1-nl_WIN/nl_YFN) + res_nl_mkup,

nl_SZD: nl_SZD = nl_SZN/(nl_ZER + nl_SCR) + res_nl_szd,

nl_UNN: nl_UNN = nl_LFN - nl_LNN + res_nl_unn,

nl_URX: nl_URX = 100*nl_UNN/nl_LFN + res_nl_urx,

nl_PYR: nl_PYR = nl_PYN/nl_PCD + res_nl_pyr,

nl_KGR: nl_KGR = nl_GIR + (1-nl_depkgr)*nl_KGR(-1) + res_nl_KGR,

nl_KPR: nl_KPR = nl_IPR + (1-nl_depkpr)*nl_KPR(-1) + res_nl_KPR,

nl_KSR: nl_KSR = nl_ITR + (1-nl_depksr)*nl_KSR(-1) + res_nl_KSR,

nl_KHR: nl_KHR = nl_KSR - nl_KPR - nl_KGR + res_nl_KHR,

nl_FWN: nl_FWN = nl_OID*nl_KPR(-1) + nl_IHD*nl_KHR(-1) + nl_GDN(-1) + nl_NFA(-1) + res_nl_fwn,

nl_FWR: nl_FWR = nl_FWN/nl_PCD + res_nl_FWR,

nl_FWRH: nl_FWRH = (nl_OID*nl_KPR(-1) + nl_IHD*nl_KHR(-1) + nl_GDN(-1))/nl_PCD + res_nl_FWRH,

nl_SALE: nl_SALE = nl_PCR + nl_XTR + nl_ITR + res_nl_SALE,

nl_YER: nl_YER = nl_PCR + nl_GCR + nl_ITR + nl_SCR + nl_XTR - nl_MTR + nl_ZER + res_nl_YER,

nl_SZN: nl_SZN = nl_YEN - nl_PCN - nl_GCN - nl_ITN - nl_XTN + nl_MTN + res_nl_SZN,

nl_LEN: nl_LEN = nl_LEX*nl_LNN + res_nl_LEN,

nl_PRO: nl_PRO = nl_YER / nl_LNN + res_nl_PRO,

nl_WIN: nl_WIN = nl_WUN*nl_LNN + res_nl_WIN,

nl_CEX: nl_CEX = nl_WUN*nl_LNN/nl_LEN + res_nl_CEX,

nl_ULA: nl_ULA = nl_WUN/nl_PRO + res_nl_ula,

nl_WUG: nl_WUG = nl_WUN + res_nl_wug,

nl_GON: nl_GON = nl_YEN - nl_WIN - nl_TIN + nl_ZIN + res_nl_gon,

nl_PYN: nl_PYN = nl_WIN + nl_OPN + nl_TRN - nl_PDN + res_nl_pyn,

nl_PSN: nl_PSN = nl_PYN - nl_PCN + res_nl_psn,

nl_GYN: nl_GYN = nl_PDN + nl_ODN + nl_TIN + nl_OGN - nl_TRN - nl_INN + res_nl_gyn,

nl_PDNB: nl_PDNB = (1+nl_pdnb.win)*nl_WIN + nl_TRN + nl_OPN + res_nl_pdnb,

nl_INN: nl_INN = (1/400)*nl_STI*nl_GDN(-1) + nl_ZINN + res_nl_inn ,

nl_GSN: nl_GSN = nl_GYN - nl_GCN + res_nl_gsn,

nl_GLN: nl_GLN = nl_GSN - nl_GIN + res_nl_gln,

```
nl_GDN:     nl_GDN = nl_GDN(-1) - nl_GLN + nl_ZGDN + res_nl_gdn,

nl_ODNB:    nl_ODNB  =  nl_GON - 0.01*nl_ITD*nl_KSR(-1) + res_nl_odnb,

nl_OLN:     nl_OLN = nl_CAN - nl_PSN - nl_GLN + nl_IHN + res_nl_oln,

nl_BTN:     nl_BTN = nl_XTN - nl_MTN + res_nl_btn,

nl_CAN:     nl_CAN = nl_XTN - nl_MTN + nl_NFN + nl_TWN + nl_ZCAN + res_nl_can,

nl_NFN:     nl_NFN = (1/400)*nl_STI*nl_NFA(-1) + nl_ZNFN + res_nl_nfn,

nl_NFA:     nl_NFA  = nl_NFA(-1) + nl_CAN + nl_ZNFA + res_nl_nfa,

nl_OYN:     nl_OYN = nl_GON + nl_TWN + nl_NFN + nl_INN - nl_ODN - nl_OPN - nl_OGN + res_nl_oyn,

nl_PLN:     nl_PLN = nl_PSN - nl_IHN + res_nl_pln,

nl_TRN:     nl_TRN = nl_TRX*nl_YEN + res_nl_trn,

nl_OPN:     nl_OPN  = nl_dfor*nl_ZZOPX*nl_YEN + (1-nl_dfor)*nl_OPX*nl_GON + res_nl_opn,

nl_WER:     nl_WER  = + nl_wer.pcr*nl_PCR
                      + nl_wer.gcr*nl_GCR
                      + nl_wer.itr*nl_ITR
                      + nl_wer.xtr*nl_XTR
                      + nl_wer.scr*nl_SCR
                      + res_nl_wer,

nl_IHN:     nl_IHN   = nl_IHR*nl_IHD + res_nl_ihn,

nl_TIN:     nl_TIN = + nl_TII*nl_OIR*nl_OID
                     + nl_TII*nl_GIR*nl_GID
                     + nl_TCI*nl_PCR*nl_PCD
                     + nl_TGI*nl_GCR*nl_GCD
                     + res_nl_tin,

nl_TIR:     nl_TIR = + nl_TIIR*nl_OIR
                     + nl_TIIR*nl_GIR
                     + nl_TCIR*nl_PCR
                     + nl_TGIR*nl_GCR
                     + res_nl_tir,
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