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The international transmission of shocks

Some selected simulations with the NIME model



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The macro-econometric NIME model is one of the analytical tools used by the Belgian Federal Planning Bureau to improve its understanding of developments in the Belgian international economic environment. In this paper, we use the NIME model to assess the transmission of shocks from the United States to the euro area under a flexible and a fixed exchange rate regime. Four shocks to the US economy are considered: a fiscal shock, a productivity shock, a stock market shock, and a monetary shock. Tables with detailed simulation results are discussed in the text. The simulations illustrate that the international transmission of shocks via international trade is rather limited, because most of the country blocks constitute large, relatively closed economies. The spill-over effects through financial flows can be very important, especially under a fixed exchange rate regime where there is a direct link between the interest rates of the different country blocks. The simulations show also that expectations can be an important channel that speeds up international adjustment. Appendix A of the paper describes some recent changes to the NIME model.

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Introduction

The macro-econometric NIME model is one of the analytical tools used by the Belgian Federal Planning Bureau to improve its understanding of developments in the Belgian international economic environment¹. This paper shows some concrete applications with this model by analysing the spill-over effects of shocks from the United States (US) to the euro area and the rest of the world. The shocks we investigate are a temporary increase in public expenditures in the US, a US-led world-wide permanent increase in total factor productivity, an increase in the risk premium in the US stock market, and a temporary 1 percentage point increase in the US short-term interest rate. Here, we will discuss how these shocks affect economic activity in the US and how they are transmitted to the euro area². Such an analysis can be useful because it catalogues answers to questions which are often posed by economists who want to assess their medium term projection of the euro area economy.

The NIME model is a macro-econometric world model developed at the Belgian Federal Planning Bureau. Although the most important features of the NIME model will be discussed in the next section, we want to highlight here several channels through which shocks are transmitted across the different country blocks of the model³. First, there is international trade in goods and services, whereby exports and imports are determined by relative prices and by the effective foreign and domestic output level, respectively. However, the impact of changes in exports and imports on overall domestic activity should be limited, as, for example, exports constitute about 15 percent of gross domestic product in the euro area, 25 percent in the non-euro EU countries, and 9 percent in the US. Second, there are financial flows which respond to the expected asset returns in the different country blocks. If the exchange rates are fixed at a predetermined rate, interest rates adjust in order to equalise expected returns, adjusted for a risk premium, across country blocks. If exchange rates are flexible and interest rates are set to accommodate domestic objectives, the exchange rates adjust to induce capital gains in order to equalise expected returns across country blocks. Given the importance of the changes in the exchange rate and interest rates on the (composition of) economic activity, the subsequent analysis will consider shocks under a flexible and fixed exchange rate regime. Third, in the productivity shock variant, the technological innovations in the leading country, i.e., the US, are diffused with a one year lag to the other country blocks. Moreover, economic agents in the other country blocks

1. Other tools include the NEMESIS model and the forecasts and assessments by international organisations, such as the European Commission, the Organisation for Economic Co-operation and Development, and the International Monetary Fund. See www.nemesis-model.net for more details regarding the NEMESIS model.
2. Other simulation exercises with shocks to the euro area are described in Meyermans and Van Brusselen (2003).
3. These country blocks are the euro area (EU), the non-euro European Union countries (NE), the United States (US), Japan (JP) and the "rest of the world" (RW).

anticipate these future spill-over effects, and they adjust their expenditure plans in line with their expectations.

The structure of this paper is as follows. The second section describes briefly the NIME model. The third section shows the simulation results for a temporary increase in public expenditures in the US. There the public expenditures of the US are increased by about 3.5 percent, inducing, *ex ante*, a 1 percentage point increase in the deficit to GDP ratio. The fourth section illustrates the case of a permanent productivity shock in the US. There the shock is not only transmitted via the traditional trade and financial flows, but also via (expected) changes in trend productivity. In the fifth section, we discuss a permanent increase in the risk premium in the US stock market, while the sixth section shows the simulation results for a temporary increase in the US interest rate. The last section draws some conclusions.

The simulations illustrate that the international transmission of shocks via international trade is rather limited, because most of the country blocks constitute large, relatively closed economies. The spill-over effects through financial flows can be very important, especially under a fixed exchange rate regime where there is a direct link between the interest rates of the country blocks. The simulations show also that expectations can be an important channel that speeds up international adjustment.

Before we proceed, we want to make the following three remarks. First, in the following sections we focus mainly on the spill-over effects on the euro area, because this is the main trading partner of Belgium. The simulation results for the other country blocks can be found in Appendix B of this working paper. Second, we want to emphasise that the simulations of this paper are of an illustrative and technical nature, and they should not be considered as predictions. Third, interpreting the simulations of this paper, it should be remembered that the NIME model is a Keynesian model with classical long run properties. In the long run, the economy is at its natural equilibrium, whereby the relative prices clear the markets and the nominal variables do not affect equilibrium in the real sector. However, in the medium run, the model has typical Keynesian features, whereby prices adjust sluggishly to their equilibrium value, supply is determined by demand, and expectations have some backward looking features.



The NIME model

The NIME model is a macro-econometric world model developed at the Belgian Federal Planning Bureau. This model is built to make medium-term forecasts of the Belgian international economic environment and to study the transmission of the effects of economic policies and exogenous shocks on the Belgian and European economy. This section gives a very brief overview of this model¹.

The current version of the NIME model divides the world into the following country blocks: the euro area (EU), a block consisting of the countries of the European Union that did not adopt the euro (NE), the United States (US), Japan (JP) and the "rest of the world" (RW). These country blocks are linked to each other through trade and financial flows, and the diffusion of trend productivity. In each of these country blocks, except for the RW block, we distinguish a household sector, an enterprise sector, a public sector, and a monetary sector. A similar set of behavioural equations and accounting identities is specified for each sector across blocks, while the parameter values of the equations are obtained using econometric techniques applied to the aggregated data of the different blocks².

The NIME model makes an analytical distinction between three different time horizons: the short run that is demand driven and during which the plans of the agents are not fully realised due to the existence of adjustment costs; the medium run where the plans are realised but still changing due to lagging adjustment of the other endogenous variables and a steady state long run. In the steady state, productivity, the natural rate of unemployment, secular inflation, the real interest rate, the labour participation rate, and population growth are exogenous, while the steady state values of the other variables, such as potential output, are determined by these exogenous variables and the structural equations of the model.

The expectations of the agents are partly forward-looking, and partly backward-looking (i.e., chartists). The forward-looking expectations are quasi-rational in the sense that agents have model consistent expectations about the steady state but the speed of convergence towards this steady state is determined by a reduced form function rather than by the underlying structural parameters of the model.

Finally, the version of the NIME model used in this paper is a modified version of the model described in Meyermans and Van Brusselen (2001). The modifications are described in Appendix A, and they include an update of the NIME databank, a re-estimation of the household demand equations, a re-specification of the short

1. More technical details regarding the model can be found in Meyermans and Van Brusselen (2000.a, 2000.b, and 2001).
2. The RW block consists of a limited number of equations describing overall economic activity in the rest of the world.

run factor demand equations, the wage equation, and the risk premium in the stock market.

Before we proceed with a discussion of the results, we will have a closer look at each of the sectors of the NIME model.

A. The four sectors of the NIME model

The NIME model distinguishes four sectors per country block: the household sector, the enterprise sector, the fiscal sector, and the monetary sector.

1. The household sector

The household sector allocates its total available means over goods and services, real money balances, residential buildings, and other assets as a function of the nominal interest rate, the real interest rate, the user cost of residential buildings, and a scale variable. The scale variable consists of inherited assets, plus current income from assets, plus current and expected future labour income. Error correction mechanisms and partial adjustment schemes are used to capture sluggish adjustment in the expenditure plans of the household sector. Moreover, in the short run, the household sector is liquidity constrained so that a fraction of its expenditures must be financed by disposable income.

The interest rate influences household demand through several channels. First, there is the income effect. An interest rate increase will increase households' asset income in the next period. Next, there is the wealth effect, through which an increase in the discount rate will decrease¹ the present value of expected future income. Third, there is the liquidity effect, through which an increase in the nominal interest rate will increase the opportunity cost of money and will lower money demand. The impact of changes in the opportunity cost of money on demand for other goods and services is less clear a priori, and it is an empirical issue to determine the sign of this cross-elasticity. Fourth, there is the intertemporal substitution effect. An increase in the real interest rate will lead households to reduce contemporaneous consumption and hold more interest-bearing assets. Fifth, the interest rate affects the user cost of residential buildings. An increase in the nominal interest rate increases the user cost of residential buildings, and decreases the demand for residential buildings. Finally, it should be noted the above mentioned effects do not all point in the same direction, and that it is an empirical issue to determine the net impact of all these effects.

2. The enterprise sector

The enterprise sector maximizes its profits by hiring production factors and selling its products to the final users. There are three production factors, i.e., labour, capital and intermediary imports. Error correction mechanisms and partial ad-

1. Since stock prices are equal to the present value of expected future profits, an increase in the interest rate increases the discount rate, and thus reduces the present value of future profits.

justment schemes are used to model short run demand for the production factors. In these demand schemes, the long run factor demand equations are derived from a Cobb-Douglas production function with constant returns to scale.

Labour demand is function of supply for final demand and the real wage. The real wage rate is defined as the nominal wage rate deflated by the producer price. Gross fixed capital formation is determined by the change (and the change in the change) in the supply for final demand and the user cost of capital. The user cost of capital is determined by the interest rate, the rate of depreciation, the price of capital, the expected price change and a risk premium. Imports and exports are determined by a scale variable and relative prices. The scale variable for imports is domestic total supply for final demand, while the scale variable for exports is the effective foreign total supply for final demand (short “effective foreign output”).

In the long run, prices of inputs and outputs clear the markets, but they adjust only sluggishly to their equilibrium value because menu costs and incomplete information prevent immediate adjustment. As a consequence, it is quantities that adjust in order to meet demand in the short run. Here, it may be worthwhile to recall price setting for international trade in the NIME model. Country blocks are engaged in multilateral trade, whereby importers are price setters and exporters are price takers. Imports are used as intermediary inputs in the production of total supply for final demand. As such, their price is determined by their productivity in this process, and in equilibrium importers are not prepared to pay in excess of their productivity. The flip side of this is that exporters have to set their export price with a view on the willingness of importers to pay for their imports. Hence, exporters are price takers. However, it should also be noted that these are equilibrium conditions to which the economy converges in the long run. In the medium run, all kind of rigidities prevent exporters and importers to set their prices immediately equal to their equilibrium level.

3. The public sector

Public sector receipts are determined by endogenous tax bases and predetermined tax rates, while the public expenditures are to a large extent determined by the business cycle and trend growth. In the NIME model, the automatic fiscal stabilisers operate on the expenditure side through the unemployment benefits and interest payments on public debt, and on the revenue side through direct labour income taxes, profit taxes, social security contributions, and indirect taxes¹.

4. The monetary sector

The monetary authorities set the short-term interest rate according to the exchange rate regime, while the long-term interest rate is determined by the term structure of interest rates. Under a flexible exchange rate regime, the short-term interest rate deviates from the steady state interest rate to the extent that inflation

1. See also Meyermans (2002.a).

and output deviate from their target value¹. Under a fixed exchange rate regime, the short-term interest rate is set to fix the exchange rate at a predetermined target². Under a flexible exchange rate regime, the effective nominal exchange rate is determined by a weighted average of the equilibrium effective nominal exchange rate and the lagged exchange rate, by the interest rate differential, and by the expected inflation differential. The equilibrium exchange rate stabilises the foreign debt to GDP ratio³ and it is equal to the relative price level multiplied by the real exchange rate. The real exchange rate is determined by relative indirect tax rates and the relative level of economic activity, corrected for a term related to the ratio of net factor income and net current transfers to the output of the rest of the world⁴. If the domestic price level increases, *ceteris paribus*, then the equilibrium nominal exchange rate will depreciate. Moreover, if domestic output increases, *ceteris paribus*, then the equilibrium real exchange rate will also depreciate. The latter effect is due to the fact that if domestic output increases, then the import volume will also increase. Hence, to maintain equilibrium in the current account, the exchange rate has to depreciate⁵.

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1. Under a flexible exchange rate regime, the monetary authorities follow a modified Taylor rule:

$$SI_t = HP_RLI_t + G_PCH_t + si_s1(INFL_t - G_PCH_t) + si_s2 \ln(ASPO_t/HP_ASPO_t),$$
 where ASPO is the contemporaneous private supply for final demand, in constant prices, G_PCH is the steady state growth of general price level, (i.e., "reference value for inflation"), HP_ASPO is the steady state private supply for final demand, in constant prices, (i.e., "reference value for potential output"), HP_RLI is the steady state real interest rate, INFL is the contemporaneous inflation, SI is the short-term interest rate, and where the parameter values are $si_s1 = 1.5$, and $si_s2 = 0.5$. See also Meyermans (2002.b).
 2. In this paper, we consider only unsterilised interventions in the foreign exchange market. Due to the lack of data on the supply of outside bonds, the risk premium in the foreign exchange market is constant in the NIME model. Furthermore, it should be noted that in a model with n country blocks, there are only $n-1$ independent bilateral exchange rates, while there are n interest rates that affect the bilateral exchange rates. Hence, under a fixed exchange rate regime, one monetary authority is free to set its domestic interest rate to pursue its own objectives without regard of the exchange rate. Here, we will assume that it is the US that follows its own domestic objectives, while the other country blocks set their interest rates to fix their bilateral exchange rate vis-à-vis the US dollar.
 3. Several equilibrium options are available in the NIME model: the current account in equilibrium, the trade balance in equilibrium, or a stable foreign debt-to-GDP ratio.
 4. For more details see Section IV.C of Meyermans and Van Brusselen (2001).
 5. It should be noted that this is a partial equilibrium. This depreciation may be offset by the appreciation which is induced by an increase in the short run interest rate.



The spill-over effects of a fiscal shock in the US

A. Introduction and summary of the spill-over effects

In this first variant, we examine the direct and spill-over effects of a temporary increase in the public expenditures of the US. More specifically, we assume that the US fiscal authorities increase their expenditures across the board during the first 3 years by such an amount that it induces ex ante a 1 percentage point increase in the public deficit-to-GDP ratio¹. As of the fourth year, public expenditures are cut so that the ex ante public deficit-to-GDP ratio is again equal to its baseline level.

We investigate this variant under a flexible and a fixed exchange rate regime. Under a flexible exchange rate regime, the monetary authorities set the short-term interest rate as a function of the deviation of inflation from its target and the output gap, and they let the nominal exchange rate free. Under a fixed exchange rate regime, the monetary authorities of the US set their short-term interest rate in accordance with their domestic objectives, while the monetary authorities of the other country blocks set their domestic interest rates in order to fix the nominal exchange rate vis-à-vis the US dollar at the baseline level.

Briefly summarised, the fiscal shock causes the following (spill-over) effects. The higher public expenditures increase aggregate demand in the US without changing potential output. As a consequence, the US short-term interest rate is raised by up to 40 basis points in order to temper the emerging inflationary pressures. The main spill-over effects of this shock are as follows for the euro area. Under a flexible exchange rate regime, real GDP of the euro area increases initially by less than 0.1 percent and falls quickly back to the baseline once the shock is reversed. This increase in real GDP can almost completely be attributed to higher exports. Exports increase by 0.25 percent because the effective nominal euro exchange rate depreciates initially by 0.26 percent, while the effective foreign output level increases by 0.16 percent. Under a fixed exchange rate regime, real GDP of the euro area falls by 0.06 percent in the first year, and by about 0.24 percent in the third year. The difference with a flexible exchange rate regime can almost completely be ascribed to the difference in the behaviour of the interest rates. Under a fixed exchange rate regime, the domestic short-term interest rate increases by 40 basis points, compared to an increase of less than 10 basis points under a flexible exchange rate regime. These high interest rates reduce private consumption and

1. These expenditures include public consumption of goods and services, the public wage bill, which is increased through an increase in the number of employees, public gross fixed capital formation, and transfers to households, enterprises and the rest of the world. The public wage rate and the tax base adjust endogenously, while the tax rates are kept at their baseline level.

gross fixed capital formation. Note also how the general price level is affected by the exchange rate regime. Under a flexible exchange rate regime, the GDP deflator increases by up to 0.15 percent in the fourth year, compared to a 0.15 percent fall under a fixed exchange rate regime. Under a flexible exchange rate regime, the increase of prices is triggered by the euro depreciation and increased demand. Under a fixed exchange rate regime, the fall in prices is caused by the fall in demand. Finally, the fiscal accounts of the euro area show a very small surplus under a flexible exchange rate regime, and the debt to GDP ratio falls by 0.18 percentage points in the third year. These improvements are due to the working of the automatic fiscal stabilisers in an expanding economy. Under a fixed exchange rate regime, economic activity falls and the public sector runs a deficit to GDP ratio that is about 0.10 percentage points higher than in the baseline, resulting in an 0.44 percentage points increase in the debt to GDP ratio after four years, but falling thereafter.

Let us now have a closer look at the details.

B. A flexible exchange rate regime

We start with a discussion of the effects for the US under a flexible exchange rate regime, followed by a discussion of the spill-over effects for the euro area.

1. The effects for the US economy

The first five columns of Table 1 show the first five years of the adjustment process in the US under a flexible exchange rate regime as percentage deviation from the baseline, unless mentioned otherwise¹.

In this variant, public expenditures in the US are increased ex ante by 3.5 percent vis-à-vis the baseline during the first 3 years. On impact, the higher public expenditures increase domestic demand directly through increased public consumption of goods and services and public investment, and indirectly through increased public sector employment and public transfers to households. However, monetary and fiscal feed-backs temper the expansionary effects of the increased public expenditures and the ex post public deficit is smaller than the ex ante public deficit. Indeed, as soon as the inflationary pressures emerge, the monetary authorities will increase the short-term interest rate. This nominal interest rate hike causes private and external demand to fall via an increase in the real interest rate and the user cost of capital, an appreciation of the exchange rate, and a reduction in the financial wealth of the household sector. Moreover, the automatic fiscal stabilisers are free to operate, so that with economic activity expanding and the number of unemployed falling, the public transfers to households fall and tax revenues increase.

In the first year, the household sector of the US receives a higher disposable income, but it also experiences a fall in its financial wealth and an increase in the real interest rate². Real disposable income increases by 0.84 percent because total

1. It should also be noted that in this paper the shocks are applied to a technical baseline.
2. Here, it should be remembered that the households are partly liquidity constrained and use their disposable income to finance part of their consumption bundle. See also section 2.

employment, the real take home wage rate and real transfers to households increase by, respectively, 0.85, 0.24 and 0.68 percent. This effect will induce the households to consume more and save less. However, at the same time, the 0.31 percent nominal interest rate hike decreases the financial wealth of the household sector and raises the real interest rate. Both effects will induce the household sector to consume less and save more. It is an empirical matter to determine which of these effects will dominate. From Table 1 we learn that private consumption increases by 0.55 percent in the first year relative to the baseline, indicating that in the first year the effects of an increase in disposable income dominate the wealth and intertemporal substitution effect. However, as of the second year, the negative effects of the interest rate hike become more important and private consumption starts to decrease, falling to a level of 0.23 percent above the baseline in the third year. Once the shock is reversed, private consumption falls immediately 0.41 percent below the baseline, despite the monetary easing and the working of the automatic fiscal stabilisers. Nevertheless, the economy will recover and converge to its baseline level in due course.

Total gross fixed capital formation increases by 1.30 percent in the first year. During the first three years public investment and residential building investment are, respectively, about 4.5 and 2.5 percent above the baseline, while investments by the enterprise sector remain almost unaffected. This different behaviour can be understood as follows. Investment by the public sector is primarily determined by the ex ante autonomous increase in public outlays, augmented by the endogenous reaction of public investment to the change in real GDP. Investment by the household sector and the enterprise sector are explained by the (endogenous) change in a scale variable and the user cost of capital. For the enterprise sector, the scale effect is private supply for final demand, while for the household sector this scale effect is a weighted average of disposable income and the total available means of the household sector. The user cost of capital is determined by the interest rate, the rate of depreciation, and the expected change in prices. For the enterprise sector the latter is related to the expected change in the price of enterprise capital, while for the household sector the latter is related to the expected change in the consumer price. Here, we have that the increased scale effect stimulates gross fixed capital formation, while the increased user cost of capital reduces gross fixed capital formation. Clearly, in the case of investments in residential buildings, the scale effect dominates the user cost effect, while in the case of investment in enterprise capital both effects almost cancel each other.

The GDP deflator increases gradually and is 0.13 percent above the baseline in the third year. This price increase is caused by higher aggregate demand, but it is somewhat tempered by the appreciation of the effective exchange rate. Once the fiscal shock is retracted, the general price level shows a high degree of persistence, as it is 0.16 percent above the baseline in the fourth year and 0.13 percent in the fifth year. Looking at the prices separately, we see the following. First, it should be remembered that, given that potential output remains unchanged, the increased public expenditures require a switch from private to public consumption. This switch will, inter alia, be induced by an increase in the relative price of private consumption. As a consequence, we see that the price of private consumption increases by more than the general price level, i.e., 0.29 percent in the fourth year, compared to 0.16 percent for the GDP deflator in the fourth year. Second, export prices fall by more than 0.40 percent in the second and third year, reflecting the need to remain competitive in the export markets in the face of an

0.6 percent appreciation of the effective nominal US dollar exchange rate. The exchange rate appreciates because the domestic short-term interest rate is increased, while the interest rates in the other country blocks remain almost unchanged. Third, import prices, denominated in local currency, fall initially by 0.14 percent in line with the exchange rate appreciation, and rise above the baseline as of the third year. Indeed, as domestic prices start to increase, import prices can increase without too much loss of competitiveness.

The changes in activity and relative prices affect international trade. Imports of the US increase by 0.97 percent in the first year, because domestic economic activity gets a strong boost and import prices fall somewhat. In the second year, as domestic demand starts to fall, imports decline gradually. When the shock is retracted in the fourth year, imports fall below their baseline level. During the whole simulation period exports remain close to their baseline level, because the small changes in effective foreign output are to a large extent off-set by the movements of the real exchange rate. All in all, the current account to GDP ratio falls by more than 0.10 percentage points during the first three years, but recovers quickly once the shock is retracted.

Private sector employment increases by 0.43 percent in the first year, while the unemployment rate falls by 0.64 percentage points. This tightening of the labour market leads immediately to a 0.22 percent increase in the nominal wage rate of the private sector, and further increases thereafter. The real producer wage increases immediately by 0.22 percent and shows a high degree of persistence at that level. As of the fourth year, employment falls 30 percent below the baseline because aggregate demand falls and the real wage adjusts only sluggishly.

Due to the nature of the shock, the fiscal stance deteriorates immediately. However, because the automatic fiscal stabilisers are free to work, the ex post increase in the fiscal deficit is smaller than ex ante programmed, i.e., the deficit to GDP ratio increases from 0.45 percentage points in the first year to 0.66 percentage points in the third year, compared to a 1 percentage point ex ante programmed deterioration. During the simulation period, the debt to GDP ratio deteriorates, albeit at a much slower pace at the end of the period, when it reaches 1.89 percentage points above the baseline.

2. The spill-over effects on the euro area

Here, we will limit ourselves to a discussion of the main spill-over effects to the euro area. These results are shown in the first five columns of Table 2. The spill-over effects to the other country blocks for this and the following variants are shown in Appendix B.

Trade and financial flows are the main channels through which the shock is transmitted from the US to the other country blocks. In the first year, the effective nominal exchange rate of the euro area depreciates by 0.26 percent and the effective foreign output level increases by 0.16 percent, - mainly reflecting the interest rate hike and the increased output in the US. The following years the exchange rate depreciates further, and the effective foreign output level starts to fall. Export and import prices, denominated in euro, increase by, respectively, 0.18 and 0.08

percent in the first year, and rise further during the two following years as the effective nominal exchange rate continues to depreciate. However, because the pass-through of the changes in the exchange rate to export prices is not immediate, the competitiveness of the euro area improves. As a result, exports of the euro area increase initially by 0.25 percent, and remain at that level during the following two years, indicating that the subsequent changes in the scale effect and the real prices cancel each other out. Once the US fiscal shock is retracted, exports fall somewhat below the baseline to return to the baseline in due course. Through-out the simulation, the imports of the euro area stay close to the baseline level, reflecting small changes in the domestic output level and the price of imports. As a consequence, the current account balance to GDP ratio improves during the first five years, reaching 0.12 percentage points above the baseline in the third year, but falling thereafter as demand in the US falls.

The domestic components of final demand are almost unaffected by the shock, because the changes in their determinants remain modest. Indeed, the nominal short-term interest rate is raised by less than 0.1 percentage point in the first three years and the real disposable income increases by less than 0.1 percent because private sector employment and the real take home wage rise only slightly.

The GDP deflator increases up to 0.14 percent in the third year because the exchange rate depreciation and increased total demand exert an upward trend on prices. Afterwards, the general price level shows a high degree of persistence, i.e., in the fourth year, the GDP deflator is still 0.15 percent above the baseline.

The fiscal accounts of the euro area show a very small surplus, and the debt to GDP ratio falls by 0.18 percentage points in the third year. These improvements are due to the working of the automatic fiscal stabilisers, whereby tax revenues increase and outlays for unemployment benefits decrease.

C. A fixed exchange rate regime

1. The effects for the US economy

Columns 6 until to 10 of Table 1 show the adjustment path in the US under a fixed exchange rate regime. Comparing these results with the results under a flexible exchange rate regime, we see that the US economy is almost unaffected by the nature of the exchange rate regime. The most noticeable differences are to be found in international trade.

Under a flexible exchange rate regime, export prices, denominated in local currency, were lowered in order to compensate for the appreciation of the US dollar. However, export prices did not fall far enough and there was a loss of price competitiveness. Under a fixed exchange rate regime there is almost no loss of competitiveness, because the exchange rate and the export price does not change much. Nevertheless, exports fall more under a fixed exchange rate regime than under a flexible exchange rate regime. This is because under a fixed exchange rate regime there is a less favourable development in the effective foreign output level, caused by a world-wide interest rate hike. Indeed, under a fixed exchange rate

regime, the US interest rate determines the path of the interest rates in the other country blocks. As a consequence, the short-term interest rates of the other country blocks increase also by about 0.3 percentage points in the first year, followed by further interest rate hikes thereafter.

2. The spill-over effects on the euro area

Table 2 also shows the spill-over effects to the euro area under a fixed exchange rate regime¹. Here, the effects are largely determined by the changes in the interest rate. In the euro area, private consumption and total gross fixed capital formation decrease initially by, respectively, 0.1 and 0.25 percent in the first year, and fall further to, respectively, 0.25 and 0.5 percent below the baseline in the two following years. Once the shock in the US reverses and the US monetary authorities lower their interest rate, the interest rates in the other country blocks also fall and private consumption and gross fixed capital formation start to converge back to their baseline level. Remember that under a flexible exchange rate regime the domestic components of final demand are closer to their baseline level, because the changes in the domestic interest rates are smaller.

Prices of exports and imports, denominated in euro, remain throughout the simulation close to their baseline level, reflecting to a large extent the fixed nominal exchange rate. However, as demand continues to stay low, the prices of private consumption and the GDP deflator fall, respectively, 0.22 and 0.15 percent below the baseline in the fourth year. Remember that under a flexible exchange rate regime, the GDP deflator increased by 0.15 percent in the fourth year. There, the price increases were triggered by the depreciation of the euro and increased total demand.

Exports of the euro area increase by 0.15 percent in the first year, mainly due to the 0.10 percent increase in the effective foreign output level. However, exports start to fall as of the second year, reaching 0.19 percent below the baseline in the fourth year, mainly because the effective foreign output level falls, reaching 0.13 percent below the baseline in the fourth year. Imports fall 0.16 percent in the third year, which is in line with the 0.24 percent fall in domestic supply for final demand. Summarising the international trade effects, we note that the increase in the current account balance to the GDP ratio is larger under a flexible exchange rate regime than under a fixed exchange rate regime, i.e., 0.12 percentage points compared to 0.04 percentage points in the third year.

Labour demand falls by about 0.1 percent in the second and third year, reflecting the fall in output which is somewhat tempered by the fall in the real wage rate. The fiscal stance deteriorates and the public sector runs a deficit, resulting in an 0.44 percentage points increase in the debt to GDP ratio after four years.

1. Remember that we consider only unsterilised interventions in the foreign exchange market.

TABLE 1 - A fiscal shock in the us: macro-economic effects for the us^a

	Flexible exchange rate regime					Fixed exchange rate regime				
	1	2	3	4	5	1	2	3	4	5
<i>Demand/supply (in constant prices)</i>										
private consumption	0.55	0.37	0.23	-0.41	-0.28	0.55	0.38	0.24	-0.41	-0.28
public consumption	3.58	3.67	3.74	0.24	0.17	3.59	3.67	3.74	0.22	0.16
gross fixed capital formation	1.30	1.20	1.12	-0.12	0.03	1.32	1.25	1.18	-0.09	0.01
o/w enterprise sector	0.16	0.08	0.01	-0.03	0.12	0.16	0.11	0.06	0.01	0.12
residential buildings	2.70	2.61	2.46	-0.25	-0.19	2.77	2.71	2.57	-0.22	-0.24
public sector	4.54	4.31	4.21	-0.34	-0.10	4.56	4.34	4.24	-0.34	-0.14
exports	0.07	0.00	-0.02	-0.08	0.00	0.03	-0.09	-0.11	-0.12	0.02
imports	0.97	0.82	0.68	-0.43	-0.37	0.92	0.70	0.58	-0.40	-0.22
gross domestic product (GDP)	1.09	0.88	0.80	-0.29	-0.08	1.10	0.91	0.83	-0.30	-0.12
total private supply for final demand	0.87	0.63	0.51	-0.39	-0.18	0.87	0.63	0.52	-0.39	-0.19
<i>Prices</i>										
GDP deflator	0.01	0.08	0.13	0.16	0.13	0.04	0.13	0.18	0.19	0.14
consumption price	-0.02	0.11	0.20	0.29	0.23	0.00	0.13	0.21	0.28	0.22
export price (in local currency)	-0.33	-0.46	-0.40	-0.03	0.12	0.00	0.00	-0.01	-0.03	-0.04
import price (in local currency)	-0.14	-0.11	0.07	0.34	0.38	0.03	0.10	0.17	0.20	0.18
<i>Labour market</i>										
total employment	0.85	0.79	0.64	-0.30	-0.29	0.86	0.79	0.65	-0.30	-0.30
private sector employment	0.43	0.35	0.18	-0.35	-0.35	0.43	0.36	0.19	-0.35	-0.35
unemployment rate *	-0.64	-0.58	-0.47	0.24	0.22	-0.64	-0.58	-0.47	0.23	0.22
nominal wage (private sector)	0.22	0.31	0.47	0.39	0.42	0.27	0.38	0.53	0.39	0.39
take home real wage	0.24	0.20	0.27	0.10	0.19	0.27	0.25	0.32	0.11	0.18
producer real wage	0.22	0.23	0.33	0.20	0.25	0.22	0.23	0.33	0.20	0.25
<i>Financial sector</i>										
short-term interest rate *	0.31	0.41	0.32	-0.03	-0.15	0.34	0.42	0.31	-0.07	-0.16
long-term interest rate *	0.10	0.13	0.11	-0.01	-0.05	0.11	0.14	0.10	-0.02	-0.05
effective nominal exchange rate (-:appr.)	-0.49	-0.63	-0.50	0.04	0.21	0.00	0.00	0.00	0.00	0.00
effective real exchange rate (-:appr.)	-0.14	-0.13	-0.05	0.13	0.13	-0.00	-0.01	-0.01	-0.01	-0.01
bilateral exchange rate (local/eur) (-:appr.)	-0.69	-1.07	-1.11	-0.42	-0.01	0.00	0.00	0.00	0.00	0.00
nominal money stock	-0.32	-0.33	-0.10	0.35	0.49	-0.35	-0.33	-0.08	0.40	0.49
<i>Public finance</i>										
nominal public revenues	0.97	1.00	1.04	0.14	0.19	1.02	1.07	1.10	0.14	0.16
real public revenues	0.96	0.92	0.91	-0.02	0.05	0.98	0.94	0.92	-0.04	0.02
nominal public expenditures	2.18	2.67	3.02	1.11	0.93	2.20	2.71	3.05	1.11	0.91
real public expenditures	2.16	2.59	2.89	0.95	0.79	2.16	2.58	2.87	0.92	0.77
deficit to GDP ratio * (+:surplus)	-0.45	-0.58	-0.66	-0.27	-0.21	-0.44	-0.57	-0.65	-0.27	-0.21
debt to GDP ratio *	-0.07	0.57	1.22	1.84	1.89	-0.10	0.51	1.15	1.80	1.88
<i>Household sector</i>										
total available means	0.08	0.02	0.02	-0.07	-0.00	0.07	0.02	0.02	-0.06	0.01
real disposable income	0.84	0.89	0.91	0.10	0.11	0.86	0.92	0.95	0.12	0.09
savings as % of disposable income *	0.28	0.49	0.65	0.49	0.36	0.29	0.51	0.67	0.50	0.36
<i>Spill-over effects</i>										
effective foreign output	0.07	0.05	0.05	-0.03	-0.01	0.02	-0.06	-0.07	-0.08	0.00
effective foreign price level	0.01	0.04	0.06	0.05	0.04	-0.00	-0.01	-0.02	-0.04	-0.05
effective foreign interest rate *	0.11	0.17	0.14	0.01	-0.06	0.40	0.44	0.32	-0.07	-0.17
<i>Memo items</i>										
current account to GDP ratio * (+:surplus)	-0.10	-0.12	-0.13	-0.01	0.01	-0.08	-0.09	-0.10	-0.01	-0.01
total stock of real assets	0.09	0.17	0.24	0.21	0.20	0.09	0.17	0.24	0.22	0.20

a. Variables without *: deviation from baseline, in percent. Variables with *: deviation from baseline, in differences.

TABLE 2 - A fiscal shock in the us: macro-economic spill-over effects on the euro area ^a

	Flexible exchange rate regime					Fixed exchange rate regime				
	1	2	3	4	5	1	2	3	4	5
<i>Demand/supply (in constant prices)</i>										
private consumption	0.01	-0.01	-0.02	-0.03	-0.01	-0.09	-0.23	-0.24	-0.09	0.09
public consumption	0.01	0.01	0.00	-0.01	-0.01	-0.00	-0.03	-0.07	-0.09	-0.06
gross fixed capital formation	0.01	-0.01	0.01	0.03	0.07	-0.24	-0.52	-0.53	-0.26	0.04
o/w enterprise sector	-0.01	-0.05	-0.02	0.02	0.09	-0.34	-0.75	-0.79	-0.43	0.01
residential buildings	0.03	0.06	0.08	0.07	0.05	-0.09	-0.15	-0.13	0.02	0.15
public sector	0.02	0.02	0.02	-0.00	0.00	-0.02	-0.06	-0.07	-0.04	0.01
exports	0.25	0.23	0.23	-0.03	-0.01	0.15	0.01	-0.04	-0.19	-0.05
imports	0.04	0.00	-0.02	-0.08	-0.03	-0.04	-0.14	-0.16	-0.13	-0.04
gross domestic product (GDP)	0.07	0.06	0.06	-0.01	0.01	-0.06	-0.22	-0.24	-0.14	0.06
total private supply for final demand	0.07	0.05	0.05	-0.02	0.00	-0.06	-0.23	-0.24	-0.13	0.06
<i>Prices</i>										
GDP deflator	0.03	0.09	0.14	0.15	0.11	0.00	-0.01	-0.08	-0.15	-0.21
consumption price	0.01	0.04	0.07	0.08	0.06	0.00	-0.03	-0.12	-0.22	-0.28
export price (in local currency)	0.18	0.39	0.53	0.41	0.24	0.01	0.01	0.01	-0.01	-0.02
import price (in local currency)	0.08	0.19	0.26	0.19	0.08	0.00	-0.00	-0.02	-0.04	-0.08
<i>Labour market</i>										
total employment	0.02	0.02	0.02	-0.01	-0.01	-0.02	-0.08	-0.07	-0.01	0.08
private sector employment	0.03	0.02	0.02	-0.01	-0.01	-0.03	-0.09	-0.09	-0.01	0.09
unemployment rate *	-0.02	-0.02	-0.01	0.01	0.01	0.02	0.07	0.06	0.01	-0.07
nominal wage (private sector)	0.04	0.11	0.16	0.16	0.12	-0.01	-0.05	-0.17	-0.26	-0.30
take home real wage	0.03	0.06	0.09	0.08	0.06	-0.01	-0.03	-0.05	-0.05	-0.02
producer real wage	-0.00	-0.00	-0.00	0.00	0.01	-0.01	-0.04	-0.09	-0.13	-0.11
<i>Financial sector</i>										
short-term interest rate *	0.05	0.08	0.06	0.01	-0.03	0.39	0.44	0.32	-0.07	-0.17
long-term interest rate *	0.03	0.05	0.04	0.01	-0.02	0.22	0.24	0.18	-0.04	-0.09
effective nominal exchange rate (-:appr.)	0.26	0.52	0.66	0.44	0.18	0.00	0.00	0.00	0.00	0.00
effective real exchange rate (-:appr.)	0.09	0.17	0.20	0.10	-0.01	-0.00	-0.00	-0.01	-0.01	-0.01
bilateral exchange rate (local/eur) (-:appr.)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
nominal money stock	-0.05	-0.08	-0.02	0.06	0.11	-0.83	-1.16	-1.15	-0.43	-0.03
<i>Public finance</i>										
nominal public revenues	0.06	0.13	0.17	0.14	0.11	-0.03	-0.13	-0.24	-0.28	-0.23
real public revenues	0.03	0.03	0.03	-0.01	-0.01	-0.03	-0.13	-0.17	-0.13	-0.02
nominal public expenditures	0.00	0.08	0.13	0.14	0.08	0.01	0.11	0.00	-0.16	-0.35
real public expenditures	-0.02	-0.01	-0.01	-0.01	-0.03	0.01	0.12	0.08	-0.01	-0.14
deficit to GDP ratio * (+:surplus)	0.03	0.02	0.02	0.00	0.01	-0.02	-0.11	-0.11	-0.06	0.05
debt to GDP ratio *	-0.08	-0.14	-0.18	-0.15	-0.14	0.05	0.27	0.42	0.44	0.28
<i>Household sector</i>										
total available means	-0.01	-0.03	-0.02	-0.01	0.01	-0.12	-0.13	-0.07	0.07	0.12
real disposable income	0.02	0.04	0.06	0.05	0.04	-0.01	-0.04	-0.04	0.01	0.07
savings as % of disposable income *	0.01	0.04	0.06	0.06	0.04	0.07	0.16	0.17	0.08	-0.01
<i>Spill-over effects</i>										
effective foreign output	0.16	0.11	0.09	-0.07	-0.03	0.10	0.00	-0.03	-0.13	-0.03
effective foreign price level	0.01	0.05	0.07	0.08	0.06	0.00	0.01	-0.00	-0.02	-0.04
effective foreign interest rate *	0.13	0.19	0.16	-0.00	-0.07	0.39	0.44	0.32	-0.07	-0.17
<i>Memo items</i>										
current account to GDP ratio * (+:surplus)	0.07	0.10	0.12	0.06	0.04	0.04	0.04	0.04	0.00	0.02
total stock of real assets	-0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.04	-0.06	-0.06	-0.06

a. Variables without *: deviation from baseline, in percent. Variables with *: deviation from baseline, in differences.



The spill-over effects of a supply shock in the US

A. Introduction and summary of the spill-over effects

In this variant, we examine the spill-over effects of a permanent 1 percent increase in total factor productivity in the US. Here, there are not only the earlier discussed trade and financial spill-over effects, but also the (expected) spill-over effects on the trend productivity of the other country blocks. Indeed, as the shock hits the US economy, it is expected that (after some time) this increase in trend productivity will spill-over to the rest of the world, raising trend productivity in the other country blocks. Economic agents will act immediately upon this expectation¹ and adjust their contemporaneous expenditures. We simulated this supply shock under a flexible and a fixed exchange rate regime.

Briefly summarised, this shock causes the following (spill-over) effects. When the shock hits the US economy, potential output increases by 1 percent, while aggregate demand increases by less than 1 percent because rigidities prevent agents implementing their expenditure plans immediately. As a consequence, the output gap will increase and the US monetary authorities will take a more accommodative stance. The main spill-over effects of this shock are as follows for the euro area. Under a flexible exchange rate regime, real GDP of the euro area increases by 0.37 percent in the first year, followed by further increases as the rise in trend productivity of the euro area materialises, i.e., 0.87 percent in the second year and 1.09 percent in the third year. This strong initial jump in real GDP is to a large extent explained by the increase in private consumption which increases by 0.53 percent in the first year, reflecting higher expected future household income. Under a fixed exchange rate regime, real GDP of the euro area increases by 0.49 percent in the first year, followed by further increases. Once again, the initial jump in private consumption is largest and it increases by 0.62 percent in the first year. This extra increase in private consumption is largely due to a lower interest rate, i.e., 0.05 percentage points below the baseline under a fixed exchange rate regime, compared to 0.11 percent above the baseline under a flexible exchange rate regime. Under both exchange rate regimes, the price level of the euro area increases as of the second year and shows a high degree of persistence thereafter. The initial price increases are a result of the excess demand that arises in the first year when demand increases and the increase in potential output has not yet materialised, while the persistence of the deviation is due to menu costs and backward looking behaviour in price setting. Under a flexible exchange rate regime, the fiscal stance of the euro area improves because the automatic fiscal

1. I.e., the expected future increase in trend productivity will generate a higher real wage in the future.

stabilisers are free to operate. The public sector runs a surplus equal to 0.25 percent of GDP in the second year, but this surplus starts to decline thereafter reaching 0.04 percent of GDP in the fifth year. Lower outlays for unemployment benefits and higher tax revenue explain these fiscal developments. Under a fixed exchange rate, the fiscal surpluses are somewhat higher, due to the higher economic activity.

Before we have a closer look at the simulation results, we will discuss briefly how we modelled technology diffusion in the NIME model. We postulate a diffusion mechanism whereby the US is the leading innovator, and whereby it takes one year for the other country blocks to absorb these innovations. Furthermore, we assume that when the productivity shock occurs in the US, the economic agents anticipate a spill-over of trend productivity to the other country blocks the following year. This implies that in the first year of the simulation, when trend productivity increases in the US, but has not yet materialised in the other country blocks, the expected future income in the other country blocks increases immediately. Moreover, we assume that the monetary authorities revise immediately their reference value for output in their Taylor rule when potential output increases. Since trend productivity of the other country blocks only rises in the second year, the reference value for output in the Taylor rule of the other country blocks will only be revised as of the second year.

B. A flexible exchange rate regime

We start with a discussion of the results for the US under a flexible exchange rate regime. These results are shown in the first five columns of Table 3. Next, we discuss the results for the euro area.

1. The effects for the US economy

Before we have a closer look at the simulation results, it may be useful to remind the most important steady state implications of this permanent supply shock¹ in the NIME model. In the new steady state, the employment level, the level of the capital stock of the enterprise sector, the general price level, the unemployment rate, the interest rate will be unaffected². At the same time, the real wage rate and the price of enterprise capital will increase by 1 percent. The results shown in the first five columns of Table 3 describe the first five years of the adjustment process towards the new steady state.

The productivity shock increases the production capacity of the US economy. However, not all new production capacity will be utilised immediately. Indeed, although expenditure plans may increase in line with the increase in factor productivity, rigidities prevent an immediate implementation of these plans³. As a consequence, output will be below potential output and there will be some room to lower the nominal interest rate. This nominal interest rate cut will decrease the

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1. I.e., a simultaneous increase in trend productivity of labour and capital. Although intermediary imports are also a production factor, their trend productivity is not affected by the shock.
 2. See Section III of Meyermans and Van Brusselen (2001).
 3. These rigidities are captured by the error correction mechanisms and partial adjustment schemes described in Meyermans and Van Brusselen (2001) and Appendix A of this paper.

real interest rate and the user cost of capital, and it will also increase the financial wealth of households and depreciate the nominal exchange rate. Let us now investigate how these effects affect the different components of demand.

In the first year, the higher expected future income, increased economic activity, and lower interest rates increase private consumption and total gross fixed capital formation by, respectively, 0.77 and 1.14 percent. Although gross fixed capital formation remains high in subsequent years, it should be noted that as total factor productivity increases, the new steady state stock of enterprise capital will be at the same level as in the baseline, while the price of enterprise capital will increase by 1 percent. However, the stock of residential buildings and the public capital stock will increase in the long run, because the productivity shock only affects the capital stock of the enterprise sector.

The prices of the domestic goods remain subdued during the simulation period, while export and import prices, denominated in local currency, increase by up to 0.29 and 0.15 percent, respectively. The prices of imports and exports follow to a large extent the movement of the effective exchange rate. The effective US dollar exchange rate depreciates initially by 0.42 percent because the US interest rate falls and the effective foreign interest rate increases¹. However, as the interest rates in the different country blocks follow different paths, the effective US dollar exchange rate hovers around its baseline level in subsequent years.

Imports increase in line with domestic output, i.e., they are 0.84 percent above the baseline in the first year, and continue to rise in subsequent years, reaching 1.13 percent in the third year. Exports increase by 0.30 percent in the first year, and increase further in subsequent years reaching 1.66 percent in the third year. Exports are to a large extent determined by the effective foreign output level which increases by 0.17 percent in the first year, and reaches a level of about 1 percent above the baseline in the second year, i.e., the period the diffusion of productivity materialises.

Private sector employment increases in the first year, because the real producer wage falls relative to trend productivity. However, as real wages catch up, employment stabilises at its baseline level. The fiscal stance improves as the public sector runs a surplus, and the debt to GDP ratio falls by 0.56 percentage points in the first year, followed by some further improvements in subsequent years. However, as public outlays are indexed to productivity growth with a lag, the real public expenditures will catch up and fiscal balance will be restored.

2. The spill-over effects on the euro area

The productivity shock is not only transmitted from the US to the other country blocks through the traditional trade and financial channels, but also through the diffusion of technology and the expectations. First, the higher demand in the US will increase exports to the US - even though that this increase will be somewhat tempered by the depreciation of the US dollar. Second, as soon as the households

1. Note that the downward pressure on the exchange rate is reinforced by the fact that a higher potential output level will induce a higher import volume, requiring a depreciation of the exchange rate in order to maintain long run equilibrium in the current account.

of the other country blocks expect that their future income will increase, they will anticipate on these future increases and increase their contemporaneous spending. Third, since in the first year potential output does not change, inflationary pressures will arise and the monetary authorities will increase the short-term interest rate by 0.18 percent. However, as of the second year, when trend productivity effectively increases and aggregate demand lags behind the productivity gains, the monetary authorities take a more accommodative stance as they revise their reference value for potential output¹.

The first five columns of Table 4 show that in the euro area, private consumption increases by 0.53 percent in the first year. In the second year, private consumption gets an additional boost as the interest rates start to fall and the real take home wage and employment increase by, respectively, 0.55 and 0.27 percent, followed by further increases in the real wage in subsequent years. Total gross fixed capital formation remains almost unaffected because the impact of increased economic activity and higher interest rates cancel each other out. As of the second year, investments increase by 0.43 percent and continue to increase until the fifth year, in line with economic activity.

The changes in the overall price level of the euro area remain modest. However, the prices of imports and exports, denominated in euro, fall immediately by, respectively, 0.08 and 0.16 percent, reflecting the 0.23 percent appreciation of the effective nominal euro exchange rate. In subsequent years, prices will fall back to their baseline level as the exchange rate starts to depreciate.

Exports and imports of the euro area get an immediate boost, due to increased domestic and foreign economic activity and the fall in prices. In subsequent years, exports and imports increase even further as they have to catch up with their new equilibrium level. All in all, after an initial deficit, the current account balance to GDP ratio reaches a surplus of 0.17 percentage points in the second year, falling only gradually thereafter.

Private sector employment of the euro area increases by 0.13 percent in the first year, because output increases while trend labour productivity has not yet adjusted. In the second year, employment increases even further because the real producer wage is slow to adjust and employment responds faster to changes in output than to changes in real wages. However, once real wages have caught up to productivity increases, employment falls back to its baseline level.

The fiscal stance in the euro area improves, because the automatic fiscal stabilisers are free to operate. The public sector runs a surplus equal to 0.25 percent of GDP in the second year, but this surplus declines thereafter reaching 0.04 percent of GDP in the fifth year. At the same time, the debt to GDP ratio falls to 1.21 percentage points below the baseline in the fourth year, but starts to rise again thereafter. Initially, lower outlays for unemployment benefits and higher tax revenue explain the initial improvement. However, as outlays are indexed to productivity growth with a lag, real public expenditures will increase, and the fiscal balance will be restored.

1. See Meyermans (2002.b) for a discussion of the revision of the reference value of potential output in a Taylor rule.

C. A fixed exchange rate regime

The results shown in columns 6 to 10 of Table 3 indicate that economic activity in the US is only moderately affected by the nature of the exchange rate regime. This is to a large extent explained by the behaviour of the domestic interest rate, which does not differ much across exchange rate regimes.

The spill-over effects to the euro area are shown in the last five columns of Table 4. Here, the behaviour of the interest rate is of some importance¹. In the euro area, the short-term interest rate decreases by 0.09 percentage points under a fixed exchange rate regime in the first year, compared to a 0.18 percentage points increase under a flexible exchange rate regime. Under a flexible exchange rate regime, the domestic interest rate was raised to temper the inflationary pressures caused by higher domestic demand. Under the fixed exchange rate regime, the domestic interest rate is linked to the US interest rate and the latter falls because US effective demand increases initially by less than US potential output. This lower euro interest rate gives an additional boost to domestic demand. As a consequence, private consumption and gross fixed capital formation are respectively, 0.62 and 0.22 percent above the baseline in the first year, compared to, respectively, 0.53 and 0.0 percent under a flexible exchange rate regime. In the second year, private consumption and gross fixed capital formation are still higher under a fixed exchange rate regime than under a flexible exchange rate regime, partly because of a lagged reaction to the initial interest rate adjustments. As of the third year, they show a similar pattern under both regimes.

Under a fixed exchange rate regime, the general price level is almost unaffected in the first year. However, as of the second year, the GDP deflator is higher under a fixed exchange rate regime than under a flexible exchange rate regime, reaching 0.18 percent compared to 0.09 percent in the fifth year, because under a flexible exchange rate regime the initial appreciation of the effective exchange rate has a moderating effect on prices.

Exports and imports are somewhat higher under a fixed exchange rate regime than under a flexible exchange rate regime, because under a fixed exchange rate regime world wide economic activity is higher due to the world-wide cut in interest rates.

As the output effects are larger under a fixed exchange rate regime than under a flexible exchange rate regime, the employment effects will also be somewhat higher, i.e., total employment is up by 0.33 percent in the second year, compared to 0.27 percent under a flexible exchange rate regime. Finally, note that now the surpluses on the public account are somewhat higher under a fixed exchange rate regime than under a flexible exchange rate regime, mainly due to the higher economic activity and lower unemployment.

1. Remember that we consider only unsterilised interventions in the foreign exchange market.

TABLE 3 - A productivity shock in the us: macro-economic effects for the us^a

	Flexible exchange rate regime					Fixed exchange rate regime				
	1	2	3	4	5	1	2	3	4	5
<i>Demand/supply (in constant prices)</i>										
private consumption	0.77	0.97	0.88	0.83	0.81	0.76	0.97	0.88	0.82	0.81
public consumption	0.41	0.86	0.89	0.93	0.93	0.40	0.87	0.90	0.92	0.92
gross fixed capital formation	1.14	1.58	1.17	0.99	0.88	1.12	1.56	1.16	0.99	0.88
o/w enterprise sector	0.89	1.21	0.74	0.55	0.45	0.88	1.19	0.72	0.56	0.46
residential buildings	2.16	3.01	2.65	2.39	2.19	2.11	2.98	2.66	2.37	2.17
public sector	0.88	1.28	1.07	0.97	0.93	0.87	1.26	1.08	0.98	0.93
exports	0.30	1.57	1.65	1.45	1.22	0.35	1.62	1.66	1.46	1.26
imports	0.84	1.22	1.13	1.10	0.95	0.89	1.31	1.10	1.01	0.94
gross domestic product (GDP)	0.81	1.18	1.00	0.91	0.87	0.80	1.17	1.00	0.92	0.88
total private supply for final demand	0.84	1.23	1.05	0.95	0.89	0.84	1.24	1.04	0.95	0.89
<i>Prices</i>										
GDP deflator	0.04	0.00	0.02	0.06	0.06	0.01	-0.01	0.03	0.05	0.06
consumption price	0.01	-0.02	0.01	0.03	0.04	0.00	-0.03	0.02	0.03	0.03
export price (in local currency)	0.29	0.18	-0.12	0.10	0.16	0.00	0.03	0.05	0.06	0.08
import price (in local currency)	0.15	0.05	-0.14	0.00	0.10	0.00	-0.01	0.01	0.03	0.05
<i>Labour market</i>										
total employment	0.01	0.11	0.06	-0.00	-0.04	0.01	0.11	0.06	-0.01	-0.04
private sector employment	0.05	0.16	0.09	0.01	-0.04	0.05	0.16	0.09	0.01	-0.04
unemployment rate *	-0.01	-0.08	-0.04	0.00	0.03	-0.01	-0.08	-0.04	0.01	0.03
nominal wage (private sector)	0.88	0.98	0.93	0.98	1.00	0.84	0.96	0.95	0.97	0.98
take home real wage	0.86	1.00	0.92	0.95	0.96	0.84	0.98	0.93	0.94	0.95
producer real wage	0.83	0.97	0.93	0.93	0.93	0.83	0.98	0.93	0.93	0.93
<i>Financial sector</i>										
short-term interest rate *	-0.05	0.07	0.07	0.03	-0.03	-0.07	0.08	0.10	0.01	-0.04
long-term interest rate *	-0.02	0.02	0.02	0.01	-0.01	-0.02	0.03	0.03	0.00	-0.01
effective nominal exchange rate (-:appr.)	0.42	0.18	-0.26	0.08	0.14	0.00	0.00	0.00	0.00	0.00
effective real exchange rate (-:appr.)	0.12	0.02	-0.11	0.03	0.04	0.00	0.01	0.01	0.01	0.02
bilateral exchange rate (local/eur) (-:appr.)	0.60	0.43	-0.17	0.07	0.09	0.00	0.00	0.00	0.00	0.00
nominal money stock	0.83	0.63	0.65	0.74	0.84	0.85	0.60	0.62	0.78	0.86
<i>Public finance</i>										
nominal public revenues	0.80	1.07	1.00	0.99	0.97	0.76	1.06	1.02	0.97	0.95
real public revenues	0.76	1.07	0.97	0.93	0.91	0.75	1.07	0.99	0.93	0.90
nominal public expenditures	0.23	0.61	0.78	0.84	0.88	0.21	0.60	0.80	0.84	0.88
real public expenditures	0.20	0.61	0.76	0.78	0.82	0.20	0.61	0.77	0.80	0.82
deficit to GDP ratio * (+:surplus)	0.16	0.12	0.06	0.04	0.03	0.16	0.13	0.06	0.03	0.02
debt to GDP ratio *	-0.56	-0.80	-0.76	-0.75	-0.73	-0.54	-0.79	-0.76	-0.73	-0.70
<i>Household sector</i>										
total available means	0.74	0.75	0.73	0.74	0.76	0.75	0.74	0.72	0.74	0.77
real disposable income	0.66	1.00	0.97	0.95	0.94	0.65	0.99	0.97	0.94	0.93
savings as % of disposable income *	-0.10	0.03	0.08	0.12	0.13	-0.11	0.02	0.09	0.12	0.12
<i>Spill-over effects</i>										
effective foreign output	0.17	0.98	1.08	1.06	1.02	0.22	1.04	1.09	1.07	1.04
effective foreign price level	-0.01	0.02	0.03	0.04	0.05	0.00	0.05	0.06	0.08	0.09
effective foreign interest rate *	0.13	0.12	-0.04	0.08	0.03	-0.09	0.09	0.10	-0.00	-0.05
<i>Memo items</i>										
current account to GDP ratio * (+:surplus)	-0.04	0.05	0.06	0.05	0.04	-0.06	0.04	0.07	0.06	0.04
total stock of real assets	0.07	0.18	0.25	0.31	0.35	0.07	0.18	0.25	0.30	0.35

a. Variables without *: deviation from baseline, in percent. Variables with *: deviation from baseline, in differences.

TABLE 4 - A productivity shock in the US: macro-economic spill-over effects on the euro area ^a

	Flexible exchange rate regime					Fixed exchange rate regime				
	1	2	3	4	5	1	2	3	4	5
<i>Demand/supply (in constant prices)</i>										
private consumption	0.53	0.70	0.76	0.77	0.73	0.62	0.82	0.76	0.74	0.75
public consumption	0.03	0.39	0.95	0.99	0.98	0.04	0.42	0.99	1.02	1.00
gross fixed capital formation	0.00	0.43	0.85	0.89	0.81	0.22	0.70	0.88	0.93	0.96
o/w enterprise sector	-0.05	0.29	0.82	0.84	0.72	0.25	0.68	0.86	0.90	0.94
residential buildings	0.07	0.83	1.19	1.29	1.27	0.19	0.94	1.18	1.28	1.29
public sector	0.10	0.25	0.33	0.34	0.33	0.14	0.30	0.34	0.34	0.34
exports	0.31	1.43	1.54	1.48	1.38	0.41	1.56	1.59	1.50	1.42
imports	0.24	0.55	0.74	0.70	0.67	0.32	0.63	0.74	0.74	0.76
gross domestic product (GDP)	0.37	0.87	1.09	1.08	1.00	0.49	1.03	1.10	1.07	1.04
total private supply for final demand	0.38	0.83	1.05	1.03	0.95	0.51	0.99	1.06	1.02	1.00
<i>Prices</i>										
GDP deflator	-0.05	0.01	0.01	0.05	0.09	-0.02	0.08	0.11	0.16	0.18
consumption price	-0.01	0.15	0.08	0.11	0.13	-0.00	0.21	0.20	0.23	0.24
export price (in local currency)	-0.16	-0.18	-0.02	0.03	0.06	0.01	0.03	0.05	0.07	0.09
import price (in local currency)	-0.08	-0.10	-0.00	0.05	0.08	-0.00	0.01	0.04	0.07	0.10
<i>Labour market</i>										
total employment	0.13	0.27	0.12	0.01	-0.05	0.17	0.33	0.11	-0.02	-0.06
private sector employment	0.16	0.34	0.15	0.02	-0.05	0.21	0.40	0.14	-0.01	-0.07
unemployment rate *	-0.11	-0.23	-0.09	0.00	0.05	-0.15	-0.28	-0.08	0.03	0.06
nominal wage (private sector)	0.01	0.69	0.91	1.03	1.06	0.05	0.81	1.07	1.18	1.19
take home real wage	0.02	0.55	0.83	0.92	0.93	0.05	0.61	0.87	0.95	0.95
producer real wage	0.06	0.69	0.90	0.97	0.96	0.07	0.73	0.96	1.03	1.01
<i>Financial sector</i>										
short-term interest rate *	0.18	0.15	-0.07	0.06	0.01	-0.09	0.09	0.10	-0.00	-0.05
long-term interest rate *	0.10	0.09	-0.04	0.03	0.01	-0.05	0.05	0.05	-0.00	-0.03
effective nominal exchange rate (-:appr.)	-0.23	-0.26	-0.00	0.04	0.06	0.00	0.00	0.00	0.01	0.01
effective real exchange rate (-:appr.)	-0.08	-0.07	0.03	0.05	0.05	0.00	0.01	0.02	0.02	0.02
bilateral exchange rate (local/eur) (-:appr.)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
nominal money stock	0.51	0.56	0.92	0.75	0.83	1.17	0.98	0.84	1.02	1.15
<i>Public finance</i>										
nominal public revenues	0.15	0.73	0.94	1.05	1.06	0.24	0.91	1.09	1.17	1.20
real public revenues	0.19	0.72	0.94	1.00	0.97	0.26	0.83	0.98	1.02	1.01
nominal public expenditures	-0.10	0.18	0.64	0.87	1.00	-0.11	0.17	0.78	1.05	1.11
real public expenditures	-0.05	0.17	0.64	0.82	0.92	-0.09	0.09	0.66	0.89	0.93
deficit to GDP ratio * (+:surplus)	0.11	0.25	0.15	0.10	0.04	0.16	0.34	0.16	0.08	0.06
debt to GDP ratio *	-0.31	-0.90	-1.14	-1.21	-1.18	-0.46	-1.17	-1.35	-1.37	-1.37
<i>Household sector</i>										
total available means	0.66	0.64	0.74	0.71	0.73	0.75	0.66	0.67	0.71	0.73
real disposable income	0.05	0.65	0.89	0.98	0.98	0.09	0.71	0.90	0.98	0.99
savings as % of disposable income *	-0.41	-0.04	0.11	0.19	0.22	-0.45	-0.10	0.12	0.20	0.20
<i>Spill-over effects</i>										
effective foreign output	0.24	1.04	1.11	1.07	1.02	0.29	1.11	1.13	1.09	1.06
effective foreign price level	-0.01	0.01	0.02	0.04	0.05	0.00	0.04	0.06	0.08	0.10
effective foreign interest rate *	0.11	0.12	-0.01	0.07	0.02	-0.09	0.09	0.10	-0.00	-0.05
<i>Memo items</i>										
current account to GDP ratio * (+:surplus)	-0.01	0.17	0.17	0.16	0.15	0.02	0.20	0.18	0.16	0.14
total stock of real assets	0.00	0.02	0.06	0.11	0.14	0.01	0.04	0.08	0.12	0.17

a. Variables without *: deviation from baseline, in percent. Variables with *: deviation from baseline, in differences.



The spill-over effects of a stock market shock in the US

A. Introduction and summary of the spill-over effects

In this variant, we examine the effects of a 1 percentage point increase in the risk premium in the US equity market, while there is not a similar shock in the other country blocks¹. In the current version of the NIME model, an increase in this risk premium lowers household financial wealth and it increases the user cost of enterprise capital, thereby reducing private consumption and gross fixed capital formation in the enterprise sector. Here, it is assumed that this increase in the risk premium in the US stock market does not spill-over to the other country blocks. We simulated this financial shock under a flexible and a fixed exchange rate regime.

Briefly summarised, this financial shock reduces demand in the US and triggers a cut in US interest rates. The spill-over effects of this shock are as follows. Under a flexible exchange rate regime, real GDP of the euro area falls by about 0.1 percent in the medium term, mainly because exports fall by 0.3 percent. The fall in exports is caused by the appreciation of the effective euro exchange rate and the decrease in the effective foreign output level. Under a fixed exchange rate regime the euro interest rate is set in accordance with the US interest rate, which falls by about 0.3 percentage points in the first year, so that the euro interest rate is also reduced by about 0.3 percentage points in the first year. As a consequence, all components of demand in the euro area get a boost and real GDP of the euro area increases by 0.2 percent. Furthermore, note how the behaviour of the general price level is affected by the nature of the exchange rate regime. Under the flexible exchange rate regime, the price level of the euro area falls by 0.3 percent, compared to a 0.2 percent rise under a fixed exchange rate regime. Under a flexible exchange rate regime, the price level falls because aggregate demand falls and the effective nominal exchange rate appreciates, while under a fixed exchange rate regime prices increase because aggregate demand increases. Finally, with the automatic fiscal stabilisers free to operate, the fiscal stance of the euro area improves under a fixed exchange rate regime, and the deficit to GDP ratio falls by 10 basis points during the first few years, compared to a modest worsening under a flexible exchange rate regime.

1. This is a technical assumption. See Meyermans and Van Brusselen (2003) for a world-wide stock market correction.

B. The risk premium in the NIME model

Before we present the simulation results, we will recall briefly how this increase in the risk premium affects economic activity in the NIME model.

In the current version of the NIME model, we make a distinction between the bond market and the equity market. In the bond market the long-term interest rate, LI , is determined by the contemporaneous and expected future short-term interest rates¹. In the equity market, the price of equity is equal to the discounted flow of future profits, with the discount rate, LIP , equal to the interest rate, LI , plus a risk premium. In Appendix A, Section F, we present some analytical results for the relationship between the risk premium, the user cost of capital and the price of capital. There it is shown that, given the assumptions of the NIME model, a permanent increase in the risk premium will reduce the price of capital in the long run, but that it will not affect the user cost of capital in the long run². Indeed, as the discount rate increases, the present value of future returns on capital declines thereby triggering a drop in the price of capital. The user cost of capital tends to increase as the financing cost increases. However, this increase will be tempered by the fall in the price of capital goods. In the steady state the latter effect is equal to the former, so that in the steady state the user cost of capital will not be affected by the risk premium shock. Moreover, since the user cost of capital is not affected in the long run, the demand for capital will also not be affected in the long run. Finally, it should be noted that, in the short run, the user cost of capital will change as the speed of adjustment of its different components differs.

C. A flexible exchange rate regime

1. The effects for the US economy

The first five columns of Table 5 show the simulation results for the US economy. In the first year, US real GDP falls by 0.57 percent, followed by further decreases in the second year and a rebound as of the third year. Apart from the increase in the risk premium, another driving force of the adjustment process is the short-term interest rate.

In the current version of the NIME model, an increase in this risk premium lowers household financial wealth and it increases the user cost of capital (on impact), thereby reducing private consumption and gross fixed capital formation. As a consequence, economic activity and prices fall so that the monetary authorities will have some room to cut the short-term interest rate. This interest rate cut will reduce the long-term interest rate and the discount rate in the equity markets³. Table 5 shows that in the first year, the short-term interest rate is cut by 0.29 percentage points, while the long-term interest rate falls by 0.10 percentage points. In subsequent years, the interest rates fall even further and remain below their baseline level throughout the simulation period.

1. See equation (IV.6) of Meyermans and Van Brusselen (2001).
2. Remember that the user cost of capital is determined by the interest rate (augmented by the risk premium), the rate of depreciation (which is assumed constant), the expected change in the price of capital, and the price of capital.
3. Discount rate in equity markets = long run interest rate in bond market + risk premium.

Private consumption falls by 0.46 percent in the first year, and it stays below its baseline level for some time. This fall in private consumption is primarily caused by the drop in financial wealth¹ and disposable income², but it is somewhat tempered by the fall in interest rates. Total gross fixed capital formation falls by 1.33 percent in the first year. Enterprise investment is hardest hit as it falls by 1.72 percent in the first year and 2.17 percent in the second year. At the same time, investments in residential buildings fall by 0.56 percent in the first year and 1.22 percent in the second year. Enterprise investments fall by more because the risk premium only affects the user cost of investments in enterprise capital. Nevertheless, investments in residential buildings fall also because the overall cut in interest rates can not compensate for the fall in overall economic activity.

Prices are almost unaffected in the first year, and only the price of exports and imports rise in line with the exchange rate depreciation. As of the second year, the price level falls in a (lagged) response to the excess capacity (of the previous year), but this price fall is somewhat tempered by the depreciation of the effective nominal exchange rate. As long as the output gap persists, the downward pressure on prices continues and the GDP deflator falls to 0.34 percent below the baseline in the fifth year.

Imports fall by 0.67 percent in the first year, mainly reflecting the fall in domestic activity. The fall in exports is much smaller, i.e. 0.07 percent, because the drop in foreign activity is rather limited and the effective real exchange rate does not change much. As a consequence, the US current account balance improves by almost 0.1 percent of GDP.

Private sector employment falls by 0.27 percent in the first year, due to the fall in contemporaneous output and the lagged response of labour demand to changes in the real producer wage. The real producer wage falls by 0.18 percent, due to the drop in contemporaneous productivity. As of the second year, the real wage shows a high degree of persistence.

The fiscal stance deteriorates as the automatic fiscal stabilisers are free to operate. After five years the debt-to-GDP ratio has increased by 0.8 percentage points, while the deficit-to-GDP ratio is 0.06 percentage points below the baseline, falling from 0.14 percentage points in the first year.

2. The spill-over effects on the euro area

Let us now have a closer look at the spill-over effects for the euro area, which are shown in the first five columns of Table 6.

Real GDP of the euro area falls by about 0.1 percent after the first year, mainly due to the fall in exports. Exports of the euro area fall by about 0.3 percent as of the second year. This fall in exports is caused by the appreciation of the effective

1. The risk premium is 4 percent in the baseline, see Ibotson and Chen (2001). A 1 percent increase in the risk premium causes a 16.6 percent drop in equity value.
2. In the NIME model, the household sector is liquidity constrained in the short term, so that disposable income is an important short term determinant of private consumption. See Meyermans and Van Brusselen (2001) and Appendix A of this paper.

real euro exchange rate and the more than 0.1 percent fall in the effective foreign output level. The latter is due to the decline in economic activity in the US, while the former is due to the appreciation of the effective nominal exchange rate. Indeed, the effective nominal exchange rate appreciates by 0.23 percent in the first year, and continues to appreciate in subsequent years. At the same time, the prices of exports and imports, denominated in euro, fall to compensate for the exchange rate appreciation. However, this price adjustment is not sufficient to keep price competitiveness at its baseline level. All in all, the deficit on the current account amounts to a deficit increase of more than 0.20 percent of GDP in the fifth year.

The other components of total demand remain almost unchanged, partly because the fall in external demand is compensated by small cuts in the domestic interest rate. Private sector employment in the euro area remains almost unaffected, because the changes in private supply and the real wage are small. As the automatic fiscal stabilisers start to work, the deficit to GDP ratio deteriorates by less than 0.05 percentage points throughout the simulation period, and the debt to GDP ratio increases up to 0.35 percentage points above the baseline in the fifth year. Finally, note that the general price level falls by less than 0.1 percent, reflecting lower aggregate demand and the exchange rate appreciation.

D. A fixed exchange rate regime

1. The effects for the US economy

Under a fixed exchange rate regime, the responses of the domestic components of total demand in the US are very similar to the ones under a flexible exchange rate regime. Although it concerns only small differences, we want to mention the following results regarding international trade of the US.

In the first year, US exports fall by 0.02 percent compared to 0.07 percent under a flexible exchange rate regime. However, as of the second year, exports rise above the baseline reaching about 0.1 percent in the third year, compared to 0.07 percent below the baseline under a flexible exchange rate regime. This difference is almost entirely explained by the different behaviour of the effective foreign output level. Indeed, under a flexible exchange rate regime the effective foreign output level falls by more than 0.05 percent throughout the simulation, while it rises up to 0.06 percent above the baseline under a fixed exchange rate regime¹. The imports of the US are not much affected by the nature of the exchange rate regime, because changes in imports are determined by changes in domestic output and the real import prices, denominated in local currency, and these variables do not differ much across exchange rate regimes. During the first few years, export prices, denominated in US dollar, remain close to their baseline level because the exchange rate does not change, and exporters want to stay competitive. However, as the output gaps widens and the other prices start to fall in the second year, import prices, denominated in US dollar, also fall because imports have to stay competitive with domestic supply.

1. See the discussion below.

2. The spill-over effects on the euro area

Let us now have a closer look at the spill-over effects of this shock under a fixed exchange rate regime. See the last five columns of Table 6. Here, it is important to remember that the risk premium shock induces a cut in the US short-term interest rates. However, since we are now considering a fixed exchange rate regime, the monetary authorities of the other country blocks also have to cut their interest rate, and these interest rate cuts will stimulate demand¹.

In the euro area, private consumption and total gross fixed capital formation increase by, respectively, 0.07 and 0.16 percent in the first year, followed by further increases, reaching, respectively, 0.25 and 0.43 percent in the third year, and falling only gradually to their baseline afterwards.

Prices increase in line with the increase in aggregate demand, i.e., the GDP deflator and the private consumer price are, respectively, 0.20 and 0.16 percent above the baseline in the fifth year. However, the prices of exports and imports change little, primarily because the nominal exchange rate is fixed.

The exports of the euro area fall by 0.1 percent in the first year, compared to 0.19 percent under a flexible exchange rate regime. However, in the third year, exports are back to their baseline level, compared to 0.30 percent below the baseline under a flexible exchange rate regime. These differences can be explained by the fact that under a fixed exchange rate regime world demand is supported by the world-wide cut in interest rates, so that while the effective foreign output level falls 0.10 below the baseline under a flexible exchange rate regime, it stays close to its baseline level under a fixed exchange rate regime. Moreover, under a fixed exchange rate regime the effective real exchange rate is almost unaffected, while it appreciates by more than 0.3 percent under a flexible exchange rate regime.

The imports of the euro area are barely affected in the first year, but increase by 0.11 percent in the second year and stay above the baseline in subsequent years. Remember that under a flexible exchange rate regime, imports started to increase only as of the third year. Under the fixed exchange rate regime it is primarily the rise in domestic activity which triggers the rise in imports, while the effect of price changes is negligible. Under the flexible exchange rate regime, it is primarily the decline in import prices that triggers the rise in imports, while the modest decline in output tempered the price effect².

Finally, remember that the automatic fiscal stabilisers are free to operate. As a consequence, the fiscal stance improves under a fixed exchange rate regime, and the deficit to GDP ratio falls by 10 basis points during the first few years, compared to a modest worsening under a flexible exchange rate regime.

1. Remember that we consider only unsterilised interventions in the foreign exchange market.
2. The difference in the time lag is due to the fact that output elasticities are much higher than the impact price elasticities.

TABLE 5 - A stock market shock in the us: macro-economic effects for the us^a

	Flexible exchange rate regime					Fixed exchange rate regime				
	1	2	3	4	5	1	2	3	4	5
<i>Demand/supply (in constant prices)</i>										
private consumption	-0.46	-0.59	-0.49	-0.44	-0.40	-0.47	-0.59	-0.49	-0.44	-0.41
public consumption	-0.09	-0.19	-0.24	-0.26	-0.25	-0.10	-0.19	-0.23	-0.25	-0.24
gross fixed capital formation	-1.33	-1.84	-1.28	-1.17	-1.04	-1.34	-1.85	-1.29	-1.17	-1.03
o/w enterprise sector	-1.72	-2.27	-1.52	-1.38	-1.21	-1.72	-2.27	-1.52	-1.38	-1.19
residential buildings	-0.56	-1.22	-1.05	-0.98	-0.94	-0.59	-1.24	-1.05	-0.98	-0.92
public sector	-0.62	-0.75	-0.54	-0.50	-0.47	-0.62	-0.75	-0.53	-0.49	-0.44
exports	-0.07	-0.09	-0.07	-0.07	-0.08	-0.02	0.04	0.09	0.07	0.04
imports	-0.67	-0.86	-0.67	-0.57	-0.46	-0.66	-0.81	-0.61	-0.56	-0.49
gross domestic product (GDP)	-0.57	-0.70	-0.51	-0.47	-0.44	-0.57	-0.69	-0.50	-0.46	-0.42
total private supply for final demand	-0.63	-0.77	-0.55	-0.50	-0.45	-0.63	-0.75	-0.53	-0.48	-0.44
<i>Prices</i>										
GDP deflator	0.02	-0.05	-0.17	-0.25	-0.34	0.02	-0.07	-0.18	-0.25	-0.32
consumption price	0.01	-0.10	-0.24	-0.35	-0.45	0.00	-0.11	-0.24	-0.34	-0.43
export price (in local currency)	0.09	0.15	0.08	-0.02	-0.10	0.00	0.01	0.01	0.03	0.05
import price (in local currency)	0.06	0.05	-0.09	-0.25	-0.37	0.01	-0.03	-0.11	-0.21	-0.30
<i>Labour market</i>										
total employment	-0.22	-0.31	-0.20	-0.12	-0.06	-0.22	-0.30	-0.20	-0.11	-0.06
private sector employment	-0.27	-0.37	-0.24	-0.14	-0.07	-0.27	-0.36	-0.23	-0.13	-0.07
unemployment rate *	0.17	0.23	0.15	0.09	0.04	0.17	0.23	0.14	0.08	0.04
nominal wage (private sector)	-0.15	-0.27	-0.38	-0.52	-0.63	-0.16	-0.29	-0.39	-0.51	-0.60
take home real wage	-0.16	-0.17	-0.14	-0.17	-0.18	-0.16	-0.18	-0.15	-0.16	-0.16
producer real wage	-0.18	-0.23	-0.22	-0.26	-0.28	-0.18	-0.23	-0.21	-0.26	-0.28
<i>Financial sector</i>										
short-term interest rate *	-0.29	-0.53	-0.48	-0.41	-0.38	-0.30	-0.53	-0.46	-0.39	-0.36
long-term interest rate *	-0.10	-0.17	-0.16	-0.13	-0.12	-0.10	-0.17	-0.15	-0.13	-0.12
effective nominal exchange rate (-:appr.)	0.13	0.23	0.14	0.03	-0.06	0.00	0.00	0.00	0.00	0.00
effective real exchange rate (-:appr.)	0.03	0.04	-0.01	-0.04	-0.06	0.00	0.00	0.00	0.01	0.01
bilateral exchange rate (local/eur) (-:appr.)	0.34	0.82	1.02	1.08	1.09	0.00	0.00	0.00	0.00	0.00
nominal money stock	-0.43	-0.15	-0.34	-0.53	-0.65	-0.42	-0.16	-0.37	-0.55	-0.65
<i>Public finance</i>										
nominal public revenues	-0.35	-0.55	-0.57	-0.64	-0.71	-0.36	-0.57	-0.57	-0.63	-0.69
real public revenues	-0.37	-0.50	-0.41	-0.39	-0.38	-0.38	-0.50	-0.40	-0.38	-0.36
nominal public expenditures	0.19	0.04	-0.20	-0.33	-0.48	0.18	0.02	-0.20	-0.32	-0.46
real public expenditures	0.17	0.09	-0.03	-0.08	-0.14	0.17	0.09	-0.03	-0.07	-0.14
deficit to GDP ratio * (+:surplus)	-0.14	-0.16	-0.11	-0.09	-0.06	-0.15	-0.16	-0.10	-0.09	-0.06
debt to GDP ratio *	0.40	0.63	0.68	0.75	0.79	0.41	0.65	0.68	0.75	0.79
<i>Household sector</i>										
total available means	-0.83	-0.73	-0.66	-0.61	-0.58	-0.82	-0.72	-0.66	-0.62	-0.59
real disposable income	-0.18	-0.40	-0.38	-0.39	-0.40	-0.19	-0.41	-0.38	-0.39	-0.39
savings as % of disposable income *	0.27	0.17	0.10	0.04	0.00	0.27	0.17	0.10	0.05	0.01
<i>Spill-over effects</i>										
effective foreign output	-0.05	-0.07	-0.06	-0.06	-0.05	-0.02	0.02	0.06	0.05	0.03
effective foreign price level	-0.01	-0.04	-0.07	-0.09	-0.11	0.00	0.01	0.02	0.04	0.05
effective foreign interest rate *	-0.09	-0.20	-0.21	-0.19	-0.18	-0.30	-0.49	-0.41	-0.33	-0.30
<i>Memo items</i>										
current account to GDP ratio * (+:surplus)	0.07	0.10	0.09	0.09	0.09	0.07	0.10	0.11	0.12	0.13
total stock of real assets	-0.08	-0.19	-0.26	-0.31	-0.35	-0.08	-0.19	-0.25	-0.31	-0.35

a. Variables without *: deviation from baseline, in percent. Variables with *: deviation from baseline, in differences.

TABLE 6 - A stock market shock in the US: macro-economic spill-over effects on the euro area ^a

	Flexible exchange rate regime					Fixed exchange rate regime				
	1	2	3	4	5	1	2	3	4	5
<i>Demand/supply (in constant prices)</i>										
private consumption	-0.01	-0.00	0.01	0.02	0.02	0.07	0.19	0.25	0.21	0.14
public consumption	-0.00	-0.01	-0.00	0.01	0.01	0.00	0.02	0.06	0.08	0.08
gross fixed capital formation	-0.01	-0.01	-0.02	-0.06	-0.09	0.16	0.39	0.43	0.34	0.25
o/w enterprise sector	-0.00	0.02	0.01	-0.04	-0.08	0.22	0.56	0.62	0.50	0.39
residential buildings	-0.02	-0.06	-0.10	-0.13	-0.15	0.07	0.16	0.15	0.09	0.01
public sector	-0.01	-0.02	-0.02	-0.03	-0.03	0.01	0.05	0.07	0.06	0.04
exports	-0.19	-0.28	-0.28	-0.29	-0.29	-0.11	-0.07	0.02	0.02	0.01
imports	-0.03	-0.01	0.03	0.05	0.05	0.03	0.11	0.15	0.15	0.14
gross domestic product (GDP)	-0.05	-0.08	-0.08	-0.09	-0.10	0.04	0.17	0.22	0.18	0.11
total private supply for final demand	-0.05	-0.07	-0.07	-0.07	-0.08	0.05	0.17	0.22	0.17	0.12
<i>Prices</i>										
GDP deflator	-0.02	-0.09	-0.17	-0.23	-0.29	0.00	0.01	0.06	0.14	0.20
consumption price	-0.01	-0.04	-0.08	-0.11	-0.14	0.00	0.02	0.09	0.18	0.26
export price (in local currency)	-0.16	-0.46	-0.70	-0.86	-0.97	0.00	0.00	0.00	0.01	0.02
import price (in local currency)	-0.07	-0.22	-0.34	-0.41	-0.43	0.00	0.00	0.02	0.04	0.08
<i>Labour market</i>										
total employment	-0.02	-0.03	-0.03	-0.03	-0.02	0.02	0.06	0.07	0.03	-0.01
private sector employment	-0.02	-0.03	-0.03	-0.03	-0.03	0.02	0.07	0.08	0.04	-0.01
unemployment rate *	0.01	0.02	0.02	0.02	0.02	-0.01	-0.05	-0.06	-0.03	0.01
nominal wage (private sector)	-0.03	-0.11	-0.19	-0.26	-0.31	0.01	0.05	0.14	0.24	0.31
take home real wage	-0.02	-0.07	-0.12	-0.15	-0.17	0.01	0.03	0.04	0.06	0.05
producer real wage	0.00	0.01	0.01	0.00	-0.00	0.00	0.03	0.08	0.11	0.13
<i>Financial sector</i>										
short-term interest rate *	-0.03	-0.09	-0.10	-0.09	-0.08	-0.29	-0.47	-0.39	-0.31	-0.28
long-term interest rate *	-0.02	-0.05	-0.05	-0.05	-0.05	-0.16	-0.26	-0.22	-0.17	-0.16
effective nominal exchange rate (-:appr.)	-0.23	-0.63	-0.90	-1.04	-1.12	0.00	0.00	-0.00	0.00	-0.00
effective real exchange rate (-:appr.)	-0.08	-0.22	-0.29	-0.31	-0.31	0.00	-0.00	-0.00	0.00	0.00
bilateral exchange rate (local/eur) (-:appr.)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
nominal money stock	0.03	0.08	0.06	0.00	-0.03	0.63	1.20	1.24	1.18	1.13
<i>Public finance</i>										
nominal public revenues	-0.04	-0.13	-0.21	-0.27	-0.32	0.03	0.11	0.21	0.28	0.32
real public revenues	-0.02	-0.04	-0.04	-0.04	-0.03	0.02	0.10	0.15	0.14	0.12
nominal public expenditures	-0.00	-0.07	-0.15	-0.19	-0.23	-0.01	-0.08	-0.05	0.10	0.21
real public expenditures	0.02	0.02	0.02	0.04	0.06	-0.01	-0.10	-0.11	-0.04	0.01
deficit to GDP ratio * (+:surplus)	-0.02	-0.03	-0.03	-0.04	-0.04	0.02	0.09	0.12	0.09	0.06
debt to GDP ratio *	0.06	0.15	0.22	0.29	0.35	-0.05	-0.22	-0.39	-0.48	-0.52
<i>Household sector</i>										
total available means	0.01	0.02	0.03	0.03	0.02	0.09	0.15	0.10	0.05	0.02
real disposable income	-0.01	-0.04	-0.07	-0.09	-0.11	0.01	0.04	0.04	0.01	-0.03
savings as % of disposable income *	-0.01	-0.03	-0.07	-0.09	-0.11	-0.05	-0.13	-0.18	-0.17	-0.14
<i>Spill-over effects</i>										
effective foreign output	-0.11	-0.15	-0.11	-0.10	-0.10	-0.08	-0.05	0.01	0.01	0.01
effective foreign price level	-0.01	-0.05	-0.09	-0.13	-0.16	0.01	0.00	-0.00	0.01	0.02
effective foreign interest rate *	-0.11	-0.24	-0.24	-0.21	-0.19	-0.30	-0.49	-0.41	-0.34	-0.31
<i>Memo items</i>										
current account to GDP ratio * (+:surplus)	-0.05	-0.11	-0.15	-0.18	-0.21	-0.03	-0.04	-0.04	-0.04	-0.05
total stock of real assets	0.00	0.00	0.01	0.01	0.02	0.01	0.03	0.04	0.06	0.06

a. Variables without *: deviation from baseline, in percent. Variables with *: deviation from baseline, in differences.



The spill-over effects of a monetary shock in the US

A. Introduction and summary of the spill-over effects

In the last variant, we assume that the monetary authorities of the US increase the short-term interest rate by 1 percentage point in the first year, and that they follow a Taylor rule in subsequent years. We simulated this variant under a flexible and a fixed exchange rate regime.

Briefly summarised, this monetary shock causes the following (spill-over) effects. The interest rate hike in the US increases the user cost of capital and the real interest rate, it decreases the financial wealth of the household sector, and it appreciates the effective nominal exchange rate (under a flexible exchange rate regime). All these effects lower demand in the US, and US GDP falls by 0.64 percent in the first year. The simulation results show that the euro area can insulate itself to a fair degree from this shock if it lets its exchange rate depreciate. First, under a flexible exchange rate regime, real GDP of the euro area remains almost unaffected, compared to a 0.42 percent decrease under a fixed exchange rate regime. This difference in responses is almost entirely due to the 1 percentage point increase in the euro interest rate which is needed under a fixed exchange rate regime. Second, under a flexible exchange rate regime, the price level increases by up to 0.1 percent in the medium run, mainly due to the depreciation of the exchange rate, while under a fixed exchange rate regime the price level falls by up to 0.25 percent, mainly due to the fall in aggregate demand. Third, note that under a fixed exchange rate regime, the public deficit to GDP ratio increases by up to 21 basis points in the second year, while it remains very close to the baseline under a flexible exchange rate regime. This worsening fiscal stance under a fixed exchange rate regime is in line with the overall decline in economic activity.

B. A flexible exchange rate regime

First, we examine the effects for the US economy, next we present the spill-over effects on the euro area.

1. The effects for the US economy

The first five columns of Table 7 show the main macro-economic effects for the US economy. Real GDP falls by 0.64 percent in the first year, and stays below the baseline in the second year even when the interest rate falls below baseline. However,

as of the third year, real GDP is close to its baseline level. Let us now have a closer look at how the different components of demand are affected by the interest rate hike.

In the first year, private consumption in the US decreases by 0.59 percent because the interest rate hike decreases financial wealth of the household sector and it increases the real interest rate, thereby inducing the household sector to save more and consume less. In addition, real disposable income falls by 0.25 percent thereby limiting the purchases of the liquidity constrained households. Disposable income falls because the real wage rate and employment fall by 0.23 and 0.29 percent, respectively.

Total gross fixed capital formation decreases by 1 percent in the first year because the real user cost of capital increases, and economic activity slows down. The initial fall is largest for residential investment and lowest for public investment. Remember that public investment is determined by changes in real GDP and not by changes in the interest rate, while private investment is determined by the scale variable and the user cost of capital. In the case of investments in residential buildings, the scale effect is determined by disposable income and the total available means of the household sector, while in the case of investments by the enterprise sector, the scale effect is determined by private supply for final demand. As of the second year, when interest rates are cut and economic activity rebounds, gross fixed capital formation recovers, and it is close to its baseline level as of the fourth year.

Imports and exports are determined by a scale effect and a relative price effect. The interest rate hike decreases the domestic supply for final demand by 0.65 percent and appreciates the effective exchange rate by 1.77 percent, allowing for a reduction in import prices denominated in US dollars. The former effect decreases imports, while the latter effect increases imports. In the first year, the scale effect dominates the price effect and imports fall by 0.49 percent. After the first year, when the interest rates are lowered and economic activity increases, imports recover, and settle around their baseline level. Exports decrease by 0.19 percent in the first year, indicating a loss of competitiveness as the effective real exchange rate appreciates by 0.50 percent, while the movements in the effective foreign output level are too small to have any important impact on exports. As of the second year, when the interest rates are cut in the US, the effective US dollar nominal exchange rate depreciates and competitiveness is restored, allowing exports to recover.

Most prices remain almost unchanged in the first year. However, import and export prices, denominated in US dollars, fall by respectively 0.60 and 1.22 percent, due to the 1.77 percent appreciation of the effective nominal dollar exchange rate. The general price level responds with a one year lag to the output gap, as a consequence it starts to fall as of the second year, and the GDP deflator falls 0.1 percent below the baseline.

Private sector employment decreases by 0.28 percent in the first year, mainly due to the 0.65 percent decrease in private supply, but the fall in employment is somewhat tempered by the 0.18 percent fall in the real producer wage rate.

The fiscal deficit to GDP ratio increases by 0.17 percentage point in the first year, while the debt to GDP ratio increases by 0.51 percentage point. However, as of the second year, when the monetary shock is reversed, economic activity increases and the fiscal stance of the US improves, converging back to its baseline level in due course.

2. The spill-over effects on the euro area

The initial appreciation of the effective US dollar exchange rate and the decline in the US output level are the two major channels through which the US monetary tightening affects economic activity in the other country blocks. In this section, we limit ourselves to a brief discussion of the spill-over effects on the euro area.

The first five columns of Table 8 show that most components of aggregate demand of the euro area are not affected by the monetary shock in the US. Real GDP does not change in the first year, and does not increase by more than 0.05 percent in subsequent years. The spill-over effects are modest because the euro domestic interest rate effects are negligible and the international trade effects have a limited impact on overall economic activity in the euro area. Indeed, exports increase by about 0.10 percent, while imports decrease by about 0.06 percent in the second and third year.

Exports and imports are determined by the changes in the effective exchange rate and the foreign output level. In the first year, the effective foreign output level falls by 0.10 percent, while the effective nominal euro exchange rate depreciates by 0.86 percent. At the same time, export and import prices, denominated in local currency, increase immediately by, respectively, 0.6 and 0.3 percent, thereby reducing the gain in international price competitiveness. Moreover, this gain in competitiveness is insufficient to off-set the negative effect of the fall in the effective foreign output, and exports decrease by 0.05 percent in the first year. In subsequent years, exports increase 0.10 percent above the baseline, mainly reflecting a small improvement in the effective foreign output level and the effective real exchange rate. Imports are almost unaffected in the first year, because the domestic output remains almost unchanged, and despite the 0.29 percent increase in import prices. This reflects the fact that imports react with some delay to price changes. All in all, the results in Table 8 show that during the first five years the current account surplus to GDP ratio improves modestly, reaching 0.08 percent in the second and third year.

C. A fixed exchange rate regime

Here, we investigate the effects of a 1 percentage point increase in US interest rate under a fixed exchange rate regime.

Let us start with a brief discussion the results for the US. Comparing the results under fixed and flexible exchange rate regimes, i.e., columns 6 until 10 of Table 7 with columns 1 until 5 of Table 7, we note that the domestic components of demand barely differ. However, exports fall by 0.33 percent under a fixed exchange rate regime, compared to a 0.19 percent drop under a flexible exchange

rate regime. This worsening of exports is due to a 0.21 percent fall in effective foreign output under a fixed exchange rate regime, compared to a 0.03 percent fall under a flexible exchange rate regime. This difference in foreign output is explained by the behaviour of the interest rates in other country blocks. Under a fixed exchange rate regime, the interest rates of the other country blocks are tied to the US interest rate and increase by about 1 percentage point in the first year¹. Obviously, such a world-wide interest rate hike has important deflationary effects.

The results for the euro area are shown in the last five columns of Table 8. Under a fixed exchange rate regime, private consumption and total gross fixed capital formation decrease by, respectively, 0.33 and 0.73 percent in the first year, compared to very small increases of, respectively, 0.01 and 0.02 percent under a flexible exchange rate regime. Gross fixed capital formation by the enterprise sector falls by 1 percent, while investments in residential buildings and public investments fall, respectively, by 0.32 and 0.12 percent. These differences stem from the different pattern of their scale variable and the user cost. Enterprise investment is linked to private supply for final demand, which falls by 0.44 percent in the first year and 0.29 percent in the second year. Investment in residential buildings is linked to the change in disposable household income, which falls by 0.07 percent in the first year and 0.08 percent in the second year, and the total available means of the household sector. As can be seen from Table 8, the drop in these variables is less severe than the drop in private supply. Once the shock is reversed and the interest rates are cut, gross fixed capital formation recovers only gradually, because the user cost and economic activity affect enterprise investments with some delay.

Exports and imports of the euro area fall by, respectively, 0.39 and 0.28 percent in the first year, mainly reflecting important decreases in the scale variables, i.e., a 0.28 percent fall in the effective foreign output level and a 0.44 percent fall in private supply for final demand. Once the shock is reversed, exports and imports recover gradually, indicating that lagged price and quantity effects have an important impact on trade.

All in all, real GDP of the euro area falls by 0.42 percent in the first year, reaching the baseline level in the third year, while the general price level falls by about 0.25 percent in the medium term. The latter reflects the initial sharp drop in aggregate demand and the persistence of prices caused by menu costs and backward looking behaviour during price setting. Finally, note that under a fixed exchange rate regime, the fiscal deficit to GDP ratio increases by up to 21 basis points in the second year, while it remains very close to the baseline under a flexible exchange rate regime. At the same time, the debt to GDP ratio rises by up to 58 basis points in the second year. This worsening fiscal stance is caused by the higher outlays for unemployment benefits, and lower revenues from taxes, which both respond to the overall decline in economic activity. Once the shock is reversed, public finances of the euro area converge back to their baseline level.

1. Remember that we consider only unsterilised interventions in the foreign exchange market.

TABLE 7 - A monetary shock in the us: macro-economic effects for the us^a

	Flexible exchange rate regime					Fixed exchange rate regime				
	1	2	3	4	5	1	2	3	4	5
<i>Demand/supply (in constant prices)</i>										
private consumption	-0.59	-0.12	0.00	0.01	0.02	-0.54	-0.09	0.02	0.00	0.01
public consumption	-0.13	-0.05	-0.04	-0.04	-0.02	-0.10	-0.08	-0.06	-0.04	-0.01
gross fixed capital formation	-1.00	-0.36	0.20	0.02	0.06	-0.88	-0.26	0.22	-0.01	0.02
o/w enterprise sector	-1.04	-0.53	0.16	-0.09	-0.04	-0.94	-0.41	0.19	-0.11	-0.06
residential buildings	-1.12	0.04	0.42	0.37	0.36	-0.89	0.13	0.43	0.31	0.29
public sector	-0.69	-0.16	0.10	0.06	0.06	-0.61	-0.09	0.08	0.01	0.02
exports	-0.19	-0.07	0.03	0.06	0.07	-0.33	-0.16	0.03	0.05	0.06
imports	-0.49	0.10	-0.07	-0.18	-0.07	-0.65	-0.11	0.06	0.00	0.04
gross domestic product (GDP)	-0.64	-0.15	0.08	0.05	0.05	-0.56	-0.09	0.07	0.00	0.02
total private supply for final demand	-0.65	-0.12	0.07	0.02	0.04	-0.62	-0.09	0.08	0.01	0.03
<i>Prices</i>										
GDP deflator	-0.09	-0.10	-0.13	-0.11	-0.10	0.01	-0.07	-0.10	-0.09	-0.09
consumption price	-0.06	-0.11	-0.11	-0.11	-0.12	0.00	-0.11	-0.12	-0.11	-0.12
export price (in local currency)	-1.22	-0.11	-0.05	-0.01	0.00	0.00	-0.03	-0.05	-0.06	-0.06
import price (in local currency)	-0.60	0.02	0.14	0.06	-0.05	0.00	-0.03	-0.08	-0.09	-0.10
<i>Labour market</i>										
total employment	-0.23	-0.08	0.06	0.07	0.06	-0.22	-0.07	0.06	0.06	0.05
private sector employment	-0.28	-0.09	0.07	0.08	0.07	-0.26	-0.08	0.07	0.07	0.06
unemployment rate *	0.17	0.06	-0.05	-0.05	-0.05	0.17	0.05	-0.05	-0.04	-0.04
nominal wage (private sector)	-0.34	-0.13	-0.13	-0.14	-0.12	-0.17	-0.10	-0.12	-0.14	-0.12
take home real wage	-0.29	-0.02	-0.01	-0.03	-0.00	-0.17	0.00	0.00	-0.03	-0.01
producer real wage	-0.18	-0.04	-0.03	-0.06	-0.03	-0.18	-0.03	-0.03	-0.05	-0.03
<i>Financial sector</i>										
short-term interest rate *	1.00	-0.13	0.02	0.01	-0.00	1.00	-0.21	0.01	0.01	0.00
long-term interest rate *	0.33	-0.04	0.01	0.00	-0.00	0.33	-0.07	0.00	0.00	0.00
effective nominal exchange rate (-:appr.)	-1.77	0.04	0.04	0.04	0.03	0.00	0.00	0.00	0.00	0.00
effective real exchange rate (-:appr.)	-0.50	0.19	0.12	0.08	0.05	-0.00	-0.01	-0.02	-0.01	-0.01
bilateral exchange rate (local/eur) (-:appr.)	-2.43	-0.44	-0.33	-0.23	-0.16	0.00	0.00	0.00	0.00	0.00
nominal money stock	-2.01	-0.01	-0.21	-0.16	-0.14	-1.93	0.13	-0.19	-0.17	-0.14
<i>Public finance</i>										
nominal public revenues	-0.53	-0.20	-0.08	-0.10	-0.08	-0.37	-0.17	-0.07	-0.10	-0.09
real public revenues	-0.44	-0.11	0.05	0.02	0.02	-0.37	-0.10	0.02	-0.01	0.00
nominal public expenditures	0.10	-0.01	-0.17	-0.16	-0.18	0.18	0.00	-0.18	-0.15	-0.17
real public expenditures	0.19	0.08	-0.04	-0.04	-0.08	0.17	0.07	-0.08	-0.06	-0.07
deficit to GDP ratio * (+:surplus)	-0.17	-0.05	0.02	0.02	0.03	-0.15	-0.05	0.03	0.01	0.02
debt to GDP ratio *	0.51	0.32	0.20	0.18	0.13	0.41	0.26	0.17	0.17	0.13
<i>Household sector</i>										
total available means	-0.39	0.00	0.00	0.02	0.03	-0.40	0.04	0.02	0.02	0.03
real disposable income	-0.25	-0.02	0.11	0.10	0.11	-0.19	0.02	0.12	0.09	0.09
savings as % of disposable income *	0.32	0.10	0.10	0.09	0.09	0.33	0.10	0.10	0.08	0.08
<i>Spill-over effects</i>										
effective foreign output	-0.03	0.02	0.03	0.01	0.01	-0.21	-0.10	-0.00	0.00	0.02
effective foreign price level	0.05	0.04	0.03	0.03	0.03	0.00	-0.04	-0.06	-0.07	-0.07
effective foreign interest rate *	0.24	-0.02	0.03	0.02	0.01	1.13	-0.21	0.01	0.02	0.01
<i>Memo items</i>										
current account to GDP ratio * (+:surplus)	-0.03	-0.05	-0.02	0.02	0.02	0.03	-0.03	-0.01	0.00	0.00
total stock of real assets	-0.05	-0.07	-0.05	-0.04	-0.04	-0.06	-0.06	-0.04	-0.04	-0.03

a. Variables without *: deviation from baseline, in percent. Variables with *: deviation from baseline, in differences.

TABLE 8 - A monetary shock in the us: macro-economic spill-over effects on the euro area ^a

	Flexible exchange rate regime					Fixed exchange rate regime				
	1	2	3	4	5	1	2	3	4	5
<i>Demand/supply (in constant prices)</i>										
private consumption	0.01	0.00	0.00	-0.00	-0.00	-0.33	-0.26	0.01	0.06	0.08
public consumption	0.00	-0.03	-0.01	0.01	0.02	-0.03	-0.11	-0.11	-0.06	-0.02
gross fixed capital formation	0.02	0.04	0.04	0.03	0.03	-0.73	-0.57	-0.09	-0.12	-0.07
o/w enterprise sector	0.01	0.04	0.04	0.03	0.03	-1.01	-0.85	-0.17	-0.24	-0.17
residential buildings	0.07	0.07	0.06	0.06	0.05	-0.32	-0.11	0.05	0.10	0.14
public sector	0.00	0.01	0.01	0.01	0.01	-0.12	-0.09	-0.01	0.00	0.01
exports	-0.05	0.10	0.10	0.06	0.04	-0.39	-0.17	-0.02	-0.01	0.02
imports	-0.00	-0.06	-0.06	-0.02	0.01	-0.28	-0.18	-0.07	-0.10	-0.07
gross domestic product (GDP)	0.00	0.05	0.05	0.03	0.01	-0.42	-0.30	-0.00	0.03	0.06
total private supply for final demand	0.00	0.04	0.03	0.02	0.01	-0.44	-0.29	0.01	0.02	0.05
<i>Prices</i>										
GDP deflator	0.12	0.09	0.09	0.09	0.08	0.03	-0.12	-0.23	-0.24	-0.24
consumption price	0.02	0.02	0.03	0.03	0.04	0.00	-0.18	-0.30	-0.30	-0.29
export price (in local currency)	0.60	0.39	0.31	0.25	0.20	0.00	-0.03	-0.04	-0.05	-0.06
import price (in local currency)	0.29	0.22	0.14	0.07	0.03	0.00	-0.02	-0.06	-0.10	-0.14
<i>Labour market</i>										
total employment	-0.00	0.03	0.02	0.01	-0.00	-0.15	-0.10	0.05	0.09	0.08
private sector employment	0.00	0.03	0.03	0.01	-0.00	-0.18	-0.11	0.06	0.11	0.10
unemployment rate *	0.00	-0.02	-0.02	-0.00	0.00	0.13	0.08	-0.05	-0.08	-0.07
nominal wage (private sector)	0.11	0.08	0.09	0.10	0.10	-0.04	-0.24	-0.36	-0.34	-0.28
take home real wage	0.09	0.06	0.07	0.07	0.06	-0.04	-0.06	-0.06	-0.04	0.01
producer real wage	-0.04	-0.02	-0.00	0.01	0.02	-0.06	-0.14	-0.16	-0.12	-0.07
contemporaneous productivity	0.00	0.00	0.01	0.01	0.02	-0.26	-0.17	-0.06	-0.08	-0.05
<i>Financial sector</i>										
short-term interest rate *	0.04	0.01	0.03	0.02	0.01	1.11	-0.21	0.01	0.02	0.01
long-term interest rate *	0.02	0.01	0.02	0.01	0.01	0.62	-0.12	0.01	0.01	0.01
effective nominal exchange rate (-:appr.)	0.86	0.48	0.35	0.24	0.17	0.00	-0.00	-0.00	-0.00	-0.00
effective real exchange rate (-:appr.)	0.30	0.13	0.06	0.02	-0.02	-0.00	-0.02	-0.02	-0.02	-0.02
bilateral exchange rate (local/eur) (-:appr.)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
nominal money stock	-0.04	0.01	-0.00	0.01	0.03	-2.43	-0.40	-0.58	-0.41	-0.29
<i>Public finance</i>										
nominal public revenues	0.12	0.10	0.10	0.10	0.09	-0.20	-0.34	-0.31	-0.27	-0.24
real public revenues	-0.00	0.02	0.01	0.01	0.01	-0.22	-0.23	-0.08	-0.03	-0.00
nominal public expenditures	0.06	0.05	0.05	0.06	0.06	0.09	0.11	-0.42	-0.34	-0.33
real public expenditures	-0.05	-0.03	-0.04	-0.03	-0.02	0.07	0.23	-0.19	-0.10	-0.09
deficit to GDP ratio * (+:surplus)	0.02	0.02	0.02	0.02	0.01	-0.13	-0.21	0.04	0.03	0.04
debt to GDP ratio *	-0.10	-0.13	-0.15	-0.14	-0.14	0.38	0.58	0.41	0.34	0.27
<i>Household sector</i>										
total available means	-0.01	0.00	-0.00	-0.00	-0.00	-0.32	0.09	0.07	0.07	0.07
real disposable income	0.04	0.04	0.05	0.04	0.04	-0.07	-0.08	0.03	0.06	0.08
savings as % of disposable income *	0.02	0.04	0.04	0.04	0.04	0.22	0.16	0.02	-0.00	0.00
<i>Spill-over effects</i>										
effective foreign output	-0.10	0.01	0.03	0.01	0.01	-0.28	-0.12	-0.02	-0.01	0.01
effective foreign price level	0.04	0.03	0.03	0.03	0.02	-0.00	-0.04	-0.07	-0.07	-0.08
effective foreign interest rate *	0.32	-0.04	0.03	0.02	0.01	1.10	-0.21	0.01	0.02	0.01
<i>Memo items</i>										
current account to GDP ratio * (+:surplus)	0.06	0.08	0.08	0.06	0.05	-0.02	0.01	0.02	0.03	0.04
total stock of real assets	-0.00	-0.00	-0.00	-0.00	-0.00	-0.04	-0.06	-0.05	-0.05	-0.05

a. Variables without *: deviation from baseline, in percent. Variables with *: deviation from baseline, in differences.



Summary

This paper investigates the spill-over effects of different shocks in the US on the euro area, through the simulation of four variants with the NIME model. The simulation results are summarised in Table 9.

In the first variant, we examined the spill-over effects of a temporary *ex ante* increase by 3.5 percent in the public expenditures of the US under a flexible and a fixed exchange rate regime. The higher public expenditures increase aggregate demand in the US without changing potential output, while the US short-term interest rate is raised by up to 40 basis points to reduce the emerging inflationary pressures. The spill-over effects to the euro area depend on the nature of the exchange rate regime. Under a flexible exchange rate regime, real GDP of the euro area increases initially by less than 0.1 percent and falls quickly back to the baseline after the initial shock. This increase in real GDP can almost completely be attributed to a 0.25 percent increase in exports. Exports increase because the effective euro exchange rate depreciates and the effective foreign output level increases. Under a fixed exchange rate regime, real GDP of the euro area falls by 0.06 percent in the first year, and by about 0.25 percent in the third year. This is much more than under a flexible exchange rate regime because under a fixed exchange rate regime, the domestic interest rate is increased by up to 0.4 percentage point, compared to less than 0.1 percentage point under a flexible exchange rate regime. Under a flexible exchange rate regime, the GDP deflator increases by up to 0.15 percent in the fourth year, compared to a 0.15 percent fall under a fixed exchange rate regime, reflecting an exchange rate depreciation and higher demand pressures under a flexible exchange rate regime. The fiscal accounts of the euro area show a very small surplus under a flexible exchange rate regime, while the debt to GDP ratio falls by 0.18 percentage points in the third year. Under a fixed exchange rate regime, economic activity falls and the public sector has a deficit to GDP ratio that is 0.10 percentage points higher than in the baseline, resulting in a 0.44 percentage point increase in the debt to GDP ratio after four years.

In the second variant, we examined the spill-over effects of a permanent 1 percent increase in total factor productivity in the US under a flexible and a fixed exchange rate regime. The spill-over effects to the euro area depend on the nature of the exchange rate regime. Under a fixed exchange rate regime, real GDP of the euro area increases by 0.37 percent in the first year, followed by further increases. This strong initial jump in real GDP is to a large extent explained by the increase in private consumption which increases by 0.53 percent in the first year, reflecting higher expected future household income. Under a flexible exchange rate regime, real GDP of the euro area increases by 0.49 percent in the first year, followed by further increases. The extra increase in private consumption under a fixed exchange rate regime is largely due to a lower interest rate. Under both exchange rate regimes, the price level of the euro area increases as of the second year and

shows some persistence thereafter. Under a flexible exchange rate regime, the fiscal balance improves by 0.25 percent of GDP in the second year, but starts to decline thereafter reaching 0.04 percentage points above the baseline in the fifth year. Lower outlays for unemployment benefits and higher tax revenue explain these fiscal developments. Under a fixed exchange rate, the fiscal surpluses are somewhat higher, due to the higher economic activity.

In the third variant, we examined the spill-over effects of a permanent 1 percentage point increase in the risk premium in the US stock market under a flexible and a fixed exchange rate regime. This shock reduces final demand in the US and triggers a cut in the US interest rate. The spill-over effects to the euro area depends on the nature of the exchange rate regime. Under a flexible exchange rate regime, real GDP of the euro area falls by about 0.1 percent, mainly because exports fall by 0.2 percent. The fall in exports is caused by the appreciation of the effective euro exchange rate and the decrease in the effective foreign output level. Under a fixed exchange rate regime the euro interest rate is set in line with the US interest rate which falls almost 0.3 percent in the first year. As a consequence, the euro interest rate is also cut by about 0.3 percentage points, so that all components of demand get a boost and real GDP of the euro area increases. Under the flexible exchange rate regime the price level of the euro area falls by 0.3 percent in the fifth year, compared to a 0.2 percent rise under a fixed exchange rate regime. Under a flexible exchange rate regime, prices fall because the exchange rate appreciates and aggregate demand falls, while under a fixed exchange rate regime prices increase because aggregate demand increases. The fiscal stance of the euro area improves under a fixed exchange rate regime, and the deficit to GDP ratio falls by 10 basis points during the first few years, compared to a modest worsening under a flexible exchange rate regime.

In the fourth variant, we examined the spill-over effects of a temporary 1 percentage point increase in the US short-term interest rate under a flexible and a fixed exchange rate regime. The simulation results show that the euro area can insulate itself to a fair degree from this shock if it lets its exchange rate depreciate. Indeed, real GDP of the euro area remains almost unaffected under a flexible exchange rate regime, compared to a 0.42 percent decrease in the first year under a fixed exchange rate regime. This difference in responses is almost entirely due to the 1 percentage point increase in the euro interest rate which is needed under a fixed exchange rate regime. Under a flexible exchange rate regime the price level of the euro area increases by up to 0.1 percent, mainly due to the depreciation of the exchange rate, while under a fixed exchange rate regime the price level of the euro area falls by up to 0.25 percent, because aggregate demand in the euro area falls. Finally, note that under a fixed exchange rate regime, the deficit to GDP ratio increases by up to 21 basis points in the second year, while it remains very close to the baseline under a flexible exchange rate regime.

TABLE 9 - Main macro-economic spill-over effects on the euro area: summary table^a

	Flexible exchange rate regime					Fixed exchange rate regime				
	1	2	3	4	5	1	2	3	4	5
A fiscal shock in the us										
gross domestic product (GDP)	0.07	0.06	0.06	-0.01	0.01	-0.06	-0.22	-0.24	-0.14	0.06
GDP deflator	0.03	0.09	0.14	0.15	0.11	0.00	-0.01	-0.08	-0.15	-0.21
unemployment rate *	-0.02	-0.02	-0.01	0.01	0.01	0.02	0.07	0.06	0.01	-0.07
short-term interest rate *	0.05	0.08	0.06	0.01	-0.03	0.39	0.44	0.32	-0.07	-0.17
long-term interest rate *	0.03	0.05	0.04	0.01	-0.02	0.22	0.24	0.18	-0.04	-0.09
effective nominal exchange rate (-:appr.)	0.26	0.52	0.66	0.44	0.18	0.00	0.00	0.00	0.00	0.00
deficit to GDP ratio * (+:surplus)	0.03	0.02	0.02	0.00	0.01	-0.02	-0.11	-0.11	-0.06	0.05
debt to GDP ratio *	-0.08	-0.14	-0.18	-0.15	-0.14	0.05	0.27	0.42	0.44	0.28
current account to GDP ratio * (+:surplus)	0.07	0.10	0.12	0.06	0.04	0.04	0.04	0.04	0.00	0.02
A productivity shock in the us										
gross domestic product (GDP)	0.37	0.87	1.09	1.08	1.00	0.49	1.03	1.10	1.07	1.04
GDP deflator	-0.05	0.01	0.01	0.05	0.09	-0.02	0.08	0.11	0.16	0.18
unemployment rate *	-0.11	-0.23	-0.09	0.00	0.05	-0.15	-0.28	-0.08	0.03	0.06
short-term interest rate *	0.18	0.15	-0.07	0.06	0.01	-0.09	0.09	0.10	-0.00	-0.05
long-term interest rate *	0.10	0.09	-0.04	0.03	0.01	-0.05	0.05	0.05	-0.00	-0.03
effective nominal exchange rate (-:appr.)	-0.23	-0.26	-0.00	0.04	0.06	0.00	0.00	0.00	0.01	0.01
deficit to GDP ratio * (+:surplus)	0.11	0.25	0.15	0.10	0.04	0.16	0.34	0.16	0.08	0.06
debt to GDP ratio *	-0.31	-0.90	-1.14	-1.21	-1.18	-0.46	-1.17	-1.35	-1.37	-1.37
current account to GDP ratio * (+:surplus)	-0.01	0.17	0.17	0.16	0.15	0.02	0.20	0.18	0.16	0.14
A stock market shock in the us										
gross domestic product (GDP)	-0.05	-0.08	-0.08	-0.09	-0.10	0.04	0.17	0.22	0.18	0.11
GDP deflator	-0.02	-0.09	-0.17	-0.23	-0.29	0.00	0.01	0.06	0.14	0.20
unemployment rate *	0.01	0.02	0.02	0.02	0.02	-0.01	-0.05	-0.06	-0.03	0.01
short-term interest rate *	-0.03	-0.09	-0.10	-0.09	-0.08	-0.29	-0.47	-0.39	-0.31	-0.28
long-term interest rate *	-0.02	-0.05	-0.05	-0.05	-0.05	-0.16	-0.26	-0.22	-0.17	-0.16
effective nominal exchange rate (-:appr.)	-0.23	-0.63	-0.90	-1.04	-1.12	0.00	0.00	-0.00	0.00	-0.00
deficit to GDP ratio * (+:surplus)	-0.02	-0.03	-0.03	-0.04	-0.04	0.02	0.09	0.12	0.09	0.06
debt to GDP ratio *	0.06	0.15	0.22	0.29	0.35	-0.05	-0.22	-0.39	-0.48	-0.52
current account to GDP ratio * (+:surplus)	-0.05	-0.11	-0.15	-0.18	-0.21	-0.03	-0.04	-0.04	-0.04	-0.05
A monetary shock in the us										
gross domestic product (GDP)	0.00	0.05	0.05	0.03	0.01	-0.42	-0.30	-0.00	0.03	0.06
GDP deflator	0.12	0.09	0.09	0.09	0.08	0.03	-0.12	-0.23	-0.24	-0.24
unemployment rate *	0.00	-0.02	-0.02	-0.00	0.00	0.13	0.08	-0.05	-0.08	-0.07
short-term interest rate *	0.04	0.01	0.03	0.02	0.01	1.11	-0.21	0.01	0.02	0.01
long-term interest rate *	0.02	0.01	0.02	0.01	0.01	0.62	-0.12	0.01	0.01	0.01
effective nominal exchange rate (-:appr.)	0.86	0.48	0.35	0.24	0.17	0.00	-0.00	-0.00	-0.00	-0.00
current account to GDP ratio * (+:surplus)	0.06	0.08	0.08	0.06	0.05	-0.02	0.01	0.02	0.03	0.04

a. Variables without *: deviation from baseline, in percent. Variables with *: deviation from baseline, in differences.



Appendix A: Modifications to the NIME model

The main features of the NIME model can be found in Meyermans and Van Bruseselen (2001). In this appendix, we describe some recent changes to the NIME model. In the first section, we discuss how we updated the stock of household assets on the basis of OECD data. In the previous version of the model the stock of residential buildings and other financial assets were equal to the cumulated net flows, conditional upon a carefully chosen starting point. In the second section, we present the estimation results of the behavioural equations of the household sector with the new household data. In the third section, we show estimation results for the error correction mechanism of factor demand with the short-run cross-price elasticities restricted to zero. In the previous version of the model, the short-run cross-price elasticities could be different from zero. Since this complicated sometimes the interpretation of the results, we simplified the model by assuming a priori that the cross-price elasticities are always equal to zero. However, in this new version, we allow for a richer dynamic structure of the own price effect. In the fourth section, the measurement of labour productivity growth in the wage equation of the private sector is changed. In the previous version of the model, it was assumed that the household sector and the enterprise sector negotiated over the wage growth with trend labour productivity growth as the reference. Here, we assume that the reference productivity growth rate is a weighted average of trend productivity growth and contemporaneous productivity growth, and we re-estimate subsequently the wage equation with the new productivity measure. In the fifth section, we present the new short-term interest rate equation. In this new equation the interest rate is function of the output gap and the deviation of the contemporaneous inflation rate from its target rate. In the previous version of the model, the short-term interest rate was function of the deviation between the contemporaneous unemployment rate and the natural unemployment rate, and of the deviation of contemporaneous inflation from its target. In the sixth section, we augment the user cost of enterprise capital with a risk premium and we derive the relationship between the risk premium and prices in the stock market. In the seventh section, we discuss how we interpolated some missing data.

A. The data

Most of the data of the NIME model are described in Meyermans and Van Bruseselen (2000.a, 2000.b, and 2001). Here, we describe how we updated some of the series.

1. The assets of the household sector: new data

The assets of households consist of money (M), residential buildings (CIRU), inventories (INVHU) and other financial assets (CAOU). In the previous version of the model the stock of residential buildings and other financial assets were equal to the cumulated net flows, conditional upon a carefully chosen starting point. The data of these stocks are now refined using data published by the OECD.

2. Stocks of financial assets

The NIME model data for net other financial assets of households (CAOU) are now based on OECD data sources¹. The OECD gives historical data on ratios of total household net nominal financial assets to household disposable income, as well as ratios of household nominal equity holdings to household disposable income, for France, Germany, Italy, Japan, the UK and the US. These ratios are used in the following manner to generate the desired NIME series for household financial assets. In a first step, the total household net nominal financial asset ratios are multiplied by the household disposable income series available in NIME, to give series for total household net nominal financial assets, including money balances. Money balances are then subtracted from these data, so as to give the net other financial assets of households series (CAOU). In a second step, the household nominal equity ratios are multiplied by the NIME household disposable income series, to give series for household nominal equity stocks (CAOUE). In a third step, we define a residual variable that we call 'net bond holdings' (CAOUB), computed as the difference between total household net nominal financial assets and household nominal equity assets².

3. Stocks of residential buildings

The same OECD sources also allow us to construct series for stocks of residential buildings, giving also the ratios of stocks of non-financial assets to household disposable income. On multiplying these ratios by the NIME series for household disposable income, we define the nominal stock of residential buildings (CIRU).

4. Some other data

The OECD does not publish all the data we need, so that it is still necessary to interpolate some missing series, e.g. the price and the stock of residential buildings in constant prices, and the price of the financial assets. In the last section of this appendix, we describe some of the procedures to interpolate the missing data.

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1. OCDE, Perspectives économiques de l'OCDE, Tableau 6. "Épargne, patrimoine net et endettement des ménages", p.24, vol. n°50, décembre 1991; OCDE, Perspectives économiques de l'OCDE, Annexe, Tableau 56. "Patrimoine et endettement des ménages", p.300, vol. 2002/1, n°71, juin 2002.
 2. Note that for the NIME model's EU block, the GDP-weighted asset ratio averages for France, Germany, and Italy are used. For the NE block, it is the UK asset ratios that are used.

B. The household demand equations

Using the earlier described new data, we re-estimated the behavioural equations of the household sector as follows.

1. Private consumption and money demand

We re-estimated the household demand equations with the Two-Step Engle-Granger estimator. The household equations are described in Chapter II of Meyermans and Van Brusselen (2001).

In a first step, we estimate the long run equation¹:

$$\begin{aligned}
 \text{(A.1)} \quad \ln\left(\frac{Y_t}{\text{NPO}_t}\right) &= y_{10} + y_{1b} \ln\left(\frac{\text{SCALEH}_t}{\text{NPO}_t}\right) \\
 &+ y_{12} \ln\left(\frac{\text{LIC}_t}{(1 + \text{LIC}_t)}\right) \\
 &+ y_{13} \ln\left(\frac{(1 + \text{LIC}_t) \text{PCIR}_t - \widehat{\text{PCIR}}_{t+1}(1 - \text{gir_rh})}{(1 + \text{LIC}_t) \text{PCH}_t}\right) \\
 &- y_{14} \ln\left(\frac{(1 + \text{LIC}_t) \text{PCH}_t}{\widehat{\text{PCH}}_{t+1}}\right) \\
 &+ y_{105} \text{DUMGE}_t + y_{106} \text{UKBUILD}_t + y_{107} \text{DUMEMS}_t
 \end{aligned}$$

for $Y_t = \text{CPO}_t$, M_t/PCH_t , $y = \text{cp}$, m , and with CPO private consumption, M money, LIC the interest rate of the household sector, SCALEH total available means of the household sector deflated by the price of private consumption, PCH price of private consumption, PCIR the price of residential buildings, and NPO total population. The scale variable, SCALEH , is determined by the wealth inherited from the past, plus contemporaneous total income, plus the discounted stream of future non-asset income². Dummies were added to the equation³. For more details see Chapter II of Meyermans and Van Brusselen (2001). The estimation results for the long run are shown in Table A.1 and Table A.2.

-
1. See Appendix A of Meyermans and Van Brusselen (2001) for a list of symbols.
 2. I.e., 30 years forward looking. Future real non-asset income calculated as HP filtered trend of real non-asset income, discounted at a constant rate.
 3. Including, DUMGE is a dummy to capture the effect of German re-unification, while UKBUILD is a dummy to capture the shift in the UK money data which was due to the inclusion of deposits of the building societies in the monetary aggregates as of 1987. DUMEMS is a dummy to capture the EMS crisis in 1992-1993.

Table A.1 - Private consumption: long run (semi-)elasticities

	EU	NE	US	JP
cp_l0	-3.15	-3.47	-3.07	-3.63
cp_lb	1.00	1.00	1.00	1.00
cp_l2	0.00	-0.03	-0.05	0.00
cp_l3	0.02	0.00	0.07	-0.01
-cp_l4	-0.66	-0.82	-1.29	-0.22
Implicit interest semi-elasticity	-0.38	-0.99	-0.73	-0.30
Diagnostic statistics				
R2-adjusted	1.00	0.99	0.99	0.99
Dickey Fuller	-3.72	-3.66	-4.18	-2.41
Augmented Dickey Fuller	-3.66	-3.62	-4.11	-2.37

Table A.2 - Money demand: long run (semi-)elasticities

	EU	NE	US	JP
m_l0	-3.97	-4.78	-4.58	-4.58
m_lb	1.00	1.00	1.00	1.00
m_l2	-0.05	-0.37	-0.04	-0.16
m_l3	0.02	0.11	0.00	0.00
-m_l4	-2.47	-4.02	-1.80	-3.03
Implicit interest semi-elasticity	-2.49	-4.64	-1.98	-4.22
Diagnostic statistics				
R2-adjusted	0.95	0.96	0.62	0.94
Dickey Fuller	-2.72	-3.25	-2.56	-1.06
Augmented Dickey Fuller	-2.65	-3.19	-2.37	-0.98

In a second step, we estimate the short run adjustment mechanism:

$$\begin{aligned}
 \text{(A.2)} \quad \Delta \ln \left(\frac{Y_t}{NPO_t} \right) = & \\
 & y_sb \left\{ y_sbw \Delta \ln \left(\frac{SCALEH_t}{NPO_t} \right) + (1-y_sbw) \Delta \ln \left(\frac{GDIH_t}{PCH_t NPO_t} \right) \right\} \\
 & + y_s2 \Delta \ln \left(\frac{LIC_t}{1 + LIC_t} \right) \\
 & + y_s3 \Delta \ln \left(\frac{(1 + LIC_t) PCIR_t - \widehat{PCIR}_{t+1} (1 - gir_rh)}{(1 + LIC_t) PCH_t} \right) \\
 & - y_s4 \Delta \ln \left(\frac{(1 + LIC_t) PCH_t}{\widehat{PCH}_{t+1}} \right) \\
 & + y_s1 ECM_{t-1},
 \end{aligned}$$

for $Y_t = CPO_t$, M_t/P_t , $y = cp, m$, and where ECM is the error correction term derived from equation (A.1), and GDIH disposable household income in current prices.

The estimation results for these equations are reported in Table A.3 and Table A.4. See Chapter II of Meyermans and Van Brusselen (2001), for an interpretation of these results.

Table A.3 - Private consumption: short run (semi-)elasticities^a

	EU	NE	US	JP
cp_sb	0.97 (0.05)	0.99 (0.08)	1.11 (0.07)	0.95 (0.06)
cp_sbw	0.72 (0.09)	0.42 (0.13)	0.41 (0.09)	0.36 (0.11)
cp_s2	0.02 (0.01)	0.02 (0.02)	-0.00 (0.01)	-0.01 (0.01)
cp_s3	0.01 (0.01)	0.00 (0.01)	0.01 (0.01)	0.02 (0.01)
-cp_s4	-0.51 (0.18)	-0.36 (0.23)	-0.44 (0.30)	-0.42 (0.20)
cp_sl	-0.64 (0.16)	-0.28 (0.13)	-0.26 (0.09)	-0.21 (0.08)
Implicit interest semi-elasticity	-0.15	-0.10	-0.30	-0.24
Diagnostic statistics				
R2-adjusted	0.87	0.73	0.83	0.78
Durbin Watson	1.87	1.43	2.07	1.44

a. Standard errors between brackets.

Table A.4 - Money demand: short run (semi-)elasticities^a

	EU	NE	US	JP
m_sb	1.00 --	1.00 --	1.00 --	1.00 --
m_sbw	1.00 --	1.00 --	1.00 --	1.00 --
m_s2	-0.08 (0.05)	-0.11 (0.08)	-0.09 (0.06)	-0.17 (0.03)
m_s3	0.00 --	0.00 --	0.00 --	0.00 --
-m_s4	-1.07 (0.56)	-0.64 (0.85)	-0.56 (0.81)	-1.31 (0.61)
m_sl	-0.55 (0.17)	-0.37 (0.17)	-0.20 (0.25)	-0.24 (0.11)
Implicit interest semi-elasticity	-1.66	-1.61	-1.34	-2.74
Diagnostic statistics				
R2-adjusted	0.55	0.34	0.32	0.54
Durbin Watson	1.43	1.44	1.15	1.43

a. Standard errors between brackets.

2. Gross fixed capital formation in residential buildings

Gross fixed capital formation in residential buildings, GIRO, is estimated as:

$$\begin{aligned}
 \text{(A.3)} \quad \frac{\text{GIRO}_t}{\text{NPO}_t} &= \text{gir_l0} \text{ gir_sl} \text{ gir_rh} \\
 &+ \text{gir_sl} \text{ gir_lb} \text{ gir_lbw} \left\{ \left(\frac{\text{GDIH}_t}{\text{PCH}_t \text{ NPO}_t} \right) \right. \\
 &\quad \left. - (1 - \text{gir_rh}) \left(\frac{\text{GDIH}_{t-1}}{\text{PCH}_{t-1} \text{ NPO}_{t-1}} \right) \right\} \\
 &+ \text{gir_sl} \text{ gir_lb} (1 - \text{gir_lbw}) \left\{ \left(\frac{\text{SCALEH}_t}{\text{NPO}_t} \right) - (1 - \text{gir_rh}) \left(\frac{\text{SCALEH}_{t-1}}{\text{NPO}_{t-1}} \right) \right\} \\
 &+ \text{gir_sl} \text{ gir_l1} \left\{ \ln \left(\frac{\text{USERIR}_t}{\text{PCH}_t} \right) - (1 - \text{gir_rh}) \ln \left(\frac{\text{USERIR}_{t-1}}{\text{PCH}_{t-1}} \right) \right\} \\
 &+ (1 - \text{gir_sl}) \frac{\text{GIRO}_{t-1}}{\text{NPO}_{t-1}},
 \end{aligned}$$

with GIRO gross fixed capital formation in residential buildings, and USERIR the user cost of residential buildings. See equation (II.10) of Meyermans and Van Brusselen (2001), where we added a scale effect with a weight:

$$0 \leq \text{gir_lbw} \leq 1.$$

The estimation results for this equation are reported in Table A.5. See also Meyermans and Van Brusselen (2001), Chapter II for an interpretation of these results.

Table A.5 - Gross fixed capital formation of residential buildings: semi-elasticities^a

	EU	NE	US	JP
Short run elasticities				
Scale	1.35	1.47	3.32	2.33
User cost of res. building	-0.37	-0.47	-0.64	-1.13
Long run elasticities				
Scale	0.70	0.17	0.61	0.20
User cost of res. building	-0.19	-0.05	-0.12	-0.10
Coefficients				
gir_sl	0.06 (0.02)	0.12 (0.02)	0.10 --	0.15 (0.02)
gir_rh	0.03 --	0.01 --	0.02 --	0.01 --
gir_lb	2.04 (0.19)	0.69 (0.26)	1.92 (0.19)	1.23 (0.32)
gir_lbw	1.00 --	0.96 (0.03)	1.00 --	0.97 (0.02)
gir_l1	-0.28 (0.38)	-0.64 (0.91)	-0.29 (0.43)	-38.07 (30.47)
Diagnostic statistics				
R2-adjusted	0.90	0.80	0.78	0.86
Durbin Watson	1.39	1.56	1.53	2.07
Durbin h	1.70	1.23	1.31	-0.19

a. Standard errors between brackets; dummies were added.

C. The factor demand equations

We re-estimated the error correction mechanism for factor demand by imposing the restriction that the short run cross-price elasticities are equal to zero.

1. Labour

Consider equation (III.17) of Meyermans and Van Brusselen (2001), i.e., the error-correction mechanism for labour demand:

$$\begin{aligned}
 \text{(A.4)} \quad \Delta \ln(NP_t) = & \text{np_sb} \Delta \ln(\text{ASPO}_t) \\
 & + \text{np_s1} \Delta \ln \left(\frac{\text{WRP}_t}{(1 - \text{NITR}_t) \text{PASP}_t} \right) \\
 & + \text{np_s2} \Delta \ln \left(\frac{\text{USERIP}_t}{(1 - \text{NITR}_t) \text{PASP}_t} \right) \\
 & + (-\text{np_sb} - \text{np_s1} - \text{np_s2}) \Delta \ln \left(\frac{\text{PMT}_t}{(1 - \text{NITR}_t) \text{PASP}_t} \right) \\
 & + \text{np_sl} \text{ECM_NP}_{t-1} \\
 & + (1 - \text{np_sb}) \text{G_LS}_t
 \end{aligned}$$

with ASPO private supply for final demand, in constant prices, NITR the net indirect tax rate, PASP the price of goods and services supplied by the enterprise sector, PMT the price of imports denominated in local currency, WRP the nominal wage in the private sector, G_LS the growth rate of labour supply, and with the error correction term, ECM_NP, defined as:

$$ECM_NP_{t-1} = \ln(NP_{t-1}) - \ln\left(\frac{asp_11 ASPO_{t-1} PASP_{t-1} (1 - NITR_{t-1})}{WRP_{t-1}}\right).$$

Here, we restrict the short run interactions by imposing the condition that $np_s1 = -np_sb$ and $np_s2 = 0$. Furthermore, we introduce also a lag on output and the wage rate, so that we estimate as the new error correction mechanism for labour:

$$\begin{aligned} (A.5) \quad \Delta \ln(NP_t) = & np_sb [np_sbw1 \Delta \ln(ASPO_t) + (1-np_sbw1) \Delta \ln(ASPO_{t-1})] \\ & -np_sb [np_sbw2 \Delta \ln\left(\frac{WRP_t}{(1 - NITR_t) PASP_t}\right) \\ & + (1-np_sbw2) \Delta \ln\left(\frac{WRP_{t-1}}{(1 - NITR_{t-1}) PASP_{t-1}}\right)] \\ & + np_sl ECM_NP_{t-1} \\ & + (1-np_sb) G_LS_t, \end{aligned}$$

with $0 \leq np_sbw1, np_sbw2 \leq 1$.

The estimation results for the above equation are shown in Table A.6. Remember that, due to the Cobb Douglas production function with constant returns to scale, the long run own elasticity is equal to unity, while the long run cross-elasticities are equal to zero.

Table A.6 - Labour demand: error correction mechanism^a

	EU	NE	US	JP
np_sb	0.45 (0.12)	0.50 (0.11)	0.66 (0.12)	0.11 (0.03)
np_sbw1	0.90 (0.18)	0.60 (0.15)	0.82 (0.10)	1.00 --
np_sbw2	0.00 --	0.47 (0.16)	0.74 (0.21)	0.59 (0.18)
np_sl	-0.09 --	-0.10 (0.17)	-0.07 (0.15)	-0.27 (0.16)
Diagnostic statistics				
Adj. R2	0.86	0.63	0.83	0.91
Durbin Watson	0.93	0.83	1.53	1.25

a. Standard errors between brackets; error correction term with lag of two periods; dummies were added.

2. Imports

In a way similar to the one described in the previous section, we re-specified the equation for imports, i.e., equation (III.21) of Meyermans and Van Brusselen (2001), as:

$$\begin{aligned}
 \text{(A.6)} \quad \Delta \ln(\text{MTO}_t) = & \text{mt_s0} \\
 & \text{mt_sb} (\text{mt_sbw1} \Delta \ln(\text{ASPO}_t) + (1-\text{mt_sbw1}) \Delta \ln(\text{ASPO}_t)) \\
 & -\text{mt_sb} \left[\text{mt_sbw2} \Delta \ln \left(\frac{\text{PMT}_t}{(1 - \text{NITR}_t) \text{PASP}_t} \right) \right. \\
 & \left. + (1-\text{mt_sbw2}) \Delta \ln \left(\frac{\text{PMT}_{t-1}}{(1 - \text{NITR}_{t-1}) \text{PASP}_{t-1}} \right) \right] \\
 & + \text{mt_sl} \text{ECM_MTO}_{t-1} \\
 & + (1-\text{mt_sb}) \text{G_LS}_t.
 \end{aligned}$$

with $0 \leq \text{mt_sbw1}, \text{mt_sbw2} \leq 1$, and ECM_MTO is the error correction term, with MTO (intermediary) imports in constant prices, and PMT the price of imports, measured in local currency.

Here, we restricted the short run interactions of equation (III.21) of Meyermans and Van Brusselen (2001) by imposing the condition that $\text{mt_s1} = \text{mt_s2} = 0$. Furthermore, we introduce also a lag on the import price¹ and added a constant term, mt_s0 . Table A.7 shows the estimation results for the error correction mechanism of imports.

Table A.7 - Imports: error correction mechanism^a

	EU	NE	US	JP
mt_s0	0.03 (0.01)	0.01 (0.01)	0.02 (0.01)	0.02 (0.01)
mt_sb	0.63 (0.12)	0.91 (0.16)	1.06 (0.12)	0.42 (0.10)
mt_sbw1	1.00 --	1.00 --	1.00 --	1.00 --
mt_sbw2	0.06 (0.16)	0.36 (0.11)	0.42 (0.10)	0.03 (0.21)
mt_sl	-0.07 (0.05)	-0.10 (0.07)	-0.07 (0.03)	-0.13 (0.05)
Diagnostic statistics				
Adj. R2	0.76	0.75	0.79	0.55
Durbin Watson	1.62	2.09	2.17	2.03

a. Standard errors between brackets; error correction term with lag of two periods; dummies were added.

1. No lags on output are used, because the free estimation of the weight of contemporaneous output was larger than one.

3. Gross fixed capital formation

Here, we repeat equation (37.a) of Meyermans and Van Brusselen (2000.b):

$$\begin{aligned}
 (A.7) \quad \frac{GIPO_t}{NPO_t} &= gip_l \left(\frac{CIPOL_t}{NPO_t} - (1-gip_rh) \frac{CIPOL_{t-1}}{NPO_{t-1}} \right) + (1-gip_l) \frac{GIPO_{t-1}}{NPO_{t-1}} \\
 &+ gip_sb \left[\Delta \ln \left(\frac{ASPO_t}{NPO_t} \right) - (1-gip_rh) \Delta \ln \left(\frac{ASPO_{t-1}}{NPO_{t-1}} \right) \right] \\
 &+ gip_s1 \left[\Delta \ln \left(\frac{WRP_t}{(1-NITR_t)PASP_t} \right) \right. \\
 &\quad \left. - (1-gip_rh) \Delta \ln \left(\frac{WRP_t}{(1-NITR_{t-1})PASP_{t-1}} \right) \right] \\
 &+ gip_s2 \left[\Delta \ln \left(\frac{USERIP_t}{(1-NITR_t)PASP_t} \right) \right. \\
 &\quad \left. - (1-gip_rh) \Delta \ln \left(\frac{USERIP_{t-1}}{(1-NITR_{t-1})PASP_{t-1}} \right) \right] \\
 &+ (-gip_sb-gip_s1-gip_s2) \left[\Delta \ln \left(\frac{PMT_t}{(1-NITR_t)PASP_t} \right) \right. \\
 &\quad \left. - (1-gip_rh) \Delta \ln \left(\frac{PMT_{t-1}}{(1-NITR_{t-1})PASP_{t-1}} \right) \right].
 \end{aligned}$$

with the equilibrium capital stock, CIPOL, defined as:

$$(A.8) \quad \ln(CIPOL_t) = \ln(asp_l2) + \ln(ASPO_t) - \ln \left(\frac{USERIP_t}{(1-NITR_t)PASP_t} \right).$$

Here, we impose the restriction that $gip_s1 = 0$ and that $gip_s2 = -gip_sb^1$, and we allow for a lag on the short run impact variables, so that we get:

$$\begin{aligned}
 (A.9) \quad \frac{GIPO_t}{NPO_t} &= gip_l \left(\frac{CIPOL_t}{NPO_t} - (1-gip_rh) \frac{CIPOL_{t-1}}{NPO_{t-1}} \right) + (1-gip_l) \frac{GIPO_{t-1}}{NPO_{t-1}} \\
 &+ gip_sb \{ gip_sbw1 \left[\Delta \ln \left(\frac{ASPO_t}{NPO_t} \right) - (1-gip_rh) \Delta \ln \left(\frac{ASPO_{t-1}}{NPO_{t-1}} \right) \right] \right. \\
 &\quad \left. + (1-gip_sbw1) \left[\Delta \ln \left(\frac{ASPO_{t-1}}{NPO_{t-1}} \right) - (1-gip_rh) \Delta \ln \left(\frac{ASPO_{t-2}}{NPO_{t-2}} \right) \right] \right\} \\
 &- gip_sb \{ gip_sbw2 \left[\Delta \ln \left(\frac{USERIP_t}{(1-NITR_t)PASP_t} \right) \right. \right. \\
 &\quad \left. \left. - (1-gip_rh) \Delta \ln \left(\frac{USERIP_{t-1}}{(1-NITR_{t-1})PASP_{t-1}} \right) \right] \right\}
 \end{aligned}$$

1. The latter restriction guarantees long run homogeneity of technological progress, see Appendix G of Meyermans and Van Brusselen (2000.b).

$$+(1-gib_sbw2)\left[\Delta \ln\left(\frac{USERIP_{t-1}}{(1-NITR_{t-1})PASP_{t-1}}\right) - (1-gip_rh)\Delta \ln\left(\frac{USERIP_{t-2}}{(1-NITR_{t-2})PASP_{t-2}}\right)\right]$$

The estimation results for equation (A.9) are shown in Table A.8. For a derivation of the short run elasticities, see Appendix H of Meyermans and Van Brusselen (2000.b).

Table A.8 - Gross fixed capital formation by enterprise sector^a

	EU	NE	US	JP
Impact elasticities				
Output	0.44	0.50	0.62	0.13
Real user cost of capital	-0.33	-0.50	-0.62	-0.13
Technical coefficients				
gip_sl	0.04 (0.01)	0.03 (0.01)	0.04 --	0.04 --
gip_rh	0.07 (0.02)	0.09 (0.03)	0.09 (0.02)	0.13 (0.05)
gip_sb	-0.54 (0.34)	-0.48 (1.18)	0.73 (0.26)	-151.34 (56.55)
gip_sbw1	0.63 (0.65)	0.00 --	0.00 --	1.00 --
gip_sbw2	1.00 --	0.00 --	0.00 --	1.00 --
Diagnostic statistics				
Adj. R2	0.97	0.98	0.98	0.92
Durbin Watson	1.38	1.82	1.73	1.10
Durbin h	1.73	0.51	0.75	2.51

a. Standard errors between brackets; dummies were added. Elasticities evaluated for sample mean.

D. The wage equation

In previous versions of the NIME model, see for example equation (III.14) of Meyermans and Van Brusselen (2001), we estimated a wage equation similar to:

$$(A.10) \quad \Delta \ln(WRP_t) = \Delta \ln[(1-NITR_t)PASP_t] \\ + (1-wrp_l1) \Delta \ln(asp_l1 HP_YNP_t) \\ - wrp_l1 \Delta \ln(TAXWP_t) \\ + wrp_sl1 U_WRP_{t-1} \\ + wrp_sl2 U_UR_{t-1}$$

with the error correction terms, U_WRP and U_UR , defined as:

$$(A.11a) \quad U_WRP_t = \ln[WRP_t/(PASP_t (1-NITR_t))] - \ln(asp_l1 HP_YNP_t),$$

$$(A.11b) \quad U_UR_t = \ln(UR_t) - \ln(HP_UR_t),$$

and with the tax wedge defined as:

$$(A.11c) \quad TAXWP_t = (1 - NITR_t)(1 - DTHR_t)(1 - SSRHR_t) \frac{PASP_t}{PCH_t},$$

and with $0 \leq wrp_l1 \leq 1$, and $wrp_sl1, wrp_sl2 \leq 0$.

Of particular importance is to note that in previous versions we measured productivity by trend productivity. In the new version we relax this assumption, and rewrite equation (A.10) as:

$$(A.12) \quad \begin{aligned} \Delta \ln(WRP_t) = & \Delta \ln[(1-NITR_t) PASP_t] \\ & + (1-wrp_l1) [wrp_swynp \Delta \ln(asp_l1 HP_YNP_t) \\ & \quad + (1-wrp_swynp) \Delta \ln(asp_l1 YNP_t)] \\ & - wrp_l1 \Delta \ln(TAXWP_t) \\ & + wrp_sl1 U_WRP_{t-1} \\ & + wrp_sl2 U_UR_{t-1} \end{aligned}$$

with $0 \leq wrp_swynp \leq 1$, and with HP_YNP trend productivity and YNP contemporaneous productivity.

Equation (A.12) has now productivity growth as a weighted average of contemporaneous and trend productivity growth, with wrp_swynp the weight. An interpretation of wrp_swynp is that it measures the proportion of people that is informed about the steady state growth rates, and $(1-wrp_swynp)$ the proportion of people that uses the contemporaneous growth rate as a rule of thumb to approximate the trend growth rate.

The estimation results for equation (A.12) are shown in Table A.9.

Table A.9 - The private sector wage rate^a

	EU	NE	US	JP
wrp_l1	0.30 (0.12)	0.43 (0.16)	0.05 (0.14)	0.58 (0.08)
wrp_swynp	0.69 (0.28)	0.69 (0.39)	0.47 (0.13)	0.00 --
wrp_sl1	-0.05 --	-0.32 (0.14)	-0.11 (0.06)	-0.34 (0.08)
wrp_sl2	-0.05 (0.03)	-0.01 (0.03)	-0.01 --	-0.01 --
implicit semi-elasticity for unemployment	-0.59	-0.14	-0.14	-0.24
Diagnostic statistics				
Adj. R2	0.90	0.84	0.82	0.96
Durbin Watson	1.33	1.62	2.16	1.69

a. Standard errors between brackets; dummies were added.

E. The short-term interest rate

The short-term interest rate rule has been changed in that the authorities now target the output gap instead of the deviation of the contemporaneous unemployment rate from its natural rate, i.e.:

$$(A.13) \quad SI = HP_RLI + G_PCH + si_s1 (INFL - G_PCH) + si_s2 \ln(ASPO/HPASPO)$$

with SI the short term interest rate, HP_RLI the steady state real interest rate, G_PCH trend inflation (target), INFL contemporaneous (consumer price) inflation, and ASPO/HP_ASPO the output gap.

The parameters have not been estimated, but restricted to $si_s1 = 1.5$ and $si_s2 = 0.5$, which are the parameter values usually found in the literature¹.

F. The stock market price and the risk premium

Here, we model the relationship between the price of stock and the risk premium, as discussed in Section V of the main text.

1. The analytical framework

We start from the hypothesis that the stock market price, STOCK, is equal to the discounted flow of nominal profits, PROF, i.e.:

$$(A.14) \quad STOCK = \sum_{i=0}^{\infty} \left(\frac{1}{1+LIP} \right)^{i+1} PROF_i,$$

with LIP the discount rate in the equity market².

Assuming that the nominal profits, PROF, grow each year at a rate $(1+G_PCH)(1+G_YCP)-1$, with G_PCH inflation and G_YCH real profits growth, and assuming a constant discount rate, we can rewrite equation (A.14) as:

$$STOCK = \frac{1}{1+LIP} PROF \sum_{i=0}^{\infty} \left(\frac{1}{1+LIP} \right)^i ((1+G_PCH)(1+G_YCP))^i,$$

or

$$(A.15) \quad STOCK = \frac{1}{1+LIP} PROF \sum_{i=0}^{\infty} R^i,$$

with

$$R = \frac{(1+G_PCH)(1+G_YCP)}{1+LIP}.$$

1. See also Meyermans (2002.b), Section III.

2. Note that we assume that profits accrue at the end of the period.

It should be remembered that:¹

$$\sum_{i=0}^{\infty} R^i = \frac{1}{1-R} = \frac{1}{1 - \frac{(1 + G_PCH)(1 + G_YCP)}{1+LIP}} = \frac{1 + LIP}{1 + LIP - (1 + G_PCH)(1 + G_YCP)}$$

Inserting the latter result into equation (A.15), we get that:

$$(A.16) \quad STOCK = PROF \frac{1}{1 + LIP - (1 + G_PCH)(1 + G_YCP)}$$

2. The changes in the risk premium

Using equation (A.16), the stock market price is determined in the baseline as:

$$(A.17) \quad YSTOCK = YPROF \frac{1}{1 + YLIP - (1 + YG_PCH)(1 + YG_YCP)}$$

where we add the label Y in front of a variable to indicate that it is the baseline variable.

Subtracting equation (A.17) from equation (A.16), we get:

$$\begin{aligned} & \ln\left(\frac{PROF}{1 + LIP - (1 + G_PCH)(1 + G_YCP)}\right) - \\ & \ln\left(\frac{YPROF}{1 + YLIP - (1 + YG_PCH)(1 + YG_YCP)}\right) = \\ & \ln(STOCK) - \ln(YSTOCK) = x, \end{aligned}$$

where x is the fall in equity value.

Assuming that profits, the long-term interest rate and trend growth rates do not change², the previous equation can be rewritten as:

$$\begin{aligned} & \ln\left(\frac{1}{1 + LIP - (1 + YG_PCH)(1 + YG_YCP)}\right) - \\ & \ln\left(\frac{1}{1 + YLIP - (1 + YG_PCH)(1 + YG_YCP)}\right) = x, \end{aligned}$$

or,

$$(A.18) \quad \begin{aligned} & \ln(1 + YLI + RISKPREM - (1 + YG_PCH)(1 + YG_YCP)) \\ & - \ln(1 + YLI + YRISKPREM - (1 + YG_PCH)(1 + YG_YCP)) = x, \end{aligned}$$

1. Provided that $0 < R < 1$.

2. I.e., $PROF = YPROF$, $G_PCH = YG_PCH$ and $G_YCP = YG_YCP$.

where use has been made of $YLIP = YLI + YRISKPREM$, with $RISKPREM$ the risk premium. Equation (A.18) shows by how much the stock market price change when one changes the risk premium, provided that the outlook for profits, inflation and growth does not change.

3. Interest rate changes and the induced changes in bond value

Applying the same methodology as in the previous sections, we get that the price of a consol¹ is equal to² $\frac{1}{LI}$, with LI the interest rate in the bond market. As a consequence, capital gains in the bond market, due to changes in the interest rate, are then equal to:

$$(A.19) \quad \ln(PCAOB/YPCAOB) = [\ln(1/LI) - \ln(1/YLI)] \text{pcaob_l1} \\ = [\ln(YLI) - \ln(LI)] \text{pcaob_l1},$$

with pcaob_l1 the share of long-term bonds in the portfolio³.

4. Some further analytical results for the steady state

Here, we investigate analytically how the changes in the risk premium affect the the price of capital and the user cost of capital in the long run. The results show that an increase in the risk premium causes the price of capital to *fall* in the long run. Indeed, as the discount rate increases, ceteris paribus, the present value of future returns on capital declines, thereby triggering a drop in the price of capital. The results show also that the user cost will *not change* in the long run as the drop in the price of capital matches exactly the increase in the financing cost caused by the increase in the discount rate. These are, however, long run results. In the short run, important changes in the user cost may arise as the speed of adjustment of the different prices and interest rates differ. In the NIME model, prices adjust at different speeds because of menu costs and information costs, see Meyermans and Van Brusselen (2000.b).

a. The price of capital in the steady state

We repeat here the equation that determines the price of capital, i.e. equation (III.8) of Meyermans and Van Brusselen (2001), and we assume that the future flows are discounted by LIP ⁴:

$$\frac{PCIP}{(1 - NITR)PASP} \\ = \frac{\text{asp_l2} \cdot YCP}{(1 + LIP) - (1 - \text{gip_rh})(1 + G_PCH)(1 + G_YCP)} \cdot \frac{1}{(1 + LIP)}$$

-
1. A consol is a bond that yields every year ad infinitum a nominal yield equal to LI .
 2. This can be verified by assuming in equation (A.16) that $PROF = 1$ and $G_PCH = G_YCH = 0$.
 3. See equation (A.36) below.
 4. For notational convenience, the time subscripts have been suppressed. $LIP = LI + \text{risk premium}$.

or, in logarithm:

$$(A.20) \quad \ln\left(\frac{PCIP}{(1 - NITR)PASP}\right) = \ln(\text{asp_l2 YCP}) \\ - \ln((1+LIP) - (1-gip_rh) (1+G_PCH) (1+G_YCP)) \\ + \ln(1+LIP).$$

Differentiating the previous equation we get:

$$(A.21) \quad d \ln\left(\frac{PCIP}{(1 - NITR)PASP}\right) = d \ln(\text{asp_l2 YCP}) \\ - d \ln((1+LIP) - (1-gip_rh) (1+G_PCH) (1+G_YCP)) \\ + d \ln(1+LIP),$$

so that for a change in the discount rate LIP, we get:

$$d \ln(PCIP) = - \frac{1}{(1 + LIP) - (1-gip_rh) (1+G_PCH)(1+G_YCP)} d LIP \\ + \frac{1}{1+LIP} d LIP,$$

or:

$$(A.22) \quad d \ln(PCIP) = - \frac{(1-gip_rh) (1+G_PCH) (1+G_YCP)}{((1+LIP) - (1-gip_rh) (1+G_PCH)(1+G_YCP))} d \ln(1+LIP).$$

The previous result shows that an *increase* in the discount rate, *reduces* the price of capital¹. Indeed, as the discount rate increases, ceteris paribus, the present value of future returns on capital declines, triggering a drop in the price of capital.

b. The user cost of capital in the steady state

We repeat here the equation that determines the user cost of capital, i.e. equation (III.3) of Meyermans and Van Brusselen (2001), and we assume that the discount rate in the capital market is LIP²:

$$USERIP = \frac{LIP + gip_rh - \left(\frac{PCIP_{+1}}{PCIP} - 1\right)(1 - gip_rh)}{1 + LIP} PCIP$$

which can be rewritten as:

$$(A.23) \quad USERIP = \frac{1 + LIP - \frac{PCIP_{+1}}{PCIP}(1 - gip_rh)}{1 + LIP} PCIP.$$

-
1. Note that $0 < (1-gip_rh) (1+G_PCH) (1+G_YCP) < 1+LIP$ has to be met in order to have long run convergence. See Meyermans and Van Brusselen (2000.b), Section II.E on this.
 2. For notational convenience, the time subscripts are suppressed.

Taking the logarithm of the latter we get:

$$\begin{aligned} \ln(\text{USERIP}) &= \ln\left(1 + \text{LIP} - \frac{\text{PCIP}_{+1}}{\text{PCIP}}(1 - \text{gip_rh})\right) \\ &\quad - \ln(1 + \text{LIP}) + \ln(\text{PCIP}) \end{aligned}$$

which yields, after differentiating w.r.t LIP:

$$\begin{aligned} d \ln(\text{USERIP}) &= \frac{1}{1 + \text{LIP} - \frac{\text{PCIP}_{+1}}{\text{PCIP}}(1 - \text{gip_rh})} d \text{LIP} \\ &\quad - \frac{1}{1 + \text{LIP}} d \text{LIP} + \frac{\ln(\text{PCIP}_t)}{\partial \text{LIP}}, \end{aligned}$$

or

$$\begin{aligned} \text{(A.24)} \quad d \ln(\text{USERIP}) &= \frac{\frac{\text{PCIP}_{+1}}{\text{PCIP}}(1 - \text{gip_rh})}{\left(1 + \text{LIP} - \frac{\text{PCIP}_{+1}}{\text{PCIP}}(1 - \text{gip_rh})\right)(1 + \text{LIP})} d \text{LIP} \\ &\quad + \frac{\ln(\text{PCIP}_t)}{\partial \text{LIP}}. \end{aligned}$$

Note that in the steady state¹:

$$\text{(A.25)} \quad \frac{\text{PCIP}_{+1}}{\text{PCIP}} = (1 + \text{G_PCH})(1 + \text{G_YCP}).$$

Using result (A.22) and (A.25) in equation (A.24), we get:

$$\begin{aligned} \text{(A.26)} \quad d \ln \text{USERIP} &= \frac{(1 - \text{gip_rh})(1 + \text{G_PCH})(1 + \text{G_YCP})}{((1 + \text{LIP}) - (1 - \text{gip_rh})(1 + \text{G_PCH})(1 + \text{G_YCP}))(1 + \text{LIP})} d \text{LIP} \\ &\quad - \frac{(1 - \text{gip_rh})(1 + \text{G_PCH})(1 + \text{G_YCP})}{((1 + \text{LIP}) - (1 - \text{gip_rh})(1 + \text{G_PCH})(1 + \text{G_YCP}))(1 + \text{LIP})} d \text{LIP} \\ &= 0 d \text{LIP}. \end{aligned}$$

In other words, equation (A.26) shows that in the long run the user cost of capital will not change as the discount rate increases. This is because the increase in the financing cost is exactly matched by the fall in the price of capital induced by the increase in the discount rate. This implies also that the desired stock of capital does not change in the long run.

1. See Meyermans and Van Brusselen (2000.b), Section II.E.

G. Interpolation of missing data

Not all the data we need are readily available. In this section, we describe how we interpolated some of the missing data, e.g., the price and the stock of residential buildings in constant prices.

1. The accounting framework

Let CXU be the stock of asset X in current prices, and CXO be the stock of asset X in constant prices, PCX the price of the stock, and XU the net flow in current prices. Assume that we have observations for the stock in current prices, CXU , and net fixed investment in current and constant prices, XU and XO respectively. In order to construct a series for the price, PCX , and the stock in constant prices, CXO , we proceed as follows.

We start from the accounting identity that:

$$(A.27) \quad CXU_t = CXO_{t-1} PCX_t + XU_t,$$

and,

$$(A.28) \quad CXU_t = CXO_t PCX_t.$$

Inserting (A.28) in equation (A.27) yields:

$$(A.29) \quad CXU_t = [CXU_{t-1}/PCX_{t-1}] PCX_t + XU_t,$$

so that:

$$(CXU_t - XU_t) PCX_{t-1} = CXU_{t-1} PCX_t,$$

or:

$$(A.30) \quad PCX_t = (CXU_t - XU_t) PCX_{t-1} / CXU_{t-1}.$$

Equation (A.30) describes how price PCX can be generated with the available series for CXU and XU , provided we have a starting value for PCX . A natural starting point would be to normalise the price PCX to 1 in 1995, the model's base year, and calculate PCX using equation (A.30) for time t beyond 1995.

For time t smaller than 1995, rewrite equation (A.30) as:

$$(A.31) \quad PCX_{t-1} = CXU_{t-1} PCX_t / (CXU_t - XU_t)$$

or on shifting the time subscript one period:

$$(A.32) \quad PCX_t = CXU_t PCX_{t+1} / (CXU_{t+1} - XU_{t+1})$$

Given the series generated by equation (A.30), we can now complete the series for the period before 1995 by means of equation (A.32).

The previous equations can be used to generate data for prices of residential buildings, PCIR, and financial assets, PCAO. Of course, these equations cannot be used as behavioural equations explaining PCAO or PCIR. Hence, once these prices are calculated, one has to specify a behavioural equation for these prices and estimate them. Let us start with the case of the price of residential buildings, PCIR.

2. The price of residential buildings

Similar to the modelling strategy outlined in Appendix F of Meyermans and Van Brusselen (2000.b), we assume that there are menu costs and information costs when prices for residential buildings are set. In other words, we estimate the short-run adjustment scheme¹:

$$(A.33) \quad \begin{aligned} \ln(PX_t) - \ln(PX_{t-1}) = & (px_sl-1) [\ln(PX_{t-1}) - \ln(PXR_{t-1})] \\ & + (1-px_sl) [\ln(PXR_t) - \ln(PXR_{t-1})] \\ & - (1-px_sl) px_sw [\ln(PXR_t) - \ln(PX_{t-1})] \\ & + (1-px_sl) px_sw [\ln(UX_t) - \ln(UX_{t-1})], \end{aligned}$$

with $X = CIR$ and $x=cir$ and $0 \leq px_sl, px_sw \leq 1$, and where px_sl is the fraction of the composite good for which the price is kept to its old price, and px_sw the fraction of the price that is revised according to a rule of thumb.

The rational reset price, PCIRR, is defined as:

$$(A.34) \quad \ln(PCIRR) = pcir_l0 + pcir_l1 \ln(PASP) + pcir_l2 \ln(STOCK),$$

with STOCK the stock market index and $pcir_l1 = 1$.

Remember that cost push inflation is defined as ²:

$$\begin{aligned} \Delta \ln(UX_t) = & -\Delta \ln(1-NITR_t) + (asp_l1+asp_l2) \Delta \ln(PX_{t-1} (1-NITR_{t-1})) \\ & + asp_l3 \Delta \ln(PMP_t/HP_YMP_{t-1}), \end{aligned}$$

Equation (A.33) describes how the price converges to its equilibrium, while equation (A.34) describes the equilibrium.

1. See equation (F.10) of Appendix F of Meyermans and Van Brusselen (2000.b).
2. See equation (F.7.a) of Appendix F of Meyermans and Van Brusselen (2000.b).

The estimation results for PCIR are shown in Table A.10.

Table A.10 - Prices of residential buildings: short run elasticities^a

	EU	NE	US	JP
pcir_sl	0.00	0.00	0.00	0.14
	--	--	--	(0.08)
pcir_sw	0.93	0.77	0.81	0.78
	(0.03)	(0.07)	(0.06)	(0.06)
error correction term	-1.00	-1.00	-1.00	-0.86
partial adjustment term	0.93	0.77	0.81	0.67
Diagnostic statistics				
Adj. R2	0.68	0.43	0.50	0.73
Durbin Watson	2.16	2.44	2.42	2.04
Durbin h	-0.49	-1.66	-1.30	-0.14

a. Standard errors between brackets; dummies were added.

3. The price of financial assets

Here, we describe how the price of the financial assets of the household sector is determined in the NIME model.

The portfolio of the household sector, CAO, consists of equity and bonds. Accordingly, the price of the total portfolio, PCAO, may be determined as:

$$(A.35) \quad \ln(\text{PCAO}) = \text{caoub} \ln(\text{PCAOB}) + (1-\text{caoub}) \ln(\text{PCAOE})$$

with PCAOB the unit price of the households' bond portfolio, PCAOE the unit price of the households' equity portfolio, and with the share of bonds in the portfolio satisfying the condition $0 \leq \text{caoub} \leq 1$ ¹.

In equilibrium, the price of the households' bond portfolio is determined by the price of long term bond, which is approximately equal to $1/LI$, and the price of short term bills (one year), which is equal to 1 ², as:

$$(A.36) \quad \ln(\text{PCAOB}) = \text{pcaob}_l0 + (1-\text{pcaob}_l1) \ln(1) + \text{pcaob}_l1 \ln(1/LI)$$

with the share of long term bonds satisfying the condition $0 \leq \text{pcaob}_l1 \leq 1$.

In equilibrium, the price of the households' equity portfolio is valued as:

$$(A.37) \quad \ln(\text{PCAOE}) = \text{pcaoe}_l0 + \text{pcaoe}_l1 \ln(\text{STOCK}).$$

1. For the moment, the parameter caoub is a constant in the NIME model.
2. See section F.3 of this appendix, and remember that $\ln(1)=0$.

Here, we assume that households do not take immediately full account of changes in asset prices when they assess their portfolio wealth. In empirical terms, a change in the stock market value has to be sustained for some time before it is considered to fully affect household wealth. Hence, we assume that in the short run, PCAOB and PCAOE are determined by an error correction mechanism, i.e.:

$$(A.38) \quad d \ln(\text{PCAOB}) = \text{pcaob_s1} d \ln(1/\text{LI}) \\ + \text{pcaob_sl} [\ln(\text{PCAOB}_{-1}) - \text{pcaob_l0} - \text{pcaob_l1} \ln(1/\text{LI}_{-1})],$$

and

$$(A.39) \quad d \ln(\text{PCAOE}) = \text{pcaoe_s1} d \ln(\text{STOCK}) \\ + \text{pcaoe_sl} [\ln(\text{PCAOE}_{-1}) - \text{pcaoe_l0} - \text{pcaoe_l1} \ln(\text{STOCK}_{-1})],$$

with $-1 \leq \text{pcaob_sl} \leq 0$ and $0 \leq \text{pcaob_s1}$,

and $-1 \leq \text{pcaoe_sl} \leq 0$ and $0 \leq \text{pcaoe_s1}$,

and where use has been made of equation (A.36) and (A.37) to define the equilibrium price.

Taking first differences of equation (A.35), i.e.:

$$(A.40) \quad d \ln(\text{PCAO}) = \text{caoub} d \ln(\text{PCAOB}) + (1-\text{caoub}) d \ln(\text{PCAOE}),$$

and inserting equations (A.38) and (A.39) into equation (A.40), yields:

$$d \ln(\text{PCAO}) = \text{caoub} \text{pcaob_s1} d \ln(1/\text{LI}) \\ + \text{caoub} \text{pcaob_sl} [\ln(\text{PCAOB}_{-1}) - \text{pcaob_l0} - \text{pcaob_l1} \ln(1/\text{LI}_{-1})] \\ + (1-\text{caoub}) \text{pcaoe_s1} d \ln(\text{STOCK}) \\ + (1-\text{caoub}) \text{pcaoe_sl} \\ [\ln(\text{PCAOE}_{-1}) - \text{pcaoe_l0} - \text{pcaoe_l1} \ln(\text{STOCK}_{-1})],$$

or on collecting terms:

$$d \ln(\text{PCAO}) = \text{caoub} \text{pcaob_s1} d \ln(1/\text{LI}) \\ + (1-\text{caoub}) \text{pcaoe_s1} d \ln(\text{STOCK}) \\ + \text{caoub} \text{pcaob_sl} \ln(\text{PCAOB}_{-1}) \\ - \text{caoub} \text{pcaob_sl} \text{pcaob_l1} \ln(1/\text{LI}_{-1}) \\ + (1-\text{caoub}) \text{pcaoe_sl} \ln(\text{PCAOE}_{-1}) \\ - (1-\text{caoub}) \text{pcaoe_sl} \text{pcaoe_l1} \ln(\text{STOCK}_{-1}) \\ - \text{caoub} \text{pcaob_sl} \text{pcaob_l0} - (1-\text{caoub}) \text{pcaoe_sl} \text{pcaoe_l0}.$$

Imposing $\text{pcaob_sl} = \text{pcaoe_sl}$ and using equation (A.35), we can further simplify:

$$(A.41) \quad d \ln(\text{PCAO}) = \text{caoub} \text{pcao_s1} d \ln(1/\text{LI}) \\ + (1-\text{caoub}) \text{pcao_s2} d \ln(\text{STOCK}) \\ + \text{pcao_sl} [\ln(\text{PCAO}_{-1}) - \text{pcao_l0} - \text{caoub} \text{pcao_l1} \ln(1/\text{LI}_{-1})] \\ - (1-\text{caoub}) \text{pcao_l2} \ln(\text{STOCK}_{-1})]$$

with:

$$\begin{aligned} \text{pcaob_sl} &= \text{pcae_sl} = \text{pcao_sl} \\ \text{pcao_s1} &= \text{pcaob_s1} \\ \text{pcao_s2} &= \text{pcae_s1} \\ \text{pcao_l0} &= \text{caoub} \text{pcaob_l0} + (1 - \text{caoub}) \text{pcae_l0}, \\ \text{pcao_l1} &= \text{pcaob_l1}, \\ \text{pcao_l2} &= \text{pcae_l1}. \end{aligned}$$

Finally, note that long run homogeneity requires that $\text{pcao_l2} = 1$. Furthermore, it should hold that $0 \leq \text{pcao_l1} \leq 1$, and that $-1 \leq \text{pcao_sl} \leq 0$. Point estimates for equation (A.41) are reported in Table A.11.

Table A.11 - Prices of residential buildings: short run elasticities^a

	EU	NE	US	JP
pcao_s1	0.23 (0.29)	0.48 (0.20)	0.09 (0.11)	0.12 --
pcao_s2	0.52 (0.11)	1.27 (0.26)	0.83 (0.13)	1.33 (0.36)
pcao_sl	-0.06 (0.03)	-0.09 (0.05)	-0.15 (0.13)	-0.10 --
pcao_l0	-5.67 (0.22)	-4.28 (2.11)	-3.73 (0.18)	-2.34 (0.72)
pcao_l1	0.83 --	0.96 (1.18)	0.79 --	0.28 (0.27)
pcao_l2	1.00 --	1.00 --	1.00 --	1.00 --
caoub	0.35 --	0.62 --	0.58 --	0.85 --
Diagnostic statistics				
Adj. R2	0.62	0.76	0.68	0.30
Durbin Watson	2.65	3.14	2.63	1.33

a. Standard errors between brackets; dummies were added.



Appendix B: Some additional simulation results

Table B.1 - A fiscal shock in the us: macro-economic spill-over effects on the non-euro EU country block^a

	Flexible exchange rate regime					Fixed exchange rate regime				
	1	2	3	4	5	1	2	3	4	5
<i>Demand/supply (in constant prices)</i>										
private consumption	0.02	0.02	0.01	-0.02	-0.03	-0.05	-0.24	-0.37	-0.35	-0.17
public consumption	0.01	0.01	0.01	0.01	0.02	-0.00	-0.03	-0.06	-0.08	-0.07
gross fixed capital formation	0.02	0.03	0.08	0.10	0.12	-0.33	-0.49	-0.49	-0.18	0.05
o/w enterprise sector	0.01	0.02	0.07	0.11	0.14	-0.31	-0.47	-0.50	-0.23	-0.03
residential buildings	-0.00	0.02	0.09	0.13	0.13	-0.58	-0.67	-0.46	0.17	0.49
public sector	0.13	0.11	0.10	-0.03	-0.02	-0.06	-0.33	-0.44	-0.38	-0.07
exports	0.20	0.16	0.14	-0.07	-0.04	0.11	-0.04	-0.07	-0.16	0.00
imports	0.06	0.04	0.03	-0.03	-0.00	-0.03	-0.19	-0.26	-0.24	-0.08
gross domestic product	0.07	0.07	0.06	-0.01	-0.00	-0.04	-0.19	-0.26	-0.24	-0.07
total private supply for final demand	0.07	0.06	0.06	-0.02	-0.01	-0.04	-0.20	-0.27	-0.24	-0.06
<i>Prices</i>										
GDP deflator	0.04	0.13	0.19	0.19	0.14	-0.00	-0.01	-0.07	-0.13	-0.18
consumption price	0.01	0.06	0.09	0.10	0.07	-0.00	-0.01	-0.09	-0.18	-0.27
export price (in local currency)	0.16	0.36	0.49	0.41	0.26	0.01	0.01	-0.00	-0.03	-0.05
import price (in local currency)	0.06	0.16	0.22	0.19	0.12	-0.00	-0.01	-0.05	-0.10	-0.16
<i>Labour market</i>										
total employment	0.02	0.04	0.04	0.01	-0.01	-0.01	-0.06	-0.10	-0.09	-0.03
private sector employment	0.03	0.05	0.05	0.01	-0.01	-0.01	-0.07	-0.12	-0.11	-0.03
unemployment rate *	-0.02	-0.03	-0.03	-0.00	0.01	0.01	0.04	0.07	0.06	0.01
nominal wage (private sector)	0.04	0.11	0.17	0.18	0.14	-0.01	-0.04	-0.10	-0.18	-0.22
take home real wage	0.03	0.05	0.09	0.08	0.07	-0.01	-0.02	-0.02	0.01	0.05
producer real wage	-0.01	-0.03	-0.03	-0.01	0.01	-0.00	-0.02	-0.04	-0.06	-0.05
contemporaneous productivity	0.05	0.02	0.01	-0.03	0.01	-0.03	-0.13	-0.16	-0.13	-0.03
<i>Financial sector</i>										
short-term interest rate *	0.06	0.09	0.07	0.00	-0.04	0.38	0.43	0.32	-0.07	-0.17
long-term interest rate *	0.01	0.02	0.02	0.00	-0.01	0.10	0.11	0.08	-0.02	-0.04
effective nominal exchange rate (-:appr.)	0.17	0.35	0.45	0.33	0.17	0.00	0.00	0.00	0.00	0.00
effective real exchange rate (-:appr.)	0.02	0.04	0.04	0.01	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01
bilateral exchange rate (local/eur) (-:appr.)	-0.04	-0.07	-0.08	-0.03	0.02	0.00	0.00	0.00	0.00	0.00
nominal money stock	-0.09	-0.19	-0.20	-0.09	0.03	-0.93	-1.67	-1.96	-1.31	-0.60
<i>Public finance</i>										
nominal public revenues	0.08	0.16	0.21	0.17	0.13	-0.02	-0.13	-0.24	-0.29	-0.25
real public revenues	0.04	0.03	0.02	-0.02	-0.01	-0.02	-0.11	-0.17	-0.17	-0.07
nominal public expenditures	0.01	0.07	0.11	0.14	0.11	0.01	0.05	-0.01	-0.12	-0.26
real public expenditures	-0.04	-0.06	-0.08	-0.05	-0.03	0.01	0.06	0.05	0.01	-0.07
deficit to GDP ratio * (+:surplus)	0.03	0.03	0.04	0.01	0.01	-0.01	-0.06	-0.08	-0.06	0.01
debt to GDP ratio *	-0.07	-0.12	-0.17	-0.15	-0.15	0.02	0.13	0.24	0.29	0.24
<i>Household sector</i>										
total available means	-0.02	-0.04	-0.02	0.00	0.02	-0.18	-0.20	-0.13	0.05	0.12
real disposable income	0.02	0.06	0.08	0.07	0.06	-0.00	-0.04	-0.06	-0.03	0.02
savings as % of disposable income *	0.00	0.03	0.07	0.09	0.08	0.04	0.19	0.30	0.30	0.18
<i>Spill-over effects</i>										
effective foreign output	0.15	0.11	0.09	-0.06	-0.02	0.08	-0.03	-0.05	-0.12	0.00
effective foreign price level	0.01	0.05	0.08	0.09	0.06	0.00	0.01	-0.01	-0.04	-0.06
effective foreign interest rate *	0.12	0.18	0.15	0.00	-0.07	0.39	0.44	0.32	-0.07	-0.17
<i>Memo items</i>										
current account to GDP ratio * (+:surplus)	0.08	0.10	0.13	0.06	0.04	0.05	0.05	0.07	0.04	0.06
total stock of real assets	-0.00	-0.01	-0.01	-0.01	-0.01	-0.02	-0.04	-0.06	-0.07	-0.06

a. Variables without *: deviation from baseline, in percent. Variables with *: deviation from baseline, in differences.

Table B.2 - A fiscal shock in the us: macro-economic spill-over effects on Japan^a

	Flexible exchange rate regime					Fixed exchange rate regime				
	1	2	3	4	5	1	2	3	4	5
<i>Demand/supply (in constant prices)</i>										
private consumption	0.00	0.01	0.02	0.00	-0.01	-0.07	-0.07	-0.06	-0.02	0.01
public consumption	0.01	0.01	0.01	0.01	0.01	-0.00	-0.02	-0.02	-0.02	-0.01
gross fixed capital formation	0.04	0.05	0.07	0.03	0.02	-0.13	-0.23	-0.20	-0.06	0.09
o/w enterprise sector	0.01	0.02	0.03	0.04	0.05	-0.09	-0.23	-0.25	-0.15	-0.01
residential buildings	0.10	0.11	0.15	0.01	-0.03	-0.46	-0.46	-0.18	0.35	0.60
public sector	0.07	0.09	0.11	0.01	-0.02	-0.04	-0.09	-0.08	-0.05	0.05
exports	0.42	0.45	0.46	0.00	-0.08	0.33	0.20	0.15	-0.18	-0.06
imports	0.03	-0.02	-0.06	-0.10	-0.01	-0.02	-0.04	-0.04	-0.04	-0.01
gross domestic product	0.06	0.08	0.10	0.02	-0.01	-0.04	-0.08	-0.07	-0.05	0.03
total private supply for final demand	0.07	0.08	0.09	0.01	-0.01	-0.04	-0.08	-0.07	-0.05	0.03
<i>Prices</i>										
GDP deflator	0.01	0.06	0.11	0.14	0.14	-0.01	-0.03	-0.06	-0.08	-0.10
consumption price	0.00	0.04	0.08	0.12	0.12	-0.00	-0.02	-0.06	-0.09	-0.12
export price (in local currency)	0.16	0.35	0.48	0.37	0.21	0.01	0.03	0.04	0.04	0.03
import price (in local currency)	0.16	0.30	0.30	0.06	-0.13	-0.00	-0.01	-0.03	-0.05	-0.07
<i>Labour market</i>										
total employment	0.01	0.01	0.01	-0.01	-0.01	-0.00	-0.01	-0.00	0.00	0.02
private sector employment	0.01	0.01	0.01	-0.01	-0.02	-0.01	-0.01	-0.00	0.00	0.02
unemployment rate *	-0.01	-0.01	-0.00	0.00	0.01	0.00	0.00	0.00	-0.00	-0.01
nominal wage (private sector)	0.04	0.10	0.16	0.16	0.14	-0.02	-0.05	-0.10	-0.12	-0.12
take home real wage	0.03	0.06	0.08	0.05	0.03	-0.02	-0.04	-0.04	-0.03	0.01
producer real wage	0.01	0.01	0.03	0.03	0.03	-0.01	-0.03	-0.04	-0.04	-0.02
contemporaneous productivity	0.06	0.07	0.08	0.02	0.00	-0.03	-0.07	-0.06	-0.05	0.01
<i>Financial sector</i>										
short-term interest rate *	0.04	0.09	0.10	0.06	-0.00	0.36	0.42	0.31	-0.07	-0.16
long-term interest rate *	0.01	0.03	0.03	0.02	-0.00	0.10	0.11	0.08	-0.02	-0.04
effective nominal exchange rate (-:appr.)	0.41	0.69	0.68	0.17	-0.16	0.00	-0.00	0.00	0.00	0.00
effective real exchange rate (-:appr.)	0.25	0.38	0.28	-0.10	-0.29	0.00	0.02	0.01	0.01	-0.01
bilateral exchange rate (local/eur) (-:appr.)	0.03	0.01	-0.10	-0.26	-0.29	0.00	0.00	0.00	0.00	0.00
nominal money stock	-0.15	-0.26	-0.20	-0.08	0.10	-1.88	-1.82	-1.33	-0.12	0.29
<i>Public finance</i>										
nominal public revenues	0.06	0.12	0.18	0.16	0.12	-0.03	-0.08	-0.11	-0.13	-0.09
real public revenues	0.05	0.06	0.07	0.01	-0.02	-0.02	-0.05	-0.05	-0.04	0.01
nominal public expenditures	0.01	0.07	0.12	0.16	0.13	-0.00	-0.00	-0.05	-0.09	-0.13
real public expenditures	-0.01	0.01	0.01	0.02	-0.01	0.01	0.03	0.01	-0.00	-0.03
deficit to GDP ratio * (+:surplus)	0.01	0.02	0.02	-0.00	-0.00	-0.01	-0.02	-0.02	-0.01	0.01
debt to GDP ratio *	-0.11	-0.20	-0.30	-0.23	-0.18	0.06	0.16	0.20	0.22	0.11
<i>Household sector</i>										
total available means	0.00	-0.01	-0.01	-0.02	-0.02	-0.05	-0.05	-0.02	0.03	0.05
real disposable income	0.03	0.05	0.07	0.05	0.02	-0.01	-0.02	0.00	0.03	0.06
savings as % of disposable income *	0.02	0.03	0.04	0.04	0.03	0.05	0.05	0.05	0.04	0.04
<i>Spill-over effects</i>										
effective foreign output	0.36	0.26	0.21	-0.16	-0.07	0.33	0.19	0.13	-0.20	-0.06
effective foreign price level	0.00	0.04	0.08	0.11	0.09	0.01	0.04	0.05	0.04	0.01
effective foreign interest rate *	0.18	0.26	0.21	-0.01	-0.10	0.37	0.43	0.32	-0.07	-0.16
<i>Memo items</i>										
current account to GDP ratio * (+:surplus)	0.05	0.10	0.14	0.11	0.06	0.04	0.09	0.13	0.10	0.05
total stock of real assets	0.00	0.00	0.00	-0.00	-0.00	-0.01	-0.02	-0.03	-0.04	-0.03

a. Variables without *: deviation from baseline, in percent. Variables with *: deviation from baseline, in differences.

Table B.3 - A fiscal shock in the us: macro-economic spill-over effects on the rest of the world^a

	Flexible exchange rate regime					Fixed exchange rate regime				
	1	2	3	4	5	1	2	3	4	5
1. Output	0.07	0.05	0.04	-0.03	-0.01	0.06	0.01	0.00	-0.05	-0.01
2. Short-term interest rate	0.14	0.21	0.17	-0.00	-0.08	0.39	0.44	0.32	-0.07	-0.17
3. Total exports	0.67	0.48	0.40	-0.30	-0.14	0.54	0.19	0.09	-0.45	-0.10
4. Total imports	0.26	0.14	0.16	-0.01	0.12	0.11	-0.21	-0.26	-0.28	0.08
5. Price of exports (in euro)	0.12	0.31	0.47	0.47	0.35	0.01	0.03	0.04	0.02	-0.01
6. Price of imports (in euro)	0.28	0.50	0.63	0.44	0.29	0.13	0.12	0.08	-0.09	-0.10
7. Eff. foreign output	0.37	0.27	0.23	-0.16	-0.07	0.30	0.12	0.07	-0.23	-0.05
8. Eff. nominal exchange rate (+=depr)	-0.04	-0.26	-0.45	-0.46	-0.26	-0.00	-0.00	-0.00	-0.00	-0.00
9. Bilateral exchange rate (local/eur)	-0.30	-0.67	-0.90	-0.66	-0.31	0.00	0.00	0.00	0.00	0.00

a. Variables without *: deviation from baseline, in percent. Variables with *: deviation from baseline, in differences.

Table B.4 - A productivity shock in the us: macro-economic spill-over effects on the non-euro EU country block^a

	Flexible exchange rate regime					Fixed exchange rate regime				
	1	2	3	4	5	1	2	3	4	5
<i>Demand/supply (in constant prices)</i>										
private consumption	0.36	0.67	0.81	0.86	0.81	0.42	0.84	0.96	0.97	0.95
public consumption	0.04	0.31	0.98	1.05	1.08	0.05	0.33	1.01	1.09	1.13
gross fixed capital formation	0.31	1.60	1.57	1.34	1.07	0.59	1.81	1.69	1.62	1.39
o/w enterprise sector	-0.00	1.44	1.29	1.04	0.75	0.26	1.64	1.43	1.35	1.10
residential buildings	1.82	2.43	2.85	2.62	2.40	2.29	2.65	2.85	2.82	2.60
public sector	0.56	1.63	1.88	1.76	1.54	0.73	1.87	2.03	1.91	1.74
exports	0.37	1.31	1.41	1.33	1.22	0.46	1.42	1.43	1.34	1.26
imports	0.31	0.90	1.08	1.05	0.96	0.41	1.03	1.17	1.13	1.07
gross domestic product	0.32	0.95	1.14	1.11	1.02	0.42	1.10	1.23	1.21	1.15
total private supply for final demand	0.33	0.96	1.14	1.10	1.00	0.44	1.11	1.23	1.19	1.12
<i>Prices</i>										
GDP deflator	-0.02	0.03	0.03	0.07	0.10	0.01	0.11	0.18	0.26	0.33
consumption price	-0.01	0.11	0.09	0.13	0.17	0.00	0.16	0.21	0.28	0.35
export price (in local currency)	-0.10	-0.12	-0.22	-0.25	-0.26	0.00	0.03	0.05	0.08	0.10
import price (in local currency)	-0.04	-0.01	0.00	0.04	0.08	0.01	0.08	0.17	0.25	0.32
<i>Labour market</i>										
total employment	0.08	0.20	0.20	0.14	0.05	0.11	0.26	0.25	0.17	0.08
private sector employment	0.10	0.24	0.24	0.17	0.06	0.13	0.31	0.30	0.21	0.10
unemployment rate *	-0.06	-0.15	-0.14	-0.09	-0.02	-0.09	-0.19	-0.17	-0.11	-0.04
nominal wage (private sector)	0.02	0.57	0.75	0.91	1.00	0.06	0.66	0.91	1.11	1.25
take home real wage	0.03	0.46	0.66	0.77	0.83	0.06	0.50	0.71	0.83	0.89
producer real wage	0.05	0.54	0.72	0.84	0.90	0.05	0.55	0.73	0.85	0.91
contemporaneous productivity	0.24	0.72	0.90	0.93	0.94	0.31	0.80	0.93	0.98	1.02
<i>Financial sector</i>										
short-term interest rate *	0.15	0.15	0.02	0.11	0.05	-0.09	0.09	0.10	-0.00	-0.05
long-term interest rate *	0.04	0.04	0.01	0.03	0.01	-0.02	0.02	0.02	-0.00	-0.01
effective nominal exchange rate (-:appr.)	-0.10	-0.14	-0.26	-0.31	-0.33	0.00	0.00	0.00	0.00	0.01
effective real exchange rate (-:appr.)	-0.02	-0.01	-0.02	-0.02	-0.01	-0.00	0.00	0.00	0.00	0.00
bilateral exchange rate (local/eur) (-:appr.)	0.09	0.07	-0.22	-0.29	-0.33	0.00	0.00	0.00	0.00	0.00
nominal money stock	0.45	0.36	0.51	0.47	0.53	1.11	1.03	0.90	1.10	1.33
<i>Public finance</i>										
nominal public revenues	0.17	0.77	0.99	1.08	1.09	0.26	0.94	1.21	1.33	1.39
real public revenues	0.19	0.74	0.96	1.01	0.98	0.25	0.83	1.02	1.07	1.06
nominal public expenditures	-0.08	0.09	0.62	0.83	1.00	-0.08	0.11	0.73	0.99	1.19
real public expenditures	-0.05	0.06	0.59	0.76	0.90	-0.09	-0.00	0.54	0.72	0.86
deficit to GDP ratio * (+:surplus)	0.09	0.24	0.12	0.08	0.02	0.12	0.29	0.16	0.11	0.06
debt to GDP ratio *	-0.19	-0.63	-0.77	-0.81	-0.78	-0.28	-0.80	-0.98	-1.05	-1.05
<i>Household sector</i>										
total available means	0.67	0.67	0.75	0.71	0.72	0.80	0.71	0.73	0.75	0.76
real disposable income	0.05	0.51	0.79	0.90	0.93	0.08	0.57	0.85	0.95	1.00
savings as % of disposable income *	-0.30	-0.15	-0.03	0.04	0.11	-0.33	-0.26	-0.11	-0.01	0.04
<i>Spill-over effects</i>										
effective foreign output	0.28	0.98	1.07	1.04	0.99	0.34	1.06	1.08	1.04	1.02
effective foreign price level	-0.02	0.00	0.01	0.04	0.06	-0.00	0.04	0.05	0.08	0.09
effective foreign interest rate *	0.12	0.12	-0.03	0.06	0.01	-0.09	0.09	0.10	-0.00	-0.05
<i>Memo items</i>										
current account to GDP ratio * (+:surplus)	0.00	0.10	0.04	-0.00	-0.03	0.02	0.11	0.05	0.02	-0.01
total stock of real assets	0.01	0.10	0.18	0.26	0.32	0.03	0.12	0.20	0.28	0.35

a. Variables without *: deviation from baseline, in percent. Variables with *: deviation from baseline, in differences.

Table B.5 - A productivity shock in the us: macro-economic spill-over effects on Japan^a

	Flexible exchange rate regime					Fixed exchange rate regime				
	1	2	3	4	5	1	2	3	4	5
<i>Demand/supply (in constant prices)</i>										
private consumption	0.25	0.62	0.89	0.96	0.95	0.31	0.65	0.87	0.95	0.96
public consumption	0.06	0.16	0.74	0.84	0.91	0.07	0.18	0.75	0.84	0.91
gross fixed capital formation	0.52	0.87	1.47	1.40	1.17	0.66	0.99	1.40	1.38	1.28
o/w enterprise sector	0.02	0.37	0.82	0.77	0.57	0.10	0.51	0.82	0.74	0.68
residential buildings	2.88	3.07	4.59	4.36	3.92	3.36	3.20	4.13	4.36	4.10
public sector	0.39	0.84	1.33	1.35	1.23	0.49	0.93	1.29	1.31	1.27
exports	0.37	1.00	1.10	1.11	0.95	0.45	1.13	1.08	1.03	1.01
imports	0.16	0.37	0.64	0.57	0.60	0.19	0.37	0.60	0.63	0.67
gross domestic product	0.34	0.71	1.12	1.14	1.05	0.42	0.79	1.08	1.11	1.08
total private supply for final demand	0.34	0.73	1.15	1.15	1.04	0.43	0.80	1.11	1.12	1.08
<i>Prices</i>										
GDP deflator	0.01	0.24	0.23	0.29	0.33	0.03	0.29	0.29	0.34	0.39
consumption price	-0.00	0.17	0.02	0.07	0.14	0.00	0.22	0.09	0.13	0.19
export price (in local currency)	-0.11	-0.12	0.10	0.03	-0.10	0.00	0.01	0.02	0.03	0.05
import price (in local currency)	-0.11	-0.02	0.33	0.28	0.14	0.01	0.09	0.18	0.26	0.33
<i>Labour market</i>										
total employment	0.04	0.09	0.11	0.06	-0.02	0.06	0.09	0.10	0.05	-0.01
private sector employment	0.05	0.09	0.12	0.06	-0.02	0.06	0.10	0.11	0.05	-0.01
unemployment rate *	-0.02	-0.04	-0.06	-0.03	0.01	-0.03	-0.05	-0.05	-0.02	0.01
nominal wage (private sector)	0.12	0.49	0.75	1.01	1.17	0.17	0.58	0.82	1.06	1.24
take home real wage	0.12	0.32	0.73	0.94	1.03	0.16	0.37	0.72	0.93	1.05
producer real wage	0.12	0.27	0.50	0.72	0.85	0.14	0.30	0.53	0.72	0.85
contemporaneous productivity	0.30	0.63	1.02	1.08	1.06	0.37	0.70	1.00	1.07	1.09
<i>Financial sector</i>										
short-term interest rate *	0.16	0.11	-0.18	0.15	0.13	-0.08	0.09	0.10	0.00	-0.05
long-term interest rate *	0.04	0.03	-0.05	0.04	0.03	-0.02	0.02	0.03	-0.00	-0.01
effective nominal exchange rate (-:appr.)	-0.29	-0.19	0.44	-0.01	-0.37	0.00	0.00	0.00	0.00	0.01
effective real exchange rate (-:appr.)	-0.18	-0.07	0.34	-0.02	-0.22	0.00	0.01	0.02	0.03	0.03
bilateral exchange rate (local/eur) (-:appr.)	0.04	0.12	0.40	0.00	-0.35	0.00	0.00	0.00	0.00	0.00
nominal money stock	0.16	0.36	1.45	0.53	0.58	1.53	0.64	0.62	1.04	1.27
<i>Public finance</i>										
nominal public revenues	0.22	0.71	1.05	1.22	1.26	0.30	0.83	1.10	1.26	1.35
real public revenues	0.21	0.48	0.82	0.93	0.93	0.27	0.54	0.81	0.91	0.95
nominal public expenditures	-0.01	0.26	0.67	0.93	1.10	-0.00	0.31	0.76	1.00	1.14
real public expenditures	-0.02	0.02	0.44	0.64	0.77	-0.03	0.02	0.47	0.65	0.75
deficit to GDP ratio * (+:surplus)	0.07	0.14	0.11	0.08	0.04	0.09	0.16	0.10	0.07	0.06
debt to GDP ratio *	-0.49	-1.36	-1.94	-2.08	-2.01	-0.63	-1.55	-1.98	-2.11	-2.14
<i>Household sector</i>										
total available means	0.74	0.74	0.83	0.78	0.76	0.78	0.74	0.79	0.79	0.77
real disposable income	0.12	0.41	0.82	1.01	1.06	0.16	0.45	0.80	0.98	1.06
savings as % of disposable income *	-0.11	-0.17	-0.05	0.05	0.10	-0.12	-0.16	-0.05	0.04	0.09
<i>Spill-over effects</i>										
effective foreign output	0.41	1.08	1.07	1.02	0.97	0.45	1.13	1.07	1.02	0.99
effective foreign price level	0.01	0.00	0.00	0.03	0.05	0.00	0.01	0.04	0.05	0.07
effective foreign interest rate *	0.06	0.11	0.01	0.06	0.00	-0.08	0.09	0.10	0.00	-0.05
<i>Memo items</i>										
current account to GDP ratio * (+:surplus)	0.01	0.04	0.02	0.02	-0.00	0.02	0.04	0.01	0.01	-0.01
total stock of real assets	0.03	0.09	0.20	0.29	0.37	0.04	0.11	0.20	0.30	0.38

a. Variables without *: deviation from baseline, in percent. Variables with *: deviation from baseline, in differences.

Table B.6 - A productivity shock in the us: macro-economic spill-over effects on the rest of the world^a

	Flexible exchange rate regime					Fixed exchange rate regime				
	1	2	3	4	5	1	2	3	4	5
1. Output	0.07	1.06	1.07	1.05	1.03	0.09	1.08	1.07	1.05	1.04
2. Short-term interest rate	0.10	0.12	-0.02	0.07	0.02	-0.09	0.09	0.10	0.00	-0.05
3. Total exports	0.98	1.71	1.80	1.64	1.44	1.11	1.88	1.82	1.64	1.50
4. Total imports	0.71	2.68	2.78	2.48	2.14	0.87	2.89	2.85	2.50	2.19
5. Price of exports (in euro)	-0.10	-0.15	-0.07	0.02	0.10	0.00	0.03	0.07	0.11	0.15
6. Price of imports (in euro)	-0.09	-0.38	-0.34	-0.22	-0.14	0.04	-0.16	-0.18	-0.12	-0.06
7. Eff. foreign output	0.54	0.99	1.08	1.03	0.95	0.61	1.07	1.09	1.03	0.99
8. Eff. nominal exchange rate (+=depr)	0.01	0.17	0.13	0.02	0.05	-0.00	0.00	-0.00	-0.01	-0.00
9. Bilateral exchange rate (local/eur)	0.26	0.35	0.10	0.02	-0.00	0.00	0.00	0.00	0.00	0.00

a. Variables without *: deviation from baseline, in percent. Variables with *: deviation from baseline, in differences.

Table B.7 - A stock market shock in the us: macro-economic spill-over effects on the non-euro EU country block^a

	Flexible exchange rate regime					Fixed exchange rate regime				
	1	2	3	4	5	1	2	3	4	5
<i>Demand/supply (in constant prices)</i>										
private consumption	-0.01	-0.03	-0.03	-0.02	-0.02	0.04	0.20	0.36	0.43	0.42
public consumption	-0.00	-0.00	-0.00	-0.01	-0.02	0.00	0.02	0.04	0.07	0.09
gross fixed capital formation	-0.02	-0.04	-0.08	-0.13	-0.16	0.19	0.34	0.31	0.26	0.19
o/w enterprise sector	-0.02	-0.04	-0.07	-0.11	-0.14	0.16	0.28	0.26	0.22	0.18
residential buildings	0.00	-0.03	-0.11	-0.20	-0.26	0.46	0.73	0.57	0.35	0.15
public sector	-0.09	-0.15	-0.14	-0.13	-0.13	0.04	0.23	0.39	0.40	0.34
exports	-0.15	-0.20	-0.17	-0.17	-0.16	-0.08	-0.02	0.05	0.03	0.00
imports	-0.04	-0.06	-0.04	-0.04	-0.04	0.02	0.13	0.22	0.25	0.23
gross domestic product	-0.05	-0.09	-0.09	-0.09	-0.09	0.02	0.13	0.23	0.24	0.22
total private supply for final demand	-0.05	-0.08	-0.08	-0.07	-0.07	0.02	0.14	0.24	0.25	0.23
<i>Prices</i>										
GDP deflator	-0.04	-0.14	-0.25	-0.34	-0.42	0.01	0.02	0.06	0.12	0.18
consumption price	-0.01	-0.05	-0.10	-0.14	-0.17	0.00	0.01	0.06	0.15	0.24
export price (in local currency)	-0.15	-0.43	-0.68	-0.87	-1.03	0.00	0.00	0.01	0.03	0.04
import price (in local currency)	-0.06	-0.18	-0.29	-0.38	-0.44	0.01	0.02	0.04	0.10	0.16
<i>Labour market</i>										
total employment	-0.02	-0.04	-0.05	-0.05	-0.05	0.01	0.04	0.08	0.09	0.08
private sector employment	-0.02	-0.05	-0.06	-0.06	-0.05	0.01	0.05	0.10	0.11	0.09
unemployment rate *	0.01	0.03	0.04	0.04	0.03	-0.01	-0.03	-0.06	-0.06	-0.05
nominal wage (private sector)	-0.03	-0.12	-0.22	-0.30	-0.38	0.01	0.04	0.09	0.16	0.23
take home real wage	-0.02	-0.07	-0.11	-0.16	-0.21	0.01	0.02	0.02	0.01	-0.00
producer real wage	0.01	0.03	0.05	0.04	0.04	-0.00	0.01	0.03	0.05	0.06
contemporaneous productivity	-0.03	-0.03	-0.01	-0.01	-0.02	0.02	0.09	0.14	0.14	0.14
<i>Financial sector</i>										
short-term interest rate *	-0.04	-0.10	-0.11	-0.09	-0.08	-0.29	-0.47	-0.39	-0.30	-0.27
long-term interest rate *	-0.01	-0.03	-0.03	-0.02	-0.02	-0.07	-0.12	-0.10	-0.08	-0.07
effective nominal exchange rate (-:appr.)	-0.16	-0.44	-0.65	-0.80	-0.92	0.00	0.00	-0.00	0.00	-0.00
effective real exchange rate (-:appr.)	-0.03	-0.06	-0.07	-0.07	-0.06	0.00	-0.00	0.00	0.00	0.00
bilateral exchange rate (local/eur) (-:appr.)	0.03	0.07	0.08	0.05	-0.00	0.00	0.00	0.00	0.00	0.00
nominal money stock	0.06	0.18	0.25	0.24	0.19	0.72	1.64	2.07	2.20	2.21
<i>Public finance</i>										
nominal public revenues	-0.06	-0.17	-0.27	-0.35	-0.42	0.02	0.10	0.20	0.29	0.35
real public revenues	-0.02	-0.03	-0.03	-0.02	-0.01	0.01	0.08	0.15	0.17	0.17
nominal public expenditures	-0.01	-0.07	-0.14	-0.20	-0.26	-0.00	-0.03	-0.01	0.08	0.18
real public expenditures	0.03	0.07	0.11	0.14	0.16	-0.01	-0.05	-0.07	-0.04	0.00
deficit to GDP ratio * (+:surplus)	-0.02	-0.04	-0.05	-0.05	-0.05	0.01	0.05	0.07	0.07	0.06
debt to GDP ratio *	0.05	0.12	0.19	0.25	0.30	-0.02	-0.11	-0.21	-0.29	-0.35
<i>Household sector</i>										
total available means	0.01	0.04	0.03	0.02	0.01	0.14	0.22	0.17	0.12	0.07
real disposable income	-0.01	-0.06	-0.10	-0.14	-0.17	0.01	0.03	0.05	0.05	0.03
savings as % of disposable income *	-0.00	-0.03	-0.07	-0.12	-0.15	-0.03	-0.16	-0.30	-0.36	-0.37
<i>Spill-over effects</i>										
effective foreign output	-0.11	-0.14	-0.11	-0.10	-0.10	-0.06	-0.02	0.03	0.02	-0.00
effective foreign price level	-0.01	-0.05	-0.10	-0.14	-0.17	0.00	0.00	0.01	0.03	0.04
effective foreign interest rate *	-0.11	-0.22	-0.22	-0.20	-0.19	-0.30	-0.49	-0.41	-0.34	-0.31
<i>Memo items</i>										
current account to GDP ratio * (+:surplus)	-0.06	-0.13	-0.17	-0.21	-0.24	-0.03	-0.05	-0.06	-0.09	-0.12
total stock of real assets	0.00	0.01	0.01	0.02	0.02	0.01	0.02	0.04	0.05	0.06

a. Variables without *: deviation from baseline, in percent. Variables with *: deviation from baseline, in differences.

Table B.8 - A stock market shock in the us: macro-economic spill-over effects on Japan^a

	Flexible exchange rate regime					Fixed exchange rate regime				
	1	2	3	4	5	1	2	3	4	5
<i>Demand/supply (in constant prices)</i>										
private consumption	-0.00	-0.01	-0.02	-0.02	-0.01	0.05	0.06	0.06	0.06	0.06
public consumption	-0.00	-0.01	-0.01	-0.02	-0.02	0.00	0.01	0.02	0.02	0.01
gross fixed capital formation	-0.02	-0.05	-0.08	-0.09	-0.09	0.09	0.18	0.17	0.11	0.07
o/w enterprise sector	-0.01	-0.02	-0.04	-0.06	-0.07	0.05	0.15	0.18	0.15	0.12
residential buildings	-0.05	-0.12	-0.18	-0.17	-0.11	0.36	0.52	0.28	0.06	-0.06
public sector	-0.05	-0.10	-0.13	-0.14	-0.11	0.03	0.06	0.07	0.05	0.03
exports	-0.31	-0.50	-0.54	-0.54	-0.47	-0.24	-0.25	-0.16	-0.16	-0.15
imports	-0.02	0.01	0.07	0.09	0.07	0.01	0.03	0.04	0.04	0.04
gross domestic product	-0.04	-0.09	-0.11	-0.12	-0.10	0.03	0.05	0.06	0.04	0.03
total private supply for final demand	-0.04	-0.08	-0.10	-0.10	-0.09	0.03	0.05	0.06	0.04	0.03
<i>Prices</i>										
GDP deflator	-0.01	-0.05	-0.11	-0.17	-0.23	0.01	0.03	0.05	0.08	0.10
consumption price	-0.00	-0.03	-0.07	-0.12	-0.17	0.00	0.01	0.04	0.07	0.09
export price (in local currency)	-0.12	-0.36	-0.57	-0.69	-0.76	0.00	-0.01	-0.02	-0.03	-0.05
import price (in local currency)	-0.12	-0.32	-0.40	-0.34	-0.26	0.00	0.01	0.03	0.05	0.07
<i>Labour market</i>										
total employment	-0.01	-0.01	-0.01	-0.01	0.00	0.00	0.01	0.01	0.00	-0.00
private sector employment	-0.01	-0.01	-0.01	-0.01	0.00	0.00	0.01	0.01	0.00	-0.00
unemployment rate *	0.00	0.01	0.01	0.00	-0.00	-0.00	-0.00	-0.00	0.00	0.00
nominal wage (private sector)	-0.02	-0.09	-0.16	-0.23	-0.28	0.01	0.04	0.08	0.11	0.13
take home real wage	-0.02	-0.05	-0.08	-0.10	-0.11	0.01	0.03	0.04	0.04	0.03
producer real wage	-0.01	-0.01	-0.02	-0.04	-0.05	0.00	0.02	0.03	0.03	0.03
contemporaneous productivity	-0.04	-0.07	-0.09	-0.10	-0.09	0.02	0.05	0.05	0.04	0.03
<i>Financial sector</i>										
short-term interest rate *	-0.03	-0.08	-0.12	-0.13	-0.12	-0.25	-0.43	-0.36	-0.28	-0.25
long-term interest rate *	-0.01	-0.02	-0.03	-0.03	-0.03	-0.07	-0.12	-0.10	-0.08	-0.07
effective nominal exchange rate (-:appr.)	-0.32	-0.77	-0.92	-0.85	-0.78	0.00	0.00	-0.00	0.00	-0.00
effective real exchange rate (-:appr.)	-0.20	-0.45	-0.45	-0.32	-0.21	0.00	-0.01	-0.03	-0.03	-0.03
bilateral exchange rate (local/eur) (-:appr.)	-0.05	-0.09	0.02	0.20	0.34	0.00	0.00	0.00	0.00	0.00
nominal money stock	0.09	0.23	0.24	0.19	0.14	1.39	1.93	1.50	1.20	1.13
<i>Public finance</i>										
nominal public revenues	-0.04	-0.11	-0.19	-0.25	-0.29	0.02	0.06	0.09	0.12	0.13
real public revenues	-0.03	-0.06	-0.08	-0.08	-0.06	0.02	0.03	0.04	0.04	0.03
nominal public expenditures	-0.01	-0.05	-0.12	-0.18	-0.24	0.00	0.01	0.03	0.06	0.09
real public expenditures	0.00	-0.00	-0.01	-0.01	-0.01	-0.01	-0.02	-0.03	-0.02	-0.01
deficit to GDP ratio * (+:surplus)	-0.01	-0.02	-0.02	-0.02	-0.02	0.01	0.02	0.02	0.02	0.01
debt to GDP ratio *	0.07	0.19	0.32	0.41	0.47	-0.05	-0.12	-0.18	-0.21	-0.23
<i>Household sector</i>										
total available means	0.00	0.01	0.01	0.02	0.03	0.04	0.05	0.03	0.01	0.00
real disposable income	-0.01	-0.05	-0.08	-0.09	-0.09	0.01	0.02	0.00	-0.02	-0.03
savings as % of disposable income *	-0.01	-0.03	-0.05	-0.06	-0.07	-0.03	-0.04	-0.05	-0.06	-0.07
<i>Spill-over effects</i>										
effective foreign output	-0.26	-0.32	-0.24	-0.22	-0.20	-0.24	-0.25	-0.15	-0.14	-0.13
effective foreign price level	0.00	-0.04	-0.11	-0.15	-0.20	0.01	-0.02	-0.05	-0.06	-0.08
effective foreign interest rate *	-0.17	-0.33	-0.31	-0.27	-0.26	-0.30	-0.50	-0.43	-0.36	-0.33
<i>Memo items</i>										
current account to GDP ratio * (+:surplus)	-0.04	-0.10	-0.16	-0.21	-0.22	-0.03	-0.08	-0.13	-0.16	-0.16
total stock of real assets	-0.00	-0.00	-0.00	-0.00	-0.00	0.01	0.02	0.03	0.04	0.04

a. Variables without *: deviation from baseline, in percent. Variables with *: deviation from baseline, in differences.

Table B.9 - A stock market shock in the us: macro-economic spill-over effects on the rest of the world^a

	Flexible exchange rate regime					Fixed exchange rate regime				
	1	2	3	4	5	1	2	3	4	5
1. Output	-0.06	-0.07	-0.05	-0.05	-0.04	-0.04	-0.04	-0.01	-0.01	-0.01
2. Short-term interest rate	-0.13	-0.26	-0.26	-0.23	-0.22	-0.30	-0.49	-0.42	-0.34	-0.31
3. Total exports	-0.48	-0.59	-0.44	-0.40	-0.36	-0.38	-0.33	-0.12	-0.11	-0.12
4. Total imports	-0.23	-0.33	-0.33	-0.38	-0.40	-0.09	0.08	0.24	0.19	0.10
5. Price of exports (in euro)	-0.05	-0.21	-0.40	-0.57	-0.70	0.00	-0.00	-0.01	-0.02	-0.02
6. Price of imports (in euro)	-0.21	-0.51	-0.75	-0.95	-1.11	-0.09	-0.12	-0.08	-0.03	0.01
7. Eff. foreign output	-0.27	-0.34	-0.26	-0.24	-0.22	-0.21	-0.19	-0.08	-0.08	-0.09
8. Eff. nominal exchange rate (+=depr)	0.20	0.60	0.93	1.13	1.25	-0.00	-0.00	0.00	-0.00	-0.00
9. Bilateral exchange rate (local/eur)	0.33	0.91	1.33	1.57	1.71	0.00	0.00	0.00	0.00	0.00

a. Variables without *: deviation from baseline, in percent. Variables with *: deviation from baseline, in differences.

Table B.10 - A monetary shock in the us: macro-economic spill-over effects on the non-euro EU country block^a

	Flexible exchange rate regime					Fixed exchange rate regime				
	1	2	3	4	5	1	2	3	4	5
<i>Demand/supply (in constant prices)</i>										
private consumption	0.04	0.02	0.03	0.01	-0.00	-0.22	-0.50	-0.26	-0.15	-0.07
public consumption	-0.01	-0.01	0.01	0.02	0.03	-0.04	-0.08	-0.09	-0.08	-0.06
gross fixed capital formation	0.04	0.11	0.10	0.08	0.06	-1.06	-0.15	-0.24	-0.13	-0.06
o/w enterprise sector	0.04	0.10	0.09	0.08	0.07	-0.98	-0.17	-0.31	-0.21	-0.15
residential buildings	0.03	0.17	0.15	0.11	0.07	-1.78	0.15	0.14	0.28	0.37
public sector	-0.01	0.09	0.09	0.04	0.01	-0.65	-0.51	-0.20	-0.09	-0.00
exports	-0.11	0.05	0.06	0.03	0.02	-0.41	-0.19	0.03	0.03	0.05
imports	-0.02	0.00	0.02	0.04	0.03	-0.36	-0.31	-0.17	-0.09	-0.03
gross domestic product	-0.00	0.05	0.05	0.03	0.01	-0.38	-0.31	-0.14	-0.08	-0.03
total private supply for final demand	-0.01	0.04	0.05	0.03	0.01	-0.39	-0.32	-0.15	-0.08	-0.02
<i>Prices</i>										
GDP deflator	0.17	0.13	0.13	0.12	0.10	0.00	-0.11	-0.19	-0.22	-0.24
consumption price	0.05	0.03	0.03	0.04	0.04	0.00	-0.14	-0.26	-0.31	-0.34
export price (in local currency)	0.55	0.39	0.34	0.26	0.18	0.01	-0.05	-0.08	-0.09	-0.10
import price (in local currency)	0.23	0.18	0.12	0.09	0.07	0.00	-0.07	-0.16	-0.21	-0.24
<i>Labour market</i>										
total employment	0.01	0.03	0.03	0.01	-0.00	-0.10	-0.14	-0.07	-0.01	0.03
private sector employment	0.01	0.04	0.03	0.01	-0.00	-0.12	-0.17	-0.09	-0.01	0.03
unemployment rate *	-0.01	-0.02	-0.02	-0.01	0.00	0.08	0.10	0.04	-0.00	-0.02
nominal wage (private sector)	0.12	0.12	0.12	0.12	0.11	-0.05	-0.15	-0.24	-0.27	-0.27
take home real wage	0.08	0.09	0.09	0.08	0.07	-0.05	-0.01	0.02	0.04	0.07
producer real wage	-0.06	-0.03	-0.00	0.01	0.02	-0.05	-0.05	-0.05	-0.05	-0.04
contemporaneous productivity	-0.02	0.00	0.01	0.01	0.02	-0.28	-0.15	-0.06	-0.07	-0.05
<i>Financial sector</i>										
short-term interest rate *	0.07	-0.01	0.02	0.02	0.01	1.10	-0.21	0.01	0.02	0.01
long-term interest rate *	0.02	-0.00	0.00	0.01	0.00	0.28	-0.05	0.00	0.00	0.00
effective nominal exchange rate (-:appr.)	0.59	0.37	0.30	0.21	0.14	0.00	-0.00	-0.00	-0.00	-0.00
effective real exchange rate (-:appr.)	0.09	0.02	-0.00	-0.01	-0.02	0.00	-0.01	-0.01	-0.01	-0.00
bilateral exchange rate (local/eur) (-:appr.)	-0.12	-0.02	0.01	0.01	-0.00	0.00	0.00	0.00	0.00	0.00
nominal money stock	-0.10	-0.04	-0.04	-0.04	-0.04	-2.64	-1.54	-1.21	-0.96	-0.75
<i>Public finance</i>										
nominal public revenues	0.15	0.15	0.14	0.13	0.11	-0.22	-0.32	-0.32	-0.30	-0.28
real public revenues	-0.02	0.01	0.02	0.01	0.01	-0.22	-0.21	-0.12	-0.08	-0.04
nominal public expenditures	0.09	0.06	0.06	0.07	0.08	0.08	-0.02	-0.23	-0.30	-0.34
real public expenditures	-0.09	-0.08	-0.07	-0.04	-0.02	0.08	0.09	-0.04	-0.07	-0.11
deficit to GDP ratio * (+:surplus)	0.03	0.03	0.03	0.02	0.01	-0.10	-0.11	-0.03	-0.00	0.03
debt to GDP ratio *	-0.09	-0.12	-0.15	-0.15	-0.15	0.24	0.35	0.34	0.31	0.26
<i>Household sector</i>										
total available means	-0.03	0.01	0.01	0.00	0.00	-0.50	0.08	0.03	0.06	0.08
real disposable income	0.05	0.07	0.08	0.08	0.06	-0.06	-0.10	-0.02	0.02	0.06
savings as % of disposable income *	0.02	0.05	0.05	0.06	0.06	0.15	0.38	0.24	0.17	0.12
<i>Spill-over effects</i>										
effective foreign output	-0.09	0.01	0.03	0.01	0.01	-0.31	-0.14	0.01	0.01	0.03
effective foreign price level	0.05	0.04	0.03	0.03	0.02	0.01	-0.05	-0.10	-0.10	-0.10
effective foreign interest rate *	0.30	-0.03	0.03	0.02	0.01	1.11	-0.21	0.01	0.02	0.01
<i>Memo items</i>										
current account to GDP ratio * (+:surplus)	0.07	0.08	0.08	0.05	0.04	-0.02	0.03	0.08	0.08	0.07
total stock of real assets	-0.01	-0.01	-0.00	-0.00	-0.00	-0.05	-0.05	-0.06	-0.06	-0.06

a. Variables without *: deviation from baseline, in percent. Variables with *: deviation from baseline, in differences.

Table B.11 - A monetary shock in the us: macro-economic spill-over effects on Japan^a

	Flexible exchange rate regime					Fixed exchange rate regime				
	1	2	3	4	5	1	2	3	4	5
<i>Demand/supply (in constant prices)</i>										
private consumption	0.01	0.03	0.02	0.01	-0.00	-0.26	-0.01	0.01	0.02	0.03
public consumption	-0.01	-0.01	0.01	0.02	0.01	-0.05	-0.06	-0.02	-0.00	0.01
gross fixed capital formation	0.02	0.09	0.06	0.02	0.01	-0.52	-0.20	0.02	0.01	0.02
o/w enterprise sector	0.01	0.04	0.04	0.03	0.03	-0.29	-0.40	-0.09	-0.10	-0.09
residential buildings	0.08	0.24	0.13	0.03	-0.01	-1.73	0.44	0.48	0.47	0.45
public sector	0.01	0.11	0.07	0.01	-0.02	-0.39	-0.08	0.04	0.04	0.05
exports	-0.05	0.29	0.16	-0.01	-0.06	-0.36	-0.12	0.01	-0.02	-0.00
imports	-0.00	-0.15	-0.12	-0.02	0.06	-0.15	-0.04	-0.04	-0.06	-0.04
gross domestic product	0.00	0.09	0.06	0.01	-0.01	-0.33	-0.07	0.02	0.02	0.03
total private supply for final demand	0.01	0.08	0.05	0.01	-0.01	-0.34	-0.07	0.02	0.02	0.03
<i>Prices</i>										
GDP deflator	0.04	0.06	0.09	0.10	0.09	-0.03	-0.13	-0.18	-0.18	-0.18
consumption price	0.02	0.01	0.04	0.06	0.07	-0.00	-0.17	-0.21	-0.21	-0.20
export price (in local currency)	0.51	0.43	0.32	0.23	0.16	0.00	-0.02	-0.04	-0.05	-0.06
import price (in local currency)	0.54	0.29	0.01	-0.13	-0.13	-0.01	-0.05	-0.10	-0.14	-0.16
<i>Labour market</i>										
total employment	0.01	0.02	0.01	-0.01	-0.01	-0.05	0.00	0.03	0.02	0.01
private sector employment	0.01	0.02	0.01	-0.01	-0.01	-0.05	0.00	0.03	0.02	0.01
unemployment rate *	-0.00	-0.01	-0.00	0.00	0.01	0.02	-0.00	-0.01	-0.01	-0.01
nominal wage (private sector)	0.05	0.08	0.11	0.11	0.10	-0.14	-0.22	-0.22	-0.20	-0.18
take home real wage	0.03	0.07	0.07	0.05	0.03	-0.14	-0.05	-0.01	0.01	0.03
producer real wage	-0.04	-0.00	0.03	0.03	0.02	-0.10	-0.10	-0.05	-0.02	-0.00
contemporaneous productivity	0.00	0.06	0.04	0.02	0.00	-0.29	-0.07	-0.01	-0.00	0.02
<i>Financial sector</i>										
short-term interest rate *	0.03	0.03	0.07	0.04	0.01	1.05	-0.20	0.01	0.02	0.01
long-term interest rate *	0.01	0.01	0.02	0.01	0.00	0.28	-0.05	0.00	0.00	0.00
effective nominal exchange rate (-:appr.)	1.38	0.52	0.17	0.03	0.01	0.00	-0.00	-0.00	-0.00	-0.00
effective real exchange rate (-:appr.)	0.85	0.08	-0.16	-0.20	-0.16	0.00	-0.03	-0.04	-0.03	-0.02
bilateral exchange rate (local/eur) (-:appr.)	0.07	0.05	-0.17	-0.21	-0.15	0.00	0.00	0.00	0.00	0.00
nominal money stock	-0.12	-0.05	-0.15	-0.05	0.03	-5.24	0.30	-0.41	-0.38	-0.31
<i>Public finance</i>										
nominal public revenues	0.06	0.12	0.12	0.10	0.08	-0.24	-0.22	-0.19	-0.18	-0.16
real public revenues	0.02	0.05	0.03	0.00	-0.01	-0.21	-0.09	-0.01	0.00	0.02
nominal public expenditures	0.04	0.04	0.08	0.10	0.09	-0.00	-0.17	-0.24	-0.20	-0.18
real public expenditures	-0.01	-0.02	-0.00	-0.00	-0.01	0.03	-0.03	-0.06	-0.02	-0.00
deficit to GDP ratio * (+:surplus)	0.01	0.02	0.01	0.00	0.00	-0.07	-0.02	0.01	0.01	0.01
debt to GDP ratio *	-0.07	-0.22	-0.22	-0.16	-0.12	0.52	0.32	0.24	0.23	0.20
<i>Household sector</i>										
total available means	0.00	0.01	-0.01	-0.01	-0.01	-0.16	0.06	0.05	0.05	0.04
real disposable income	0.02	0.06	0.06	0.04	0.03	-0.12	-0.02	0.05	0.06	0.08
savings as % of disposable income *	0.01	0.03	0.03	0.03	0.03	0.11	-0.01	0.03	0.03	0.04
<i>Spill-over effects</i>										
effective foreign output	-0.26	-0.03	0.04	0.01	0.02	-0.36	-0.11	0.03	0.01	0.02
effective foreign price level	-0.02	-0.01	-0.01	-0.01	-0.01	0.01	-0.05	-0.08	-0.08	-0.08
effective foreign interest rate *	0.52	-0.06	0.03	0.01	0.01	1.07	-0.21	0.01	0.02	0.01
<i>Memo items</i>										
current account to GDP ratio * (+:surplus)	0.01	0.14	0.10	0.06	0.03	-0.01	0.15	0.06	0.04	0.03
total stock of real assets	-0.00	0.00	0.00	0.00	0.00	-0.03	-0.04	-0.03	-0.03	-0.03

a. Variables without *: deviation from baseline, in percent. Variables with *: deviation from baseline, in differences.

Table B.12 - A monetary shock in the us: macro-economic spill-over effects on the rest of the world^a

	Flexible exchange rate regime					Fixed exchange rate regime				
	1	2	3	4	5	1	2	3	4	5
1. Output	-0.05	0.01	0.02	0.01	0.01	-0.11	-0.03	0.01	0.01	0.01
2. Short-term interest rate	0.36	-0.04	0.03	0.02	0.01	1.11	-0.21	0.01	0.02	0.01
3. Total exports	-0.44	0.06	0.15	0.06	0.05	-0.89	-0.29	0.09	0.05	0.09
4. Total imports	-0.26	0.13	0.39	0.29	0.14	-0.79	-0.32	0.15	0.17	0.17
5. Price of exports (in euro)	0.39	0.41	0.31	0.22	0.15	0.00	-0.04	-0.10	-0.14	-0.16
6. Price of imports (in euro)	0.50	0.56	0.37	0.31	0.30	-0.01	-0.01	-0.06	-0.07	-0.06
7. Eff. foreign output	-0.24	-0.01	0.05	0.02	0.02	-0.49	-0.19	0.02	0.01	0.03
8. Eff. nominal exchange rate (+=depr)	-0.08	-0.58	-0.39	-0.26	-0.18	-0.00	0.00	0.00	0.00	0.00
9. Bilateral exchange rate (local/eur)	-1.00	-0.74	-0.53	-0.37	-0.26	0.00	0.00	0.00	0.00	0.00

a. Variables without *: deviation from baseline, in percent. Variables with *: deviation from baseline, in differences.



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