Mika Kortelainen

Adjustment of the US current account deficit

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The views expressed are those of the author and do not necessarily reflect the views of the Bank of Finland.

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Abstract

We present a two country DGE model and estimate it using Bayesian techniques and euro area and US quarterly data for 1977–2004. In analysing the current accounts we find that a lower US rate of time preference or a higher dollar risk premium could render the deficit sustainable, but that these could push the interest rate to the zero bound. Secondly, we find that fiscal policy is not sufficiently effective to improve the current account although the zero bound is not hit.

Key words: current account, zero bound, policy coordination

JEL classification numbers: E61, F32

Yhdysvaltojen vaihtotaseen vajeiden sopeutuminen

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Mika Kortelainen
Rahapolitiikka- ja tutkimusosasto

Tiivistelmä

Tässä tutkimuksessa esitellään kahden maan DGE-malli ja estimoidaan se käyttäen Bayesin menetelmiä euroalueen ja Yhdysvaltojen neljännesvuosiaineistolla vuosilta 1977–2004. Vaihtotaseanalyysissä havaitaan, että aikapreferenssinasteen lasku Yhdysvalloissa tai dollarin riskipreemion kasvu voivat palauttaa Yhdysvaltojen vaihtotaseen vajeet kestävälle tasolle, mutta samalla korko saattaa laskea nollakorkorajalle. Lisäksi havaitaan, että finanssipolitiikka ei kykene riittävän tehokkaasti vähentämään vaihtotaseen vajeita, vaikka korot eivät laske nollakorkorajalle.

Avainsanat: vaihtotase, nollakorkoraja, koordinoitu politiikka

JEL-luokittelu: E61, F32

Contents

1 Introduction

One of the main topics of concern in recent debate over economic policy has been the growing current account deficit in the United States. In practice, this means the United States is moving deeper and deeper into debt to the rest of the world. On the other hand, the rest of the world has been willing to finance the US deficit and invest in US dollar-denominated financial assets instead of, for example, investing in their own domestic markets.

The US current account deficit has grown in recent years and currently stands at 6.6% of GDP (see Bureau of Economic Analysis 2006). The deficit stems largely from the trade account, which has been substantially in the red. The current account deficit has raised US net foreign debt to more than 20% of GDP. This amounts to around 200% of the value of the country's exports in goods and services. On the other hand, the US debt burden is lessened by the fact that outward investment from the United States to the rest of the world yields a higher return on average than inward investment in the US market. Thus, the US investment income balance (interest and dividends paid) has only recently moved into deficit. If the United States continues to accumulate foreign debt, however, the interest payments on debt will start contributing to a further deepening of the current account deficit.

Has the US current account deficit grown too large? Since the current account deficit is also the difference between domestic savings and investment, this question can be rephrased: Can the United States' present consumption and investment demand be sustained at current levels of debt and capital? We may further ask what would happen if investors in the rest of the world were no longer willing to finance the US deficit. What consequences would this have for exchange rates and for the US and other economies around the world?

In the recent literature, the US current account deficit has been analysed eg by Obstfeld and Rogoff (2004), Faruqee et al (2005), and Erceg et al (2005a). In Obstfeld and Rogoff (2004) a stylised general equilibrium model is used to analyse the effects of an immediate adjustment of the current account deficit. This analysis assumes that the whole deficit is unsustainable and thus the adjustment is associated with large changes in real exchange rate and terms of trade. Moreover, the model does not incorporate any dynamic optimisation decisions and is thus more suitable for long-run analysis.

Erceg et al (2005a) use an open economy DGE model to analyse the quantitative effects of fiscal shocks on the US trade balance. They find that changes in fiscal policy have small effects on the US trade balance, irrespective of whether the source is a spending increase or a tax cut. They find also that an increase in the fiscal deficit of one percentage point of GDP causes the trade balance to deteriorate by less than 0.2 percentage point. All in all, their results suggest that a large reduction in the US government deficit would not play a major role in correcting the current account imbalance.

Faruqee et al (2005) use the IMF's Global Economy Model to conduct some interesting simulations. In their baseline scenario, the US deficit returns to a sustainable level as the shocks that hit the US and world economies fade away. This baseline adjustment is seen as a relatively smooth process even though the real interest rate increases considerably in the United States. In an alternative scenario, a sudden portfolio reshuffling in the rest of the world results in higher US real interest rates, and a weaker dollar, with harmful effects on US and possibly global growth. They run a US fiscal consolidation scenario where the government debt-to-GDP ratio is reduced by 60%-points in the long-run by increasing taxes by 3 per cent of GDP over 15 years. Their results suggest that extensive and credible fiscal consolidation could have large and durable benefits by reducing the current account imbalance. In addition, they find that the more flexible exchange rates in emerging Asian countries could help to amplify the effects of US fiscal consolidation on the US current account deficit. Furthermore, they find that more competition-friendly policies in Japan and the euro area could improve the US current account balance by 0.2–1.0%-point.

In this paper, we examine what factors could trigger the adjustment and what kinds of paths of adjustment these imply using an extended version of the Euro area Dynamic General Equilibrium (EDGE) model developed at the Bank of Finland. EDGE model is a New Keynesian DGE model in which both households and firms make optimising decisions. This model is appended with new open economy features and is currently a two country model. As wealth accumulation is always taken into account in the model, we consider this type of model to be an ideal tool to analyse adjustment of the US current account deficit.

In matching the model to data, we apply calibration techniques to fix a number of the parameters in the model. We proceed with Bayesian estimation of the shock processes and their persistence as well as the coefficients of policy rules and adjustment cost parameters. Bayesian estimation has been recently applied in the one country case by Smets and Wouters (2003), Juillard et al (2004) and Adolfson et al (2005) and in the two country case by de Walque et al (2005) and Rabanal and Tueste (2005). After estimation of parameters, we compare the moments of the model to the data. In general, it is difficult to fit the model to data. We nevertheless get a reasonable fit, at least for the standard deviations of most of the variables. However, the model seems to have trouble producing some of the cross correlations in data.

In the following analysis, we utilise the estimated two country EDGE model[1] to study the dynamic adjustment of the US current account deficit. We assume

[1] The simulation properties of the model (in single country, small open economy version) are reported in Tarkka and Kortelainen (2001) and Kortelainen (2002).

that half of the prevailing current account deficit is unsustainable and ask what factors could generate the necessary adjustment of the US current account to this sustainable level.[2] Here, we focus on four different mechanisms: increased savings by US households, a bigger dollar risk premium for international investors, an uncoordinated fiscal policy tightening in the United States, and a coordinated fiscal policy tightening in the United States and simultaneous fiscal policy loosening in the rest of the world.

We find that if the adjustment happens through increased savings by US households, adjustment of deficit is quite abrupt. In the medium run, US consumption decreases considerably. On the other hand, US investment and exports increase, which boosts US output. Inflation decreases considerably, and the zero bound of nominal interest rate could become a binding constraint. In the rest of the world, both investment and consumption increase. The shock is calibrated to halve the US current account deficit, and the real effective dollar exchange rate weakens by over 20% in the first three years.

If the financial markets trigger the adjustment by increasing the dollar risk premium, this adjustment is less painful for US consumers. However, in this scenario the rest of the world inflation decreases substantially, and the zero bound of nominal interest rate could become a binding constraint for the rest of the world.

As a third alternative, we assume that US fiscal policy is tightened in an uncoordinated fashion. This reduces the US current account deficit but is clearly not sufficient to induce the needed adjustment. As a fourth alternative, we assume that both the US and the rest of the world use their fiscal policies in a coordinated way. In the United States fiscal policy is tightened while in the rest of the world it is loosened. This is not strong enough to halve the prevailing US current account deficits. However, neither uncoordinated nor coordinated fiscal policy will push the nominal interest rates close to zero bound, and the effects on private consumption are at least in the coordinated case relatively moderate. Finally, the changes in the US and rest of the world private consumption are smaller in the coordinated case than in the uncoordinated US fiscal policy case.

In reality, the world economy includes economic regions other than the United States and the euro area and therefore the calculations based on the estimated model are merely indicative. One source of imprecision is that the weight given to the US economy in the model is greater than its actual weight in the world economy. The calculations based on these estimation results nevertheless illustrate the effects of US economic adjustment on the rest of the world economy.

[2] In various studies, the sustainable level of US current account deficit is estimated to be between zero and four per cent of GDP (see Obstfeld and Rogoff 2004, Holman 2001 and Faruqee el al 2005).

All in all, the analysis suggests that perhaps several different shocks impacting through several different channels would be needed in order to bring about the needed current account adjustment. Moreover, these shocks would have to be much bigger and more persistent than those found in the data. In addition, the need for the adjustment lies not solely with the United States but also with the rest of the world.

The rest of this paper is organised as follows. In section 2 we explain the workings of the dynamic general equilibrium model used in the analysis. In the next section, we estimate the model, and in section 4 we analyse the adjustment of the US current account deficit. In the final section, we draw some conclusions.

2 Model

2.1 Households

Households are treated according to Blanchard's stochastic lifetime model with endogenous labour supply. Consumption is derived from the household maximisation problem with no liquidity constraints, habit persistence or other forms of myopic behaviour. The instantaneous utility function is additively separable in consumption and leisure

$$\max E_t \sum_{k=0}^{\infty} \left(\frac{1-p}{1+\theta_t} \right) \left[\log c_{s,t} + \nu \log\left(1+n_{s,t}\right) \right] \tag{2.1}$$

where E_t, $c_{s,t}$, $n_{s,t}$, ν, θ, and p are respectively the expectations operator conditional on information at time t, the period t consumption of a cohort born at time s, the period t labour supply of a cohort born at time s, the weight of disutility of providing labour supply, the rate of time preference, and the constant probability of dying. The stochastic variation in the rate of time preference is assumed to follow an AR(1) process as in Levin et al (2005). The periodic budget constraint is $\overline{w}_{s,t} = \frac{1+z_{t-1}}{1-p}\overline{w}_{s,t-1} + y_{s,t} - c_{s,t}$, where $\overline{w}_{s,t}$, $y_{s,t}$, and z_{t-1} are the period t wealth and labour income of an agent born at time s, and the expected return on wealth.

The optimal consumption plan is obtained by maximising above subject to the lifetime budget constraint. This yields the first-order conditions, which are then substituted back into the lifetime budget constraint to yield the consumption function for each household. Aggregating as in Black et al (1994), enables us to write the aggregate consumption function as

$$C_t = \left[\frac{1}{1-p} - \Lambda\right]^{-1} \frac{E_t C_{t+1}}{E_t(1+z_t)} + \left[\frac{1}{1-p} - \Lambda\right]^{-1} \Lambda \left[\frac{1}{1-p} - 1\right] \{(1+z_{t-1})\Psi_{t-1} + YD_t\} \quad (2.2)$$

where $\Lambda = 1-(1-p)/(1+\theta)$ is the marginal propensity to consume. C_t, Ψ_t, $YD_t = z_{t-1}\Psi_{t-1} + Y_t$, and Y_t are respectively aggregate consumption, aggregate wealth, private disposable income, and output. We define aggregate wealth as the accumulated net present value of capital income

$$\begin{aligned} P_t^C \Psi_t = & \frac{E_t\left(P_{t+1}^C \Psi_{t+1} - NFA_{t+1} - G_{t+1}\right)}{(1+R_t/400)(1+\chi)} \\ & + \left[(1-\tau_t^Y)P_t Y_t - W_t L_t - \delta P_t^I K_{t-1}\right] + NFA_t + G_t \end{aligned} \quad (2.3)$$

where P_t^C, τ_t^Y, P_t, W_t, L_t, NFA_t, G_t, R_t, δ, P_t^I, K_t, and χ are consumption deflator, indirect tax rate, output deflator, nominal wage rate, labour, net foreign assets, government debt, nominal interest rate, depreciation rate, investment deflator, capital stock and the equity premium. We further define private nominal disposable income as

$$\begin{aligned} P_t^C YD_t = & (1-\tau_t^Y)P_t Y_t - \tau_t^W W_t L_t + \frac{R_{t-1}}{400} G_{t-1} \\ & + (\omega_1 U_t + \omega_2)P_t Y_t + NFN_t - b_4 P_t Y_t - \delta P_t^I K_{t-1} \end{aligned} \quad (2.4)$$

where τ_t^W, NFN, and U are direct tax on wages, the net factor income on net foreign assets, and unemployment. ω_1, ω_2, and b_4 are parameters. On the right hand side are we have the value of output after indirect taxes, income taxes, interest income, transfers from government, income from net foreign assets, share of capital income paid to the government, and finally depreciation.

The aggregate labour supply is obtained by aggregating the corresponding first order condition

$$F_t = N_t - \nu \frac{C_t}{(1-\tau_t^W)\frac{W_t}{P_t}} \quad (2.5)$$

where F_t and N_t are the total labour force and total population.

Blanchard's model introduces finite lifetimes for households, which affects the relevant discount rate. The market rate of interest that the government pays on its debt is different from this. The difference results in failure of Ricardian equivalence. It is further assumed that income taxes are distortionary, which creates a tax wedge and affects the labour supply decision. This creates an additional non-Ricardian channel. Blanchard's model also provides a well-defined steady-state for international asset positions.

Households set new nominal wage contracts at stochastic intervals à la Calvo. Those households that can not set new wages are able to adjust their wages to the pace of past inflation, ie dynamic indexation applies. Thus, the firms minimise following loss function

$$\frac{1}{2}\sum_{j=0}^{\infty}\rho^{j}(1-\phi_{w})^{j}E_{t}\left[\left(\frac{W_{t}}{W_{t-1}}\right)^{j}W_{i,t}^{new}-\overline{W}_{t+j}\right]^{2} \tag{2.6}$$

where ρ, ϕ_W, $W_{i,t}^{new}$, W_t, and $\overline{W}_t$ are the discount factor, the Calvo probability of making new contracts, the new nominal wage contract, observed nominal wage rate, and optimal wage. The optimal wage equals the marginal product of labour.

2.2 Firms

There are several types of firms in the economy. In modelling the final goods sector we follow Laxton and Pesenti (2003). Final goods firms combine both domestic value added goods and imported goods with constant-elasticity-of-substitution technology to produce private consumption goods, public consumption goods, investment goods and export goods. An example of the production function for private consumption goods is

$$C_t(x)=\left(\gamma_C^{\frac{1}{\theta_c}}\left[Y_t^h(x)\right]^{1-\frac{1}{\theta_C}}+(1-\gamma_C)^{\frac{1}{\theta_C}}\left[Y_t^f(x)\right]^{1-\frac{1}{\theta_c}}\right)^{\frac{\theta_C}{\theta_C-a}} \tag{2.7}$$

where x is the domestic final goods firm. Intermediate goods are produced by firms h (domestic) and f (foreign). $\gamma_C \in (0,1)$ is the weight of local value added inputs in the production of final consumption. θ_C is the elasticity of substitution between domestic value added goods and imported inputs. The minimum cost of producing one unit of C_t is thus $P_t^C=\left(\gamma_C[P_t]^{1-\theta_C}+(1-\gamma_C)[P_t^M]^{1-\theta_C}\right)^{\frac{1}{1-\theta_C}}$, where P_t and P_t^M are the prices of domestic value added goods and imports. The export and investment price deflators are derived similarly.

The intermediate firms combine labour and capital with Cobb-Douglas technology to produce value added goods

$$Y_t^h = \left(K_t^h\right)^\alpha \left(\eta_{A,t} A_t^h L_t^h\right)^{1-\alpha} \qquad (2.8)$$

where Y_t^h, K_t^h, L_t^h, α, and A_t^h are output, capital stock, labour input, capital share of income, and the labour-augmenting (Harrod-neutral) level of technology in domestic intermediate goods firm h. The stochastic productivity shock, $\eta_{A,t}$, is assumed to follow an AR(1) process common to all intermediate goods firms.

Inventory management firms minimise costs arising from the imbalance between realised production and the normal level of production implied by the Cobb-Douglas production function and the deviations of inventories from some exogenous reserve level

$$\frac{1}{2} E_t \sum_{j=0}^{\infty} \rho^j \left[\phi_{KI} \left(KI_{t+j}^h - \overline{KI}_{t+j}^h \right)^2 + \left(Y_{t+j}^h - \overline{Y}_{t+j}^h \right)^2 \right] \qquad (2.9)$$

where ϕ_{KI}, KI, and $\overline{KI}$ are the adjustment cost parameter, inventories, and the exogenous reserve level.

The factor demands are modelled via capital and labour service firms. The capital service firms maximise the discounted present value of real dividends

$$E_t \sum \rho^j \left[p_{t+j} F\left(K_{t+j}^h, L_{t+j}^h\right) - \Gamma\left(K_{t+j}^h, K_{t-1+j}^h, K_{t-2+j}^h\right) - I_{t+j}^h \right] \qquad (2.10)$$

subject to the capital accumulation equation $K_t^h = I_t^h + (1-\delta) K_{t-1}^h$, where I is investment, ρ is the discount factor and $p_t = P_t / P_t^I$. These firms face a translog adjustment cost function describing how costs arise in changing capital and investment: $F\left(K_t^h, K_{t-1}^h, K_{t-2}^h\right) = \phi_k \left(\Delta K_t^h - \phi_{\Delta K} \Delta K_{t-1}^h\right)^2 / \left(2 K_{t-1}^h\right)$, where ϕ_K and $\phi_{\Delta K}$ are adjustment cost parameters.

Labour services are provided by a firm that minimises a Rotembergian adjustment cost function. The representative labour service firm minimises a loss function for changes in labour and deviations of labour input from the optimal amount. Optimal level of labour demand is defined by inverting the Cobb-Douglas production function. The firms minimise following loss-function

$$\frac{1}{2} E_t \sum_{j=0}^{\infty} \rho^j \left[\left(L_{i,t+j} - L_{i,t+j-1}\right)^2 + \phi_L \left(L_{i,t+j} - \overline{L}_{t+j}\right)^2 \right] \qquad (2.11)$$

where ρ is the discount factor and ϕ_L is the adjustment cost parameter.

Furthermore, we assume that the prices of intermediate goods are defined by Calvo contracts. As with wage determination, intermediate firms that cannot change prices are nevertheless able to adjust their prices to the pace of past inflation, ie dynamic indexation applies. The firms minimises

$$\frac{1}{2}\sum_{j=0}^{\infty}\rho^j(1-\phi_P)^j E_t\left[\left(\frac{P_{i,t}}{P_{i,t-1}}\right)^j P_{i,t}-\overline{P}_{t+j}\right]^2 \tag{2.12}$$

where ϕ_P is the Calvo probability that the firm will change prices. In the long run, prices equal marginal costs.

2.3 Government

The government sector does not optimise explicitly. It is characterised by the government budget constraint and two policy rules: the budget closure rule of the fiscal authority and the monetary policy rule of the monetary authority. Government budget constraint is defined as

$$\begin{aligned}-(G-G_{t-1}) &= \tau_t^W W_t L_t+\tau_t^Y P_t Y_t+b_4 P_t Y_t \\ &\quad -(b_1+\eta_{CG,t})P_t Y_t+b_2 P_t^I Y_t+(\omega_1 U+\omega_2)P_t Y_t+\frac{R_{t-1}}{400}G_{t-1}\end{aligned} \tag{2.13}$$

where $\eta_{CG,t}$ is the government expenditure shock and b_1, b_2, ω_1, ω_2, and b_4 are parameters. The left hand side is government net lending. The right hand side comprises government income (direct and indirect taxes, capital income) and government outlays (government consumption, investment, transfers and interest outlays). We assume that the government consumption shock is stochastic and follows an AR(1) process.

The fiscal policy rule is imposed to guarantee that the dynamic budget constraint is binding. The income tax rule assumes that the government balances its budget in the long run through tax changes. As target variables in this fiscal rule both the debt-to-GDP and budget deficit-to-GDP ratios are applied

$$\tau_t^W-\tau_{t-1}^W=\tau_1\left[\frac{G_t}{P_t Y_t}-4b_4\right]-\tau_2\left[\frac{G_t-G_{t-1}}{P_t Y_t}+4b_3\frac{(1+g)(1+\overline{\pi})-1}{(1+g)(1+\overline{\pi})}\right] \tag{2.14}$$

where τ_t is the coefficient of deviations from the targeted debt level and τ_2 is the coefficient of deviations of net lending from targeted net lending. b_3, g and π are the debt-to-GDP target, real growth rate, and the inflation target.

The monetary policy rule is used to pin down the growth rate of the undetermined price level. A Taylor-rule type of monetary policy rule is applied

$$\frac{R}{400} = \lambda_1 \frac{R_{t-1}}{400} + (1-\lambda_1)[((1+\pi_t)(1+\bar{r})-1) + \lambda_2(\pi_t - \bar{\pi}) + \lambda_3(y_t - \bar{y})] + \eta_{R,t} \qquad (2.15)$$

where $\bar{r}$, λ_1, λ_2, and λ_3 are respectively the real interest rate, smoothing parameter, weight of the inflation gap, and weight of the output gap respectively. $\eta_{R,t}$ is the interest rate shock, which follows an AR(1) process. $y_t = \log Y_t$ and $\bar{y}$ is the log of steady-state output. The central bank provides an anchor for inflation expectations by setting an explicit inflation target $\bar{\pi}$. The monetary policy rule is a variant of the Taylor -rule (see Taylor 1993).

2.4 Foreign country

The country blocks (home and foreign) are isomorphic. Trade linkages are used to connect the country blocks, to that the current account balance is defined as $CA_t = P_t^X X_t - P_t^M M_t + NFN_t$, where P_t^X, X_t, P_t^M, M_t, and NFN_t are export prices, exports, import prices, imports, and net factor income from net foreign assets. The latter is defined as $NFN_t = \left(1 + \frac{R_{t-1}^*}{400}\right) NFA_{t-1}$, where the international factor incomes are modelled as interest on USD -denominated short-term debt. In a closed world economy, the domestic and foreign net factor incomes of net foreign assets sum to zero. Thus, the foreign net factor income is defined as $NFN_t^* = -NFN_t S_t$. In addition, the net foreign assets of the home country are accumulated from the current account positions: $NFA_t = NFA_{t-1} + CA_t$. Foreign net foreign assets are defined as $NFA_t^* = -NFA_t S_t$. Moreover, we assume that the nominal exchange rate is determined by the uncovered interest rate parity arbitrage condition: $\log S_t = \log E_t S_{t+1} + \frac{R_t - R_t^*}{400} + \eta_{s,t}$, where S_t is the foreign currency price of home currency and $\eta_{s,t}$ is a shock to the exchange rate premium, which is assumed to follow an AR(1) process.

2.5 Equilibrium

In a competitive equilibrium, households maximise their utility subject to the budget constraint, and firms maximise their profits subject to technological feasibility. In addition, all markets clear. Finally, all prices are zero for goods in excess supply.

3 Matching model to data

3.1 Data

The euro area (EA) data is from Eurostat, ECB, OECD and IMF. Most of the EA series are unfortunately very short, starting from 1991. Therefore, we extended the historical data by chaining it with the AWM database (see Fagan et al, 2001). The US data is from the Bureau of Economic Analysis, Bureau of Labor Statistics, OECD and IMF. Using these data sources, we built a database covering 1977q1 to 2004q4.

Our model is a closed economy two country model, and the actual data includes EA, US and implicitly a third country (rest of the world). To cope with this discrepancy between model and data we adjust the observed data to match the model. We do this by first redefining the US exports and imports so that these match corresponding EA figures (adjusted with the exchange rate). To balance the GDP identity we recalculate US inventories as a residual. In a similar way we use the EA current account, net factor incomes and net foreign assets data to replace corresponding US data.

We estimate the model in two steps. First, we calibrate the structural parameters to be broadly in line with the existing literature. Second, we estimate the adjustment cost parameters, policy parameters and shock dynamics of the model. In this latter step, we utilise Bayesian estimation techniques.

3.2 Calibration

Calibrated parameters are shown in Table 1 below. Almost all variables are calibrated symmetrically. The capital share of income is typically found to be around 0.3–0.4. In calculating the ratio of nominal compensation to nominal GDP at factor cost we find that both the US capital share and the EA capital share are close to 0.4 on average in 1999–2004. The quarterly depreciation rate is assumed to be around 0.013–0.025 in the literature (see Cooley 1995, Smets and Wouters 2003, Juillard et al, 2004 and Adolfson et al, 2005). We assume that the depreciation rate is symmetrically 10% per annum. With this depreciation rate, half of the new capital is depreciated in about seven years. Siegel (1992) finds that the equity premium in US data for the years 1800–1990 is roughly 3% p.a. We calibrate the equity premium to be symmetrically 4.9% per annum.

Table 1. **Calibrated parameters**

		EA	US
Capital share of income	α	0.4	0.4
Quarterly depreciation rate	δ	0.025	0.025
Quarterly equity premium	χ	$1.049^{.25}$-1	$1.049^{.25}$-1
Quarterly mortality rate	p	1/80	1/80
Quarterly birth rate	b	1/75	1/75
Quarterly growth rate of total factor productivity	ε	0.0043	0.0043
Quarterly rate of time preference	θ	0.007	0.007
Quarterly inflation target	$\bar{\pi}$	$1.02^{.25}$-1	$1.02^{.25}$-1
Disutility of labour effort	ν	0.19	0.19
Targeted inventories/output	K	0.5	0.5
Share of domestic value added goods in private consumption	γ_C	0.9	0.9
Share of domestic value added goods in gov consumption	γ_{CG}	0.9	0.9
Share of domestic value added goods in investment	γ_I	0.85	0.85
Share of domestic value added goods in exports	γ_X	0.75	0.75
Subst.elast.(value added vs. imports) in private consumption	θ_C	1.5	1.5
Subst.elast.(value added vs. imports) in gov consumption	θ_{CG}	1.5	1.5
Subst.elast.(value added vs. imports) in investment	θ_I	1.5	1.5
Subst.elast.(value added vs. imports) in exports	θ_X	1.5	1.5
Steady-state government real consumption to GDP ratio	b_1	0.2	0.15
Steady-state government nominal investments to GDP ratio	b_2	0.02	0.03
Steady-state government debt to GDP ratio	b_3	0.6	0.6
Steady-state government other income to GDP ratio	b_4	0.22	0.12
Steady-state government transfers elasticity to unempl	ω_1	0.2	0.2
Steady-state level of government transfers	ω_2	0.21	0.11
Indirect tax rate	τ^Y	0.14	0.07
NAIRU	U	0.08	0.05
Equilibrium real interest rate	$\bar{r}$	$1.025^{.25}$-1	$1.025^{.25}$-1

The mortality rate is calibrated to give a remaining average lifetime of 20 years. The birth rate is calibrated so that the annual population growth rate is 0.27%. The annual growth rate of total factor productivity is 1.7 per cent and thus the annual growth rate of the economy is roughly 2%. The rate of time preference is 2.8% in annual terms. With this rate of time preference, we see that the real interest rate on government debt in equilibrium is higher than the real growth rate. We also find that the sum of the pure rate of time preference and the probability of death exceeds the real rate of interest rate in the steady-state. The inflation target is calibrated symmetrically to 2% per annum. Currently for EA target of inflation rate is less than 2% while for US there is no explicit inflation target.

The disutility of labour is calibrated symmetrically to 0.19. This and other parameters in steady-state imply that the Frisch elasticity (elasticity of labour supply with respect to real wage) is close to 0.33 for EA and USA. These Frisch elasticities are close to those found in micro studies, which range from 0.05–0.35, and to the 0.33 used by Juillard et al (2004). The RBC literature, on the other hand, has found higher Frisch elasticities. The targeted inventories-to-output ratio is set symmetrically to 0.5.

The share of value added goods in final goods production is calibrated roughly in line with the data. Erceg et al (2005b) find that the average share of imports in US consumption (investment) is around 9 (38) per cent. We calibrate the import share of consumption (both public and private) to be 10%. The import share of investment is set to 15%. Finally, we set the import share of exports to 25%. The substitution elasticities between the value added goods and imports in final goods production is set to 1.5 for all final goods firms. This is at the lower end of estimates used in NOEM models, which generally range between 1.5 and 6 (see Bayoumi et al, 2004, Erceg et al, 2005b and Obstfeld and Rogoff, 2004). However, Bergin (2004) finds evidence of a unitary long-run elasticity.

The steady-state ratios of government variables are set to levels of last observation in the data.

3.3 Estimation

We estimate the adjustment cost parameters, policy parameters, and shock dynamics of the model by Bayesian methods. We assume that there are 9 structural shocks in the two country model. For the EA we assume that there are productivity, government absorption, interest rate and preference shocks. Similar shocks hit the US economy. Finally, we allow an exchange rate risk premium shock. The latter may not have profound economic interpretation, as noted by Rabanal and Tueste (2005). However, we find it useful to include this shock to generate more variation in the real exchange rate. In estimation, we allow the shocks to be autoregressive processes.

With these nine shocks we explain nine observed variables: EA output, EA consumption, EA inflation, EA interest rate, US output, US consumption, US inflation, US interest rate, and the real exchange rate. The model variables are measured in efficiency units, eg output is divided by both population and the level of technology. The relative growth rate is used when we express exports in efficiency units. We write a dynamic equation for the relative growth rate that generates an additional unit root in the model. We take this into account in estimation by using diffuse priors. Stationarisation may leave some variables with trending behaviour in our sample. Specifically, both EA output and US output in efficiency units are increasing slightly in 1977q1–2004q4. Thus, we prefilter the observed variables by Hodrick-Prescott with a smoothing parameter value of 10,000. This prefiltering removes the long-run trends from our data.

In order to estimate the model we assume certain prior distributions, which are based on our previous calibration exercises and existing literature. We estimate the model in two steps in Dynare/Matlab, as in Juillard et al (2004). In the first step, we compute the posterior mode using the CSMINWEL optimisation routine by Sims. We then sample the posterior distribution using a Metropolis-Hastings Markov chain Monte Carlo algorithm to make sample inferences about the parameters. We sampled two separate chains for 40,000 periods, discarding the first 10,000. In order to assess convergence of the Markov chains, we use the potential scale reduction statistics described by Brooks and Gelman (1998). The multivariate statistics indicate that the parameters do convergence. The last two columns in Table 2 report the posterior means of the parameters and the 90% confidence intervals.

We assume that our priors for the standard errors of the stochastic processes have inverted gamma distributions. The priors of all other parameters have beta distributions. An exception is the level parameter in capital adjustment cost, which is only constrained from below and so we use a gamma distribution for it. The mean of the priors is set mainly according to our previous calibration exercises as well as the existing literature. We set a relatively strong prior for the level of capital adjustment cost. This is also set asymmetrically. We do this in order to invoke enough investment variation. Another asymmetry lies in nominal rigidities, which we assume to be more relaxed for the US.

The estimated posterior standard errors for preference and exchange rate risk premium shocks are lower than the priors. The posterior means of standard errors for interest rates are well above the priors. The stochastic processes exhibiting the most persistence are the productivity, government consumption, and exchange rate risk premium shocks. The persistence of preference shocks, and especially monetary policy shocks, is low.

Table 2. **Estimated parameters**

		Prior			Posterior	
		distribution	mean	Std	mean	90% interval
Risk premium shock	ε_S	inv.gamma	0.5	∞	0.3994	0.3056–0.4881
EA productivity shock	ε_A^{EA}	inv.gamma	0.01	∞	0.0138	0.0117–0.0161
US productivity shock	ε_A^{US}	inv.gamma	0.01	∞	0.0092	0.0072–0.0110
EA gov spending shock	ε_A^{EA}	inv.gamma	0.01	∞	0.0157	0.0135–0.0180
US gov spending shock	ε_A^{US}	inv.gamma	0.01	∞	0.0126	0.0108–0.0148
EA interest rate shock	ε_A^{EA}	inv.gamma	0.25	∞	0.6977	0.6162–0.7838
US interest rate shock	ε_A^{US}	inv.gamma	0.25	∞	1.086	0.9449–1.2134
EA preference shock	ε_A^{EA}	inv.gamma	0.01	∞	0.0024	0.0018–0.0029
US preference shock	ε_A^{US}	inv.gamma	0.01	∞	0.0026	0.0020–0.0031
AR(1) in risk premium	ρ_S	beta	0.8	0.1	0.9048	0.8791–0.9315
AR(1) in EA productivity	ρ_S^{EA}	beta	0.8	0.1	0.9787	0.9585–0.9992
AR(1) in US productivity	ρ_S^{US}	beta	0.8	0.1	0.9859	0.9734–0.9988
AR(1) in EA gov spend	ρ_S^{EA}	beta	0.8	0.1	0.8598	0.8169–0.8983
AR(1) in US gov spend	ρ_S^{US}	beta	0.8	0.1	0.7203	0.6412–0.7850
AR(1) in EA int rate	ρ_S^{EA}	beta	0.8	0.1	0.4092	0.3113–0.4817
AR(1) in US int rate	ρ_S^{US}	beta	0.8	0.1	0.3166	0.2369–0.3911
AR(1) in EA preference	ρ_S^{EA}	beta	0.8	0.1	0.7321	0.6758–0.7959
AR(1) in US preference	ρ_S^{US}	beta	0.8	0.1	0.6676	0.6066–0.7396
EA Calvo price	ϕ_p	beta	0.25	0.025	0.3672	0.3358–0.3969
US Calvo price	ϕ_P	beta	0.5	0.05	0.5168	0.4627–0.5665
EA Calvo wage	ϕ_W	beta	0.2	0.02	0.1785	0.1542–0.2073
US Calvo wage	ϕ_W	beta	0.25	0.025	0.3253	0.2811–0.3630
EA labour adj cost	ϕ_L	beta	0.075	0.025	0.0983	0.0635–0.1361
US labour adj cost	ϕ_L	beta	0.075	0.025	0.1856	0.1365–0.2343
EA lev in capit.adj cost	ϕ_K	gamma	0.15	0.001	0.1542	0.1459–0.1623
US lev in capit.adj cost	ϕ	gamma	0.05	0.001	0.0605	0.0564–0.0643
EA chg capit.adj cost	$\phi_{\Delta K}^{EA}$	beta	0.25	0.05	0.1488	0.1041–0.1995
US chg in capit.adj cost	$\phi_{\Delta K}^{US}$	beta	0.25	0.05	0.1083	0.0685–0.1439
EA invent. adj cost	ϕ_{KI}^{EA}	beta	0.1	0.025	0.0968	0.0748–0.1181
US invent. adj cost	ϕ_{KI}^{US}	beta	0.1	0.025	0.0768	0.0751–0.0770

		Prior			Posterior	
		distribution	mean	Std	mean	90% interval
EA Taylor smoothing	λ_1	beta	0.8	0.1	0.5189	0.4416–0.5913
EA Taylor infl gap	λ_2	beta	0.5	0.1	0.484	0.3676–0.6101
EA Taylor output gap	λ_3	beta	0.5	0.1	0.6341	0.4957–0.7712
US Taylor smoothing	λ_1	beta	0.8	0.1	0.2476	0.1767–0.3394
US Taylor infl gap	λ_2	beta	0.5	0.1	0.3884	0.2799–0.4952
US Taylor output gap	λ_3	beta	0.5	0.1	0.648	0.5268–0.7787
EA debt in tax rule	τ_1	beta	0.01	0.005	0.001	0.0002–0.0016
EA deficit in tax rule	τ_2	beta	0.1	0.01	0.0904	0.0726–0.1042
US debt in tax rule	τ_1	beta	0.01	0.005	0.0036	0.0013–0.0065
US deficit in tax rule	τ_2	beta	0.1	0.01	0.0669	0.0560–0.0763

Bils and Klenow (2004) find frequent price changes in US data with half of the prices holding for less than 4.3 months. Álvarez et al (2005) find the corresponding median duration in price changes to be 10.6 months for the euro area. The posterior mean estimates are 0.37 for the EA and 0.52 for the US. These indicate that prices are changed approximately each 2.7 quarters in EA and each 1.9 quarters in US. These estimates are close to the microeconomic evidence found for EA and US. With respect to nominal inertia in wages, the posterior mean estimate of the Calvo wage parameter for EA is 0.18, but for US the posterior mean is 0.33. These estimates could be interpreted so that wages are set in every 5.5 quarters in EA and in every 3 quarters in US. In addition, we notice that the posterior mean for wage adjustments is lower than the price adjustment, suggesting that prices are adjusted more frequently than wages.

The posterior estimates for labour adjustment are higher than the priors and the US labour adjustment costs are much higher. The lower the labour adjustment cost parameter, the higher the costs of hiring and firing relative to the costs of labour deviating from the optimal level. This could be interpreted to mean that the hiring and firing costs are higher in EA than in US. The posterior estimates of inventory costs are close to the priors and neither show any clear asymmetry. The estimated posterior means of the parameters of the level of capital adjustment cost increase slightly in comparison to priors for both countries, despite the fact that we effectively nailed them down. The posteriors of the parameters of the change in capital adjustment costs are somewhat lower than the priors and the US costs seem to be somewhat lower than EA costs.

In the Taylor rule, the priors of parameters for inflation gap and output gap are set to 0.5, as conjunctured by Taylor (1993). The estimated posteriors indicate that European monetary policy during the period entails more interest rate smoothing and reacts more sharply to inflation than US monetary policy. In the fiscal rule, the posterior mean estimates indicate that European fiscal policy over the period reacts more sharply to deficit and less sharply to debt than the US fiscal policy.

3.4 Validation

In assessing the estimation of the model we consider how well the model fits the data. The stylized facts of the data and similar statistics for 50,000 stochastic model simulations (of which we discard the first 1,000) are presented in Table 3.

Table 3. **Observed and implied second moments**

Statistic	Data US	Data EA	Model US	Model EA
Standard deviations				
GDP	1.42	0.89	1.26	1.87
Consumption	1.07	0.87	1.11	1.68
Investment	4.55	2.89	3.08	2.73
Employment	0.93	0.68	0.3	0.45
Net trade	0.27	0.34	0.4	0.79
Real exchange rate	8.8		1.92	
Autocorrelations				
GDP	0.86	0.87	0.72	0.74
Consumption	0.86	0.85	0.65	0.72
Investment	0.9	0.85	0.66	0.78
Employment	0.9	0.97	0.86	0.91
Net trade	0.81	0.81	0.69	0.69
Real exchange rate	0.86		0.68	
Cross correlations over countries				
GDP	0.33		0.04	
Consumption	0.14		0.02	
Investment	0.19		0.01	
Employment	0.19		0.02	
Cross correlations within countries				
GDP – Real exchange rate	0.07	0.06	0.11	-0.33
Consumption – Real exchange rate	0.04	0.31	-0.07	0
Investment – Real exchange rate	-0.01	0.23	-0.14	-0.01
Net trade – Real exchange rate	0.39	-0.39	0.94	-0.96
Relative consumption – Real exchange rate	-0.18		0.04	
Relative GDP – Real exchange rate	0.01		0.27	

The results indicate that our model is able to replicate reasonably the standard deviations and autocorrelations observed in the data. With respect to cross-correlation structure, our model is at odds with the data. Nevertheless, this constrained set of structural shocks is able to produce moments which at least broadly agree with the data.

With a closer look, we find that the standard deviations of EA consumption and GDP are clearly higher than in the data. The model's standard deviations of employment, net trade and real exchange rate are less than those observed in the data. Also, the autocorrelation coefficients produced by the model are somewhat low compared to the data. Cross correlations over countries are small and clearly at odds with data, as also in de Walque et al (2005). This suggests that the assumed trade linkages in the model are not sufficient to produce the observed cross correlation structure.

A second area of interest concerns the degrees of independence of the stochastic processes. In the estimation process we assume that the shocks are i.i.d. We report the correlation structure of some shocks in Table 4. Although correlation does not necessarily imply dependence, we find that the null of zero correlation coefficient is rejected for the contemporaneous government spending shocks. Also, the contemporaneous interest rate shocks are significantly correlated.

Table 4. **Correlation between innovations over the two economies**

US⇒EA	contemporaneous	EA⇒US
0.07	-0.08	-0.1
-0.25	-0.46	-0.32
0.03	-0.16	0.15
-0.18	-0.29	-0.29

The variance decomposition of the observed variables is shown in Table 5. We find no interesting spillovers across countries. The US shocks do not matter much for the EA economy and vice versa. This result is similar to that of de Walque et al (2005).

Table 5. **Variance decomposition**

	Y^{EA}	C^{EA}	π^{EA}	R^{EA}	Y^{US}	C^{US}	π^{US}	R^{US}	Q
EA productivity shock	0.1	0.29	0.6	0.13	0.05	0.04	0.01	0.01	0.29
EA preference shock	0.01	0.08	0.01	0.03	0.02	0	0	0	0
EA gov.spending shock	0.61	0.38	0.12	0.19	0.02	0.02	0.01	0.02	0.05
EA interest rate shock	0.09	0.02	0.02	0.15	0	0	0	0	0.01
EA shocks	0.81	0.77	0.75	0.5	0.07	0.06	0.02	0.03	0.35
US productivity shock	0.01	0.06	0.01	0.01	0.17	0.34	0.55	0.16	0.21
US preference shock	0	0	0	0	0.02	0.14	0.04	0.05	0
US gov.spending shock	0	0	0	0.01	0.48	0.27	0.13	0.15	0.01
US interest rate shock	0	0	0	0	0.12	0.04	0.04	0.32	0
US shocks	0.01	0.06	0.01	0.02	0.79	0.79	0.76	0.68	0.22
Risk premium shock	0.18	0.17	0.24	0.48	0.14	0.15	0.22	0.29	0.43

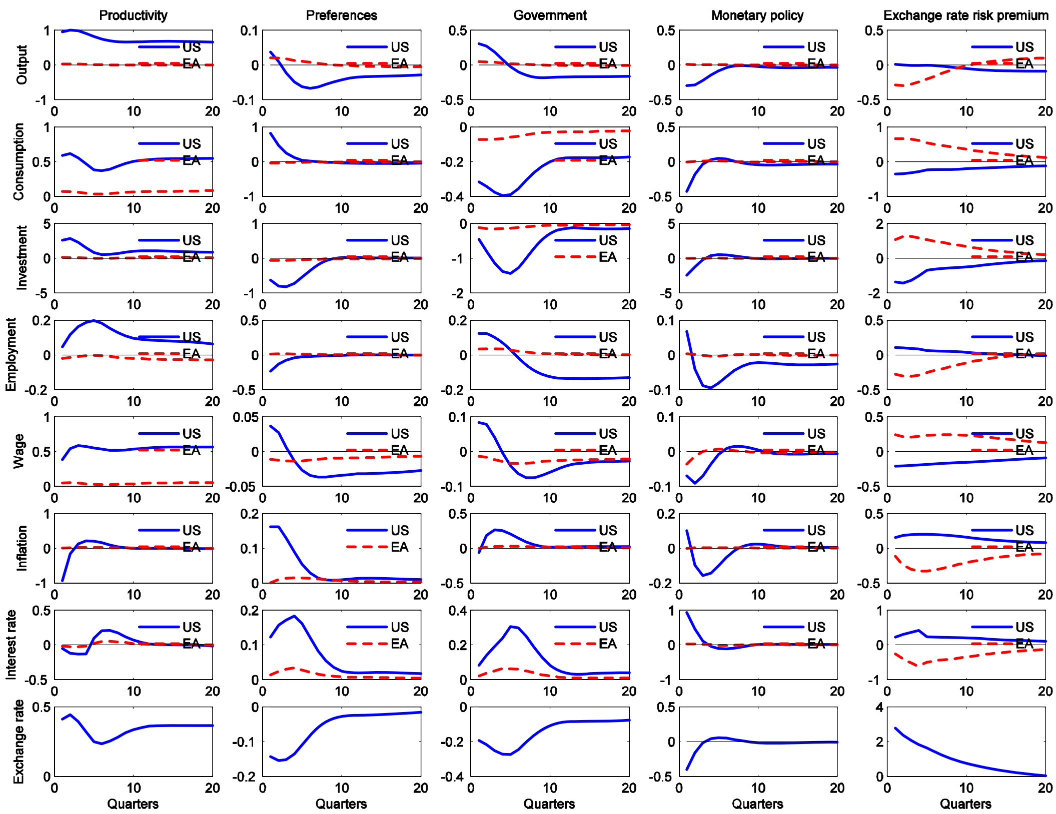
Y, C, π, R and Q denote to output, consumption, inflation, interest and real exchange rate.

For both countries it seems that domestic productivity shocks are the most import source of variation in inflation. The second important source of variation in inflation is exchange rate risk premium shocks. Also, the domestic fiscal policies do matter, but their importance is of a second order. Regarding the variability in nominal interest rates, we find that all domestic shocks matter, but exchange rate shocks have huge impacts on the variation. The variability in output stems mostly from the domestic government spending shocks. The risk premium and productivity shocks are also important sources of output variation. Consumption variation is affected by factors similar to those for output.

3.5 Impulse response functions

Impulse responses for one standard deviation shocks are shown in Figure 1. In this figure we show how US specific shocks as well as the exchange rate risk premium shocks are transmitted. EA specific shocks look almost identical to US specific shocks and so we examine only US shocks.

Figure 1. **Impulse response functions (% from baseline, %-point for inflation and interest rate)**



US specific shocks do not seem to affect the EA economy. Only the exchange rate risk premium shock has considerable effects on both countries.

The output reaction of the estimated productivity shock is almost four times as big as in eg Juillard et al (2004). Except for the size, the only notable difference from the results of Juillard et al (2004) is that here labour supply reacts positively to the productivity shock. Erceg et al (2005b) report a productivity shock with the same profile, but their exercise is much more persistent and thus the reaction lasts for several years.

The results of the preference shock are close to the estimated policy version of Levin et al (2005). Employment declines as do the labour hours in Levin et al (2005). Consumption increases immediately, since we assume no habit behaviour. Inflation increases in the short run, but the short-run increase in the nominal interest rate is much more moderate than in Levin et al (2005).

Levin et al (2005) and Juillard et al (2004) report a very similar profile of their results for an expansionary government spending shock, but the effects are somewhat smaller than here. Erceg et al (2005b), on the other hand, apply an even bigger government spending shock than estimated here.

The output reaction of contractionary monetary policy shock is between the results of Christiano et al (2005) and Juillard et al (2004) or Erceg et al (2005b). US GDP inflation actually increases in the short-run before dropping from the baseline level. The US consumer price inflation that the central bank is targeting follows GDP inflation but reacts more rapidly to tightening of the policy. Most of the results of the monetary policy shock are in line with the findings of Juillard et al (2004).

The effects of the rise in dollar risk premium may be compared to the exercise of Erceg et al (2005b). The output, inflation and domestic absorption reactions are closely aligned with those of Erceg et al (2005b).

4 Adjustment of the US current account deficit

In analysing the adjustment of the US current account deficit we utilise the two country model developed and estimated above. We apply the model as if it describes the United States and the rest of the world. For the sake of argument let us assume that the United States' present 6.6% current account deficit is approximately twice as big as the sustainable deficit. In other words, at least half the present deficit is temporary. Next, we can ask what processes could bring the deficit down to a sustainable level. As there are numerous possible channels that could lead to adjustment, it is important to consider whether the different processes would lead to radically different paths of adjustment.

Among other factors, the speed and form of the adjustment process will depend on the response of monetary policy. In such calculations, it is impossible to avoid making simple and fairly mechanical assumptions as to how monetary policy responds to changes in the economy. In the present calculation we assume that the policy interest rate (short-term money market rate) responds both in the United States and in the rest of the world according to the Taylor rule. This rule, which is widely used nowadays in applied economic analysis to describe the 'normal' response of monetary policy, assumes that interest rates are determined by how far the pace of inflation differs from the target (here assumed to be 2%) and how wide is the output gap. Including the output gap in the monetary-policy decision rule moderates interest rate movements and introduces a forward-looking element to the setting of interest rates, because demand pressure on the commodity and labour markets is one of the factors influencing future inflation.

Here, we examine more closely four different types of change that could cause the US current account deficit to adjust towards a sustainable level. These are (a) an increase in the level of household savings in the United States, (b) an increase in dollar risk premium, (c) an uncoordinated fiscal policy tightening in the United States, and (d) a coordinated fiscal policy tightening in the United States and simultaneous fiscal policy loosening in the rest of the world. In our calculations, these changes are implemented on such a large scale as to have a substantial effect on the US current account deficit.

4.1 An increase in US household savings

In the first calculation we assume that the US households' become more worried about their future. This would lead them to increase their level of saving. In the model calculation this is taken into account by lowering households' time preference rate by 1.8 percentage points per annum over the next thirty years. This has a direct impact on how US households in the model discount their future income and consumption.

According to the results of this calculation, an increase of 10 percentage points in the US household saving ratio would roughly halve the US current account deficit from its present level (see Table 6). The adjustment would also involve a lowering of US interest rates. GDP would increase, as both fixed investment and exports increase, compensating for the contraction in consumer demand. There would also be a marked deceleration in inflation in the medium term, which justifies the decline in interest rates. However, the fall in inflation is so pronounced that it pushes US nominal interest rates close to the zero bound.

As a consequence of this savings driven adjustment, there would be a little if any change in GDP outside the United States in the first five years. There would be a substantial reduction in exports to the United States, but at the same time a marked increase in both consumption and fixed investment. This is a consequence of the strong downward trend in interest rates associated with this particular adjustment alternative. As the US current account deficit contracts, the current account surplus of the rest of the world would also contract in tandem. Under this scenario, the real effective dollar exchange rate would weaken over 20% in the first five years.

4.2 An increase in dollar risk premium

In the second calculation, we assume a receding willingness on the part of international investors to hold American assets. Technically this calculation was carried out by gradually raising the risk premium on dollar investments required by international investors to 0.5% on average for the next ten years.

According to the results of this calculation, the effective dollar exchange rate weakens by over 20% nominally and by over 15% in real terms in the first three years (see Table 6). The US current account deficit relative to GDP would contract by 3 percentage points, ie by almost half. This calculation also produces a vigorous increase in the American household saving ratio and a corresponding drop in private consumption. Rising interest rates, a direct consequence of the higher risk premium on the dollar, also means a decrease in fixed investments in the United States. The weakening dollar spurs net exports, which in turn boost US GDP, but only slightly. By reducing domestic demand, the rise in interest rates facilitates adjustment of the current account deficit.

In contrast to the previous calculation, this alternative has a considerable negative impact on inflation in the rest of the world. Hence the interest rate response is also sizeable. The dramatic weakening of the dollar raises import prices in the United States and, by extension, inflation, despite the rise in interest rates. At the same time, import prices in the rest of the world fall, reducing inflation to the same extent as the increase in the United States. If the dollar decline were to occur at once, as we assumed here, the fall in inflation in the rest of the world would be so steep that it would probably lead to deflation. The fall in interest rates produced by this model is so large that outside the United States a zero nominal interest rate floor could become a binding constraint. GDP in the rest of the world increases only slightly in this calculation, as the increase in consumption and investment compensates for the contraction in net exports. From economic policy perspective, however, the picture is not quite so favourable, since the world outside the United States ends up with deflation and a binding zero interest rate floor.

Table 6. **Dynamic adjustment of the US current account deficit**

	US household saving ratio increases			Dollar risk premium increases			Uncoordinated US fiscal tightening			Coordinated fiscal policy		
	1Y	3Y	5Y	1Y	3Y	5Y	1Y	3Y	5Y	1Y	3Y	5Y
United States												
Current account, % of GDP	3	2.5	2.2	3	2.6	2.3	0.9	0.8	0.8	2	2.1	2.2
GDP, %	2.2	4.3	5.2	-0.3	-0.3	-0.8	-0.8	-0.9	-0.9	-0.8	-0.7	-0.8
Private consumption, %	-11.3	-9.3	-7.7	-3.1	-3	-2.8	2.3	2.8	2.7	0.7	1.1	0.9
Private fixed investment, %	18.1	20.8	21	-10.6	-7.5	-6.5	-6.2	-0.4	0.3	-8.4	-2.5	-2
Household savings ratio, %-point	10.8	8.2	6.3	2	2.9	3.3	-3.3	-4.7	-4.7	-2.2	-3.3	-3.1
Inflation (GDP deflator), %-point	-1.9	-1.7	-2.1	0.1	1	1.2	0.1	-0.3	-0.3	-0.2	-0.3	-0.2
Nominal interest rate, %-point	-1.2	-2.4	-3	0.9	1.2	1.5	0.4	-0.4	-0.4	0.4	-0.4	-0.3
Real effective exchange rate, %	21.5	21.9	20.8	16.7	14.7	11.4	4.6	5.2	5.1	10.8	12.9	12.9
Nominal effect. exchange rate, %	19	15.8	12.5	17.5	20.3	22.2	4.6	4.8	4.5	10.7	12.2	11.8
Rest of the world												
Current account, % of GDP	-4.2	-3.6	-3.2	-4.2	-3.8	-3.3	-1.4	-1.3	-1.3	-2.9	-3.2	-3.2
GDP, %	0.2	-0.7	-0.2	0.3	0.2	0.9	0	-0.3	-0.2	0.4	1	1.2
Private consumption, %	8.5	7.7	7.9	6.3	5.5	5.1	2.4	2.3	2.4	0.1	-1.4	-1.7
Private fixed investment, %	14.8	10.7	10.5	16.9	14	12.2	3.2	2.6	2.6	12.4	4.6	2
Household savings ratio, %-point	-7	-6.4	-6.7	-6	-7.2	-7.7	-2.3	-2.3	-2.4	1	3.9	4.6
Inflation (GDP deflator), %-point	0.1	-0.5	-0.8	-0.5	-1.5	-1.8	0.1	-0.1	-0.2	-0.1	0	0.1
Nominal interest rate, %-point	-1.2	-0.6	-1	-1.6	-1.9	-2.3	-0.2	-0.1	-0.2	-1.1	-0.2	0

4.3 Uncoordinated fiscal policy

In the third calculation, we assume that US fiscal policy is tightened in an uncoordinated fashion. Technically, we reduce US public consumption by one percentage point of GDP for fifteen years. Taking account of the estimated persistence of US public consumption shocks the effective decrease in public consumption is approximately 4%-points per annum for fifteen years. In addition, we suppress the fiscal rule for fifteen years, so that fiscal savings improve the fiscal balance by approximately 4 percentage points per annum. We assume further that the fiscal savings are fully used to reduce the US government debt. Thus, the US government debt-to-GDP ratio decreases by 60 percentage points in fifteen years. After this, we allow the fiscal rule to work.

According to the results of this calculation, an uncoordinated fiscal policy tightening in the United States improves the US current account balance by roughly one percentage point (see Table 6). As government expenditure is non-productive in the model this reduction in government consumption generates a strong crowding in effect in US private consumption. Nevertheless, output falls because the decrease in government consumption is substantial. The dollar depreciates by about 5% in real terms. The US nominal interest rate and inflation change very little.

In the rest of the world both consumption and investment increase but there is very little effect on output. Inflation and nominal interest rates are almost unchanged in the rest of the world. Thus, we find that the uncoordinated fiscal policy does not push the nominal interest rate close to the zero bound.

In carrying out the calculations of these alternative adjustment processes we noticed that a tightening of US fiscal policy on any realistic scale would not be enough on its own to halve the current account deficit. The impact is small because, according to economic theory, households respond to tighter fiscal policy by reducing their level of saving. This feature is included in the EDGE model. In the case of the United States, however, the reduction in the household saving ratio could be limited by the high level of household indebtedness. Nevertheless, as in Erceg et al (2005a) but unlike Faruqee et al (2005), we do not find fiscal policy to be a very effective tool to reduce the US current account deficit.

4.4 A coordinated fiscal policy

In the fourth calculation, we assume that fiscal policy is coordinated. In effect this means that the US fiscal policy is tightened while the rest of the world fiscal policy is simultaneously loosened. We implement this by tightening US fiscal policy as in the previous calculation but with equal-magnitude fiscal loosening in the rest of the world.

According to the results of this calculation, coordinated fiscal policies improves the US current account balance by roughly two percentage points (see Table 6). We see that even this falls short of halving the US current account deficit. US output is almost unchanged compared to the uncoordinated US fiscal tightening. The crowding in effect on US private consumption is now much smaller than in the previous case. Moreover, investment falls further now in the medium term. In the rest of the world, output increases slightly in the medium term. Private consumption falls due the crowding out. Private fixed investment increases in the medium term.

According to the results of this calculation, the effective dollar exchange rate would weaken nominally as well as in real terms by over 12% in the first three years. The nominal interest rate and inflation rate fall only slightly. Thus, we find that coordinated fiscal policies do not push the nominal interest rate close to zero bound.

4.5 Discussion

Which of the above scenarios is the more favourable, and which the more likely? In the first alternative, the adjustment of the US current account deficit towards a sustainable level occurs through adjustments in economic fundamentals, in that

American households decide to consume less and save more. In this alternative the adjustment of the economy appears to be expensive in terms of consumption. Also, there is a marked fall in the US inflation rate and US nominal interest rates move close to the zero bound. If, on the other hand, adjustment of the current account deficit were to take place via the agency of the international financial markets, through a rise in the risk premium on the dollar, the change would be less dramatic for US consumption but would cause considerable pressure on monetary policy in both the United States and the rest of the world. Outside the United States, there would be a serious risk of deflation. Although an increase in the saving ratio would be a desirable development, it is unlikely. The household saving ratio has long been on a downward trajectory that even the recent dramatic price fluctuations in the share markets have done nothing to arrest.

In the third alternative, we assume that US fiscal policy is constrained in an uncoordinated fashion. This helps to reduce the deficit but it is clearly not enough. In the fourth alternative, we assume that both the United States and the rest of the world use their fiscal policies in a coordinated way. In this scenario, as in the previous one the reduction in the US deficit is not enough. Nevertheless, neither the uncoordinated nor the coordinated fiscal policy will push nominal interest rates close to the zero bound, and the effects on the private consumption are, at least in a coordinated case, relatively moderate.

The model calculations inevitably contain numerous simplifications. These include the assumptions that changes in exchange rates are passed on directly to import prices and changes in import prices are similarly passed on to final product prices in the domestic market. In practice, this is not necessarily the case. Thus, in the short run, the impact of exchange rates on inflationary pressures could be smaller. The outcomes of the calculations are also strongly influenced by the substitution elasticities in foreign trade assumed in the model. As is well known, estimating such elasticities from historical data is difficult, and the results tend to vary over time. Smaller elasticities would result in much bigger exchange rate reactions.

5 Conclusions

The present US current account deficit is probably higher than what could be considered sustainable. In the discussion above we began with the assumption that at least half the present deficit is unsustainable.

There are many different possible processes of adjustment of the current account deficit towards a sustainable level. Based on the calculations presented above, an increase in the saving ratio of American households would be an effective mean of adjustment, but it would be costly in terms of US consumption.

In addition, the US inflation rate would decrease rapidly and US interest rates would move close to the zero bound. In practice, adjustment towards a sustainable level could take place through a number of channels at once. It is, however, hard to imagine the achievement of balance without a reduction in US domestic demand.

Among other factors, the speed and form of the adjustment process will depend on the response of monetary policy. In these sorts of calculations, it is impossible to avoid making simple and fairly mechanical assumptions as to how monetary policy responds to changes in the economy. In the present calculation we assumed that the policy interest rate (short-term money market rate) responds both in the United States and in the rest of the world according to the Taylor rule.

The implications of current account adjustment for monetary policy depend largely on the precise route of adjustment. If the process is triggered by a contraction in total demand in the United States, monetary policy could be used to some extent to support total demand globally. However, if adjustment is triggered by the action of investors in the foreign exchange markets, monetary policy will face a much harder task, and the pressures it will face in the United States and elsewhere will push it in different directions. The monetary policy pressures posed by a balanced real economy would in fact be enormous. A zero interest rate floor would leave very little room for manoeuvre in monetary policy outside the United States.

Fiscal policy, either coordinated or uncoordinated, is not enough to induce the necessary adjustment in the US current account deficit. The coordinated fiscal policy would nevertheless improve the US current account by two percentage points of GDP, which is a considerable amount. Moreover, neither the uncoordinated nor the coordinated fiscal policy would push nominal interest rates close to the zero bound. Finally, the changes in US and rest of the world private consumption are in the coordinated case more moderate than in the uncoordinated US fiscal policy case.

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