Dissecting the dynamics of the US trade balance in an estimated equilibrium model

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Abstract

In an estimated two-country DSGE model, we find that shocks to the marginal efficiency of investment account for more than half of the forecast variance of cyclical fluctuations in the US trade balance. Both domestic and foreign marginal efficiency shocks have a substantial impact on the variability of the imbalance. On the other hand, while traditional technology shocks can generate counter-cyclical trade balance dynamics, they matter very little for the overall forecast variance.

Key Words: Open Economy Macroeconomics, US Trade Balance, Investment Shocks, Bayesian Estimation of DSGE Models.

JEL Classification: C11, F41

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1 Introduction

A vast literature in international macroeconomics has focused on the deterioration of the external position of the United States (US) and its consequences for the global economy.[1] This paper disentangles the stochastic influences on the US trade balance over the last three decades by estimating a two-country dynamic stochastic general equilibrium (DSGE) model with seventeen structural innovations using Bayesian methods. The model can be seen as a two-country version of the closed-economy models described in Smets and Wouters (2007) and Justiniano *et al.* (2011), where the second 'country' is a trade-weighted aggregate of sixteen OECD partners with whom the US has experienced deficits for a reasonably long span of time.

Several authors, examining different facets of the US external position using diverse methodologies, have identified a causal link between movements in US productivity and the external balance. The international real business cycle literature, *e.g.* Backus *et al.* (1994), Kollmann (1998) and Raffo (2008), explains counter-cyclical trade balance dynamics on the basis of neutral technology shocks in theoretical two-country DSGE models. More recently, Raffo (2010) has also appealed to investment-specific technological shocks. In the empirical literature, Bussière *et al.* (2005) find support for shifts in neutral productivity having a significantly negative impact on the US current account. Corsetti *et al.* (2006) report a negative association between productivity shocks in US manufacturing and US net-exports, while Corsetti and Konstantinou (2009) find that permanent technology shocks raise US consumption and lead to a persistent external deficit. Finally, Bems *et al.* (2007) find that neutral as well as investment-specific technological shocks generate a significant negative influence on the trade balance.

In line with the above literature, we find that technological shocks, both neutral and investment-specific, can generate counter-cyclical swings in the trade balance. However, their *relative* importance in generating trade balance dynamics is negligible. We find that disturbances stimulating investment demand, which the empirical literature interprets as marginal efficiency of investment shocks, contribute more than half of the forecast volatility of the US trade balance. There also seems to be a relevant impact of open-

[1] In 2011 Q4, the US trade deficit touched the 564.26 billion dollar mark on an annualized basis and as a proportion of GDP equalled 3.68 percent (FRED II data). In this paper, we restrict the attention to the cycle of the trade balance while we take the trend as given exogenously. Other authors, *e.g.* Engel and Rogers (2006) have examined the long-run path of the US trade balance.

economy disturbances, in particular export-price mark-up shocks from the Rest of the World (RoW) and uncovered interest parity shocks. However their strength is observed only in the very short-run after the shock, before the marginal efficiency of investment shocks begin to dominate. Furthermore, we find a limited role for domestic and foreign wage mark-up, consumption time-impatience, US export mark-up, monetary and fiscal policy shocks.

This paper lies at the interface of several strands of the literature. First, our results that underscore the importance of marginal efficiency shocks for the US trade balance complement the findings of closed-economy studies that emphasize the relevance of these shocks for the overall US business cycle. For instance, Justiniano *et al.* (2011) find that marginal efficiency shocks are the most important drivers of US business cycle fluctuations in the post-war period. In fact, we even find a significant greater importance of domestic and foreign investment shocks for the external position of the US than for domestic GDP. This is not a surprise given that about three quarters of US non-fuel imports and exports are capital goods and consumer durables, which contrasts with an investment share in domestic GDP of about 20 percent, as documented by Erceg *et al.* (2008). For this reason, we allow for the investment basket to be more import-intensive than consumption. When we employ the traditional specification seen in *e.g.* Backus *et al.* (1994), that allows imports to be dependent only on aggregate absorption, the reaction of the trade balance to investment shocks is more subdued.

Justiniano *et al.* (2011) observe that their estimate of the marginal efficiency disturbance is negatively correlated to data-based measures of the external finance premium and may, in reduced-form, reflect the efficiency of the latent financial intermediation sector in allocating credit. Our estimate of the marginal efficiency shock is also significantly negatively correlated with interest-rate spreads, both in the US and abroad, suggesting an important role of financial factors for trade balance dynamics.

The paper is also related to a number of macroeconometric studies that assess the driving forces of the US trade balance. Bems *et al.* (2007) find that monetary and fiscal shocks together with neutral and investment-specific technological shocks have had a negative influence on the trade balance, but they focus solely on the influence of domestic shocks in a structural vector autoregression framework. Bergin (2006) uses maximum likelihood techniques to estimate a small-scale New Keynesian model of the US and the remaining of the G-7 countries and finds that UIP, taste and home-bias shocks explain the bulk of trade balance fluctuations. We find a more suppressed role for these shocks as we employ other frictions, observable data series and shocks, in particular investment and corresponding disturbances.[2]

Finally, we contribute to the tradition of New Keynesian two-country models estimated with Bayesian methods seen in Rabanal and Tuesta (2010) and Lubik and Schorfheide (2006). These authors study the dynamics of the Euro-Dollar exchange rate, while we focus on the trade balance. Our model is also much less stylized and the considerably richer data-set that we employ in its empirical implementation enables the identification of a wider array of structural shocks.

We proceed as follows. The next section details the baseline theoretical model we set up. Section 3 presents the estimation results from this model. We also offer a structural interpretation of the marginal efficiency of investment shocks by contrasting our estimates of the shocks with movements in the external finance premium in the US and abroad. In Section 4, we carefully evaluate the robustness of the main findings by subjecting the baseline model to perturbations and examine the sources of differences relative to the existing literature. Finally, Section 5 concludes.

2 A Benchmark Two-Country Model

The baseline specification we use can be seen as a two-country version of the closed-economy models described in Smets and Wouters (2007) and Justiniano *et al.* (2011), henceforth SW (2007) and JPT (2011). The open-economy segment of the model differs from conventional two-country models in only one aspect, *i.e.* the treatment of the intensity of imports in aggregate consumption and investment.[3] Erceg *et al.* (2008) note that in the data, US exports and imports are heavily concentrated towards capital goods and durables, making the consumption basket considerably less open to imports than the investment basket. Hence, following these authors, we allow for different shares of imports

[2] Importantly, Bergin (2006) also estimates the model in country-differences and hence can only identify *relative* shocks. Our model is asymmetric as we allow parameters and shocks to vary across countries.

[3] In line with the empirical New Keynesian literature, *e.g.* Rabanal and Tuesta (2010), Bergin (2006), Lubik and Schorfheide (2006) and De Walque *et al.* (2005), we impose the open-economy parameters across the two countries. To preserve empirical tractability, just as our precedents, we do not model a non-tradable sector.

in each.[4]

The production of intermediate goods in both countries is affected by neutral labor-augmenting technological progress that has distinct components. A deterministic component is common to both countries and grows at a trend growth rate denoted by $\bar{\gamma} > 1$. The stochastic components are country-specific stationary processes. On the demand-side of the economy, we follow SW (2007) in using preferences which are non-separable between consumption and leisure and consistent with the assumption of a balanced growth path. Parameters governing the steady-state are assumed to be the same across regions. $\sigma_C > 0$ is a parameter that governs the economy's degree of risk aversion. The economy's subjective discount factor $\beta \in (0, 1)$ is adjusted for the fact that the marginal utility of consumption grows at the rate of $\bar{\gamma}^{-\sigma_C}$ in steady-state and we define $\bar{\beta} \equiv \beta\bar{\gamma}^{-\sigma_C}$. Along the steady-state growth path, we impose balanced trade and zero exchange rate depreciation.

Since the two countries in the model are isomorphic, we only present stationarized, log-linearized equilibrium conditions for the Home economy. Steady-state variables are indicated by an upper bar and variables presented as logarithmic deviations from the steady-state are denoted by a superscript '$\widehat{\ }$'. Δ indicates the temporal difference operator. Typically, foreign-country variables and parameters are denoted with a superscript '$*$'. The innovations in all the AR(1) processes, η^j are *i.i.d.* $N(0, \sigma_j)$ and $\rho_j \in [0, 1)$ $\forall j$. As in SW (2007), all the shocks in the theoretical model are normalized so that they enter the estimation with a unit coefficient. In Section 4, we discuss the robustness of the results when alternative specifications for our benchmark model are used.

Aggregation Perfectly competitive firms produce Armington (CES) aggregates of the composite Home and imported bundles for final consumption (C) and final investment (I). $Z \in \{C, I\}$ denotes the output of the aggregator firms for *either* consumption or investment. In the Home (foreign) Armington production function, Z (Z^*) is a combina-

[4] Capital goods and durables account for 76 and 80 percent of non-energy imports and exports respectively over our sample period, while investment expenditures account for about 20 percent of output. Erceg *et al.* (2008) compare such a 'disaggregated' specification with the popular 'aggregated' Armington specification, which assumes the existence of a final good sector that combines domestic and imported goods to produce a composite good that is used for both consumption and investment, disallowing the use of different import-intensities. The two-country models of Backus *et al.* (1994), De Walque *et al.* (2005), Bergin (2006) and Raffo (2008) use the aggregated specification. On the other hand, Adolfson *et al.* (2007) estimate a small open economy model using the disaggregated specification.

tion of the domestic bundle Z_H (Z_F^*) and the imported bundle Z_F (Z_H^*) that are in turn Dixit-Stiglitz aggregates of differentiated intermediate varieties. For both consumption and investment, the home and imported bundles are imperfect substitutes with an elasticity of substitution given by $\mu > 0$. However, the aggregation differs in important ways. Firstly, the share of imports in the aggregators for consumption and investment differs and we denote it by $m_Z \in [0,\, 1]$. Secondly, we follow Basu and Thoenissen (2011) in allowing for an investment-specific technological (IST) shock in the production function for final investment goods. In particular, if $F(.)$ is the CES function, $I_t = \varepsilon_t^{IST} F(I_{Ht}, I_{Ft})$ where $\hat{\varepsilon}_t^{IST} = \rho_{IST}\hat{\varepsilon}_{t-1}^{IST} + \eta_t^{IST}$. No such disturbance affects the production of the final consumption good.

The distinction between the investment and the consumption aggregators reflects in the price indices. The aggregate price levels, *i.e.* the consumer price index (CPI) and the investment deflator, are convex combinations of the domestic output deflator (P_H) and the price of imports (P_F).

$$\hat{P}_{Ct} = (1 - m_C)\hat{P}_{Ht} + m_C\hat{P}_{Ft} \tag{1}$$

$$\hat{P}_{It} = (1 - m_I)\hat{P}_{Ht} + m_I\hat{P}_{Ft} - \hat{\varepsilon}_t^{IST} \tag{2}$$

We define $\widehat{tot} \equiv \hat{P}_F - \hat{P}_H$ and $\widehat{tot}^* \equiv \hat{P}_H^* - \hat{P}_F^*$ as the Home and Foreign terms of trade that determine the rate at which agents substitute the imported bundle for the domestically produced bundle. The demand functions for the domestic and imported bundles are given as

$$\hat{c}_{Ht} = \hat{c}_t + \mu m_C \widehat{tot}_t,\ \hat{\imath}_{Ht} = \hat{\imath}_t + \mu m_I \widehat{tot}_t - \hat{\varepsilon}_t^{IST} \tag{3}$$

$$\hat{c}_{Ft} = \hat{c}_t - \mu(1 - m_C)\widehat{tot}_t,\ \hat{\imath}_{Ft} = \hat{\imath}_t - \mu(1 - m_I)\widehat{tot}_t - \hat{\varepsilon}_t^{IST} \tag{4}$$

Consumption and Investment Consumers have access to domestic and foreign currency denominated private risk-free bonds as well as the domestic capital stock to facilitate the inter-temporal transfer of wealth. The optimal choice of consumption, bonds and physical capital implies three asset-pricing conditions.

$$\hat{c}_t = c_1\hat{c}_{t-1} + (1 - c_1)\,\mathbf{E}_t\hat{c}_{t+1} + c_2\mathbf{E}_t\left[\hat{n}_t - \hat{n}_{t+1}\right] - c_3\left[\hat{R}_t - \mathbf{E}_t\hat{\pi}_{Ct+1}\right] + \hat{\varepsilon}_t^{TI} \tag{5}$$

$$\mathbf{E}_t\Delta\widehat{NEx}_{t+1} = \hat{R}_t - \left[\hat{R}_t^* - \kappa\widehat{nfa}_t + \hat{\varepsilon}_t^{UIP}\right] \tag{6}$$

$$\widehat{tq}_t = t_1\mathbf{E}_t\widehat{tq}_{t+1} + (1 - t_1)\,\mathbf{E}_t\hat{r}_{t+1}^k - \left[\hat{R}_t - \mathbf{E}_t\hat{\pi}_{Ct+1}\right] \tag{7}$$

Equation 5 presents the consumption Euler. We define reduced-form parameters $c_1 \equiv h/(\bar{\gamma}+h)$, $c_2 \equiv (1-c_1)(\bar{w}\bar{n}/\bar{c})(\sigma_C-1)/\sigma_C$ and $c_3 \equiv (\bar{\gamma}-h)/(\bar{\gamma}+h)\sigma_C$. R is the gross interest rate on domestic bonds set by the monetary authority while π_C is the gross inflation in the CPI. The curvature parameter $\sigma_C > 0$ and the external habit coefficient $h \in [0,1)$ together govern the inter-temporal elasticity of substitution. Consumption and hours worked (N) are complements in the utility function when $\sigma_C > 1$ and they are separable if and only if $\sigma_C = 1$, *i.e.* the logarithmic case considered in JPT (2011). ε^{TI} is a disturbance that can be interpreted as a 'time-impatience' shock to the subjective discount factor and evolves as $\hat{\varepsilon}_t^{TI} = \rho_{TI}\ \hat{\varepsilon}_{t-1}^{TI} + \eta_t^{TI}$. Equation 6 presents uncovered interest parity (UIP), the arbitrage condition for home and foreign bonds, which relates the expected changes in the nominal exchange rate (NEx) to the interest rate differential between the two regions. Since the failure of UIP in its primitive form has been well documented, we add to this condition a stochastic term ε^{UIP} whose evolution obeys $\hat{\varepsilon}_t^{UIP} = \rho_{UIP}\hat{\varepsilon}_{t-1}^{UIP} + \eta_t^{UIP}$. The additional cost of acquiring net foreign assets NFA measured by $\kappa > 0$ acts as a stationarity-inducing device.[5] Finally, Equation 7 is the first order condition for physical capital which relates Tobin's Q (tq), the marginal value of physical capital, to its expected value, the rental rate of capital r^k and the *ex-ante* real interest rate. t_1 is defined as $\bar{\beta}(1-\delta)$ where $\delta \in [0,1]$ denotes the depreciation rate of the capital stock.

Two relationships that are central to the empirical results of this paper are the law of accumulation of physical capital $\left(\bar{K}\right)$ and the investment Euler equation:

$$\hat{\bar{k}}_t = k_1\hat{\imath}_t + (1-k_1)\,\hat{\bar{k}}_{t-1} + k_2\hat{\varepsilon}_t^{MEI} \tag{8}$$

where $k_1 \equiv \bar{\imath}/\bar{\bar{k}}$ and $k_2 \equiv k_1\bar{\gamma}^2\phi\left(1+\bar{\beta}\bar{\gamma}\right)$

$$\hat{\imath}_t = i_1\hat{\imath}_{t-1} + (1-i_1)\,\mathbf{E}_t\hat{\imath}_{t+1} + i_2\left[\widehat{tq}_t - (m_I - m_C)\,\widehat{tot}_t + \hat{\varepsilon}_t^{IST}\right] + \hat{\varepsilon}_t^{MEI} \tag{9}$$

where $i_1 \equiv 1/\left(1+\bar{\beta}\bar{\gamma}\right)$ and $i_2 \equiv i_1/\bar{\gamma}^2\phi$. The inertia in the capital accumulation process is increasing in the adjustment cost parameter $\phi > 0$. ε^{MEI} is a stochastic shifter that denotes a disturbance to the marginal efficiency of investment (MEI) and evolves as $\hat{\varepsilon}_t^{MEI} = \rho_{MEI}\hat{\varepsilon}_{t-1}^{MEI} + \eta_t^{MEI}$. Aggregate investment rises if the marginal value of capital exceeds the marginal cost of producing the new investment good. The marginal cost is given by the relative price of investment in terms of consumption which is a negative function of

[5] See Bergin (2006) and the references therein for details of the non-stationarity problem in incomplete market models.

the IST shock and, if investment is more import-intensive than consumption, a positive function of the terms of trade: $(m_I - m_C)\,\widehat{tot}_t - \hat{\varepsilon}_t^{IST}$.[6]

Observe that, as in JPT (2011), two distinct disturbances enter the investment Euler equation. The first is the IST shock which is interpreted as sector-specific productivity in the spirit of Greenwood *et al.* (2000) and is reflected by a fall in the relative price of investment. The second, the MEI disturbance stimulates the capital accumulation constraint in Equation 8. It increases the efficiency of the conversion of finished investment goods - idle pieces of machinery exiting the factory - into the economy's stock of installed physical capital which is used to produce intermediate goods in the next period. Empirically, the IST shock is restricted by the use of time series on the price of investment goods in the estimation, while the MEI shock can freely adjust to fit the investment quantity series.

It has been customary in the empirical DSGE literature, *e.g.* Rabanal and Tuesta (2010), SW (2007) and De Walque *et al.* (2005), to label the linear combination of the two investment disturbances in Equation 9 as an IST shock.[7] These studies do not use the price of investment goods in their estimation and instead identify the combined investment shock from quantity data. JPT (2010) report that estimates of the investment shock are much more volatile and only weakly correlated to available measures of the relative price of investment.[8] Hence, they emphasize the need of allowing investment volatility to emanate from sources beyond purely technological factors which make investment goods less expensive. JPT (2011) demonstrate that the disentangling of the sources of investment volatility has profound implications for the US business cycle under closed-economy assumptions. As we will see in Section 3.3.2, this distinction is even more important for the dynamics of the US trade balance.

Optimal capacity utilization implies that the rate of capacity utilization $u^{\bar{k}}$ is a positive

[6] The relative price of investment can easily be derived by subtracting the CPI in Equation 1 from the investment deflator in Equation 2. The terms of trade effect disappears when $m_C = m_I$ or when the economy is closed. See also Basu and Thoenissen (2011).

[7] However, Guerrieri *et al.* (2010) demonstrate that the *exact* inverse relationship is violated when production functions differ across competitive sectors specializing in the production of consumption and investment goods in a closed economy. JPT (2011) show how the equality is disturbed by sector-specific mark-ups under imperfect competition. The relationship also breaks down in an open-economy setting as the terms of trade enters the definition of the relative price of investment.

[8] In an open-economy context, Mandelman *et al.* (2011) also document the inability of investment-specific shocks used in standard models to replicate the properties of the relative price of investment goods in the data.

function of the (output deflator-based) rental rate of capital: $\hat{u}_t^{\bar{k}} = \hat{r}_{y,t}^k (\varphi - 1)/\varphi$ such that $\varphi \in (0,1)$ governs the strength of capacity utilization. The agent provides a differentiated labor service in the factor market and has monopoly power. Nominal wage stickiness is modelled *à la* Calvo. If $\theta_W \in (0,1)$ is the Calvo parameter for nominal wage stickiness and $\iota_W \in [0,1]$ measures the degree of indexation of wages to lagged CPI-inflation, the dynamics of nominal wage inflation (π_W) are governed by the wage Phillips curve:

$$\hat{\pi}_{Wt} - \iota_W \hat{\pi}_{Ct-1} = \bar{\beta}\bar{\gamma}\mathbf{E}_t\left(\hat{\pi}_{Wt+1} - \iota_W \hat{\pi}_{Ct}\right) - w_1\left[\hat{w}_t - \sigma_N \hat{n}_t - \frac{\bar{\gamma}\hat{c}_t - h\hat{c}_{t-1}}{\bar{\gamma} - h}\right] + \hat{\varepsilon}_t^{WM} \quad (10)$$

where $w_1 \equiv \left(1 - \bar{\beta}\bar{\gamma}\theta_W\right)\left(1 - \theta_W\right)/\theta_W\left(1 + \sigma_N \upsilon_N\right)$. $\sigma_N > 0$ is the inverse of the Frisch elasticity of labor-supply and $\upsilon_N > 1$ is the steady-state demand elasticity for the individual labor-type. ε^{WM} is a cost-push disturbance emanating from short-run time-variation in the labor-demand elasticity and can be interpreted as a shock to the mark-up (in square brackets) of the CPI-based real wage (w) over the marginal rate of substitution between consumption and leisure. The shock follows an ARMA $(1,1)$ process defined as $\hat{\varepsilon}_t^{WM} = \rho_{WM}\hat{\varepsilon}_{t-1}^{WM} + \eta_t^{WM} - \nu_{WM}\eta_{t-1}^{WM}$ such that $\nu_{WM} \in [0,1)$.

Intermediate Firms There exists a continuum of intermediate monopolistic firms, each of which produces a differentiated variety. The firm rents effective capital and labor at (output deflator-based) real rates r_y^k and w_y and combines the factors in a Cobb-Douglas aggregate.

$$\hat{y}_{Ht} = \frac{\upsilon_Y}{\upsilon_Y - 1}\left[(1-\alpha)\hat{n}_t + \alpha(\hat{u}_t^{\bar{k}} + \hat{\bar{k}}_{t-1}) + \hat{\varepsilon}_t^{NEU}\right] \quad (11)$$

$\alpha \in [0,1]$ is the share of effective capital in the production function and $\upsilon_Y > 1$ is the elasticity of substitution between individual goods varieties which determines the steady-state mark-up of prices over marginal costs. ε^{NEU} is the stationary region-specific component of neutral technology and follows $\hat{\varepsilon}_t^{NEU} = \rho_{NEU}\hat{\varepsilon}_{t-1}^{NEU} + \eta_t^{NEU}$. The rental rate of capital is determined by $\hat{r}_{y,t}^k = \hat{w}_{y,t} + \hat{n}_t - (\hat{u}_t^{\bar{k}} + \hat{\bar{k}}_{t-1})$.

As seen in Rabanal and Tuesta (2010), the firm sets prices in the local currency in the market of destination and exchange rate pass-through is decreasing in the degree of price stickiness. $\{\theta_H, \theta_H^*\} \in (0,1)$ and $\{\iota_H, \iota_H^*\} \in [0,1]$ denote the Calvo probability parameters and the degrees of price-indexation for domestic and export sales respectively. The Phillips curve for domestic sales is given by

$$\hat{\pi}_{Ht} = \pi_1 \iota_H \hat{\pi}_{Ht-1} + \pi_2 \mathbf{E}_t \hat{\pi}_{Ht+1} + \pi_3 \widehat{rmc}_t \quad (12)$$

where $\pi_1 \equiv 1/\left(1+\bar{\beta}\bar{\gamma}\iota_H\right)$, $\pi_2 \equiv \pi_1\bar{\beta}\bar{\gamma}$ and $\pi_3 \equiv \pi_1\left(1-\bar{\beta}\bar{\gamma}\theta_H\right)(1-\theta_H)/\theta_H$. $\widehat{rmc}_t = (1-\alpha)\hat{w}_{y,t} + \alpha\hat{r}^k_{y,t} - \hat{\varepsilon}^{NEU}_t$ is the real marginal cost. The assumption of local currency pricing implies that the real exchange rate $\left(rex^Y\right)$ and the terms of trade enter the Phillips curves for export sales.

$$\hat{\pi}^*_{Ht} = x_1\iota^*_H\hat{\pi}^*_{Ht-1} + x_2\hat{\pi}^*_{Ht+1} + x_3\left[\widehat{rmc}_t - \widehat{rex}^Y_t - \widehat{tot}^*_t\right] + \hat{\varepsilon}^X_t \tag{13}$$

where $x_1 \equiv 1/\left(1+\bar{\beta}\bar{\gamma}\iota^*_H\right)$, $x_2 \equiv x_1\bar{\beta}\bar{\gamma}$ and $x_3 \equiv x_1\left(1-\bar{\beta}\bar{\gamma}\theta^*_H\right)(1-\theta^*_H)/\theta^*_H$. ε^X is a time-varying demand elasticity that the exporter faces in the foreign market and follows $\hat{\varepsilon}^X_t = \rho_X\hat{\varepsilon}^X_{t-1} + \eta^X_t - \nu_X\eta^X_{t-1}$ such that $\nu_X \in [0,1)$.[9]

Equation 14 represents the goods market clearing condition. Output is absorbed by domestic and export sales for consumption and investment, domestic government spending and the cost of capacity utilization. $\bar{c}/\bar{y}$ and $\bar{\imath}/\bar{y}$ indicate the steady-state shares of consumption and investment in output.

$$\hat{y}_{Ht} = \frac{\bar{c}}{\bar{y}}(1-m_C)\hat{c}_{Ht} + \frac{\bar{\imath}}{\bar{y}}(1-m_I)\hat{\imath}_{Ht} + \frac{\bar{c}}{\bar{y}}m_C\hat{c}^*_{Ht} + \frac{\bar{\imath}}{\bar{y}}m_I\hat{\imath}^*_{Ht} + \frac{\bar{r}^k\bar{\bar{k}}}{\bar{\gamma}\bar{y}}\hat{u}^k_t + \hat{\varepsilon}^{GOV}_t \tag{14}$$

We follow the convention in the literature by reducing government spending to a residual shock in aggregate demand that follows $\hat{\varepsilon}^{GOV}_t = \rho_{GOV}\hat{\varepsilon}^{GOV}_{t-1} + \eta^{GOV}_t$. Government spending is financed by lump-sum taxes and falls exclusively on the domestic bundle.[10]

Balance of Payments The inter-temporal flow of net foreign assets is determined by

$$\begin{aligned} \widehat{nfa}_t - \frac{1}{\bar{\beta}\bar{\gamma}}\widehat{nfa}_{t-1} &= \frac{\bar{c}}{\bar{y}}m_C\left[\widehat{NEx}_t + \hat{P}^*_{Ht} + \hat{c}^*_{Ht} - \hat{P}_{Ft} - \hat{c}_{Ft}\right] \\ &\quad + \frac{\bar{\imath}}{\bar{y}}m_I\left[\widehat{NEx}_t + \hat{P}^*_{Ht} + \hat{\imath}^*_{Ht} - \hat{P}_{Ft} - \hat{\imath}_{Ft}\right] \end{aligned} \tag{15}$$

The aggregate net-exports to GDP ratio of the Home economy, which subsumes the prices as well as volumes of imports and exports, is given by the right-hand-side of Equation 15. Net-exports for consumption and investment are each weighted by their respective shares of imports and steady-state shares in GDP. Using the conditional import demand functions

[9] In steady-state, the demand-elasticities for the intermediate variety in the domestic and foreign markets are imposed to be the same.

[10] The assumption of a balanced budget implies that this paper does not provide an empirical evaluation of the Twin Deficits hypothesis. This view suggests that the deterioration of the trade balance is determined by the lack of saving by the Federal government. See Corsetti and Müller (2006) and the references therein for more details.

in Equation 4 (and its foreign analog), the definitions of the consumption- and investment-based real exchange rates and the home and foreign terms of trade, we can decompose the trade balance into the sum of differences in the consumption and investment levels between the US and the RoW, the real exchange rates and the differential in the terms of trade. Such a disaggregation will aid our analysis of the impact of the various structural shocks on each of these components.[11] Specifically, the trade balance is redefined as

$$\begin{aligned}\widehat{rtb}_t = & \overbrace{\frac{\bar{c}}{\bar{y}} m_C \left\{\hat{c}_t^* - \hat{c}_t\right\}}^{\text{Weighted International Relative Consumption Absorption}} + \overbrace{\frac{\bar{\imath}}{\bar{y}} m_I \left\{\hat{\imath}_t^* - \hat{\imath}_t\right\}}^{\text{Weighted International Relative Investment Absorption}} \\ & + \overbrace{\frac{\bar{c}}{\bar{y}} m_C \widehat{rex}_t^C + \frac{\bar{\imath}}{\bar{y}} m_I \widehat{rex}_t^I}^{\text{Weighted Real Exchange Rates}} + \overbrace{(\mu - 1)\left[\frac{\bar{c}}{\bar{y}} m_C (1 - m_C) + \frac{\bar{\imath}}{\bar{y}} m_I (1 - m_I)\right]\left\{\widehat{tot}_t - \widehat{tot}^*\right\}}^{\text{Weighted Relative Terms of Trade}}\end{aligned} \quad (16)$$

Monetary Policy The model is closed with the monetary authority following a simple empirical Taylor-type rule to set the nominal interest rate, targeting CPI-inflation and the level as well as changes in the output-gap. The output-gap is defined as the difference between output under sticky prices and that would prevail under flexible prices (y_H^{flex}). In addition, the policy rule is subject to exogenous monetary disturbances.

$$\hat{R}_t = \rho_{MON} \hat{R}_{t-1} + (1 - \rho_{MON}) \left[\phi_\pi \hat{\pi}_t^C + \phi_y \left\{\hat{y}_{Ht} - \hat{y}_{Ht}^{flex}\right\}\right] + \phi_{\Delta y}\left[\Delta \hat{y}_{Ht} - \Delta \hat{y}_{Ht}^{flex}\right] + \eta_t^{MON} \quad (17)$$

3 Estimation

3.1 Data and Estimation Method

The empirical treatment of the foreign region in the model, the RoW, poses a significant challenge. Long macroeconomic time series are unavailable for high-saving emerging economies as China that have centered in recent debates in the context of the US deficit. This impedes our effort to disentangle the effect of external disturbances on the imbalance. To remedy the lack of data to form the RoW aggregate, we propose an alternative

[11] Alternatively, as in Raffo (2008), we can separate the effects from the net-export volumes $\hat{C}_{Ht}^* + \hat{I}_{Ht}^* - \hat{C}_{Ft} - \hat{I}_{Ft}$ and the net-export prices $\widehat{NEx}_t + \hat{P}_{Ht}^* - \hat{P}_{Ft}$. However, this strategy will not highlight the expenditure-switching due to the terms of trade movements which is part of the demand functions for export and import volumes. This terms of trade effect is important for our discussion of the dynamics that follows in Section 3.3.3.

strategy. More specifically, we use the bilateral trade balance between the US and a group of sixteen industrialized economies - Canada, Japan, Korea, the UK and twelve economies from the Euro-Area - as a proxy for the actual US trade balance. Figure 1 compares the constructed intra-OECD trade balance series with the actual non-energy trade balance since the 1980s. Clearly, a trade imbalance prevails even within the industrialized countries, which motivates our decision to use the bilateral trade balance between the US and this group of OECD economies in the estimations. The OECD series tracks the actual non-energy trade balance rather well between the early 1980s through the late 1990s before the omitted economies started to play a dominant role. As can be seen in Table 1, the two series are highly correlated. Towards the later years of the sample, the disparity between the two series increases even though they continue to display the high cross-correlation, which is what really matters if we want to analyze the cycle of the balance. Time series from the OECD trade-partners are aggregated using time-varying trade-shares to embody the RoW in the empirical analysis.[12] In a robustness check, we have also employed the actual trade balance in the estimations and obtain similar results (see Section 4).

To identify the seventeen structural innovations in the theoretical model - η^{NEU}, η^{NEU*}, η^{MEI}, η^{MEI*}, η^{IST}, η^{IST*}, η^{UIP}, η^{TI}, η^{TI*}, η^{GOV}, η^{GOV*}, η^{WM}, η^{WM*}, η^{MON}, η^{MON*}, η^{X} and η^{X*} - an equal number of macroeconomic time series are matched with their analogs in the model. As in JPT (2010, 2011), we adjust the data definition of US investment to include changes in inventories and consumer durables while subtracting expenditures on durables from consumption.[13] The addition of these components to aggregate investment data makes it more volatile and procyclical. Note that due to non-availability of data especially for the Euro-Area, we are unable to make similar adjustments to the RoW series on investment and consumption. We use US and RoW series on real consumption, real investment, real GDP, GDP deflator inflation, investment deflator inflation, export price inflation, real wage inflation, and the nominal interest rates along with the net-exports to US GDP ratio spanning 1980.Q1-2005.Q4. Since the model endogenously allows for an average growth rate, we do not need to filter any series before the estimation.

Table 1 provides the unconditional moments of the data. Observe that due to the incorporation of the additional components, US investment growth is twice as volatile as

[12] Bergin (2006), Corsetti *et al.* (2006) and Bussière *et al.* (2005) are other studies that use multi-country data aggregates in empirical models of the US external balance.

[13] In SW (2007), durables expenditures are included in the consumption series while the investment series excludes the changes in inventories.

the RoW analog. Hence, a qualification to our results is that we may be *underestimating* the importance of RoW investment disturbances. Other particulars about the data are detailed in the Appendix.

We apply the Bayesian estimation methodology employed by SW (2007) and we refer to the original paper for a detailed description. In a nutshell, the Bayesian paradigm facilitates the combination of prior knowledge about structural parameters with information in the data as embodied by the likelihood function. The blend of the prior and the likelihood function yields the posterior distribution for the structural parameters which is then used for inference. We use the open-source Matlab-based DSGE toolkit, Dynare (See Adjemian *et al* 2011), to estimate the model. Further, technical details on the estimation methodology are available in the appendix.

3.2 Priors

An overview of our priors can be found in Table 2. The prior distributions given to the estimated structural parameters are comparable to those used in other studies. The parameters that are not estimated are given dogmatic priors at calibrated values. We follow the strategy of Bergin (2006) and Rabanal and Tuesta (2010) in fixing, rather than estimating, the import-shares. We allow for different import-intensities for consumption and investment by computing the means of the shares of imports from annual data over 1980-2005 from the Bureau of Economic Analysis.[14] We set the import-share for consumption m_C at 0.023 and the investment analog m_I at 0.3994. These values are quite similar to those used by Erceg *et al.* (2008) in their simulations. It is also important to note from Figure 1, that in the data, the trend in the trade balance is negative, quite unlike the positive trend in other quantities that we use in the estimation (see sample means of growth rates in Table 1). It is unrealistic to think of a trade balance that trends (downward in the US case) asymptotically in the sense of balanced growth. Furthermore, note from Equation 16 that the model-based trade balance is the difference between variables which inherit the same trend in the balanced growth-path and hence is stationary. Hence it is

[14] In particular, we refer to Table 2b (U.S. Trade in Goods) from U.S. International Transactions Accounts Data from the BEA website. We define Investment Imports $\equiv$ Non-energy industrial supplies + Capital goods, except automotive + Automotive vehicles, parts and engines + Consumer durables manufactured and Consumption Imports $\equiv$ Consumer goods (nonfood), except automotive + Foods, feeds, and beverages - Consumer durables manufactured. The import-shares are computed by dividing these by aggregate investment and consumption.

appropriate to calibrate the trend of the trade balance time-series using the sample mean. Other calibrations are very standard in the literature.

3.3 Baseline Results

3.3.1 Posterior Estimates

The medians and the 5^{th} and 95^{th} percentiles of the posterior distributions of the structural and shock parameters are also reported in Table 2. The estimates of the US parameters are in the ballpark of those obtained in SW (2007) and JPT (2011). The RoW estimates of the structural parameters are similar except for the domestic price Calvo parameter which is quite low at about 0.30. A key estimate that is quite influential in the dynamics of the trade balance is that of the trade-elasticity μ. As also observed in Lubik and Schorfheide (2006), the 90 percent confidence bounds of this parameter are substantially below the threshold of unity, so that US and RoW output behave as complements in the final consumption and investment goods.

3.3.2 Determinants of Trade Balance Fluctuations

To evaluate the relative importance of the shocks embedded in the model, Table 3 shows the variance of the forecast errors of the trade balance at different horizons. For all shocks, we report the mean of the posterior distribution of variance decompositions. For ease of exposition, we have aggregated the contributions of disturbances that are less relevant for the discussion into 'other' US and RoW shocks. The table also reports the forecast errors of some key US macroeconomic variables, *i.e.* real GDP, consumption and investment as well as the US terms of trade.

The relative contributions of the shocks to variability in US GDP, consumption and investment are comparable to JPT (2010, 2011) or SW (2007).[15] Of special interest is the role of foreign and open-economy shocks for the overall US business cycle. For all three

[15] Relative to SW (2007), we find a more important role for investment shocks in explaining the business cycle. JPT (2010) demonstrate that this difference is due to the fact that SW (2007) include (more volatile) durable expenditures in consumption, while excluding the change in inventories from investment, but not from output. It must be noted that JPT (2010, 2011) report variance decompositions at business-cycle frequencies. Our results and those of SW (2007) based in the time-domain, even though very related, are not strictly comparable with those of JPT (2010, 2011).

variables, these shocks explain less than 12 percent for forecast horizons below 1 year. At longer horizons, when the variables are returning to the steady-state, the RoW MEI shock and the RoW export price mark-up shock seem to explain respectively 12 and 7 percent of US GDP variability.[16] Not surprisingly, the influence of the external disturbances on the terms of trade and the trade balance is much higher. On impact, the UIP and the RoW export price mark-up shock explain together approximately half of the US terms of trade and trade balance volatility. Hence, focusing solely on the influence of domestic shocks to study the deterioration of the US trade balance (*e.g.* Bems *et al.* 2007), ignores an important source of volatility. The relevance of both disturbances for the forecast error variance of the trade balance variability, however, vanishes very quickly. In particular, their contribution already declines to about 25 percent after 1 quarter and to less than 10 percent at longer horizons.

The declining relevance for trade balance fluctuations of the shocks that mainly transmit through international relative prices can be explained by the rising dominance of MEI shocks. While these disturbances contribute approximately 30 percent on impact, this becomes more than 60 percent one period afterwards and even more than 85 percent from the one-year horizon onwards. Both US and foreign investment efficiency shocks are important, but the US shock clearly dominates for explaining trade balance volatility. Remember, as discussed in Section 3.1, that US investment data is more volatile than the RoW series because it includes expenditures on consumer durables and inventories in contrast to the RoW investment series. Not surprisingly, the estimated RoW MEI innovation is only about half of the US analog (see Table 2), which could, in part, explain the lower contribution of the shock to trade balance fluctuations.

All other shocks, *i.e.* domestic and foreign neutral technology, IST, time-impatience, wage mark-up, export price mark-up, monetary and fiscal policy shocks turn out not to matter much for trade balance variability. This finding is particularly striking for neutral shocks given the fact that these disturbances are often considered as being important to understand trade balance movements in much of the theoretical as well as empirical literature. In our estimations, the US and RoW TFP shocks together contribute no more than 1 percent at all horizons, which is considerably lower than the contribution to domestic variables such as real GDP and consumption.

[16] The increasing influence of the RoW MEI and export mark-up shocks over longer horizons is due to the high estimated persistence in the processes.

Why do MEI shocks overwhelmingly dominate the forecast volatility of the trade balance, in contrast to some other disturbances that are important for domestic fluctuations? In the following subsection, we dissect the dynamic responses of the trade balance and its components to understand the mechanisms that strengthen the transmission of MEI disturbances as well as those that render some other shocks less potent.

3.3.3 Impulse Response Analysis

Figure 2 shows the dynamic effects of selected structural shocks on the trade balance and its four main elements as described in Equation 16, together with US consumption, investment and output. The dynamics of all the observables triggered by the full set of shocks used in the estimation are presented in the on-line appendix of the paper.

US Neutral Technology and MEI Shocks The solid lines and shaded areas in Panel 1 of Figure 2 represent the 90 percent posterior probability regions of the estimated responses induced by a US neutral technology and MEI shock respectively. A persistent rise in US neutral technology draws positive responses from consumption, investment and output as the income of the agents rise. The dynamics for these variables are similar to those obtained in other studies, *e.g.* SW (2007). In the second row of the panel, we observe that the rise in US consumption leads to a significant decline in relative consumption absorption while relative investment absorption does not react significantly. On the other hand, the neutral shock is accompanied by a fall in domestic prices which results in a depreciation of the dollar and the US terms of trade. Observe that the deterioration (rise) of the US terms of trade has a negative impact on the trade balance. Crucially, this is because our estimate of the trade-elasticity (μ) is substantially below unity. This implies that there prevails a high degree of complementarity between US and RoW goods, so that the rise in the demand for the US good which is triggered by a fall in its relative price, is also accompanied by a rise in the demand for the RoW good. Thus the impact of the terms of trade deterioration on the trade balance is negative. Overall, the trade balance improves slightly on impact due to the exchange rate effect but quickly becomes counter-cyclical because of the negative absorption and terms of trade effects.

A US MEI shock accelerates the conversion of the investment good into the capital stock by reducing installation costs, which raises the demand for both US and imported intermediate goods. As a result, US investment and output rise strongly. Unlike JPT (2011), US consumption rises on impact. The reason for the increase of consumption can be traced to the interaction between three specific model ingredients: counter-cyclical mark-ups due to sticky prices, variable capacity utilization and consumption-hours complementarity.[17] The first two enter the firm's optimality condition for labor input and generate a rise in labor demand. Finally, since our estimate of the risk-aversion parameter σ_C exceeds unity (see Table 2), a rise in hours worked (not exhibited) raises the marginal utility of consumption and positively stimulates consumption. Overall, the positive comovement between investment, hours and consumption in the US reflects in the negative impact of relative international consumption and investment absorption, the low import-intensity of consumption ensuring that the former reacts very mildly compared to the latter. The rise in investment demand is not potent enough to raise domestic prices significantly. However, the price of imports rises strongly, worsening the US terms of trade (not exhibited). The rising domestic terms of trade generates a negative effect on the trade balance owing to the low trade-elasticity, much as in the case of the neutral shock. The negative relative absorption and terms of trade effects swamp the positive effect from dollar depreciation and generates a very strong counter-cyclicality in the trade balance. In fact, the maximum quantitative impact of the US MEI shock - which is observed at a 6-quarter forecast horizon - is many times stronger than that of the neutral technology shock, which explains the vast disparity in strength between the two shocks in the variance decomposition as documented in the preceding section.

The strong and dominating role for MEI shocks for trade balance fluctuations is not a surprise. As documented by Erceg *et al.* (2008), US exports and imports are heavily concentrated in capital goods and consumer durables. Hence, a domestic or foreign shock that has a considerable impact on investment, also has a much larger effect on the US trade balance than a shock that rather boosts consumption.[18]

[17] In a calibrated closed-economy model, Furlanetto and Seneca (2010) demonstrate that the combination of these features can resolve the crowding out of consumption by investment shocks pointed out by Barro and King (1984). As a benchmark, they also analyze the case of logarithmic utility ($\sigma_C = 1$) examined by JPT (2010, 2011) where consumption is crowded out by a rise in investment even in the presence of sticky prices and variable capacity utilization.

[18] The dynamics induced by the second investment disturbance, the IST shock, in most variables of interest are qualitatively similar to those of the MEI shock, but the magnitudes are mild. The trade balance responds counter-cyclically albeit the movement - just as that for the neutral technology shock - is much weaker than that triggered by the MEI shock. This is not a surprise given that IST shocks explain little of fluctuations in absorption, including investment (see Table 3), which is key for trade balance

UIP and RoW Export Mark-up Shocks The dynamic effects for the two other shocks that matter for trade balance volatility in the short run, *i.e.* a UIP shock (dashed lines) and a RoW export-price mark-up shock (dotted lines), are plotted in the lower panel of Figure 2. A positive UIP shock, which can be interpreted as a rise in the risk premium on foreign borrowing, creates a wedge between the two nominal interest rates, raising the US interest rate and lowering the RoW analog while also depreciating the dollar in nominal terms. The rise in the home interest rate lowers US consumption and investment while the RoW analogs increase as a consequence of the fall in the RoW interest rate. Relative absorption in both consumption and investment rise, but the latter more strongly than the former. The movements are further reinforced by the strong positive shift in the exchange rate while the effect from the deteriorating relative terms of trade is negative. In effect, the US trade balance improves significantly.

An exogenous increase in the RoW export price deteriorates the US terms of trade very strongly on impact and raises the relative price of investment. Consequently, US investment falls strongly and persistently. The familiar comovement channel, as described above, operates here in reverse, so that US consumption also falls together with hours worked and capacity utilization. The real exchange rates appreciate because the US CPI and investment deflator increase following the rise in the US import price. Observe that for a shock that emanates mainly from the US terms of trade, the influence of this channel is surprisingly small. This is because the RoW terms of trade also deteriorates due to the appreciation of the dollar which makes US exports more expensive. Thus the movement in the *relative* terms of trade is very small. Overall, the trade balance dynamics are mainly governed by the negative exchange rate appreciation effect on impact while the positive absorption effects from relative consumption and investment dominate after about 6 quarters.

3.3.4 Interpretation of MEI shocks

JPT (2011) interpret the MEI shock as a proxy for the efficiency of the latent financial sector in channelling the flow of household savings into new capital. In particular, they draw parallels between the expansionary effect of the MEI shock on the supply curve of capital and similar effects of entrepreneurial net-worth in the agency cost model of

volatility. Notice that as in JPT (2011), the MEI shock is estimated from investment quantity data while the IST shock is restricted by movements in the investment-deflator time series.

Carlstrom and Fuerst (1997). In empirical support of their interpretation, JPT (2011) report that the estimated MEI shock is highly correlated to a data-based measure of the external finance premium - the excess of the interest rate paid by entrepreneurs over the risk-free rate. They observe that typically in periods when the functioning of the financial markets is impaired - *i.e.* the external finance premium is high and net-worth is low - the MEI shock decreases.

In Panel 1 of Figure 3, we plot our posterior mode estimate of the US MEI shock against the US external finance premium, while Panel 2 displays the analogous series for the RoW. The risk premium is proxied by the excess of the Bank of America Merrill Lynch Corporate BBB Index over the treasury bill rate.[19] Overall, we find a significant negative correlation between the MEI shocks and the interest rate spreads, which is in line with the interpretation of JPT (2011). More precisely, the correlation between the US MEI shock series and the domestic spread is -0.44 for the longest available sample period.[20] When we consider the shorter sample period for which we have spreads data for both regions in the model, *i.e.* 1998-2005, the correlation increases to -0.77. On the other hand, the analogous correlation for the RoW is -0.47. To sum up, the high correlations between the MEI shocks and the spreads are suggestive that these shocks may indeed capture in reduced-form, alterations in the implicit financial intermediation mechanism.

4 Sensitivity Analysis

In this section, we present a suite of robustness checks to evaluate the strength of the MEI shock and to clarify which features of the model are crucial to explain the differences of our results relative to the existing literature. The outcome of the analysis is summarized

[19] JPT (2011) use the Merrill Lynch Master II High Yield Corporate Bond Index, but this series is not available for the RoW. Notice that the high-yield BBB bonds series for the US starts in 1988Q4, while this is only 1998Q1 for the RoW due to the later take-off of the high-yield bond market in countries outside the US.

[20] JPT (2011) find a MEI-spread correlation of -0.71 for a sample which starts in 1989 because their sample includes the first few quarters of the 2008-2009 recession when spreads increased sharply. In contrast, our sample ends in 2005 because the expansion of the Euro-Area afterwards impedes the construction of the intra-OECD trade balance, accounting for the new members. Despite the differences in modelling and data choices, the correlation between our estimated US MEI series and that of JPT (2011) amounts to almost 0.80. On the other hand, over our subsample period, the JPT's MEI-spread correlation is -0.45, very close to what we find for the US. We thank the authors for sending us the data.

in Table 4, which reports the variance decompositions at a 4 quarter forecast horizon for the trade balance. In Table 5, we report parameter estimates for each model specification. We also consistently find a dominant role for MEI shocks in other specifications that we do not present here. For example, the results hold when we (a) use the non-energy trade balance series (b) use detrended data (c) assume complete markets instead of incomplete markets and (d) assume Jaimovich and Rebelo (2009) preferences. Details pertaining to these additional specifications are available on request.

As a first check, we supplant the UIP shock with a (relative) US home-bias preference shock which decreases the import-shares of consumption and investment. This disturbance can potentially disconnect trade balance dynamics from other variables because it directly stimulates the import-demand functions and acts as the trade balance's own driving force. However, as shown in Column 2, MEI shocks also retain their dominant influence even after the introduction of this open-economy disturbance.

Why do our results differ from those of Bergin (2006) and De Walque *et al.* (2005), our precedents in the empirical open-economy literature who find no substantive effect of MEI shocks on US trade balance fluctuations?[21] First, both studies use the popular aggregation set-up as in Backus *et al.* (1994), henceforth BKK, so that the share of imports in the final good is specified in terms of total absorption. Column 3 of Table 4 shows the variance decomposition of the trade balance for this specification when we fix the import-share of aggregate absorption at 0.15 as in BKK. As can be seen, the contribution of MEI shocks is almost halved. This is not a surprise since the BKK aggregator does not distinguish between final investment and consumption goods, whereas our model allows investment to be more open to imports than consumption.

Bergin (2006) estimates a symmetric two-country model using five structural shocks for the US and a rest of the G-7 aggregate. He has a home-bias shock that directly affects the import-share in the Armington aggregator and does not use investment-specific shocks or data. He finds that shocks to UIP, consumption and home-bias matter most for the dynamics of the current account. The fourth column shows the results for a simplified version of our baseline model that is as close as possible to the Bergin (2006) small-scale set-up. This exercise suggests that, when MEI shocks are omitted from the analysis, the contribution of these shocks to the trade balance is indeed mainly absorbed by UIP,

[21] A caveat to this exercise is that none of the modelling approaches are nested in terms of either structural features or estimation. However, the checks may still indicate the sources of discrepancy.

consumption and home-bias shocks.

De Walque *et al.* (2005) use a large-scale two-country model to examine the aggregate US and Euro-Area trade balances. Notably, they do not consider the bilateral balance between the two regions. In their trade structure, aggregate US (Euro-Area) exports are demanded by the Euro-Area (US) and an unmodelled Rest of the World that is captured through export-demand shocks that enter the definition of the US trade balance. They find that this shock accounts between 40 and 65 percent of trade balance volatility, whereas investment-specific shocks contribute less than 3 percent. To analyze the role of this omitted RoW export-demand shock more carefully, we have also estimated a model with the BKK aggregator and an additional demand shock for US exports. When we still assume an import-share of 15 percent in GDP (Column 5 of Table 4), MEI shocks still dominate, while the export-demand shock contributes about 17 percent to the forecast variance of the trade balance.

However, the decomposition changes dramatically when we *estimate* the import-share as in De Walque *et al.* (2005). The posterior estimate of this parameter turns out to be close to 2 percent.[22] As one can observe in the last column of Table 4, the export shock now contributes about 54 percent of the forecast variance. The main reason is that the very low import-share makes the two regions behave almost as autarkic economies. The trade balance becomes a disconnected variable, with the more fundamental shocks having a minimal relative impact. Justiniano and Preston (2010) note that the openness parameter can reduce to unrealistic values if left unrestricted in an estimation exercise. Since the import-share of 2 percent obtained in this experiment is much lower than the unconditional import-share of about 15 percent observed in US data, it is hard to recognize the non-structural export demand shock as the dominant source of trade balance fluctuations. Openness clearly matters in the transmission of fundamental domestic disturbances to the external position.

5 Conclusions

This paper has highlighted the influence of marginal efficiency of investment shocks on the bilateral trade balance between the US and a trade-weighted aggregate of sixteen OECD

[22] De Walque *et al.* (2005) use a very restrictive prior centered on the share of 5 percent that is accounted by European exports in US GDP and their posterior estimates are exactly the same as the prior.

economies within a two-country DSGE model estimated with Bayesian methods. The relative strength of the marginal efficiency shock, which holds through a wide array of model specifications, is primarily due to its strong impact on international relative absorption, investment absorption in particular. In contrast, while traditional technological shocks can generate counter-cyclical trade balance dynamics, their influence is quantitatively mild.

Marginal efficiency of investment shocks are typically interpreted as reduced-form indicators of changes in the efficiency of the financial intermediation sector to allocate credit. This is reflected in a negative correlation with measures of the external finance premium, both in the US and abroad. Hence, a promising avenue for future empirical research would be to endogenize financial intermediation in an open-economy model as ours and estimate it with full-information techniques. For instance, Christiano *et al.* (2010) report that the explanatory power of marginal efficiency shocks is lowered when structural shocks that affect the financial sector are introduced in closed-economy models for the US and Euro-Area. Clearly, pinpointing the sources of the alterations to investment frictions is key to better understand the dynamics of the US trade balance.

A Appendix

A.1 Data Series

All raw series are seasonally adjusted by the Census X12 method. We use the Direction of Trade Statistics (DOTS) database of the International Monetary Fund (IMF) to construct the annualized aggregated bilateral trade balance (net-exports in US dollars) between the US and the 16 OECD trade partners over 1980Q1-2005Q4. The series for nominal GDP, nominal consumption, nominal gross fixed capital formation, nominal interest rates and nominal wages for the US, Canada, Japan, Korea and the UK are obtained from the International Financial Statistics Database (IFS) of the IMF. For the Euro-Area series, we use data from the Area Wide Model (Fagan *et al.* 2001).[23] We draw import and export price series for the US from the IFS. The series for consumer durables for the US is drawn from the FRED II database of the Federal Reserve Bank of St.Louis. As mentioned in the

[23] We use the best available substitutes for the nominal interest rate for each economy. For Canada and the United Kingdom, we use the Treasury Bill rate, for Japan we use the government bond yield, and for Korea, we use the discount rate. Finally, the nominal interest rate series (STN) from the Area Wide Model is used.

main text, we add consumer durables and inventories (IFS) to the US series on gross fixed capital formation while subtracting expenditure on durables from US consumption. We use the gross private domestic investment deflator series from the Bureau of Economic Analysis while the investment deflators for the trade partners are drawn from the OECD Quarterly National Accounts database and the Area Wide Model. Shares of each individual economy are computed by dividing the sum of imports and exports with the individual economy by aggregate trade. We use these time-varying weights to aggregate individual economy series to make the RoW (Canada generally gets the highest weight while Korea gets the lowest). We multiply the natural logarithms of real consumption, real GDP, real investment, the investment deflator, the GDP deflator, the real wage, export prices and import price by 100. These series are fed into the model in first-differences. Since the model predicts that the trade balance is zero in steady-state, the trade balance to US GDP ratio is not logged and enters the estimation in first-differences. The nominal interest rates are divided by 4 to translate them into quarterly terms and enter the estimation in levels. To construct the trade-weighted high-yield bond rate for the RoW, we use Dex capital overall BBB index for Canada and Bank of America Merrill Lynch BBB (local currency) Indices for the Euro-Area and Japan and the IBoxx Non-Gilts BBB Index for the UK. We omit Korea which makes less than 5 percent of the RoW aggregate as the series its high-yield indices are very short. For the risk-free rate, we use the treasury bill rates for Canada and the UK, the government bond yield for Japan and the French treasury bill rate for the Euro-Area.

A.2 Estimation

We use 525000 iterations of the Random Walk Metropolis Hastings algorithm to simulate the posterior distributions and achieve acceptance rates of below 35 percent in all our specifications. We monitor the convergence of the marginal posterior distributions using CUMSUM statistics as defined by Bauwens *et al.* (1999). We discard the initial 25000 draws to compute the posterior moments in each case. The distributions of impulse response functions and variance decompositions that we present are computed from 150 random draws from the posterior. This strategy ensures that our results are not contingent on a particular vector of parameter values such as the posterior median or the mode.

References

[1] Adjemian, Stéphane, Houtan Bastani, Michel Juillard, Ferhat Mihoubi, George Perendia, Marco Ratto and Sébastien Villemot, 2011. "Dynare: Reference Manual, Version 4". Dynare Working Papers, 1, CEPREMAP.

[2] Backus, David, Patrick Kehoe and Finn Kydland, 1994. "Dynamics of the Trade Balance and the Terms of Trade: The J-Curve?". American Economic Review 84, pp.84-103.

[3] Barro, Robert and Robert King, 1984. "Time-separable Preferences and Intertemporal Substitution Models of the Business Cycle". Quarterly Journal of Economics 99, pp.817-39.

[4] Basu, Parantap and Christoph Thoenissen, 2011. "International Business Cycles and the Relative Price of Investment Goods". Canadian Journal of Economics 44, pp.580-606.

[5] Bauwens, Luc, Michel Lubrano and Jean-Francois Richard, 1999. "Bayesian Inference in Dynamic Econometric Models". Oxford University Press.

[6] Bems, Rudolfs, Luca Dedola and Frank Smets, 2007. "US Imbalances: The Role of Technology and Policy". Journal of International Money and Finance 26, pp.523-545.

[7] Bergin, Paul, 2006. "How Well can the New Open Economy Macroeconomics Explain the Exchange Rate and Current Account?". Journal of International Money and Finance 25, pp.675-701.

[8] Bussière, Matthieu, Marcel Fratzscher and Gernot Müller, 2005. "Productivity Shocks, Budget Deficits and the Current Account". European Central Bank Working Paper No.509.

[9] Carlstrom, Charles and Timothy Fuerst, 1997. "Agency Costs, Net Worth, and Business Fluctuations: A Computable General Equilibrium Analysis". American Economic Review 87, pp.893-910

[10] Christiano, Lawrence, Roberto Motto and Massimo Rostagno, 2010. "Financial Factors in Economic Fluctuations". European Central Bank Working Paper No.1192.

[11] Corsetti, Giancarlo, Luca Dedola and Sylvain Leduc, 2006. "Productivity, External Balance and Exchange Rates: Evidence on the Transmission Mechanism Among G7 Countries". in Lucrezia Reichlin and Kenneth West (Eds.) NBER International Seminar on Macroeconomics.

[12] Corsetti, Giancarlo and Gernot Müller, 2006. "Twin Deficits: Squaring Theory, Evidence and Common Sense". Economic Policy 48, pp.597-638.

[13] Corsetti, Giancarlo and Panagiotis Konstantinou, 2009. "What Drives US Foreign Borrowing? Evidence on External Adjustment to Transitory and Permanent Shocks". European University Institute *Mimeo.*

[14] De Walque, Gregory, Frank Smets and Rafael Wouters, 2005. "An Estimated Two-Country DSGE Model for the Euro-Area and the US Economy". National Bank of Belgium *Mimeo.* (Version December 2)

[15] Engel, Charles and John Rogers, 2006. "The U.S. Current Account Deficit and the Expected Share of World Output". Journal of Monetary Economics 53, pp.1063-1093.

[16] Erceg, Christopher, Luca Guerrieri and Christopher Gust, 2008. "Trade Adjustment and the Composition of Trade". Journal of Economic Dynamics and Control 32, pp.2622-2650.

[17] Fagan, Gabriel, Jérôme Henry and Ricardo Mestre, 2001. "An Area-Wide Model (AWM) for the Euro-Area". European Central Bank Working Paper No.42.

[18] Furlanetto, Francesco and Martin Seneca, 2010. "Investment-specific Technology Shocks and Consumption". Norges Bank Working Paper 2010/30.

[19] Greenwood, Jeremy, Zvi Hercowitz and Per Krusell, 2000. "The Role of Investment-specific Technological Change in the Business Cycle". European Economic Review 44, pp.91-115.

[20] Guerrieri, Luca, Dale Henderson and Jinill Kim, 2010. "Interpreting Investment-specific Technology Shocks". International Finance Discussion Papers 1000, Board of Governors of the Federal Reserve System.

[21] Jaimovich, Nir and Sergio Rebelo, 2009. "Can News About the Future Drive the Business Cycle? ". American Economic Review 99, pp.1097-1118.

[22] Justiniano, Alejandro and Bruce Preston, 2010. "Can Structural Small Open Economy Models Account for the Influence of Foreign Disturbances?" Journal of International Economics 81, pp.61-74.

[23] Justiniano, Alejandro, Giorgio Primiceri and Andrea Tambalotti, 2011. "Investment Shocks and the Relative Price of Investment". Review of Economic Dynamics 14, pp.101-121.

[24] Justiniano, Alejandro, Giorgio Primiceri and Andrea Tambalotti, 2010. "Investment Shocks and Business Cycles". Journal of Monetary Economics 57, pp.132-145.

[25] Kollmann, Robert, 1998. "US Trade Balance Dynamics: The Role of Fiscal Policy and Productivity Shocks and of Financial Market Linkages". Journal of International Money and Finance 17, pp.637-669.

[26] Lubik, Thomas and Frank Schorfheide, 2006. "A Bayesian Look at the New Open Economy Macroeconomics". NBER Macroeconomics Annual 20, pp.313-366.

[27] Mandelman, Federico, Pau Rabanal, Juan Francisco Rubio-Ramirez and Diego Vilan, 2011. "Investment- Specific Technology Shocks and International Business Cycles: An Empirical Assessment". Review of Economic Dynamics 14, pp.136-155.

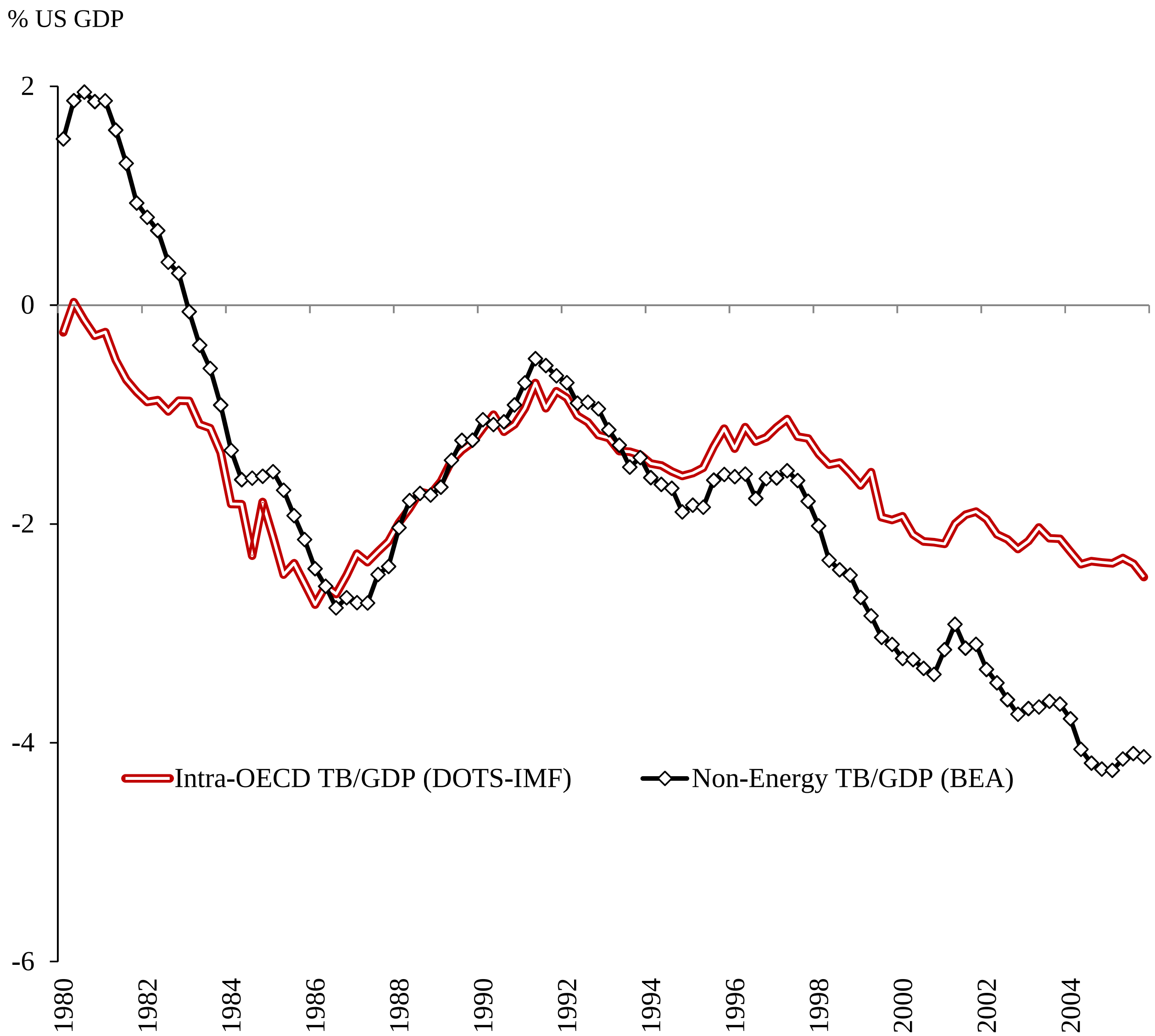
[28] Rabanal, Pau and Vicente Tuesta, 2010. "Euro-Dollar Real Exchange Rate Dynamics in an Estimated Two-Country Model: An Assessment". Journal of Economic Dynamics and Control 34, pp.780-797.

[29] Raffo, Andrea, 2010. "Technology Shocks: Novel Implications for International Business Cycles". International Finance Discussion Papers No. 992.

[30] Raffo, Andrea, 2008. "Net-exports, Consumption Volatility and International Business Cycle Models". Journal of International Economics 75, pp.14-29.

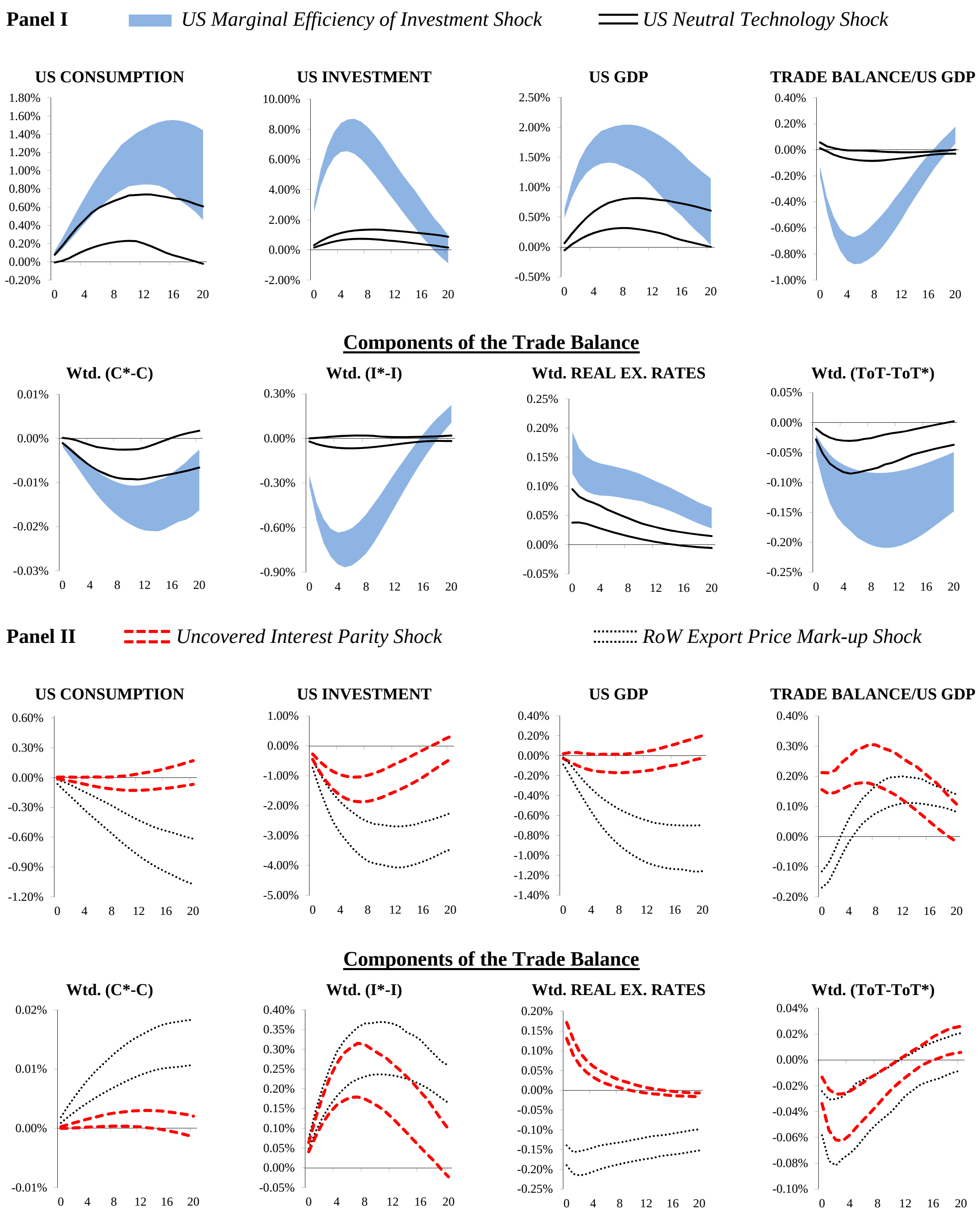
[31] Smets, Frank and Rafael Wouters, 2007. "Shocks and Frictions in US Business Cycles: A Bayesian DSGE Approach". American Economic Review 97, pp.586-606.

Figure 1: Comparing the Intra-OECD US Trade to the Aggregate Non-Energy Trade Balance



Note: The Rest of the World (RoW) is a trade-weighted aggregate of the United Kingdom, Canada, Japan, Korea and 12 members of the Euro-Area.

Figure 2: Estimated Impulse Response Functions of Selected Variables



Note: We present the 5th and 95th percentiles of IRFs computed from 150 random draws from the posterior distribution. The aggregate trade balance impulse response is the sum of the impulse responses of the components. The abbreviation 'Wtd.' indicates that the concerned variable has been multiplied by the coefficient in Equation 15 in the main text. Importantly, the coefficient on the relative terms of trade is negative because the estimate of the trade-elasticity is below unity.

Figure 3: The MEI Shock and the External Finance Premium

Note: The MEI shocks are distilled by applying the Kalman smoother when the parameters are set at the posterior mode. The external finance premium is proxied by the excess of BBB bond yields over the treasury bill rates or government bond yields. All series presented in the figure are standardized.

Table 1: Unconditional Moments of the Data

Correlation between the Intra-OECD and the Actual Non-Energy US Trade Balances

Level	0.89
Linear Detrending	0.96
Growth Rates	0.56

Observable Series	**US**		**RoW**		**Model US Variable**
	Mean	SD	Mean	SD	
Real Consumption Growth	0.86	0.44	0.64	0.50	$\bar{\gamma} + \Delta\hat{C}_t + \hat{\pi}_{Ct} - \hat{\pi}_{Ht}$
Real Investment Growth	0.61	2.56	0.60	1.27	$\bar{\gamma} + \Delta\hat{I}_t + \hat{\pi}_{It} - \hat{\pi}_{Ht}$
Real GDP Growth	0.71	0.70	0.65	0.55	$\bar{\gamma} + \Delta\hat{Y}_{Ht}$
Real Wage Inflation	0.08	0.34	0.26	0.46	$\bar{\gamma} + \Delta\hat{w}_{y,t}$
GDP Deflator Inflation	0.82	0.53	0.82	0.78	$\bar{\pi} + \hat{\pi}_{Ht}$
Investment Deflator Inflation	0.53	0.73	0.62	0.65	$\bar{\pi} + \hat{\pi}_{It}$
Export Price Inflation	0.53	1.23	0.64	2.25	$\bar{\pi} + \hat{\pi}^{*}_{Ht}$
Nominal Interest Rate	1.66	0.95	1.70	0.85	$\bar{R} + \hat{R}_t$
Intra-OECD TB/GDP Growth	-0.02	0.16			$\overline{\Delta rtb}^{OECD} + \Delta\widehat{rtb}_t$
Non-Energy TB/GDP Growth	-0.04	0.18			$\overline{\Delta rtb}^{NE} + \Delta\widehat{rtb}_t$

Note: Δ indicates the temporal difference operator. We adjust for the prices when we link aggregate consumption and investment to the data. For example, the level of real consumption, as we measure it in the data is given as $C^{DATA} = \frac{P_{CPI}}{P_{GDP}} C^{MODEL}$.

Table 2: Prior and Posterior Distributions in Baseline Estimation

ESTIMATED STRUCTURAL PARAMETERS

Symbol	Description	Prior (P1, P2)	Posterior Med [5th; 95th %ile]
μ	Trade Elasticity	G (1.00, 0.25)	0.56 [0.40; 0.73]
σ_C	Utility Curvature	G (2.00, 0.50)	1.08 [1.05; 1.12]
h	External Habit	B (0.50, 0.15)	0.86 [0.82; 0.89]
ϕ	US Investment Adj. Cost	N (4.00, 1.00)	6.60 [5.09; 8.11]
ϕ^*	RoW Investment Adj. Cost	N (4.00, 1.00)	5.04 [3.89; 6.35]
φ	US Capacity Util. Cost	B (0.50, 0.15)	0.67 [0.57; 0.77]
φ^*	RoW Capacity Util. Cost	B (0.50, 0.15)	0.88 [0.77; 0.95]
θ_H	US PPI Calvo	B (0.50, 0.10)	0.78 [0.72; 0.83]
ι_H	US PPI Indexation	B (0.50, 0.15)	0.16 [0.07; 0.30]
θ^*_F	RoW PPI Calvo	B (0.50, 0.10)	0.29 [0.19; 0.39]
ι^*_F	RoW PPI Indexation	B (0.50, 0.15)	0.26 [0.11; 0.49]
θ^*_H	US Export Calvo	B (0.50, 0.10)	0.84 [0.76; 0.90]
ι^*_H	US Export Indexation	B (0.50, 0.15)	0.26 [0.13; 0.44]
θ_F	RoW Export Calvo	B (0.50, 0.10)	0.54 [0.44; 0.63]
ι_F	RoW Export Indexation	B (0.50, 0.15)	0.31 [0.15; 0.53]
θ_W	US Wage Calvo	B (0.50, 0.10)	0.95 [0.95; 0.95]
ι_W	US Wage Indexation	B (0.50, 0.15)	0.49 [0.31; 0.66]
θ_W^*	RoW Wage Calvo	B (0.50, 0.10)	0.79 [0.66; 0.88]
ι_W^*	RoW Wage Indexation	B (0.50, 0.15)	0.13 [0.06; 0.23]
ϕ_π	US Mon. Pol. (Inflation)	N (1.50,0.25)	1.29 [1.16; 1.47]
ϕ_π^*	RoW Mon. Pol. (Inflation)	N (1.50,0.25)	1.60 [1.36; 1.92]
ϕ_y	US Mon. Pol. (Y Gap)	G (0.125,0.05)	0.01 [0.00; 0.01]
ϕ_y^*	RoW Mon. Pol. (Y Gap)	G (0.125,0.05)	0.03 [0.01; 0.05]
$\phi_{\Delta y}$	US Mon. Pol. (Δ Y Gap)	G (0.125,0.05)	0.05 [0.03; 0.08]
$\phi_{\Delta y}^*$	RoW Mon. Pol. (Δ Y Gap)	G (0.125,0.05)	0.05 [0.03; 0.08]
ρ_{MON}	US Interest Smoothing	B (0.75,0.075)	0.80 [0.76; 0.83]
ρ_{MON}^*	RoW Interest Smoothing	B (0.75,0.075)	0.92 [0.89; 0.93]
$100(\bar{\pi}-1)$	Steady-state Inflation	G (0.625, 0.10)	0.73 [0.57; 0.92]
$100(\bar{\gamma}-1)$	Trend Growth Rate	N (0.40, 0.10)	0.20 [0.16; 0.25]

CALIBRATED STRUCTURAL PARAMETERS

β	Discount Factor	0.99
α	Share of Capital Services in Production	1/3
δ	Quarterly Rate of Capital Depreciation	0.025
υ_Y	Substitution Elasticity of Goods Varieties	10
υ_N	Substitution Elasticity of Labour Varieties	10
σ_N	Inverse of Frisch Elasticity	2
κ	Cost of adjusting foreign assets	0.001
m_C	Import-share of consumption	0.023
m_I	Import-share of investment	0.3994
$\underline{g/y}$	Share of government spending in GDP	0.18
$\overline{\Delta rtb}^{OECD}$	Mean Change in Trade Balance to GDP	0.017

SHOCKS AR(1), MA(1)

Symbol	Prior (P1, P2)	Posterior Med [5th, 95th %ile]
ρ_{NEU}	B (0.50, 0.15)	0.97 [0.94; 0.98]
ρ_{NEU^*}	B (0.50, 0.15)	0.88 [0.72; 0.96]
ρ_{MEI}	B (0.50, 0.15)	0.86 [0.81; 0.89]
ρ_{MEI^*}	B (0.50, 0.15)	0.97 [0.94; 0.99]
ρ_{IST}	B (0.50, 0.15)	0.99 [0.99; 0.99]
ρ_{IST^*}	B (0.50, 0.15)	0.94 [0.90; 0.97]
ρ_{TI}	B (0.50, 0.15)	0.31 [0.19; 0.45]
ρ_{TI^*}	B (0.50, 0.15)	0.21 [0.10; 0.36]
ρ_{GOV}	B (0.50, 0.15)	0.75 [0.65; 0.84]
ρ_{GOV^*}	B (0.50, 0.15)	0.91 [0.87; 0.95]
ρ_{WM}	B (0.50, 0.15)	0.70 [0.57; 0.81]
ν_{WM}	B (0.50, 0.15)	0.51 [0.30; 0.71]
ρ_{WM^*}	B (0.50, 0.15)	0.92 [0.86; 0.96]
ν_{WM^*}	B (0.50, 0.15)	0.73 [0.53; 0.85]
ρ_{UIP}	B (0.50, 0.15)	0.92 [0.88; 0.95]
ρ_X	B (0.50, 0.15)	0.84 [0.66; 0.96]
ν_X	B (0.50, 0.15)	0.53 [0.30; 0.72]
ρ_{X^*}	B (0.50, 0.15)	0.98 [0.96; 0.99]
ν_{X^*}	B (0.50, 0.15)	0.39 [0.20; 0.59]

SHOCK INNOVATIONS

$100\sigma^{NEU}$	IG (0.10, 2)	0.67 [0.52; 0.88]
$100\ \sigma^{NEU^*}$	IG (0.10, 2)	0.54 [0.45; 0.67]
$100\sigma^{MEI}$	IG (0.10, 2)	0.49 [0.43; 0.58]
$100\sigma^{MEI^*}$	IG (0.10, 2)	0.27 [0.22; 0.33]
$100\sigma^{IST}$	IG (0.10, 2)	0.76 [0.68; 0.85]
$100\sigma^{IST^*}$	IG (0.10, 2)	0.49 [0.44; 0.56]
$100\sigma^{TI}$	IG (0.10, 2)	0.14 [0.11; 0.17]
$100\sigma^{TI^*}$	IG (0.10, 2)	0.20 [0.17; 0.24]
$100\sigma^{GOV}$	IG (0.10, 2)	0.23 [0.20; 0.26]
$100\sigma^{GOV^*}$	IG (0.10, 2)	0.43 [0.38; 0.48]
$100\sigma^{WM}$	IG (0.10, 2)	0.11 [0.09; 0.14]
$100\sigma^{WM^*}$	IG (0.10, 2)	0.12 [0.08; 0.15]
$100\sigma^{MON}$	IG (0.10, 2)	0.30 [0.26; 0.34]
$100\sigma^{MON^*}$	IG (0.10, 2)	0.18 [0.16; 0.21]
$100\sigma^{UIP}$	IG (0.10, 2)	0.19 [0.14; 0.27]
$100\sigma^{X}$	IG (0.10, 2)	0.50 [0.39; 0.62]
$100\sigma^{X^*}$	IG (0.10, 2)	1.86 [1.46; 2.48]

Note: G = Gamma, B = Beta, IG = Inverse Gamma and N = Normal distributions. P1 = Mean and P2 = Standard Deviation for all distributions. Posterior moments are computed using 500000 draws from the distribution simulated by the Random Walk Metropolis algorithm. Calibrations of the other steady-state parameters such as *i/y*, *c/y* and *wn/c* are derived from the model's steady-state restrictions and updated at every iteration of the posterior simulation.

Table 3: Forecast Error Variance Decomposition in Baseline Estimation

	US Trade Balance/GDP				**US GDP**				**US Consumption**				**US Investment**				**US Terms of Trade**			
Horizon →	0Q	1Q	4Q	10Q	0Q	1Q	4Q	10Q	0Q	1Q	4Q	10Q	0Q	1Q	4Q	10Q	0Q	1Q	4Q	10Q
Shocks ↓																				
US Shocks																				
Neutral	1.43	0.48	0.21	0.33	0.23	1.11	3.28	5.06	0.73	1.71	5.33	7.55	0.62	0.71	0.97	1.40	4.09	4.93	6.12	5.73
IST	4.32	1.35	0.31	0.24	0.77	0.25	0.18	0.48	0.04	0.05	0.06	0.09	0.54	0.52	0.55	0.76	5.63	6.64	8.32	10.46
MEI	26.88	57.77	73.24	70.28	56.35	62.73	63.47	54.59	4.34	8.30	21.54	34.97	90.63	89.46	85.97	77.87	14.36	17.84	25.16	34.00
Time-Impatience	0.07	0.04	0.02	0.01	11.51	8.02	3.34	1.35	72.38	58.84	28.43	8.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Other Shocks	8.37	2.57	0.84	0.70	22.70	16.60	12.25	11.52	19.81	26.52	34.27	29.04	1.73	1.56	1.34	1.40	8.62	9.19	9.02	8.04
RoW Shocks																				
Neutral	0.11	0.18	0.26	0.15	0.18	0.31	0.63	0.81	0.05	0.10	0.28	0.54	0.30	0.35	0.43	0.54	3.28	3.34	2.55	1.47
IST	0.25	0.53	0.72	0.79	0.07	0.04	0.14	0.32	0.02	0.05	0.13	0.29	0.01	0.01	0.01	0.05	0.10	0.11	0.13	0.16
MEI	2.97	8.56	13.24	16.13	4.86	6.11	8.24	11.93	1.44	2.37	5.05	9.21	0.07	0.09	0.19	0.81	1.98	2.22	2.62	3.76
Time-Impatience	0.21	0.08	0.02	0.01	0.00	0.01	0.02	0.03	0.00	0.00	0.01	0.02	0.03	0.03	0.04	0.04	0.21	0.23	0.19	0.11
Other Shocks	4.57	1.49	1.14	1.07	1.65	2.17	3.29	4.94	0.26	0.48	1.30	2.91	0.83	1.02	1.59	2.92	6.58	7.08	7.14	6.38
Open-Economy Shocks																				
UIP	30.43	16.95	7.93	7.66	0.03	0.05	0.12	0.15	0.01	0.02	0.07	0.12	1.40	1.65	2.19	2.74	7.65	7.95	6.60	3.90
RoW Export Price	19.85	9.72	1.90	1.80	0.59	1.29	3.37	6.83	0.88	1.51	3.44	6.45	3.84	4.59	6.69	11.44	47.48	40.44	32.11	25.94
US Export Price	0.53	0.27	0.17	0.85	1.05	1.30	1.66	2.00	0.03	0.04	0.09	0.33	0.02	0.02	0.03	0.03	0.02	0.03	0.03	0.03

Note: 'Other Shocks' indicates the sum of the contributions of wage mark-up, government spending and monetary policy shocks. The influence of each shock at forecast horizon k is measured by the variability generated by a unit standard deviation shock at time 0, cumulated over the interval 0 to k which is then divided by the aggregate variability induced by all the shocks and expressed in percentage terms. We report the mean based on 150 random draws from the posterior distribution (Each column adds to 100). Error bands are available on request.

Table 4: 4-Quarter Ahead Trade Balance Variance Decompositions in Robustness Checks

	SPECIFICATIONS					
SHOCKS	Baseline *(CvsI)*	Home-Bias *(CvsI)*	BKK *(Ag.Ab.)*	B-type *(Ag.Ab.)*	DSW-15% *(Ag.Ab.)*	DSW-2% *(Ag.Ab.)*
Marginal Efficiency of Investment	86.48	87.31	43.82		41.48	6.23
Consumption Time Impatience	0.03	0.07	3.68	45.78	5.15	0.93
Uncovered Interest Parity	7.93		19.16	24.87	19.16	32.74
US Home Bias		7.07		20.73		
US Export Demand					16.77	53.82
Others	5.56	5.54	33.34	8.63	17.44	6.28

Note: In all our checks, the number of shocks used equals the number of observables used in the estimation. The contributions of analogous US and RoW shocks are aggregated. All models using different import-intensities for consumption and investment are denoted by (CvsI) while the others using the traditional aggregate absorption-based specification are denoted by (Ag.Ab). Whenever a shock is deactivated, the variance contribution is indicated by a blank cell. 'Baseline' indicates the baseline model. 'Home-Bias' indicates the use of a US import-share shock, instead of the UIP shock. 'BKK' employs the Backus, Kydland and Kehoe (1994) aggregation of home and imported goods specified in terms of aggregate absorption (Ag.Ab=C+I). 'B-Type' uses the BKK trade specification and strips the baseline model of many features, shocks and observables to facilitate a closer comparison with Bergin (2006). 'DSW-15%' employs the export shock as in De Walque, Smets and Wouters (2005) while fixing the import-intensity at 15% as in BKK (1994). 'DSW-2%', we estimate the import-share in the De Walque, Smets and Wouters (2005) model and obtain a value of about 2%.

Table 5: Posterior Median and 90% Confidence Bounds for Shock Standard Deviations

	Baseline	Non-Energy	Home-Bias	BKK	B-type	DSW-15%	DSW-2%
$100\sigma^{NEU}$	0.67 [0.52; 0.88]	0.64 [0.49; 0.84]	0.64 [0.51; 0.82]	0.75 [0.60; 0.97]	1.16 [0.91; 1.55]	0.65 [0.52; 0.83]	0.73 [0.56; 0.99]
$100\ \sigma^{NEU*}$	0.54 [0.45; 0.67]	0.53 [0.44; 0.65]	0.53 [0.45; 0.64]	0.59 [0.48; 0.76]	0.86 [0.65; 1.16]	0.47 [0.40; 0.55]	0.52 [0.43; 0.64]
$100\sigma^{MEI}$	0.49 [0.43; 0.58]	0.48 [0.42; 0.56]	0.51 [0.44; 0.61]	0.64 [0.55; 0.78]	-	0.81 [0.68; 0.98]	0.80 [0.66; 1.00]
$100\sigma^{MEI*}$	0.27 [0.22; 0.33]	0.27 [0.22; 0.34]	0.28 [0.24; 0.34]	0.24 [0.21; 0.28]	-	0.33 [0.27; 0.41]	0.29 [0.24; 0.37]
$100\sigma^{IST}$	0.76 [0.68; 0.85]	0.76 [0.68; 0.86]	0.76 [0.68; 0.86]	0.43 [0.38; 0.49]	-	-	-
$100\sigma^{IST*}$	0.49 [0.44; 0.56]	0.50 [0.44; 0.56]	0.49 [0.44; 0.55]	0.45 [0.40; 0.50]	-	-	-
$100\sigma^{TI}$	0.14 [0.11; 0.17]	0.14 [0.11; 0.17]	0.14 [0.11; 0.17]	0.12 [0.09; 0.15]	0.26 [0.18; 0.38]	0.11 [0.09; 0.14]	0.14 [0.11; 0.17]
$100\sigma^{TI*}$	0.20 [0.17; 0.24]	0.20 [0.17; 0.24]	0.20 [0.17; 0.24]	0.19 [0.15; 0.23]	0.06 [0.04; 0.09]	0.21 [0.17; 0.25]	0.20 [0.17; 0.24]
$100\sigma^{GOV}$	0.23 [0.20; 0.26]	0.23 [0.20; 0.26]	0.29 [0.26; 0.33]	0.29 [0.26; 0.32]	-	0.24 [0.22; 0.28]	0.24 [0.21; 0.27]
$100\sigma^{GOV*}$	0.43 [0.38; 0.48]	0.43 [0.38; 0.49]	0.47 [0.42; 0.53]	0.48 [0.43; 0.54]	-	0.41 [0.36; 0.46]	0.35 [0.31; 0.39]
$100\sigma^{WM}$	0.11 [0.09; 0.14]	0.12 [0.09; 0.14]	0.12 [0.09; 0.14]	0.11 [0.09; 0.14]	-	0.12 [0.10; 0.15]	0.10 [0.08; 0.13]
$100\sigma^{WM*}$	0.12 [0.08; 0.15]	0.12 [0.08; 0.15]	0.12 [0.09; 0.16]	0.12 [0.09; 0.17]	-	0.11 [0.07; 0.14]	0.11 [0.08; 0.14]
$100\sigma^{MON}$	0.30 [0.26; 0.34]	0.30 [0.27; 0.35]	0.32 [0.28; 0.37]	0.27 [0.24; 0.31]	0.44 [0.37; 0.54]	0.30 [0.26; 0.35]	0.27 [0.24; 0.31]
$100\sigma^{MON*}$	0.18 [0.16; 0.21]	0.19 [0.16; 0.21]	0.18 [0.16; 0.21]	0.18 [0.16; 0.21]	0.24 [0.20; 0.30]	0.20 [0.17; 0.23]	0.19 [0.17; 0.22]
$100\sigma^{UIP}$	0.19 [0.14; 0.27]	0.13 [0.10; 0.19]	-	0.24 [0.17; 0.34]	0.08 [0.05; 0.13]	0.18 [0.13; 0.25]	0.38 [0.22; 0.69]
$100\sigma^{X}$	0.50 [0.39; 0.62]	0.50 [0.38; 0.63]	0.62 [0.51; 0.77]	0.58 [0.46; 0.73]	-	-	-
$100\sigma^{X*}$	1.86 [1.46; 2.48]	2.06 [1.59; 2.81]	1.68 [1.35; 2.11]	1.52 [1.19; 2.05]	-	-	-
$100\ \sigma^{HB}$	-	-	0.24 [0.21; 0.27]	-	0.32 [0.27; 0.38]	-	-
$100\ \sigma^{ED}$	-	-	-	-	-	0.31 [0.27; 0.36]	0.18 [0.16; 0.21]

Note: Whenever a parameter is not estimated, the concerned cell is left blank. **'Baseline'** indicates the baseline model. **'Non-Energy'** indicates the use of the non-energy trade balance instead of the intra-OECD measure**. 'Home-Bias'** indicates the use of a US import-share (m_C,m_I) shock, instead of the UIP shock. **'BKK'** employs the Backus, Kydland and Kehoe (1994) aggregation of home and imported goods specified in terms of aggregate absorption (Ag.Ab=C+I). **'B-Type'** uses the BKK trade specification and strips the baseline model of many features, shocks and observables to facilitate a closer comparison with Bergin (2006). **'DSW-15%'** employs the export shock as in De Walque, Smets and Wouters (2005) while fixing the import-intensity at 15% as in BKK (1994). **'DSW-2%'**, we estimate the import-share in the De Walque, Smets and Wouters (2005) model and obtain a value of about 2%. The superscripts 'HB' indicates home-bias and 'ED' indicates export-demand. See Table 2 for descriptions of parameters.

Table 5 (Contd): Posterior Median and 90% Confidence Bounds for Shock Persistence Parameters

	Baseline	Non-Energy	Home-Bias	BKK	B-type	DSW-15%	DSW-2%
ρ_{NEU}	0.97 [0.94; 0.98]	0.96 [0.94; 0.98]	0.96 [0.93; 0.98]	0.97 [0.94; 0.99]	0.89 [0.80; 0.94]	0.93 [0.89; 0.96]	0.95 [0.89; 0.98]
ρ_{NEU*}	0.88 [0.72; 0.96]	0.88 [0.73; 0.96]	0.93 [0.76; 0.98]	0.94 [0.87; 0.98]	0.78 [0.69; 0.86]	0.99 [0.96; 0.99]	0.94 [0.83; 0.99]
ρ_{MEI}	0.86 [0.81; 0.89]	0.85 [0.81; 0.89]	0.82 [0.75; 0.86]	0.88 [0.83; 0.92]	-	0.66 [0.55; 0.76]	0.70 [0.55; 0.81]
ρ_{MEI*}	0.97 [0.94; 0.99]	0.98 [0.95; 0.99]	0.98 [0.97; 0.99]	0.92 [0.88; 0.96]	-	0.63 [0.49; 0.76]	0.72 [0.58; 0.85]
ρ_{IST}	0.99 [0.99; 0.99]	0.99[0.99; 0.99]	0.99[0.99; 0.99]	0.98 [0.98; 0.99]	-	-	-
ρ_{IST*}	0.94 [0.90; 0.97]	0.93 [0.90; 0.97]	0.96 [0.92; 0.98]	0.97 [0.95; 0.98]	-	-	-
ρ_{TI}	0.31 [0.19; 0.45]	0.31 [0.19; 0.45]	0.32 [0.19; 0.45]	0.45 [0.31; 0.60]	0.91 [0.86; 0.94]	0.53 [0.39; 0.65]	0.35 [0.22; 0.50]
ρ_{TI*}	0.21 [0.10; 0.36]	0.23 [0.10; 0.38]	0.20 [0.08; 0.35]	0.24 [0.11; 0.39]	0.98 [0.96; 0.99]	0.22 [0.11; 0.36]	0.19 [0.08; 0.32]
ρ_{GOV}	0.75 [0.65; 0.84]	0.75 [0.65; 0.85]	0.93 [0.87; 0.97]	0.84 [0.77; 0.91]	-	0.89 [0.81; 0.95]	0.94 [0.86; 0.98]
ρ_{GOV*}	0.91 [0.87; 0.95]	0.92 [0.87; 0.95]	0.95 [0.92; 0.97]	0.79 [0.71; 0.87]	-	0.90 [0.83; 0.94]	0.95 [0.91; 0.97]
ρ_{WM}	0.70 [0.57; 0.81]	0.67 [0.53; 0.79]	0.67 [0.51; 0.80]	0.99 [0.99; 0.99]	-	0.99 [0.99; 0.99]	0.99 [0.98; 1.00]
ν_{WM}	0.51 [0.30; 0.71]	0.49 [0.27; 0.69]	0.50 [0.26; 0.71]	0.78 [0.63; 0.89]	-	0.79 [0.64; 0.89]	0.70 [0.49; 0.84]
ρ_{WM*}	0.92 [0.86; 0.96]	0.91 [0.85; 0.95]	0.88 [0.78; 0.94]	0.99 [0.96; 0.99]	-	0.98 [0.95; 0.99]	0.99 [0.96; 0.99]
ν_{WM*}	0.73 [0.53; 0.85]	0.74 [0.55; 0.85]	0.73 [0.50; 0.85]	0.74 [0.55; 0.86]	-	0.82 [0.62; 0.91]	0.77 [0.60; 0.88]
ρ_{UIP}	0.92 [0.88; 0.95]	0.94 [0.91; 0.97]		0.88 [0.83; 0.92]	0.95 [0.92; 0.98]	0.92 [0.88; 0.95]	0.91 [0.87; 0.95]
ρ_{X}	0.84 [0.66; 0.96]	0.84 [0.67; 0.95]	0.74 [0.56; 0.89]	0.90 [0.82; 0.96]	-	-	-
ν_{X}	0.53 [0.30; 0.72]	0.55 [0.32; 0.75]	0.47 [0.27; 0.66]	0.56 [0.35; 0.72]	-	-	-
ρ_{X*}	0.98 [0.96; 0.99]	0.98 [0.96; 0.99]	0.95 [0.91; 0.97]	0.96 [0.92; 0.98]	-	-	-
ν_{X*}	0.39 [0.20; 0.59]	0.37 [0.19; 0.56]	0.58 [0.38; 0.74]	0.53 [0.30; 0.72]	-	-	-
ρ_{HB}	-	-	0.88 [0.85; 0.91]	-	0.98 [0.96; 0.99]	-	-
ρ_{ED}	-	-	-	-	-	0.99 [0.99; 0.99]	0.97 [0.95; 0.99]

Note: Whenever a parameter is not estimated, the concerned cell is left blank. **'Baseline'** indicates the baseline model. **'Non-Energy'** indicates the use of the non-energy trade balance instead of the intra-OECD measure**. 'Home-Bias'** indicates the use of a US import-share (m_C,m_I) shock, instead of the UIP shock. **'BKK'** employs the Backus, Kydland and Kehoe (1994) aggregation of home and imported goods specified in terms of aggregate absorption (Ag.Ab=C+I). **'B-Type'** uses the BKK trade specification and strips the baseline model of many features, shocks and observables to facilitate a closer comparison with Bergin (2006). **'DSW-15%'** employs the export shock as in De Walque, Smets and Wouters (2005) while fixing the import-intensity at 15% as in BKK (1994). **'DSW-2%'**, we estimate the import-share in the De Walque, Smets and Wouters (2005) model and obtain a value of about 2%. The superscripts 'HB' indicates home-bias and 'ED' indicates export-demand. See Table 2 for descriptions of parameters.

Table 5 (Contd): Posterior Median and 90% Confidence Bounds for Structural Parameters

	Baseline	Non-Energy	Home-Bias	BKK	B-type	DSW-15%	DSW-2%
μ	0.56 [0.40; 0.73]	0.57 [0.41; 0.76]	0.82 [0.53; 1.13]	0.70 [0.64; 0.77]	0.50 [0.40; 0.61]	0.59 [0.54; 0.65]	1.28 [1.04; 1.61]
σ_C	1.08 [1.05; 1.12]	1.10 [1.07; 1.13]	1.12 [1.08; 1.16]	1.00 [0.95; 1.05]	0.71 [0.55; 0.89]	1.11 [1.03; 1.18]	1.04 [1.00; 1.11]
h	0.86 [0.82; 0.89]	0.85 [0.82; 0.88]	0.83 [0.79; 0.86]	0.89 [0.86; 0.92]	-	0.80 [0.73; 0.85]	0.88 [0.83; 0.92]
ϕ	6.60 [5.09; 8.11]	6.93 [5.37; 8.46]	7.53 [6.07; 9.02]	4.54 [3.20; 6.04]	4.52 [3.15; 6.02]	5.25 [3.93; 6.64]	4.96 [3.56; 6.47]
ϕ^*	5.04 [3.89; 6.35]	4.95 [3.85; 6.31]	4.11 [3.21; 5.14]	5.97 [4.72; 7.26]	4.75 [3.27; 6.29]	5.92 [4.64; 7.27]	5.55 [4.22; 6.98]
φ	0.67 [0.57; 0.77]	0.66 [0.55; 0.76]	0.88 [0.79; 0.94]	0.89 [0.81; 0.94]	-	0.82 [0.73; 0.89]	0.89 [0.80; 0.94]
φ^*	0.88 [0.77; 0.95]	0.89 [0.77; 0.95]	0.90 [0.82; 0.96]	0.82 [0.70; 0.92]	-	0.64 [0.48; 0.80]	0.70 [0.52; 0.86]
θ_H	0.78 [0.72; 0.83]	0.77 [0.71; 0.82]	0.77 [0.70; 0.82]	0.72 [0.64; 0.79]	0.88 [0.85; 0.90]	0.68 [0.60; 0.75]	0.74 [0.65; 0.80]
ι_H	0.16 [0.07; 0.30]	0.16 [0.07; 0.31]	0.19 [0.09; 0.38]	0.28 [0.12; 0.52]	0.28 [0.13; 0.52]	0.26 [0.12; 0.48]	0.27 [0.13; 0.48]
θ^*_F	0.29 [0.19; 0.39]	0.27 [0.19; 0.37]	0.27 [0.18; 0.37]	0.33 [0.22; 0.45]	0.56 [0.43; 0.67]	0.18 [0.11; 0.25]	0.26 [0.17; 0.36]
ι^*_F	0.26 [0.11; 0.49]	0.27 [0.11; 0.51]	0.27 [0.12; 0.51]	0.23 [0.10; 0.46]	0.34 [0.15; 0.61]	0.27 [0.12; 0.51]	0.26 [0.11; 0.49]
θ^*_H	0.84 [0.76; 0.90]	0.85 [0.78; 0.92]	0.75 [0.65; 0.84]	0.74 [0.65; 0.82]	-	0.19 [0.14; 0.24]	0.46 [0.35; 0.58]
ι^*_H	0.26 [0.13; 0.44]	0.28 [0.14; 0.46]	0.40 [0.21; 0.62]	0.35 [0.18; 0.57]	-	0.30 [0.14; 0.54]	0.28 [0.12; 0.51]
θ_F	0.54 [0.44; 0.63]	0.49 [0.39; 0.59]	0.62 [0.53; 0.71]	0.64 [0.52; 0.75]	-	-	-
ι_F	0.31 [0.15; 0.53]	0.32 [0.15; 0.54]	0.38 [0.19; 0.61]	0.38 [0.19; 0.63]	-	-	-
θ_W	0.95 [0.95; 0.95]	0.95 [0.95; 0.95]	0.95 [0.95; 0.95]	0.68 [0.59; 0.76]	-	0.64 [0.55; 0.73]	0.67 [0.58; 0.75]
ι_W	0.49 [0.31; 0.66]	0.47 [0.30; 0.63]	0.46 [0.29; 0.62]	0.22 [0.12; 0.34]	-	0.20 [0.10; 0.32]	0.53 [0.32; 0.73]
θ_W^*	0.79 [0.66; 0.88]	0.82 [0.71; 0.89]	0.85 [0.77; 0.89]	0.62 [0.51; 0.75]	-	0.71 [0.61; 0.82]	0.68 [0.59; 0.78]
ι_W^*	0.13 [0.06; 0.23]	0.13 [0.06; 0.22]	0.13 [0.06; 0.22]	0.15 [0.07; 0.26]	-	0.10 [0.04; 0.17]	0.13 [0.06; 0.24]
ϕ_π	1.29 [1.16; 1.47]	1.24 [1.12; 1.38]	1.21 [1.08; 1.38]	2.17 [1.91; 2.46]	2.25 [1.94; 2.56]	2.28 [1.99; 2.58]	2.32 [2.01; 2.62]
ϕ_π^*	1.60 [1.36; 1.92]	1.58 [1.33; 1.88]	1.36 [1.09; 1.68]	1.91 [1.65; 2.22]	1.58 [1.34; 1.87]	1.90 [1.62; 2.21]	1.89 [1.61; 2.19]
ϕ_y	0.01 [0.00; 0.01]	0.00 [0.00; 0.01]	0.01 [0.00; 0.01]	0.01 [0.00; 0.01]	0.07 [0.03; 0.12]	0.01 [0.00; 0.01]	0.01 [0.00; 0.01]
ϕ_y^*	0.03 [0.01; 0.05]	0.03 [0.02; 0.06]	0.03 [0.02; 0.06]	0.03 [0.02; 0.04]	0.05 [0.03; 0.09]	0.08 [0.06; 0.12]	0.05 [0.03; 0.08]
$\phi_{\Delta y}$	0.05 [0.03; 0.08]	0.05 [0.02; 0.07]	0.08 [0.05; 0.12]	0.13 [0.08; 0.18]	0.33 [0.25; 0.42]	0.08 [0.05; 0.11]	0.08 [0.05; 0.12]
$\phi_{\Delta y}^*$	0.05 [0.03; 0.08]	0.05 [0.03; 0.08]	0.05 [0.03; 0.07]	0.10 [0.06; 0.14]	0.27 [0.21; 0.33]	0.13 [0.08; 0.18]	0.09 [0.05; 0.13]
ρ_{MON}	0.80 [0.76; 0.83]	0.78 [0.74; 0.81]	0.77 [0.74; 0.80]	0.83 [0.81; 0.86]	0.76 [0.70; 0.81]	0.81 [0.78; 0.84]	0.83 [0.79; 0.87]
ρ_{MON}^*	0.92 [0.89; 0.93]	0.92 [0.90; 0.94]	0.91 [0.88; 0.93]	0.91 [0.89; 0.93]	0.81 [0.76; 0.85]	0.92 [0.89; 0.93]	0.91 [0.89; 0.93]
$100(\bar{\pi}-1)$	0.73 [0.57; 0.92]	0.70 [0.54; 0.86]	0.61 [0.46; 0.79]	1.22 [1.05; 1.39]	0.96 [0.75; 1.20]	1.26 [1.09; 1.42]	1.34 [1.19; 1.46]
$100(\bar{\gamma}-1)$	0.20 [0.16; 0.25]	0.20 [0.15; 0.24]	0.14 [0.08; 0.19]	0.27 [0.23; 0.31]	0.61 [0.57; 0.65]	0.21 [0.17; 0.27]	0.27 [0.19; 0.32]
m	-	-	-	-	-	-	0.02 [0.01; 0.03]

Note: Whenever a parameter is not estimated, the concerned cell is left blank. **'Baseline'** indicates the baseline model. **'Non-Energy'** indicates the use of the non-energy trade balance instead of the intra-OECD measure**. 'Home-Bias'** indicates the use of a US import-share *(m_C,m_I)* shock, instead of the UIP shock. **'BKK'** employs the Backus, Kydland and Kehoe (1994) aggregation of home and imported goods specified in terms of aggregate absorption (Ag.Ab=C+I). **'B-Type'** uses the BKK trade specification and strips the baseline model of many features, shocks and observables to facilitate a closer comparison with Bergin (2006). **'DSW-15%'** employs the export shock as in De Walque, Smets and Wouters (2005) while fixing the import-intensity at 15% as in BKK (1994). **'DSW-2%'**, we estimate the import-share in the De Walque, Smets and Wouters (2005) model and obtain a value of about 2%. The superscripts 'HB' indicates home-bias and 'ED' indicates

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