Journal of International Economics 90 (2013) 302–315

Contents lists available at SciVerse ScienceDirect

Journal of International Economics

journal homepage: www.elsevier.com/locate/jie

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

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ARTICLE INFO

Article history:
Received 22 February 2010
Received in revised form 30 January 2013
Accepted 31 January 2013
Available online 8 February 2013

JEL classification:
C11
F41

Keywords:
Open economy macroeconomics
US trade balance
Investment shocks
Bayesian estimation of DSGE models

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 generate a strong effect on the variability of the imbalance, through shifts in international relative absorption. On the other hand, shocks to uncovered interest parity and foreign export prices, which transmit mainly *via* the terms of trade and exchange rate, have a strong influence at short forecast-horizons, before the investment disturbances begin their dominance.

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. (2010) 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 (2012) find that permanent supply 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

☆ The views expressed herein do not necessarily reflect those of the Reserve Bank of New Zealand. We acknowledge the financial support from the Inter-University Attraction Poles Program-Belgium Science Policy (contract no. P6/07), the Flemish Fund for Scientific Research (FWO) and the Sinergia Program of the Swiss National Science Foundation (grant no. CRSI11-133058). This paper was in part written while Jacob was a researcher at the Department of Financial Economics, Ghent University, Belgium and the Chair of International Finance, *École Polytechnique Fédérale de Lausanne*, Switzerland and a dissertation intern at the National Bank of Belgium. We thank the Editor Giancarlo Corsetti, two anonymous referees, Matthieu Bussière, Fabrice Collard, Gregory de Walque, Francesco Furlanetto, Alejandro Justiniano, Robert Kollmann, Giulio Nicoletti, Giorgio Primiceri, Pau Rabanal, Morten Ravn, Frank Smets, Roland Straub, Christoph Thoenissen, Lenno Uusküla, colleagues at Ghent, EPFL and RBNZ, participants at the SED Meetings (Ghent) 2011, RBNZ Conference (Wellington) 2010, EEA Congress (Barcelona) 2009, ICMAIF (Crete) 2009, Dynare Conference (Boston) 2008 and seminar audiences at the universities of Lausanne, Münster and Wellington for helpful suggestions. A special thanks to Raf Wouters for constant advice. All remaining errors are ours.
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[1] In 2012 Q3, the US trade deficit touched the 497.95 billion dollar mark on an annualized basis and as a proportion of GDP equalled 3.15% (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.

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http://dx.doi.org/10.1016/j.jinteco.2013.01.004

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. When we disaggregate the trade balance dynamics into movements in international relative absorption and prices, we observe that the critical determinant of the dominance of marginal efficiency shocks is their ability to generate strong movements in relative international absorption. In contrast, disturbances which transmit mainly *via* the international relative prices, in particular uncovered interest parity shocks and export-price mark-up shocks from the Rest of the World (RoW), are potent in the very short-run after impact, before the marginal efficiency 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%, as documented by Erceg et al. (2008).[2] 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.[3]

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.

[2] The predominance of capital goods and consumer durables in international trade has also been documented by Engel and Wang (2011).

[3] 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.

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 Smets and Wouters (2007) and Justiniano et al. (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.[4] 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 in each.[5]

The production of intermediate goods in both countries is affected by neutral labor-augmenting technological progress that has distinct components. A non-stationary, deterministic component is common to both countries and grows at a rate denoted by $\overline{\gamma} > 1$. The stationary components are country-specific stochastic processes. 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 $\overline{\gamma}^{-\sigma_c}$ in steady-state and we define $\overline{\beta} \equiv \beta \overline{\gamma}^{-\sigma_c}$. 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. The non-linear optimality conditions and the functional forms for preferences and technology are detailed in the Appendix. Steady-state variables are indicated by an upper bar and variables presented as logarithmic deviations from the steady-state are denoted by a superscript '^'. 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 Smets and Wouters (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.

2.1. Aggregation

Perfectly competitive firms produce Armington (CES) aggregates of the composite Home and imported bundles for final consumption

[4] 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, we do not model non-tradables and distribution services.

[5] Capital goods and durables account for 76 and 80% of non-energy imports and exports respectively over our sample period, while investment expenditures account for about 20% 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.