Trend shocks and the countercyclical U.S. current account

Amdur, David and Ersal Kiziler, Eylem

Muhlenberg College, University of Wisconsin-Whitewater

January 2012

Trend Shocks and the Countercyclical U.S. Current Account*

David Amdur
Muhlenberg College†

Eylem Ersal Kiziler
University of Wisconsin-Whitewater‡

This Version: January 2012

Abstract

From 1960–2009, the U.S. current account balance has tended to decline during expansions and improve in recessions. We argue that trend shocks to productivity can help explain the countercyclical U.S. current account. Our framework is a two-country, two-good real business cycle (RBC) model in which cross-border asset trade is limited to an international bond. We identify trend and transitory shocks to U.S. productivity using generalized method of moments (GMM) estimation. The specification that best matches the data assigns a large role to trend shocks. The estimated model generates a countercyclical current account without excessive consumption volatility.

JEL Classification: E21, E32, F32, F41

Keywords: Current account, trend shocks, business cycles, open economy macroeconomics, DSGE models, GMM estimation

---

*The authors would like to thank Ha Nguyen, Yamin Ahmad, and two anonymous referees for helpful comments. We also received many useful comments on earlier versions of this work from Martin Evans, Dale Henderson, Pedro Gete, Rudolfs Bems, and seminar participants at the Georgetown Center for Economics Research and the Midwest Economics Association. David gratefully acknowledges research funding from Muhlenberg College. Any mistakes are our own.

†Corresponding author. Department of Accounting, Business and Economics, 2400 Chew Street, Allentown, PA 18104, USA. Tel: 484-664-3257. E-Mail: damdur@muhlenberg.edu.

‡Economics Department, 800 W. Main Street, Whitewater, WI 53190, USA. Tel: 262-472-5586. E-Mail: kizilere@uww.edu.

1 Introduction

From 1960–2009, the U.S. current account balance has been countercyclical: the U.S. borrows more from foreigners when output is growing rapidly, and less in recessions (Figure 1). Recent experience provides a striking illustration. During the expansion of 2001–2006, the U.S. current account deficit grew from 4% to 6% of GDP, prompting widespread concern about "global imbalances." In the aftermath of the financial crisis and subsequent recession, there was a dramatic correction, with the deficit retreating to about 2.7% of GDP in 2009. The graph suggests a broad pattern of current account decline during business cycle expansions and improvement just before and during recessions. This pattern appears particularly striking after 1980.

Table 1 offers quantitative evidence that the U.S. current account is countercyclical. We obtained quarterly data on log U.S. real GDP and the current-account-to-GDP ratio and filtered it in three different ways: with a Hodrick-Prescott filter, a Baxter-King band-pass filter, and a Christiano-Fitzgerald random walk filter.[1] We also analyzed deviations from a linear trend and first differences. Over the time span 1960–2009, the correlation coefficient is negative in all five specifications, and it is significantly different from zero in all except the linear trend. As suggested by Figure 1, the pattern is even stronger over the time period 1980–2009. The negative correlation coefficient over this time span is significantly different from zero in all five specifications. We conclude that the U.S. current account is countercyclical.

Countercyclical current account balances are often associated with emerging economies. Aguiar and Gopinath (2007) document that, on average, external balances are more strongly countercyclical in emerging countries than in small open developed economies. They successfully reproduce this pattern in a small open economy model with stochastic shocks to the trend growth rate of productivity. The key insight comes from the permanent income hypothesis: a positive shock to trend growth raises permanent income by more than current income. Domestic households respond optimally by borrowing against higher expected future income, opening up a current account deficit. In contrast, a positive transitory shock raises current income by more than permanent income, prompting households to save. Depending on the strength of the investment response, a transitory

[1] We set the smoothing parameter of the Hodrick-Prescott filter to 1600. The Baxter-King and Christiano-Fitzgerald filters were set to preserve components of the data with period between 6 and 32 quarters. These values are standard in the business cycle literature.

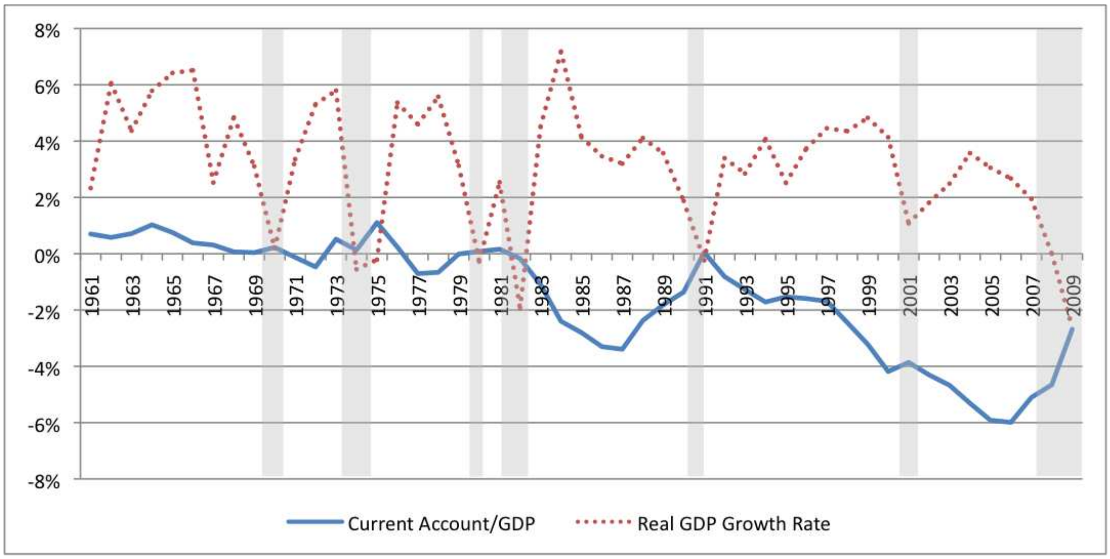

Figure 1: U.S. current account balance as a share of GDP, and U.S. real GDP growth rate. Shaded bars are NBER recessions. Source: BEA.

shock causes either a smaller current account deficit or a current account surplus. The story is then that emerging economies face relatively more volatile trend shocks than developed countries do, which makes their trade and current account balances more countercyclical.

We argue that trend shocks are more important for the U.S. than received wisdom might suggest. Our framework is a two-country DSGE model with perfectly observable trend and transitory shocks to productivity. We estimate the model using quarterly data from 1960–2009. The specification that best matches the data assigns a large role to trend shocks. The estimated model successfully generates a countercyclical (traditional) current account balance.[2] Moreover, the model does so without generating excessive consumption volatility – a feature of emerging markets that is not shared by the U.S. We conclude that trend shocks to productivity are a plausible driver of the countercyclical U.S. current account.

Our findings do not preclude a role for investment in explaining U.S. current account dynamics. Clearly U.S. investment increases in booms and falls in recessions. Holding national saving constant, the investment response alone would make the current account countercyclical. However, national saving is *not* constant over the business cycle. In particular, private consumption is procyclical.

[2] It is well established in the literature that valuation effects – fluctuations in the market value of a country's gross assets and liabilities – can be significant drivers of net foreign assets, over and above the contribution of the traditional current account. See, e.g., Lane and Milesi-Ferretti (2005), Lane and Milesi-Ferretti (2007), and Gourinchas and Rey (2007). However, this paper is concerned with the flow of net external borrowing, not the market value of the U.S. portfolio. We therefore abstract from valuation effects and concentrate on the traditional U.S. current account.

Filter	$\rho(y, ca)$ 1960.2–2009.4	$\rho(y, ca)$ 1980.1–2009.4
Hodrick-Prescott	-0.43	-0.57
	(0.000)	(0.000)
Baxter-King	-0.43	-0.60
	(0.000)	(0.000)
Christiano-Fitzgerald	-0.56	-0.72
	(0.000)	(0.000)
Linear	-0.13	-0.48
	(0.062)	(0.000)
First Difference	-0.16	-0.27
	(0.027)	(0.003)

Table 1: Business cycle correlations between log U.S. real GDP (y) and the current-account-to-GDP ratio (ca). Data is quarterly. We set the smoothing parameter of the Hodrick-Prescott filter to 1600. The Baxter-King and Christiano-Fitzgerald filters were set to preserve components of the data with period between 6 and 32 quarters. After applying each filter, the resulting "business cycle" time series were demeaned, if the mean was significantly different from zero. Values in parentheses are significance levels of the correlation coefficient. Data is from the BEA.

We analyze the joint dynamics of consumption and investment in response to different shocks and use these dynamics to predict the cyclicality of the current account.

There is a very large literature on the topic of whether U.S. GDP has a unit root; see, for example, Lumsdaine and Papell (1997) and references therein. Our read of this literature is that it is inconclusive. Indeed, the difficulty of detecting a unit root in a finite time series is a well-known empirical issue. Christiano and Eichenbaum (1990) famously argued that postwar U.S. data does not provide a long enough time span to plausibly determine whether U.S. GNP has a nonstationary component. Instead, following Aguiar and Gopinath (2007), we take a structural approach and analyze the effects of trend and transitory productivity shocks on agents' optimizing behavior and implied business cycle moments, with special attention to the correlation of the current account with output. A similar structural approach is taken by Cochrane (1988), Campbell and Deaton (1989), and Blundell and Preston (1998).

Our paper differs from Aguiar and Gopinath (2007) in that we use a two-country model, rather than a small open economy. A two-country model is the convention in the literature when studying international business cycles from the U.S. perspective (see, e.g., Backus et al. (1992), Baxter and Crucini (1995), and Heathcote and Perri (2002)). Whereas a small country like Mexico can approximately take global interest rates as given, the assumption of "smallness" is not likely to be valid for the U.S. Indeed, Aguiar and Gopinath (2007) do not analyze the U.S. To our knowledge, our paper is the first to apply the methodology of Aguiar and Gopinath (2007) to study the business cycle properties of the U.S. current account in a two-country framework.

Recent work has highlighted the effect of long-lived supply shocks on U.S. current account dynamics. Much of this literature focuses on low frequency evolution. Engel and Rogers (2006), building on Obstfeld and Rogoff (2005), develop a perfect foresight model cast in terms of country shares of world output. They conclude that expectations of a rising share of U.S. in world output can explain the large U.S. current account deficit. Also in a perfect foresight setting, Chen et al. (2009) show that a gradual rise in the relative U.S. total factor productivity (TFP) growth rate can explain the secular decline in the U.S. current account balance. Our findings support the conclusions of these papers by offering new evidence that trend shocks to productivity are large for the U.S. We also complement previous work by emphasizing the implications of trend shocks at business cycle frequencies. We focus on explaining the countercyclical nature of the current account: why the U.S. borrows more in booms and less in recessions.

Another strand of the literature focuses on disentangling the effects of trend and transitory shocks for the U.S. Working with an empirical present-value model of the current account, Corsetti and Konstantinou (2011) identify trend and transitory shocks by imposing a set of cointegrating relationships on net output, consumption, and gross foreign assets and liabilities (at market value). They find that consumption is largely driven by permanent shocks. Hoffmann et al. (2011) employ a DSGE framework in which agents have imperfect information about the trend and transitory shocks hitting the economy. They conclude that agents' expectations about future TFP growth can explain both the secular decline in the current account from 1995–2006, as well as the correction that followed. We take a different but complementary approach. Following Aguiar and Gopinath (2007), we assume perfect information and estimate the parameters governing the trend and transitory shock processes using GMM estimation.

Nguyen (2011) also estimates volatilities of trend and transitory productivity shocks for the U.S., focusing on the comovement of the (traditional) current account with valuation effects. We focus instead on the comovement of the (traditional) current account with output, abstracting from valuation effects. Furthermore, we study the business cycle properties of the current account, whereas Nguyen (2011) looks at low-frequency evolution.[3]

Some recent papers have been critical of the Aguiar and Gopinath (2007) finding that "the cycle is the trend" for emerging countries. Garcia-Cicco et al. (2010) estimate a small open economy RBC model using Argentine and Mexican data over a much longer time span and find that the model fits the data poorly over the long sample. Despite this finding, we believe that an RBC framework can shed light on the relative importance of trend versus transitory productivity shocks in the U.S. Our time span is considerably longer than in Aguiar and Gopinath (2007) and contains about seven business cycles, versus the one-and-a-half to two business cycles in the time span critiqued by Garcia-Cicco et al. (2010). Furthermore, our use of a two-country model allows foreign productivity shocks to impact macro variables in the home country, allowing for a somewhat richer set of disturbances than simply trend and transitory productivity shocks at home.[4]

The rest of the paper proceeds as follows. Section 2 describes the model. Section 3 documents the baseline calibration and develops intuition with impulse response functions. Section 4 presents our estimates of the parameters governing the trend and transitory shock processes and compares simulated business cycle moments with the data. Section 5 concludes.

2 Model

The model is a two-country, two-good DSGE model with trend and transitory productivity shocks. We assume that households can perfectly identify trend from transitory shocks. Markets are incomplete, because the only financial asset traded internationally is a non-contingent bond. We index country-specific variables with the superscript $i \in \{H, F\}$, where H is the home country and F is foreign.

[3] Relative to Nguyen (2011), the structure of goods and asset markets is also different: our model has two goods and one bond, whereas Nguyen (2011) has one good and two equities.

[4] A number of papers have offered alternative explanations for the stylized facts documented by Aguiar and Gopinath (2007). Angelopoulos et al. (2011) argue that shocks to the degree of property protection rights can match the data for Mexico well, without any technology shocks. Ozbilgin (2010) emphasizes the role of limited developing country participation in financial markets. Boz et al. (2011) consider a variant of the Aguiar and Gopinath (2007) model in which agents have imperfect information about the nature of the underlying productivity shocks (trend versus transitory). They argue that developing countries face a higher degree of uncertainty about the shocks, which can make the current account balance countercyclical without necessarily assigning a high volatility to trend shocks.

2.1 The production function

Each country is populated with a unit mass of identical, perfectly competitive firms that produce a country-specific, traded good using capital and labor:

$$y_t^i = e^{z_t^i} k_t^{i\alpha} \left(\Gamma_t^i l_t^i\right)^{1-\alpha} \tag{1}$$

y_t^i is output, k_t^i is the capital stock (determined in the previous period), and l_t^i is labor input. $\alpha \in (0,1)$ is the share of capital. z_t^i is a transitory component of TFP; it follows an AR(1) process. Γ_t^i is the level of labor-augmenting technology in country i. We interpret Γ_t^i as the "permanent" component of productivity, and we assume that it grows over time at a stochastic rate.[5] Specifically, Γ in each country evolves according to:

$$\Gamma_t^H = \Gamma_{t-1}^H e^{g_t^H} \pi_t^{\lambda}$$
$$\Gamma_t^F = \Gamma_{t-1}^F e^{g_t^F} \pi_t^{-\lambda}$$

π_t is a convergence process, as in Nguyen (2011):

$$\pi_t \equiv \frac{\Gamma_{t-1}^F}{\Gamma_{t-1}^H} = e^{g_{t-1}^F - g_{t-1}^H} \pi_{t-1}^{1-2\lambda}$$

The purpose of the convergence process is to keep the detrended model strictly stationary, so that local solution methods can be applied.[6] z_t^i and g_t^i evolve as follows:

$$z_t^i = \rho_z^i z_{t-1}^i + \epsilon_t^{z,i}$$
$$g_t^i = \left(1 - \rho_g^i\right) \bar{g} + \rho_g^i g_{t-1}^i + \epsilon_t^{g,i}$$

[5] The permanent component of productivity must be labor-augmenting in order to ensure a balanced growth path.

[6] In the calibration, we set λ quite small, to 0.001.

where $\bar{g}$ is the long-run growth rate of productivity. We assume that both countries have the same long-run growth rate. ϵ_t, defined below, is a vector of normal, independently and identically distributed, mean-zero shocks with variance-covariance matrix Σ:

$$\epsilon_t \equiv (\epsilon_t^{g,H}, \epsilon_t^{z,H}, \epsilon_t^{g,F}, \epsilon_t^{z,F})'$$

We refer to $\epsilon_t^{g,i}$ as "trend" shocks, and we refer to $\epsilon_t^{z,i}$ as "transitory" shocks. We assume that trend and transitory shocks are uncorrelated with each other and uncorrelated across countries.

2.2 Firms

Firms own their own capital and are owned entirely by domestic households. At the start of period t, a representative firm in country i takes its current capital stock k_t^i as given and chooses labor input l_t^i, investment x_t^i, and shareholder proceeds d_t^i to maximize the value of the firm:

$$\max E_t \left[\sum_{j=0}^{\infty} m_{t+j,t}^i p_{t+j}^i d_{t+j}^i \right] \tag{2}$$

$$\text{s.t. } d_t^i = y_t^i - w_t^i l_t^i - x_t^i \tag{3}$$

$$k_{t+1}^i = x_t^i + (1-\delta) k_t^i - \frac{\varphi}{2} \left(\frac{k_{t+1}^i}{k_t^i} - e^{\bar{g}} \right)^2 k_t^i \tag{4}$$

w_t^i is the real wage, in terms of country i's good. p_t^i is the price of country i's good in terms of a global numeraire, to be defined shortly. $m_{t+j,t}^i$ is the stochastic discount factor of domestic households, expressed in units of time-t numeraire per time-$(t+j)$ numeraire. $\delta \in (0,1)$ is the depreciation rate. For simplicity, we assume that investment in domestic firms requires domestic goods only. We assume a quadratic cost to adjusting the capital stock, indexed by the parameter $\varphi \geq 0$. Appendix A lists the first-order conditions for the representative firm in country i.

2.3 Households

There is a unit mass of households in each country. Households within a country are identical, but preferences may vary across countries. A representative household in country i likes to consume baskets of home and foreign goods:

$$c_t^i = \left[\omega^{\frac{1}{\phi}} \left(c_t^{i,i} \right)^{\frac{\phi-1}{\phi}} + (1-\omega)^{\frac{1}{\phi}} \left(c_t^{i,-i} \right)^{\frac{\phi-1}{\phi}} \right]^{\frac{\phi}{\phi-1}} \tag{5}$$

$c_t^{i,i}$ is consumption of the domestically produced good, and $c_t^{i,-i}$ is consumption of the other country's good. ϕ is the elasticity of substitution between goods, and $\omega \in (0,1)$ is the weight of the domestic good in the basket. In our calibration, we impose the standard assumption of consumption home bias by setting $\omega > 1/2$.

Households earn labor income by working for firms but experience disutility from working. The only internationally-traded financial asset is a non-contingent bond with a risk-free interest rate (in terms of the numeraire). At the start of period t, households take their current bond holdings b_t^i as given. They then decide how much of each good to consume, how much labor to supply, and how many bonds to hold next period to maximize their expected present discounted utility:

$$\max E_t \left[\sum_{j=0}^{\infty} \beta^j \frac{\left[c_{t+j}^{i\gamma} (1 - l_{t+j}^i)^{1-\gamma} \right]^{1-\sigma}}{1-\sigma} \right] \tag{6}$$

$$\text{s.t. } p_t^i \left(w_t^i l_t^i + d_t^i \right) + r_{t-1} b_t^i = p_t^{i,c} c_t^i + b_{t+1}^i + \frac{\xi}{2} \frac{(b_{t+1}^i)^2}{\Gamma_t^H} \tag{7}$$

$\beta \in (0,1)$ is the subjective discount factor, $\sigma > 0$ is the coefficient of relative risk aversion, and γ is the weight of consumption in the instantaneous utility function, which is Cobb-Douglas in consumption and leisure. r_{t-1} is the interest rate on bonds maturing at the start of period t. When bond holdings differ from zero, we assume that households must pay quadratic "portfolio management costs," as captured in the last term in (7).[7] $p_t^{i,c}$ is the consumer price index in country

[7] Portfolio management costs are one of several roughly equivalent ways of keeping the detrended model stationary, as discussed in Schmitt-Grohé and Uribe (2003). We set ξ to 0.001.

i, defined as follows:

$$p_t^{i,c} = \left[\omega \left(p_t^i\right)^{1-\phi} + (1-\omega)\left(p_t^{-i}\right)^{1-\phi}\right]^{\frac{1}{1-\phi}} \tag{8}$$

The numeraire is an equally-weighted geometric average of the home and foreign consumer price indices:

$$(p_t^{H,c})^{\frac{1}{2}}(p_t^{F,c})^{\frac{1}{2}} = 1 \tag{9}$$

Appendix A lists the first-order conditions for the representative household in country i. The stochastic discount factor $m_{t+j,t}^i$, which appears in the firm's objective function (2), can be written as follows:

$$m_{t+j,t}^i = \beta^j \left[\frac{c_{t+j}^{i\gamma}(1-l_{t+j}^i)^{1-\gamma}}{c_t^{i\gamma}(1-l_t^i)^{1-\gamma}}\right]^{1-\sigma} \left(\frac{p_t^{i,c}c_t^i}{p_{t+j}^{i,c}c_{t+j}^i}\right) \tag{10}$$

2.4 Market clearing

The market-clearing conditions for the two goods are:

$$y_t^i = c_t^{i,i} + c_t^{-i,i} + x_t^i \tag{11}$$

Finally, since bonds are in zero net supply, the bond market-clearing condition is:

$$0 = b_t^H + b_t^F \tag{12}$$

2.5 Current Account

The home country's current account balance can be written as follows:

$$ca_t^H = p_t^H c_t^{F,H} - p_t^F c_t^{H,F} + (r_{t-1} - 1)b_t^H \tag{13}$$

The first two terms on the right-hand side of (13) are the home country's trade balance. The last term is the net interest income on foreign assets. It is straightforward to show that home's current account must equal the change in home's net foreign assets:

$$ca_t^H = b_{t+1}^H - b_t^H$$

Appendix B explains how the model is detrended and formally defines the equilibrium. We solve the model using a standard first-order expansion around the unique nonstochastic steady-state.

3 Calibration and Impulse Responses

We use a combination of calibration and estimation to derive quantitative results from the model. In particular, we use GMM estimation to identify the parameters governing the trend and transitory shock processes, and we calibrate the remaining parameters using previous literature as a guide. In this section, we document the baseline calibration and develop intuition for the model's dynamics with impulse response functions.

3.1 Baseline calibration

The focus of our analysis is the U.S. Our proxy for the "rest of the world" is the G6; that is, the G7 countries minus the U.S.[8] The calibration is quarterly. Table 2 presents the calibrated parameter values. The parameters σ (coefficient of relative risk aversion), γ (weight on consumption versus leisure in the utility function), α (capital share), β (discount factor), and δ (depreciation rate) are the same as in Aguiar and Gopinath (2007) and are standard in the literature. We set φ (capital adjustment cost) to 1.5, roughly halfway between the estimates in Aguiar and Gopinath (2007) for

[8]Since our time period of interest extends into the 2000s, we should in principle include data from large emerging countries as well, particularly China. We are limited at this point in time by data availability.

Parameter	Value	Description
σ	2	Coefficient of relative risk aversion
γ	0.36	Exponent on consumption in utility
α	0.32	Capital share
β	0.98	Discount factor
δ	0.05	Depreciation rate
φ	1.5	Capital adjustment cost
ω	0.85	Weight of domestic good in consumption
ϕ	5	Elasticity of substitution between goods
$\bar{g}$	0.0077	Long-run growth rate
λ	0.001	Convergence parameter for growth processes
ξ	0.001	Portfolio management costs
ρ_g^i	0.55	Persistence of trend growth process
ρ_z^i	0.7	Persistence of transitory TFP process

Table 2: Baseline calibration. Values for ρ_g^i and ρ_z^i are for specifications in which these parameters are not estimated.

Canada and Mexico, and also close to the estimate in the working paper version of Nguyen (2011).[9] Since we have a two-good model, we also have two parameters governing households' preferences over home and foreign goods. Following Coeurdacier et al. (2010), we set ω (the weight on domestic goods in the consumption basket) to 0.85, corresponding to a steady-state import share of 15%. We set ϕ (the elasticity of substitution between goods) to 5, as in Coeurdacier (2009).[10] We set $\bar{g}$ (steady-state growth rate) to 0.0077, which is the average quarterly growth rate of U.S. real GDP over our sample period (1960.2–2009.4). We set the convergence parameters λ and ξ to 0.001, which are standard in the literature (see, e.g., Nguyen (2011) and Guerrieri et al. (2005)).

When not estimated, we set ρ_g^i (persistence of the trend growth process) to 0.55 and ρ_z^i (persistence of the transitory component of TFP) to 0.7 for both the U.S. and the G6. These estimates are from Nguyen (2011), based on U.S. data from 1960–2000. In some specifications, we also estimate ρ_g^i and ρ_z^i ourselves for the U.S. and the G6.

[9]The working paper version of Nguyen (2011) was calibrated to quarterly data, as is our model. The published version was calibrated to annual data and reported a somewhat smaller estimate for φ.

[10]There is a wide range of estimates in the literature for the elasticity of substitution between traded goods. Following Coeurdacier (2009), we choose the lower bound of estimates from the trade literature. Our results do not change much as long as ϕ is greater than about 1. For very low values of ϕ, a positive productivity shock at home actually makes home agents worse off, due to a massive fall in home's terms of trade – which we view as counterfactual. See Coeurdacier (2009) for details.

3.2 Impulse responses

We consider a positive, 1% transitory shock and a positive, 0.1% trend shock to productivity in the home country. Figure 2 shows the impulse responses for several key endogenous variables. In response to a positive transitory shock, home country consumption falls on impact (as a share of output). Agents understand that the shock is temporary: absent future shocks, output will revert back to trend. In the language of the permanent income hypothesis, current income exceeds permanent income. Optimal consumption smoothing requires that home households save a larger share of their income, causing the consumption share to fall. In contrast, after a positive trend shock, the consumption share rises. In this case, the shock is expected to have a *permanent* effect on the level of output; moreover, the growth process has some persistence, so output will continue to grow above trend for some time. Optimal consumption smoothing now dictates that home households save a smaller share of their income and consume a higher share today. Investment increases on impact in response to both shocks, though the response is more persistent – and much less sharp on impact – with the trend shock.

In response to a positive trend shock, the higher consumption and investment shares together push home's current account into deficit. In this case, the home country needs to invest more in its capital stock to take advantage of permanently higher productivity; but at the same time, home households are less willing to save, since they expect future income to be higher than current income. The solution, of course, is to borrow the difference from foreigners, who finance the home country's new investment. In contrast, a positive transitory shock pushes consumption and investment in opposite directions. The home country still increases investment on impact, but home households are also willing to save more. In our baseline calibration, the consumption share falls by more than the investment share increases, creating a current account surplus.[11]

Note that home's output grows more quickly than foreign output in response to both shocks. It follows that the current account is countercyclical in response to a trend shock and procyclical in response to a transitory shock in the baseline calibration. GMM estimation will attribute much of the volatility of U.S. output to trend rather than transitory productivity shocks, as we demonstrate

[11] It is possible for a positive transitory shock to cause a current account deficit *if* the transitory component of TFP is extremely persistent. We consider this case when we conduct the quantitative analysis. In this case, the consumption share falls by less than the investment share increases, because households don't need to save much if the shock is close to permanent.

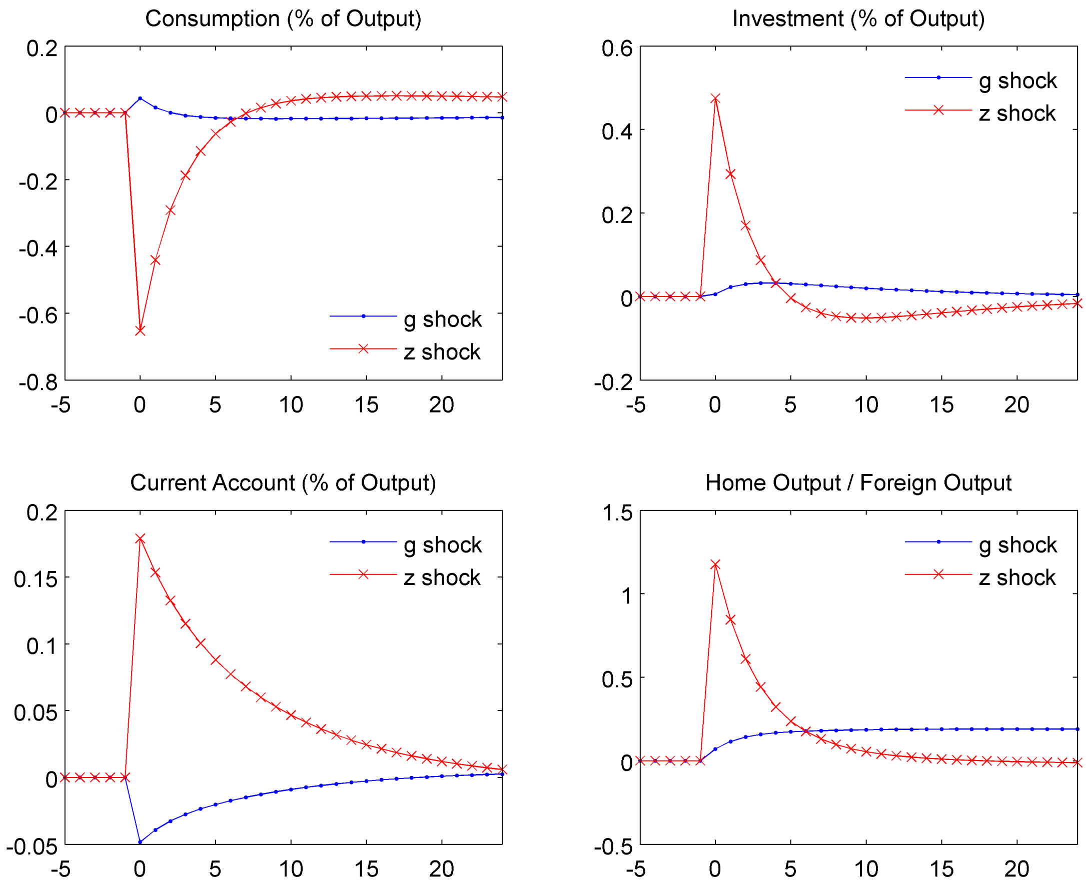

Figure 2: Impulse responses to a 1% transitory ("z") shock and a 0.1% trend ("g") shock. All responses are deviations from steady-state values.

in the next section.

4 Quantitative Results

We identify the parameters governing the trend and transitory shock processes using GMM estimation.[12] We present results based on quarterly data from 1960.2–2009.4.[13]

We estimate the model using data on U.S. and G6 macro variables. Data on U.S. output, consumption, investment, and the current account is from the BEA. G6 data is from the OECD database. Appendix D contains details on the data.

We estimate several specifications of the model with trend and transitory shocks. For comparison, we also estimate the model with transitory shocks only and with trend shocks only.

4.1 Trend and transitory shocks

In the spirit of Aguiar and Gopinath (2007), we estimate several different specifications – starting with a parsimonious set of moment conditions and building up to a richer specification. In the first specification, we fix the persistence parameters at their calibrated values ($\rho_g^H = \rho_g^F = 0.55$ and $\rho_z^H = \rho_z^F = 0.7$) and estimate only the volatilities of the shocks: σ_g^H, σ_z^H, σ_g^F, and σ_z^F. The target moments are the volatilities of Hodrick-Prescott filtered output and consumption in both regions: $\sigma(y_{us})$, $\sigma(c_{us})$, $\sigma(y_{g6})$, and $\sigma(c_{g6})$.[14] At each iteration of the GMM procedure, we run 200 simulations of 500 periods each and compute the average and standard deviation of the resulting moments.

Table 3, Column 1 presents the estimates from this specification. The estimation assigns a significant volatility to trend shocks in both regions. However, a complete comparison must also take account of the persistence parameters and the labor-augmenting nature of the growth process. Following Aguiar and Gopinath (2007), we compute a measure of the random walk component of the (log) Solow residual:

[12] See Burnside (1999) for a detailed description of the GMM technique with applications to macro models.

[13] Results are qualitatively similar if the model is estimated over 1980.1-2009.4. Appendix C presents these results.

[14] Output and consumption are nonstationary in the model, hence the need for some kind of detrending or filtering. The model solution produces decision rules for detrended output and consumption, $\hat{y}_t^H$ and $\hat{c}_t^H$. We use these decision rules to simulate a time path for detrended output and consumption, then use the realizations of the (cumulative) growth shocks to recover the levels y_t^H and c_t^H. We then HP-filter these levels.

Parameter	1	2	3	4	5
σ_g^H	0.76	0.84	0.57		0.74
	(0.07)	(0.14)	(0.23)		(0.06)
σ_z^H	0.54	0.53	0.54	0.87	
	(0.10)	(0.10)	(0.13)	(0.06)	
σ_g^F	0.44	0.54	0.40		0.58
	(0.06)	(0.13)	(0.62)		(0.07)
σ_z^F	0.52	0.51	0.36	0.60	
	(0.10)	(0.10)	(0.33)	(0.05)	
ρ_g^H		0.48	0.64		0.54
		(0.09)	(0.13)		(0.03)
ρ_z^H			0.95	0.99	
			(0.09)	(0.00)	
ρ_g^F		0.41	0.56		0.46
		(0.16)	(0.62)		(0.06)
ρ_z^F			0.93	0.98	
			(0.46)	(0.01)	
rw^H	1.82	1.60	2.07		
rw^F	0.99	0.82	1.55		
p_J			0.26	0.01	0.02

Table 3: Estimated parameter values using GMM estimation (1960.2–2009.4). Estimated values for standard deviations are expressed in percentage terms. Standard errors are in parentheses. rw^i is the variance of the random walk component of the (log) Solow residual divided by the variance of the (log) Solow residual. For overidentified models, p_J is the p-value of the J statistic for the overidentification test. A value less than 0.05 indicates that we can reject the model at the 5% level. The target moments for Specification 1 are the volatilities of HP-filtered output and consumption in each region $\{\sigma(y_{us}), \sigma(c_{us}), \sigma(y_{g6}), \sigma(c_{g6})\}$. The target moments for Specification 2 include all the target moments of Specification 1, plus the correlation of HP-filtered consumption with output in each region $\{\rho(y_{us}, c_{us}), \rho(y_{g6}, c_{g6})\}$. The target moments for Specifications 3, 4, and 5 include all the target moments from Specification 2, plus the volatilities of first-differenced (unfiltered) output in each region, $\{\sigma(\Delta y_{us}), \sigma(\Delta y_{g6})\}$; the correlation of HP-filtered current-account-to-GDP with output, $\{\rho(y_{us}, ca_{us})\}$; the first-order autocorrelation of HP-filtered output in each region, $\{\rho(y_{us}), \rho(y_{g6})\}$; and the first-order autocorrelation of first-differenced (unfiltered) output in each region, $\{\rho(\Delta y_{us}), \rho(\Delta y_{g6})\}$. Specification 4 sets $\sigma_g^H = \sigma_g^F = 0$. Specification 5 sets $\sigma_z^H = \sigma_z^F = 0$. When not estimated, we set ρ_g^H and ρ_g^F to 0.55, and we set ρ_z^H and ρ_z^F to 0.7.

Moment	Data	1	2	3	4	5
$\sigma(y_{us})$	1.53	1.53	1.53	1.42	1.29	1.22
		(0.11)	(0.11)	(0.11)	(0.09)	(0.11)
$\sigma(c_{us})/\sigma(y_{us})$	0.81	0.81	0.81	0.82	0.78	0.95
		(0.02)	(0.02)	(0.03)	(0.01)	(0.02)
$\sigma(i_{us})/\sigma(y_{us})$	4.63	2.24	2.23	2.21	2.24	2.12
		(0.05)	(0.05)	(0.05)	(0.03)	(0.06)
$\sigma(y_{g6})$	1.12	1.12	1.12	0.94	0.93	0.89
		(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
$\sigma(c_{g6})/\sigma(y_{g6})$	0.71	0.71	0.71	0.80	0.70	0.95
		(0.03)	(0.03)	(0.04)	(0.01)	(0.03)
$\sigma(i_{g6})/\sigma(y_{g6})$	2.41	2.46	2.44	2.41	2.32	2.31
		(0.10)	(0.09)	(0.12)	(0.05)	(0.11)
$\sigma(ca_{us})$	0.12	0.54	0.49	0.51	0.19	0.50
		(0.03)	(0.03)	(0.03)	(0.01)	(0.03)
$\rho(y_{us}, c_{us})$	0.87	0.84	0.87	0.84	1.00	0.89
		(0.02)	(0.02)	(0.02)	(0.00)	(0.01)
$\rho(y_{us}, i_{us})$	0.91	0.94	0.95	0.94	0.96	0.93
		(0.01)	(0.01)	(0.01)	(0.00)	(0.01)
$\rho(y_{us}, ca_{us})$	-0.43	-0.12	-0.18	-0.11	-0.65	-0.30
		(0.06)	(0.06)	(0.06)	(0.04)	(0.04)
$\rho(y_{g6}, c_{g6})$	0.82	0.77	0.82	0.80	0.99	0.87
		(0.03)	(0.03)	(0.03)	(0.00)	(0.02)
$\rho(y_{g6}, i_{g6})$	0.91	0.86	0.87	0.81	0.93	0.79
		(0.02)	(0.01)	(0.03)	(0.01)	(0.03)
$\sigma(\Delta y_{us})$	0.87	0.97	1.00	0.84	0.99	0.63
		(0.04)	(0.04)	(0.03)	(0.03)	(0.03)
$\sigma(\Delta y_{g6})$	0.76	0.80	0.82	0.57	0.69	0.48
		(0.03)	(0.03)	(0.02)	(0.02)	(0.02)
$\rho(y_{us})$	0.86	0.81	0.80	0.85	0.74	0.92
		(0.02)	(0.02)	(0.02)	(0.03)	(0.01)
$\rho(y_{g6})$	0.85	0.73	0.72	0.83	0.74	0.91
		(0.03)	(0.03)	(0.02)	(0.03)	(0.01)
$\rho(\Delta y_{us})$	0.34	0.22	0.21	0.30	0.02	0.67
		(0.04)	(0.04)	(0.04)	(0.05)	(0.03)
$\rho(\Delta y_{g6})$	0.46	0.04	0.04	0.24	0.01	0.57
		(0.05)	(0.05)	(0.05)	(0.05)	(0.03)

Table 4: Business cycle moments (1960.2–2009.4). Model moments are averages over 200 simulations of 500 periods each. Values in parentheses are standard deviations of the moments over the 200 simulations. See Table 3 for a description of the different specifications.

$$rw = \frac{(1-\alpha)^2\sigma_g^2/(1-\rho_g)^2}{[2/(1+\rho_z)]\sigma_z^2 + [(1-\alpha)^2\sigma_g^2/(1-\rho_g^2)]} \tag{14}$$

Equation (14) is based on a Beveridge-Nelson decomposition of the Solow residual (Beveridge and Nelson, 1981).[15] The resulting value for the U.S. is 1.82. This is significantly higher than the random walk components of both Canada (0.37) and Mexico (0.96), as estimated by Aguiar and Gopinath (2007). rw is also considerably higher for the U.S. than for the G6 (0.99), according to our estimation. We find it striking that so much of the variation in U.S. TFP can be attributed to trend shocks, which are commonly thought of as an emerging-market phenomenon.

Table 4 compares business cycle moments across model and data. Specification 1 matches the four target moments exactly. It also predicts a countercyclical current account balance, although the magnitude of the correlation is smaller in the model (-0.12) than in the data (-0.43). Note that consumption is less volatile than output in the U.S. ($\sigma(c_{us})/\sigma(y_{us}) = 0.81$). In this sense, the U.S. differs from emerging economies, which tend to have relatively volatile consumption. Our results show that strong trend shocks can be consistent with both a countercyclical current account and low consumption volatility. The model somewhat underestimates the volatility of investment in the U.S. and overestimates the volatility of the current account balance.

In Specification 2, we expand the set of target moments to also include the correlation of HP-filtered consumption with output in both regions, $\{\rho(y_{us}, c_{us}),\ \rho(y_{g6}, c_{g6})\}$, and we estimate two more parameters: ρ_g^H and ρ_g^F. The main quantitative results are unchanged. In particular, the estimation still predicts a high rw for the U.S. (1.60) and a moderately countercylical current account balance (-0.18).

Specification 3 is the richest specification we consider, and our preferred one. We now estimate all the parameters governing the trend and transitory shock processes: σ_g^H, σ_z^H, σ_g^F, σ_z^F, ρ_g^H, ρ_z^H, ρ_g^F, and ρ_z^F. We use 13 target moments: the volatilities of HP-filtered output and consumption in each region, $\{\sigma(y_{us}),\ \sigma(c_{us}),\ \sigma(y_{g6}),\ \sigma(c_{g6})\}$; the volatilities of first-differenced (unfiltered) output in each region, $\{\sigma(\Delta y_{us}),\ \sigma(\Delta y_{g6})\}$; the correlation of HP-filtered consumption with output in

[15] Specifically, rw is the variance of the first difference of the random walk component of the (log) Solow residual divided by the variance of the first difference of the (log) Solow residual. This is the measure advocated by Cochrane (1988).

each region, $\{\rho(y_{us}, c_{us}),\ \rho(y_{g6}, c_{g6})\}$; the correlation of HP-filtered current-account-to-GDP with output, $\{\rho(y_{us}, ca_{us})\}$; the first-order autocorrelation of HP-filtered output in each region, $\{\rho(y_{us}),\ \rho(y_{g6})\}$; and the first-order autocorrelation of first-differenced (unfiltered) output in each region, $\{\rho(\Delta y_{us}),\ \rho(\Delta y_{g6})\}$. The estimation continues to assign a significant volatility to trend shocks in both regions, and the rw statistic for the U.S. is quite high (2.07). With 13 target moments and 8 parameters to estimate, the model is now overidentified, so we can test the overidentifying restrictions. The p-value of the J statistic is 0.26, so we cannot reject the model at any of the standard confidence levels. Although some of the parameters for the G6 are not very precisely estimated, all of the estimates for the U.S. are reasonably precise.

The model moments match the data reasonably well (Table 4, Column 3). The model continues to predict a moderately countercyclical current account balance (-0.11). Most of the other moments are a good match. The main exceptions are the volatility of investment in the U.S. (underestimated) and the volatility of the current account (overestimated). This specification offers a closer match to the autocorrelations of first-differenced output than the previous two specifications did.

4.2 Transitory shocks only

Next, we ask what happens when we turn the trend shocks off. In Specification 4, we fix $\sigma_g^H = \sigma_g^F = 0$ and estimate σ_z^H, σ_z^F, ρ_z^H, and ρ_z^F. The target moments are the same as in Specification 3. Interestingly, the estimation now assigns a very high value to ρ_z^H (0.99), the persistence of the transitory TFP process.[16] Roughly speaking, the model now "wants" the transitory shock to be permanent. Even more interesting, the model now predicts a strongly countercyclical current account (-0.62). This appears to go against the intuition from impulse response functions in Section 3, where we argued that the current account tends to increase after a positive transitory shock. However, when the transitory TFP process is extremely persistent, this result is overturned, and a positive transitory shock can lead to a decline in the current account. Effectively, the transitory shock behaves more like a permanent shock when ρ_z^H is very high.[17]

[16]When estimated over 1980.1–2009.4, this result is even more dramatic: the estimation pins ρ_z^H arbitrarily close to 1, the upper bound of the valid range of values for this parameter. Appendix C contains estimation results over 1980.1–2009.4.

[17]This result turns out to be highly sensitive to the exact value of ρ_z. We also estimated a specification of the model where we fixed $\rho_z^H = \rho_z^F = 0.95$ and estimated only σ_z^H and σ_z^F. This specification predicts a significantly *positive* current account (0.36). The bottom line is that the model can generate a countercyclical current account with transitory shocks alone only if the persistence of the transitory TFP process is very high.

Overall, Specification 4 (transitory shocks only) does not fit the data as well as Specification 3 (trend and transitory shocks). In particular, Specification 4 predicts a nearly lockstep correlation between HP-filtered consumption and output in both regions. The model also underestimates the autocorrelation of HP-filtered output and the autocorrelation of first-differenced (unfiltered) output. The p-value of the J statistic is 0.01, indicating that we can reject the model at the 5% level.

4.3 Trend shocks only

Specification 5 shuts off the transitory shocks. We now fix $\sigma_z^H = \sigma_z^F = 0$ and estimate σ_g^H, σ_g^F, ρ_g^H, and ρ_g^F. The target moments are the same as in Specifications 3 and 4. Specification 5 again predicts a countercyclical current account (-0.30). However, relative to Specification 3 (trend and transitory shocks), it underestimates the volatility of output and overestimates the volatility of consumption in each region. Specification 5 also underestimates the volatility of first-differenced output and overestimates the autocorrelation of first-differenced output. The p-value of the J statistic is 0.02, again suggesting that we can reject the model at the 5% level.

5 Conclusion

Previous research has identified trend growth shocks to productivity as a possible driver of countercyclical external balances in emerging market countries. We argue that trend shocks can also help explain the countercyclical U.S. current account. Our approach has been to estimate a structural open economy macro model with trend and transitory productivity shocks. The specification that best matches the data assigns a large role to trend shocks. When estimated with transitory shocks alone, the model can produce a countercyclical current account only if the transitory TFP process is extremely persistent. While the simple RBC model considered here matches the data reasonably well, it does tend to underestimate the volatility of investment and overestimate the volatility of the current account. We speculate that adding financial frictions and shocks affecting firms' borrowing ability could improve the fit of the model, as suggested by Garcia-Cicco et al. (2010) and others. We leave these extensions for future research.

Appendix

A First-order conditions

The first-order conditions of the representative firm in country i are:

$$w_t^i = (1-\alpha)\frac{y_t^i}{l_t^i} \tag{15}$$

$$\begin{aligned} &1+\varphi\left(\frac{k_{t+1}^i}{k_t^i}-e^{\bar{g}}\right) = \\ E_t\Bigg[m_{t+1,t}^i\left(\frac{p_{t+1}^i}{p_t^i}\right)&\left\{\alpha\frac{y_{t+1}^i}{k_{t+1}^i}+1-\delta+\frac{\varphi}{2}\left(\left(\frac{k_{t+2}^i}{k_{t+1}^i}\right)^2-\left(e^{\bar{g}}\right)^2\right)\right\}\Bigg] \end{aligned} \tag{16}$$

The first-order conditions of the representative household in country i are:

$$\frac{c_t^{i,-i}}{c_t^{i,i}} = \frac{1-\omega}{\omega}\left(\frac{p_t^i}{p_t^{-i}}\right)^{\phi} \tag{17}$$

$$\frac{c_t^i}{\gamma} = \frac{p_t^i w_t^i}{p_t^{i,c}}\left(\frac{1-l_t^i}{1-\gamma}\right) \tag{18}$$

$$\frac{u_{c,t}^i}{p_t^{i,c}}\left(1+\xi\frac{b_{t+1}^i}{\Gamma_t^H}\right) = E_t\left[\beta\left(\frac{u_{c,t+1}^i}{p_{t+1}^{i,c}}\right)r_t\right] \tag{19}$$

$$\text{where } u_{c,t}^i \equiv \frac{\left[c_t^{i\gamma}(1-l_t^i)^{1-\gamma}\right]^{1-\sigma}}{c_t^i}$$

B Detrending and Equilibrium

To solve the model using locally accurate solution techniques, it is necessary to express it in detrended form. For any (trending) variable x_t, let $\widehat{x}_t \equiv x_t/\Gamma_{t-1}^H$ be its detrended counterpart. The following variables have a stochastic trend and need to be detrended: y_t^i, k_t^i, d_t^i, w_t^i, b_t^i, c_t^i, and $c_t^{i,j}$. The remaining variables are already stationary. In what follows, it is useful to define the following auxiliary variable:

$$h_t \equiv \frac{\Gamma_t^H}{\Gamma_{t-1}^H} = e^{g_t^H} \pi_t^{\lambda}$$

The production functions can then be written as follows:

$$\widehat{y}_t^H = e^{z_t^H} \widehat{k}_t^{H\alpha} \left(l_t^H h_t \right)^{1-\alpha} \tag{20}$$

$$\widehat{y}_t^F = e^{z_t^F} \widehat{k}_t^{F\alpha} \left(l_t^F e^{g_t^F} \pi_t^{1-\lambda} \right)^{1-\alpha} \tag{21}$$

The law of motion for capital can be written:

$$\widehat{k}_{t+1}^i h_t = \widehat{x}_t^i + (1-\delta)\, \widehat{k}_t^i - \frac{\varphi}{2} \left(\frac{\widehat{k}_{t+1}^i h_t}{\widehat{k}_t^i} - e^{\bar{g}} \right)^2 \widehat{k}_t^i \tag{22}$$

The household budget constraint can be written:

$$p_t^i \left(\widehat{w}_t^i l_t^i + \widehat{d}_t^i \right) + r_{t-1} \widehat{b}_t^i = p_t^{i,c} \widehat{c}_t^i + \widehat{b}_{t+1}^i h_t + \frac{\xi}{2} \left(\widehat{b}_{t+1}^i \right)^2 h_t \tag{23}$$

The intertemporal first-order condition for the representative household can be written:

$$\frac{u_{\widehat{c},t}^i}{p_t^{i,c}} \left(1 + \xi \widehat{b}_{t+1}^i \right) = E_t \left[\beta \left(\frac{u_{\widehat{c},t+1}^i}{p_{t+1}^{i,c}} \right) h_t^{\gamma(1-\sigma)-1} r_t \right] \tag{24}$$

$$\text{where } u_{\widehat{c},t}^i \equiv \frac{\left[\widehat{c}_t^{i\gamma} (1-l_t^i)^{1-\gamma} \right]^{1-\sigma}}{\widehat{c}_t^i}$$

The intertemporal first-order condition for the representative firm can be written:

$$
1+\varphi\left(\frac{\widehat{k}^i_{t+1}h_t}{\widehat{k}^i_t}-e^{\bar{g}}\right)=
$$

$$
E_t\left[m^i_{t+1,t}\left(\frac{p^i_{t+1}}{p^i_t}\right)\left\{\alpha\frac{\widehat{y}^i_{t+1}}{\widehat{k}^i_{t+1}}+1-\delta+\frac{\varphi}{2}\left(\left(\frac{\widehat{k}^i_{t+2}h_{t+1}}{\widehat{k}^i_{t+1}}\right)^2-\left(e^{\bar{g}}\right)^2\right)\right\}\right] \tag{25}
$$

The stochastic discount factor can be written:

$$
m^i_{t+1,t}=\beta\left(\frac{u^i_{\widehat{c},t+1}}{u^i_{\widehat{c},t}}\right)\left(\frac{p^{i,c}_t}{p^{i,c}_{t+1}}\right)h_t^{\gamma(1-\sigma)-1} \tag{26}
$$

The market-clearing conditions (11) and (12), the expression for the consumption basket (5), the expression for shareholder proceeds (3), the expression for the current account (13), and the remaining first-order conditions can be written in detrended form simply by replacing each trending variable x_t with its detrended counterpart, $\widehat{x}_t$.

An *equilibrium* is a sequence of prices $\{p^i_t, \widehat{w}^i_t, r^i_t\}$, capital stocks $\{\widehat{k}^i_t\}$, labor $\{l^i_t\}$, output $\{\widehat{y}^i_t\}$, consumption $\{\widehat{c}^{i,j}_t\}$, and bond holdings $\{\widehat{b}^i_t\}$ such that (i) goods and asset markets clear, and (ii) households and firms in both countries behave optimally, taking prices as given.

C Estimation results over 1980.1–2009.4

Tables 5 and 6, below, present results from estimating the model over the time period 1980.1–2009.4. The baseline calibration is the same as in Table 2, except that $\bar{g}$ is set to 0.0067 to match the quarterly growth rate of U.S. output over this time period.

D Data

This appendix describes the data used in our estimation exercises. Data is quarterly, from 1960.2–2009.4. We take output, consumption, and investment from the BEA for the U.S., and from the OECD "StatExtracts" database for the G6. We also get the U.S. current account balance from the BEA. All G6 variables are measured in terms of U.S. dollars at purchasing power parity (OECD

Parameter	1	2	3	4	5
σ_g^H	0.64	0.73	0.57		0.66
	(0.07)	(0.15)	(0.08)		(0.06)
σ_z^H	0.53	0.53	0.37	0.69	
	(0.13)	(0.13)	(0.07)	(0.06)	
σ_g^F	0.34	0.44	0.34		0.45
	(0.05)	(0.20)	(0.65)		(0.05)
σ_z^F	0.58	0.57	0.30	0.54	
	(0.13)	(0.13)	(0.38)	(0.04)	
ρ_g^H		0.46	0.57		0.54
		(0.11)	(0.06)		(0.03)
ρ_z^H			0.64	1.00	
			(0.28)	(0.00)	
ρ_g^F		0.37	0.60		0.59
		(0.38)	(0.73)		(0.05)
ρ_z^F			0.92	0.96	
			(0.94)	(0.01)	
rw^H	1.54	1.33	2.06		
rw^F	0.56	0.46	1.88		
p_J			0.52	0.08	0.18

Table 5: Estimated parameter values using GMM estimation (1980.1–2009.4). Estimated values for standard deviations are expressed in percentage terms. Standard errors are in parentheses. rw^i is the variance of the random walk component of the (log) Solow residual divided by the variance of the (log) Solow residual. For overidentified models, p_J is the p-value of the J statistic for the overidentification test. A value less than 0.05 indicates that we can reject the model at the 5% level. The target moments for Specification 1 are the volatilities of HP-filtered output and consumption in each region $\{\sigma(y_{us}),\, \sigma(c_{us}),\, \sigma(y_{g6}),\, \sigma(c_{g6})\}$. The target moments for Specification 2 include all the target moments of Specification 1, plus the correlation of HP-filtered consumption with output in each region $\{\rho(y_{us}, c_{us}),\, \rho(y_{g6}, c_{g6})\}$. The target moments for Specifications 3, 4, and 5 include all the target moments from Specification 2, plus the volatilities of first-differenced (unfiltered) output in each region, $\{\sigma(\Delta y_{us}),\, \sigma(\Delta y_{g6})\}$; the correlation of HP-filtered current-account-to-GDP with output, $\{\rho(y_{us}, ca_{us})\}$; the first-order autocorrelation of HP-filtered output in each region, $\{\rho(y_{us}),\, \rho(y_{g6})\}$; and the first-order autocorrelation of first-differenced (unfiltered) output in each region, $\{\rho(\Delta y_{us}),\, \rho(\Delta y_{g6})\}$. Specification 4 sets $\sigma_g^H = \sigma_g^F = 0$. Specification 5 sets $\sigma_z^H = \sigma_z^F = 0$. When not estimated, we set ρ_g^H and ρ_g^F to 0.55, and we set ρ_z^H and ρ_z^F to 0.7.

Moment	Data	1	2	3	4	5
$\sigma(y_{us})$	1.36	1.36	1.36	1.13	0.95	1.09
		(0.09)	(0.09)	(0.08)	(0.07)	(0.10)
$\sigma(c_{us})/\sigma(y_{us})$	0.78	0.78	0.78	0.84	0.92	0.95
		(0.03)	(0.02)	(0.02)	(0.01)	(0.02)
$\sigma(i_{us})/\sigma(y_{us})$	4.91	2.28	2.28	2.24	2.18	2.16
		(0.05)	(0.04)	(0.06)	(0.03)	(0.07)
$\sigma(y_{g6})$	1.09	1.09	1.09	0.82	0.90	0.82
		(0.06)	(0.06)	(0.06)	(0.06)	(0.07)
$\sigma(c_{g6})/\sigma(y_{g6})$	0.61	0.61	0.61	0.81	0.59	0.95
		(0.03)	(0.03)	(0.04)	(0.01)	(0.03)
$\sigma(i_{g6})/\sigma(y_{g6})$	2.45	2.51	2.49	2.40	2.37	2.29
		(0.09)	(0.08)	(0.12)	(0.05)	(0.11)
$\sigma(ca_{us})$	0.13	0.46	0.41	0.43	0.21	0.48
		(0.03)	(0.02)	(0.02)	(0.02)	(0.03)
$\rho(y_{us}, c_{us})$	0.87	0.84	0.87	0.83	0.99	0.88
		(0.03)	(0.02)	(0.02)	(0.00)	(0.01)
$\rho(y_{us}, i_{us})$	0.92	0.95	0.95	0.94	0.96	0.91
		(0.01)	(0.01)	(0.01)	(0.00)	(0.01)
$\rho(y_{us}, ca_{us})$	-0.57	-0.07	-0.13	-0.13	-0.83	-0.27
		(0.06)	(0.06)	(0.06)	(0.03)	(0.05)
$\rho(y_{g6}, c_{g6})$	0.82	0.78	0.82	0.80	0.96	0.82
		(0.03)	(0.03)	(0.03)	(0.01)	(0.02)
$\rho(y_{g6}, i_{g6})$	0.93	0.89	0.91	0.83	0.94	0.81
		(0.01)	(0.01)	(0.02)	(0.01)	(0.03)
$\sigma(\Delta y_{us})$	0.77	0.90	0.92	0.71	0.76	0.56
		(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
$\sigma(\Delta y_{g6})$	0.62	0.83	0.85	0.49	0.65	0.40
		(0.03)	(0.03)	(0.02)	(0.02)	(0.02)
$\rho(y_{us})$	0.85	0.78	0.78	0.82	0.74	0.92
		(0.03)	(0.03)	(0.02)	(0.03)	(0.01)
$\rho(y_{g6})$	0.88	0.67	0.66	0.84	0.74	0.93
		(0.03)	(0.03)	(0.02)	(0.03)	(0.01)
$\rho(\Delta y_{us})$	0.42	0.16	0.15	0.25	0.02	0.66
		(0.04)	(0.04)	(0.05)	(0.05)	(0.03)
$\rho(\Delta y_{g6})$	0.50	-0.04	-0.04	0.27	-0.00	0.72
		(0.04)	(0.04)	(0.05)	(0.05)	(0.03)

Table 6: Business cycle moments (1980.1–2009.4). Model moments are averages over 200 simulations of 500 periods each. Values in parentheses are standard deviations of the moments over the 200 simulations. See Table 5 for a description of the different specifications.

measure ‘CPCARSA’). Following Aguiar and Gopinath (2007), we HP-filter log real output, log real consumption, and log real investment in both countries, as well as the ratio of the U.S. (nominal) current account balance to nominal output.

References

Aguiar, Mark and Gita Gopinath, "Emerging Market Business Cycles: The Cycle is the Trend," *Journal of Political Economy*, 2007, *115* (1), 69–102.

Angelopoulos, Konstantinos, George Economides, and Vangelis Vassilatos, "Do Institutions Matter for Economic Fluctuations? Weak Property Rights in a Business Cycle Model for Mexico," *Review of Economic Dynamics*, 2011, *14* (3), 511–531.

Backus, David, Patrick Kehoe, and Finn Kydland, "International Real Business Cycles," *Journal of Political Economy*, 1992, *100* (4), 745–75.

Baxter, Marianne and Mario Crucini, "Business Cycles and the Asset Structure of Foreign Trade," *International Economic Review*, 1995, *36* (4), 821–854.

Beveridge, Stephen and Charles Nelson, "A New Approach to Decomposition of Economic Time Series into Permanent and Transitory Components with Particular Attention to Measurement of the 'Business Cycle'," *Journal of Monetary Economics*, 1981, *7* (2), 151–74.

Blundell, Richard and Ian Preston, "Consumption Inequality And Income Uncertainty," *The Quarterly Journal of Economics*, 1998, *113* (2), 603–640.

Boz, Emine, Christian Daude, and Ceyhun Bora Durdu, "Emerging Market Business Cycles: Learning About the Trend," *Journal of Monetary Economics*, 2011, *Forthcoming.*

Burnside, Craig, "Real Business Cycle Models: Linear Approximation and GMM Estimation," 1999. Unpublished Manuscript, The World Bank Group.

Campbell, John and Angus Deaton, "Why Is Consumption So Smooth?," *Review of Economic Studies*, 1989, *56* (3), 357–73.

Chen, Kaiji, Ayse Imrohoroglu, and Selahattin Imrohoroglu, "A Quantitative Assessment of the Decline in the U.S. Current Account," *Journal of Monetary Economics*, 2009, *56* (8), 1135–1147.

Christiano, Lawrence and Martin Eichenbaum, "Unit Roots in Real GNP: Do We Know, and Do We Care?," *Carnegie Rochester Conference Series on Public Policy*, 1990, *32*, 7–61.

Cochrane, John, "How Big is the Random Walk in GNP?," *Journal of Political Economy*, 1988, *96* (5), 893–920.

Coeurdacier, Nicolas, "Do Trade Costs in Goods Markets Lead to Home Bias in Equities?," *Journal of International Economics*, 2009, *77*, 86–100.

_ , Robert Kollman, and Philippe Martin, "International Portfolios, Capital Accumulation and Foreign Asset Dynamics," *Journal of International Economics*, 2010, *80*, 100–112.

Corsetti, Giancarlo and Panagiotis Konstantinou, "What Drives U.S. Foreign Borrowing? Evidence on the External Adjustment to Transitory and Permanent Shocks," *American Economic Review*, 2011, *Forthcoming.*

Engel, Charles and John Rogers, "The U.S. Current Account Deficit and the Expected Share of World Output," *Journal of Monetary Economics*, 2006, *53* (5), 1063–1093.

Garcia-Cicco, Javier, Roberto Pancrazi, and Martin Uribe, "Real Business Cycles in Emerging Countries?," *American Economic Review*, 2010, *100* (5), 2510–31.

Gourinchas, Pierre-Olivier and Hélène Rey, "International Financial Adjustment," *Journal of Political Economy*, 2007, *115.*

Guerrieri, Luca, Dale Henderson, and Jinill Kim, "Investment-specific and Multifactor Productivity in Multi-Sector Open Economies: Data and Analysis," International Finance Discussion Paper 828, Board of Governors of the Federal Reserve System 2005.

Heathcote, Jonathan and Fabrizio Perri, "Financial Autarky and International Business Cycles," *Journal of Monetary Economics*, 2002, *49*, 601–627.

Hoffmann, Mathias, Michael Krause, and Thomas Laubach, "Long-run Growth Expectations and 'Global Imbalances'," Discussion Paper 01/2011, Deutsche Bundesbank 2011.

Lane, Philip and Gian Maria Milesi-Ferretti, "A Global Perspective on External Positions," in Richard Clarida, ed., *G7 Current Account Imbalances: Sustainability and Adjustment*, Chicago University Press, 2005.

_ and _ , "The External Wealth of Nations Mark II: Revised and Extended Estimates of Foreign Assets and Liabilities, 1970–2004," *Journal of International Economics*, 2007, *73*, 223–250.

Lumsdaine, Robin and David Papell, "Multiple Trend Breaks and the Unit-Root Hypothesis," *Review of Economic Statistics*, 1997, *79* (2), 212–218.

Nguyen, Ha, "Valuation Effects with Transitory and Trend Productivity Shocks," *Journal of International Economics*, 2011, *Forthcoming.*

Obstfeld, Maurice and Kenneth Rogoff, "The Unsustainable U.S. Current Account Position Revisited," in Richard Clarida, ed., *G7 Current Account Imbalances: Sustainability and Adjustment*, Chicago University Press, 2005.

Ozbilgin, Husyein Murat, "Financial Market Participation and the Developing Country Business Cycle," *Journal of Development Economics*, 2010, *92* (2), 125–137.

Schmitt-Grohé, Stephanie and Martín Uribe, "Closing Small Open Economy Models," *Journal of International Economics*, 2003, *61*, 163–185.