Can International Productivity Differences Alone Account for the U.S. Current Account Deficits?

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Abstract

An influential explanation for the recent rise in the U.S. current account deficit is the boom in U.S. productivity. As U.S. productivity surged in the mid-1990s, capital was attracted to the U.S. to take advantage of the higher real returns. Using a two country general equilibrium model, this paper quantitatively shows that the gap in productivity growth between the U.S. and the "rest of the world" cannot explain the U.S. current account deficits, especially in the 1980s and the 2000s. This is because on a GDP-weighted basis, the "rest of the world" actually had higher productivity growth during these periods, and standard macroeconomic models would predict an outflow of funds from the U.S. to the rest of the world, and a consequent U.S. current account *surplus*. We show that changes in global financial integration can help explain this anomaly in U.S. current account behavior.

JEL Codes: F32, F34, F36

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1 Introduction

In recent years, rising global current account imbalances have attracted much attention. The overall U.S. current account deficit rose from a modest $120 billion in 1996 (1.6% of GDP) to $666 billion in 2005 (6.06% of GDP) (**Figure 1-A**). There are four distinct periods of evolution: 1980 to 1986 when the U.S. current account deficit widened, followed by 1986 to 1991, when the deficit declined. The 1990s were a period of almost continuous widening of the US deficit (except for a brief period during 1994 to 1997), with the current account deficit

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rising especially rapidly since 2000. In **Figure 1-B**, we decompose the U.S. current account deficit into that with Europe, Japan, emerging Asia, and the Middle East. Although because of data limitations, the decomposition including emerging Asia can only be performed after 1999, it is evident from Figure 1-B that in the last few years, the deficit with emerging Asia is the most rapidly growing component of the U.S. current account deficit (by 2005, accounting for about 30 percent of the total U.S. deficit.)[1]

Perhaps the most influential explanation of this phenomenon of widening U.S. current account deficits is that of widening productivity gaps between the U.S. and the "rest of the world." Since the mid-1990s, the U.S. economy experienced a productivity surge–and a rise in real returns to capital-while productivity in Europe and Japan stagnated. IMF (2005), Hunt and Rebucci (2005), and Engel and Rogers (2006) attribute the widening U.S. current account deficits to funds from the Europe and Japan seeking higher returns in the U.S. A rise in U.S. productivity relative to the world will raise U.S. investment and consumption, and increase the U.S. current account deficit.

This "productivity gap" view, however, cannot explain the rising U.S. deficits since 2000. Table 3 depicts our calculations of Total Factor Productivity (TFP) growth for the "rest of the world," when that region includes: 1) only Europe and Japan; and 2) Europe, Japan, and emerging Asia for different subperiods since 1980. While it is true that U.S. productivity growth has outstripped the world's between 1991 and 2000; since 2000, U.S. productivity growth has lagged by a large margin, world productivity growth, including that of emerging Asia. This is mainly because of very rapid TFP growth in emerging Asia (over 5 percent), particularly in China (Dekle and Vandenbroucke, 2006), and of the growing economic weight of emerging Asia in the world.

If the differential productivity view is correct, then the U.S. should have been running current account surpluses (or at least decreasing its deficits), and funds should have been flowing *out* from the U.S. in the 2000s, when it fact the opposite has happened. The phenomenon of high U.S. current account deficits despite relatively low U.S. TFP growth is actually not unique to the last few years. Throughout the 1980s, U.S. productivity growth lagged those of Europe and Japan's, but the U.S. ran high current account deficits (**Figure 1-A, Table 3**).

In this paper, we provide an accounting of why the U.S. ran current account deficits, despite higher productivity growth in the "rest of the world," not only in the post-2000 period, but also in the past, the 1980s.[2] Using an explicit, two-region dynamic stochastic general equilibrium model, we attribute U.S. current account deficits to changes in the "cost" of buying U.S. assets in the "rest of the

[1] See Dekle, Eaton, and Kortum (2007) for the role of China and emerging Asia in explaining U.S. current account deficits; and how much exchange rates need to adjust to equilibrate the U.S. current account deficits.

[2] In our quantitative analysis, we ignore the role of oil prices, and oil exporting countries in widening the U.S. current account deficits. Our sample stops in 2003, and the run-up in oil prices occurred subsequent to that. See Backus and Crucini (2000) for the role of oil supply shocks in widening the OECD deficits in an earlier period.

world." We interpret this "cost" as relating to regulatory and other changes in the financial sector; and find that our model-derived measure correlates closely during our period of analysis (1980-2003) with other well-known measures of global financial deregulation (Chinn and Ito, 2005); and with distinct, identifiable episodes of global financial shocks.

Our benchmark model is a standard two region business cycle model, where regions trade in final goods and international assets, but not in factors of production. In contrast to standard imperfect asset market models as in Baxter and Crucini (1995), we assume that international asset trading is costly. These costs can be interpreted as monitoring costs or administrative costs associated with international lending, and are dependent on a region's financial institutions. Introducing costs to asset trading helps capture the evolution of financial markets in a simple way. Specifically as a region's financial markets evolve, and there is a move towards increased financial integration, these trading costs decline. Regions are ex-ante symmetric, although ex-post they may differ in their productivity shocks and openness of financial markets. In our quantitative analysis, the two regions represent the United States and the "rest of the world."

The idea that changes in overseas–especially emerging Asian– financing behavior can be related to the expansion of the U.S. current account was first floated by Dooley, Folkerts-Landau, and Garber (2004) and Chadha (2006) (the so-called "Deutsche Bank" view). Mendoza, Quadrini, and Rios-Rull (2006), and Caballero, Farhi, and Gourinchas (2006) have formally modelled this idea.[3] These papers, however, are all theoretical; and do not perform the empirical exercise that we do here, depicting how a reasonable pattern of changes in global financial structure–amended to a standard two-country macroeconomic model–can quantitatively account for the evolution of the U.S. current account.

The rest of the paper is organized as follows. In Section 2, we present the theoretical model underlying our quantitative analysis. Section 3 summarizes the qualitative predictions of our model. In Section 4, we take our model to the data and present the results of our quantitative exercise.

2 Benchmark model

Our model builds on the incomplete financial markets framework developed by Baxter and Crucini (1995). In the Baxter and Crucini (1995)[4] model, instead of a full set of contingent financial contracts, there is only one internationally traded asset, a bond, which can be freely bought and sold. In our set up, we

[3] Other papers using dynamic optimizing frameworks to analyze the U.S. current account include Cavallo and Tille (2006), and Faruqee, Laxton, Muir and Pesenti (2005).

[4] Choi, Mark, and Sul (2008) also use an international business cycle model with imperfect capital markets to trace the actual time path of the U.S. current account. Like us, Choi, Mark, and Sul find that the time path of the U.S. current account cannot be explained by U.S. and "rest of the world" productivity differences. The authors attribute the unexplained portion of the U.S. current account to a declining pure rate of time preference.

introduce costs to international lending or to the buying and selling of foreign bonds, which are intended to capture various frictions arising from the lack of liberalization in international financial transactions, such as restrictions on foreign lending by domestic banks or taxes on the purchases of foreign bonds and assets.

Time is discrete, indexed by $t = 0,\ 1,\ 2....$and the time horizon is infinite. The world is comprised of two countries, Home and Foreign, indexed by $i \in (H,\ F)$, each of which is populated by an unit measure of identical, infinitely-lived households[5]. In addition to households, each country is also populated by an infinite number of perfectly competitive firms that own the production technology. There is only one good in our model, produced by the firms in each country, using country-specific capital and labor. Once produced, the good is then traded between the two countries, and is used for consumption and investment.

The goal of the paper is to quantitatively study the impact of differential productivity growth on global imbalances in an environment of increasing asset market integration. To this end, we introduce costs to international lending, or to the purchase of foreign bonds, where costs reflect the relative difficulty of foreign financial market access. Costs evolve according to changes in domestic and international regulations, with a lowering of costs reflecting increasing ease of access to global financial markets.

Uncertainty in our model arises from country-specific productivity shocks, and shocks to the costs of foreign lending. The countries are ex-ante perfectly symmetric.

2.1 Preferences and technologies

Households in country i maximize expected discounted utility over consumption c_{it}, and leisure $1 - l_{it}$:

$$E \sum_{t=0}^{\infty} \beta_i^t u(c_{it},\ l_{it}) \tag{1}$$

The budget constraint is given by:

$$c_{it} + x_{it} + s_{it} + f(s_{it}, \phi_{it}) s_{it} \leq w_{it} l_{it} + r_{it}^k k_{it-1} + R_t s_{it-1} \tag{2}$$

where $w_{it} l_{it}$ denotes labor income, and the return to capital is given by $r_{it}^k k_{it-1}$. In addition, households earn returns on international lending where R_t represents the gross world interest rate at time t.

Income is used to finance consumption, physical capital investment, x_{it}, and for international net lending. International net lending, or the purchasing (or selling) foreign bonds involves a cost, where $f(s_{it},\ \phi_{it})$ denotes the cost of purchasing a foreign bond in terms of the final good. If buying or selling bonds

[5] The assumption of equal population size is for simplicity. Relaxing the assumption would modify the resource constraints. Our main findings would not change.

is frictionless, as in the usual Baxter and Crucini (1995) model, then $f(s_{it}, \phi_{it}) = 0$.

We take $f(s_{it}, \phi_{it})$ to encompass all the impediments and frictions that the home country may have in lending to the foreign country. These impediments and frictions may include constraints on international lending such as foreign exchange controls, or bank minimum capital requirements, which restrict foreign bank lending. They may also include frictions arising from asymmetric information that impair the ability of home lenders to costlessly acquire information about the behavior of foreign firms (the borrowers). In many models, these asymmetric information problems will lead to additional monitoring costs for the home lender, raising the costs of lending (Bernanke, Gertler, and Gilchrist, 1995).

The evolution of the capital stock is captured by:

$$k_{it} = (1 - \delta_i)k_{it-1} + x_{it} \tag{3}$$

For our purposes, we assume unit costs are constant with respect to the amount of foreign lending, or the purchase of foreign bonds, s_{it}, but vary over time:

$$f(s_{it}, \phi_{it}) = \phi_{it} \tag{4}$$

ϕ_{it} captures the impact of external factors that affect the cost of purchasing bonds or of lending internationally. Financial liberalization is captured by a decline in ϕ_{it} that allows households to lend more, or to purchase more foreign bonds, at lower costs.

At certain times, ϕ_{it} can also increase for some countries. If say, banking regulations are tightened, then it may be difficult for domestic banks to lend internationally. It has been mentioned that the implementation of the Basel I capital standards in the late 1980s–which stipulated that banks must have a capital-asset ratio of at least 8 percent–made it difficult for some Japanese and European banks–who are thinly capitalized– to lend internationally, raising ϕ_{it}. The late 1990s East Asian currency crisis lowered the value of collateral for many East Asian banks, making it costly for them to lend internationally, raising ϕ_{it}. Thus, ϕ_{it} is subject to many shocks, and may fluctuate up or down over time.

The perfectly competitive firms own a production technology that combines labor l_{it} and capital k_{it-1} to produce the traded good y_{it} :

$$y_{it} \leq F(A_{it},\ k_{it-1},\ l_{it}) \tag{5}$$

A_{it} represents productivity that is exogenously determined. Ex-post, the home and the foreign countries differ with respect to country-specific productivity shocks. A country experiencing a negative productivity shock will increase saving and accumulate foreign bonds; the country experiencing a positive productivity shock will run a current account deficit.

Every period, the firm maximizes profits π_{it} subject to the production technology summarized in (5), where profits are given by:

$$\pi_{it} = y_{it} - w_{it} l_{it} - r_{it}^{k} k_{it-1} \tag{6}$$

The world goods market clearing condition requires that aggregate consumption and investment in the world be less than or equal to world production of the traded good:

$$\sum_{i=H}^{F} (c_{it} + x_{it}) \leq \sum_{i=H}^{F} y_{it} \tag{7}$$

Bond market clearing requires that the aggregate bond holdings in the world every period is zero:

$$\sum_{i=H}^{F} s_{it} = 0 \tag{8}$$

We are interested primarily in the dynamics of the current account in our model. The current account in country i is defined as the sum of the trade balance and net interest payments. Given our model, the current account is given by:

$$y_{it} - c_{it} - x_{it} - (R_t - 1)\, s_{it-1} \tag{9}$$

where $y_{it} - c_{it} - x_{it}$ is the trade balance, and $(R_t - 1)\, s_{it-1}$ is the net interest earnings on foreign lending (bonds).

Given the budget constraint summarized in (2) and the definition of the current account as summarized in (9), we can express the current account in country i as:

$$s_{it} + \phi_{it} * s_{it} - s_{it-1} \tag{10}$$

which is of course identical to the net change in international lending in the home country, or borrowing by the foreign country.

2.2 Equilibrium

An equilibrium in our model is given by a vector of allocations $\{c_{it},\ l_{it},\ x_{it},\ k_{it},\ y_{it},\ s_{it}\}_{t=0}^{\infty}$ *,* $i = H, F$ *and a vector of prices* $\{w_{it},\ r_{it}^{k},\ R_t\}_{t=0}^{\infty}$ *,* $i = H, F$ *such that given a state of the economy summarized by* $\{k_{it-1},\ s_{it-1}\}_{t=0}^{\infty}$ *,* $i = H, F$ *, and exogenous shocks to productivity and cost of lending* $\{A_{it},\ \phi_{it}\}_{t=0}^{\infty}$ *,* $i = H, F$*, the allocations and the prices solve (1) the representative household's utility maximization problem (summarized in (1) to (4)) and (2) the firm's profit maximization problem (summarized in (5) and (6)) , (3) the world resource constraint is satisfied (summarized in (7)) , and (4) the bond market clearing condition is satisfied (summarized in (8)).*

Note that balanced growth in our model assumes that the long run rate of technological progress, denoted in our model by γ, in the two countries are identical.

3 Model Predictions

Ex-ante we have two equally sized countries, H and F that are symmetric in every respect. Ex-post we allow them to vary with respect to productivity, A_{it} and bond trading cost ϕ_{it}. Taking the U.S. as the foreign country, and the rest of the world as the home country, we make the reasonable assumption that the U.S. and the rest of the world are equally sized, since U.S. GDP is about 1/3 of world GDP.

3.1 Parameters

The utility function is assumed to be quasi-linear (often referred to as GHH after Greenwood, Hercowitz and Huffman (1988)) where:

$$u(c_{it},\ l_{it}) = \frac{\left(c_{it} - \frac{\psi}{v} l_{it}^{v} (1+\gamma)^t\right)^{1-\sigma}}{1-\sigma} \tag{11}$$

The GHH preferences are widely used in the international macroeconomics literature (see Mendoza (2006)).[6]

The production function has a labor-augmenting Cobb-Douglas form:

$$F(A_{it},\ k_{it-1},\ l_{it}) = k_{it-1}^{\theta_i} \left(A_{it} l_{it} (1+\gamma)^t\right)^{1-\theta_i} \tag{12}$$

The key parameters are summarized in **Table 1**. We choose the share of capital to be 33% of GDP in both countries yielding $\theta_i = .33$, $i \in \{H,\ F\}$. Capital is assumed to depreciate at an annual rate of 10% so that $\delta_i = 0.10$, $i \in \{H,\ F\}$. These parameters are taken from Backus, Kehoe and Kydland (1992). We assume $\sigma = 2$. The long term growth rate of technological progress or γ is taken as 2% , and the steady state rate of interest is taken as 6%. Further, assuming that in the steady state, households in both countries choose to allocate 33% of their time to work (from Backus, Kehoe and Kydland (1992)), and normalizing the steady state output to be 1, we calculate $\psi = 3.95$, given $v = 1.6$ (from Mendoza (2006)).

ϕ_{it} embodies intangibles like information about domestic and international policies regarding a country's access to world financial markets. We back out the steady state value of ϕ_{it} from the budget constraint, and the first order conditions of the model. To do this, we need steady state values of the capital output $\frac{k_i}{y_i}$ ratio, and the net lending to output ratio $\frac{\Delta s_i}{y_i}$. The capital output ratio is taken as the average long run capital to output ratio of the U.S. economy.

[6] GHH preferences have the convenient property that labor supply is not affected by capital flows. In our setup, with an utility function of the Cobb-Douglass type, capital inflows would raise leisure, lower labor supply, and counterfactually, *lower* output (see Chakrabory, 2008).

The net lending (or U.S. borrowing) to output ratio is estimated to match the average ratio of net current account balances of the U.S. to its output, over the period 1980 to 2003. This yields the net lending to output ratio of .012 or gross lending to output ratio $\frac{s_i}{y_i}$ of .61. Given these parameters, the steady state ϕ_i is calculated to be .0127. Given our steady state capital output ratio, we calculate $\beta_i = .99$.

3.2 Qualitative Results

3.2.1 Solution Algorithm

Given the functional specifications, the necessary first order conditions of our model for country $i \in \{H, F\}$ are given by:

$$\begin{aligned} \left(c_{it} - \frac{\psi}{v} l_{it}^{v}\right)^{-\sigma} - \lambda_{it} &= 0 && (13) \\ (1-\theta) y_{it} - \psi l_{it}^{v} &= 0 && (14) \\ \lambda_{it+1}\left(\theta \frac{y_{it+1}}{k_{it+1}} + 1 - \delta_i\right) - \frac{(1+\gamma)^{\sigma}}{\beta_i}\lambda_{it} &= 0 && (15) \\ \lambda_{it+1} R_{t+1} - \frac{(1+\gamma)^{\sigma}}{\beta_i}\lambda_{it}\left(1+\phi_{it}\right) &= 0 && (16) \end{aligned}$$

where $\lambda_{it}\beta_i^t(1+\gamma)^{t(1-\sigma)}$ is the shadow price of consumption; and the variables are detrended by their long term growth rates. Equation (13) and (14) are standard. Equation (13) equates the marginal utility of consumption to its shadow price, and Equation (14) equates the marginal rate of substitution between consumption and leisure to the marginal product of labor. Note that under quasi-linear (or GHH) preferences, the marginal rate of substitution between consumption and leisure is independent of consumption, making labor choice immune to wealth effects. Equation (15) and (16) are the intertemporal conditions for investment in capital, and for international net lending.

We solve our model using the technique of log-linearization. To that end, we first need to specify the stochastic processes underlying our exogenous variables.

The stochastic processes are vector autoregressive processes of order one and are given by:

$$\begin{bmatrix} \widetilde{A}_{Ht} \\ \widetilde{A}_{Ft} \\ \widetilde{\phi}_{Ht} \\ \widetilde{\phi}_{Ft} \end{bmatrix} = P \begin{bmatrix} \widetilde{A}_{Ht-1} \\ \widetilde{A}_{Ft-1} \\ \widetilde{\phi}_{Ht-1} \\ \widetilde{\phi}_{Ft-1} \end{bmatrix} + \begin{bmatrix} \widetilde{\epsilon}_{AHt} \\ \widetilde{\epsilon}_{AFt} \\ \widetilde{\epsilon}_{\phi Ht} \\ \widetilde{\epsilon}_{\phi Ft} \end{bmatrix} \quad (17)$$

where $\widetilde{A}_{it},\ i \in \{H,\ F\}$ denotes the log deviation of productivity from its steady state, and $\widetilde{\phi}_{it},\ i \in \{H,\ F\}$ denotes the deviation of the cost of bond trading from its steady state. Epsilon or the error terms capture the shocks. P is a 4x4 matrix that summarizes the parameters underlying the stochastic process. The innovations $\{\widetilde{\epsilon}_{AHt},\ \widetilde{\epsilon}_{AFt},\ \widetilde{\epsilon}_{\phi Ht},\ \widetilde{\epsilon}_{\phi Ft}\}$ are serially independent, multivariate normal random variables. The variance-covariance matrix of the innovations is summarized by another 4x4 matrix that we call Q. We initially assume no contemporaneous correlation of the innovations in the two countries[7].

For our analysis, we take the parameters determining the evolution of productivity from Kehoe and Perri (2002).[8] While we have backed out the steady-state value of ϕ_{it}, the cost of international lending, the stochastic process driving ϕ_{it} over time is unknown. To this end, we make two assumptions regarding the evolution of ϕ_{it} : (1) ϕ_{it} is not correlated with A_{it}, and (2) ϕ_{it} between countries are not correlated.

Given that ϕ_i captures policy-related and other external effects on the cost of lending and the purchase of bonds, we believe that these assumptions are realistic. As for the persistence of the initial shock to ϕ_{it}, we experiment with a very high (.91); as well as very low persistence (.5). In addition, we assume that the variance of ϕ_i is low. The matrices P and Q are summarized in **Table 2**.

In any period t, given the state of the economy summarized by the vector $\{k_{it-1},\ s_{it-1}\}_{i=H,F}$, and the realization of the exogenous shocks summarized by the vector $\{A_{it},\ \phi_{it}\}_{i=H,F}$, the numerical solution to our model expresses the endogenous control and state variables as functions of the state and the exogenous variables, where the coefficients of the functions depend on the parameters underlying the stochastic processes defined in (17).

3.2.2 Impulse responses

Before carrying out the quantitative exercises, that is, apply our model to the actual data, we examine the qualitative properties of our model by performing impulse response exercises. As mentioned, our research is motivated by observed

[7] We could not detect any statistically significant correlations between our calculated "home" (European Union and Japan, and EU, Japan and emerging Asia respectively) and "foreign" (U.S.) TFPs. Despite this lack of correlation in the productivity shocks between the two regions, as a robustness check of our basic results presented in the paper, we performed impulse response analysis, imposing some spillover of shocks between the regions (contemporaneous correlation of shocks of 0.05). None of the impulse responses were affected.

[8] The referee has correctly pointed out that if financial liberalization and regulatory changes occur in the U.S. and in the other countries at the same time, then ϕ_{it} in the U.S. and in other countries can be correlated. For example, the late 1980s Basle Accord raised capital adequacy ratios both in the U.S. and abroad, possibly leading to an increase in the cost of investing all over the world.

In our impulse responses and quantitative exercises below, we decided not to allow ϕ_{it}in the U.S. and in other countries to be correlated, since we wanted to focus mainly on how changes in the cost of buying U.S. assets, or ϕ_{Ht},contributed to the widening of the U.S. current account deficit.

changes in the U.S. and the "rest of the world" current accounts between the 1980s and today.

There are two important trends: (1) during the 1980s, productivity growth in the "rest of the world", particularly in the European countries, and in Japan exceeded productivity growth in the U.S., but the trend has reversed since the 1990s; and (2) the 1980s and the 1990s were also periods of gradual financial liberalization in the European countries, in Japan, and particularly in East Asia. In our model, we assume that country H is the "rest of the world", and country F is the U.S.

While tracing the impulse responses, we are interested in the impact of three events: (1) a 1% negative shock to the productivity of the home country (A_H); (2) a 1% positive shock to the productivity of the foreign country (A_F) and (3) a 1% reduction in the cost international lending, or of international bond purchases, measured by a 1% decrease in ϕ_H.

We are primarily interested in the impact of these three shocks on the current account of the U.S. that is, of the foreign country F. Note that according to Equation (10), the amount of borrowing in any period determines the current account, with an increase in bond purchases by country H increasing the current account deficit of country F. We examine the impact of each of the three shocks on the international borrowing of the foreign country (U.S.).

In addition to concerns about ballooning current account deficits in the U.S., researchers have tried to reconcile the high U.S. current account deficits with the low levels of the global real interest rate. Typically, we would expect that the excess of investment over saving (the current account deficit) in the U.S. would lead to higher global real interest rates. This is because a positive productivity shock that expands the U.S. deficit will raise the demand for funds and the world interest rate. However, U.S. real interest rates have actually fallen from about 4.5 percent in 2000 to about 1.8 percent in 2005.

We plot the transition dynamics of our model in **Figures (2-A)** to **(2-C).** A 1% negative shock to home productivity, or a 1% positive shock to foreign productivity raises interest rates, and increases capital inflows into the foreign country (**Figures 2-A** and **2-B).** A 1% negative shock in ϕ_{it}, the cost of lending, generates a *decline* in global interest rates, along with an increase in the flow of funds to the foreign country (U.S.) (**Figure 2-C**). The decline in ϕ_{it} explains why global real rates have fallen, despite an increase in U.S. international borrowing. Increased financial liberalization in the rest of the world raises the supply of funds, and despite higher productivity growth in the U.S., lowers global interest rates.

The increased inflow of funds to the U.S. results in a deterioration of the current account. The current account as a share of output in the U.S. (country F) deteriorates from its steady state value of -2% immediately upon the shock (**Figure 2-D**). The effects are not very persistent as the shocks are not permanent. Nonetheless, a negative productivity shock in the home country, or a positive productivity shock in the foreign country, results in a sharp deterioration of the (foreign country) U.S. current account.

Holding constant the productivity shocks in both home and foreign countries, a 1% reduction in the cost of lending, ϕ_{it} in the home country sharply deteriorates the current account of the foreign country (U.S.). Comparing the magnitude of changes brought about by the shocks in our three experiments, the initial response of the current account is largest when there is a reduction in the cost of lending in the home country (or in ϕ_H). Thus, the fall in international financial barriers to investing in the U.S. may explain why U.S. current accounts have risen so sharply.

3.3 Robustness

In this section, we conduct two robustness checks: (1) how would the results change if we assume that the stochastic processes underlying the TFP shocks and the ϕ_H shocks are permanent, that is, are random walk processes? (2) Do our conclusions change if we assume the processes for TFP and ϕ_H are less persistent (.5)?

The robustness exercises for the permanent shocks are plotted in Figures 2E to 2F. The effects of the shocks on the U.S. current account deficit are unchanged from the benchmark case above. A positive shock to U.S. productivity, and a negative shock to the "rest of the world" productivity lead to an influx of funds into the U.S. Likewise, a permanent decline in the cost of investing in the U.S. raises the U.S. current account deficit, as in the benchmark.

The effects of the shocks on the global real interest rate, however, are different from the benchmark case. While as in the benchmark, the real interest rate increases when there is a negative productivity shock abroad; when there is a positive shock to U.S. productivity, real interest rates decline, which is the opposite of what happens in the benchmark. Also unlike in the benchmark, a decline in the cost of investing in the U.S. raises the real interest rate.

The robustness exercises for when the shocks to TFP and $\phi_H$are transitory are plotted in Figures 2H to 2J. In contrast to the random walk shocks case, now all the impulse responses are consistent with the impulse responses in the benchmark case. The effects of transitory shocks on the U.S. current account deficit are unchanged from the benchmark case above. A positive shock to U.S. productivity, and a negative shock to the "rest of the world" productivity lead to an influx of funds into the U.S. Likewise, a decline in the cost of investing in the U.S. raises the U.S. current account deficit, as in the benchmark. The effects of the transitory shocks on the global interest rate are also the same as in the benchmark case. A negative TFP shock abroad, and a positive TFP shock in the U.S. both raise the global real interest rate. A decline in the cost of investing in the U.S. lowers the real interest rate, as in the benchmark.

4 Quantitative Application to United States and Rest of the World

In bringing our stylized two-country model to the data, we need to define the "rest of the world." In our two country model, country F or foreign represents the U.S. For country H or the home country representing the "rest of the world," we consider two alternatives: (1) the "rest of the world" comprises of EU15 and Japan, and (2) the "rest of the world" comprises of EU-15, Japan and emerging Asia, particularly China. Especially since the late 1990s, Asia (except Japan) has emerged as a major global player in world financial markets, not only because of rapid growth, but also because of the relaxation of capital outflow controls, and the purchase of U.S. bonds as foreign exchange reserves in emerging Asia, especially in China.

Using the two country model developed above, we match the time series of the current account of the foreign country (U.S.) from 1980 to 2003, under the following scenarios. First, we combine the data from the European Union (EU-15) and Japan to see if the evolution of the U.S. current account from 1980 to 2003, can be explained by differences in TFP shocks in the home (EU-15 and Japan) and foreign (U.S.) countries. We show that while difference in TFP shocks do well in explaining the U.S. current account deficits in the late 1980s and early 1990s, they do poorly in explaining the U.S. current accounts from the late 1990s.

Second, we add the data of emerging Asia (China, Hong Kong, Korea, Taiwan, and the ASEAN countries) to the data of the EU-15 and Japan. We show that although there is some improvement in the explanatory power of the model until 1999, the model does worse after 2000. What is required for our model to explain the U.S. current account is for the financial frictions to behave in a non-monotonic fashion. That is, the ease of investing in the U.S. has to start declining from about 1985 to about 1996, *rise* from 1997 to 2000, and then sharply decline.

The decline in financial frictions starting in 1985 corresponds to the financial liberalization in Europe and Japan, including the "Big Bang" reforms at the start of Japan's "bubble economy." As domestic stock and land prices rose, Japan used the rising domestic asset prices to borrow, and invest in the U.S. In other words, the rise in domestic asset prices mitigated the financing constraints of Japanese firms, enabling them to lend to the U.S. The tightening of financing constraints from 1997 to 2000 is related to the Asian financial and Japanese banking crisis, limiting the ability of emerging Asian countries and Japan to lend to the U.S. We show that except for the Asian financial crisis years from 1997 to 2000, the decline in financing frictions (ϕ_H) from 1985 to 2003 is close to monotonic.

4.1 The Data

The data are described in detail in the Data Appendix, We assume that the two regions, home and foreign, are equal sized in the steady-state, which we take to be 1980, but the two regions can subsequently diverge in size. As mentioned, for the home country representing the "rest of the world," we take two sets of countries, 1) Japan and the EU-15, and 2) Japan, the EU-15, and emerging Asia. In our analysis, TFP is measured as a Solow residual where:

$$A_{it} = \frac{y_{it}}{k_{it-1}^{\theta_i} \left(l_{it}(1+\gamma)^t\right)^{1-\theta_i}} \tag{18}$$

To calculate TFP, we first must calculate y_{it}, l_{it}, and k_{it-1} for our two sets of countries that we take as the "rest of the world." As described in the Data Appendix, we construct the aggregate variables for the "rest of the world" by taking a weighted sum of each corresponding variable. For example, as for the GDP per capita y_{it} of the home country, we take the weighted sum of the GDPs per capita of each of the EU-15 countries and Japan, where the weight for country i is the share of country i's GDP in the sum of the EU-15+Japan's GDPs. Since the inclusion of emerging Asia changes the set of countries and the associated weights, the estimated TFPs are different for the two sets of countries in our two experiments (Experiment 1 and 2).

Thus calculated, we interpret changes in A_{it} as the deviation of TFP from its steady state, where in the steady state. In our benchmark, and thus in all of our quantitative exercises below, global TFP is assumed to grow at 2%. The benchmark detrended TFP series for both the home and foreign countries are depicted in **Figure 3-A** . The average TFP growth rates during our four subperiods are summarized in **Table 3**. The first subperiod (1980 to 1986) shows productivity growth in the EU-15 and Japan growing at .84% above trend on average, while that in the U.S. grows at .14% below trend. Similarly, during the next subperiod (1986 to 1991), productivity grows at .79% below trend in the U.S., and .87% above trend in EU-15 and Japan. This pattern changes during the third subperiod (1991 to 2000), when productivity in the EU-15 and Japan grows 1.35% below trend, while U.S. productivity grows .02% above trend. Productivity performance in the home country slightly improves in the last period (2000 to 2003), with TFP still growing slightly below trend at ($-.56\%$). In the foreign country (U.S.), productivity growth sharply picks up with TFP growing at .62% above trend during 2000-2003.

These TFP growth patterns change when we include emerging Asia in our set of countries, especially during the early 1980s, and during 2000-2003. In contrast to the previous case when only the EU-15 and Japan are in the home country, adding emerging Asia results in TFP growing at .24% below trend during 1980 to 1986. Since the mid-1980s, home country TFP growth including emerging Asia follows a cyclical pattern, growing above trend during the late 1980s, before declining below trend during the 1990s. It is remarkable that between 2000 and 2003, when emerging Asia is included in the home country, TFP growth is 3.9 percent–far above trend.

These patterns in the "rest of the world" and U.S. TFP growth suggest that if current accounts were affected by TFP growth alone, then in the 1980s and since 2000, U.S. investors should be lending to the "rest of the world." We therefore should see a decline in the U.S. current account deficit since 2000, when in fact the U.S. current account deficit has increased. Thus, some other factor than differences in the home and foreign country TFPs must be affecting the U.S. current account. We attribute this factor to changes in the ease of buying U.S. financial assets, or financial liberalization in the home country.

In **Figure 3-B,** we depict an alternative HP-filter smoothed TFP series. Note that the alternative TFP series has essentially the same pattern as the benchmark TFP series. In particular, both series show that TFP growth in the "rest-of-the-world" has outstripped TFP growth in the U.S. since 2000. The fact that both TFP series essentially behave the same suggests that using a TFP series detrended in a different way may not significantly affect our quantitative results.

4.2 Quantitative experiments

We first conduct our experiments when the "rest of the world" includes the EU-15 and Japan. We feed in the calculated annual changes in TFP in the home (EU-15 and Japan), and in the foreign (the U.S.) countries, assuming no change in financial liberalization. The results for the U.S. current account are shown in **Figure 4 (**with the legend "EXP1"**)**.

On the whole, the current account of the U.S. has been in deficit and the deficit increases from 1.36% of GDP during the 1980s to 4.35% of GDP between 2000 to 2003. Except for the 1980s, when our model predicts a U.S. current account surplus, the predictions from our model match up well with the data. In the 1980s, our model predicts a current account surplus, because TFP growth in the EU-15 and in Japan are high, while in the U.S. it is low, which should result in a flow of funds from the U.S. to the "rest of the world", when in fact, the opposite happened.

We next conduct our experiments when the "rest of the world" includes the EU-15, Japan, and emerging Asia (**Figure 4** with the legend "EXP2"). When we include emerging Asia, the fit of our model improves somewhat between 1995 and 1999, as the fall in TFP growth below trend in the "rest of the world" is higher. This narrowing of the negative TFP growth differential with the U.S. means that the model-simulated U.S. current account deficit increases between 1991 and 1999, corresponding more closely with the data.

However, between 2000 and 2003, the fit of the model deteriorates, as the positive gap in TFP growth between the "rest of the world" and the U.S. widens. Now given the very rapid TFP growth above trend in the home country (mainly China), the model predicts a current account *surplus* in the U.S., when we actually have a U.S. current account deficit.

In **Table 4**, we show how well our model captures the trend and the fluctuations in the data. *Exp1* refers to the experiment when the rest of the world includes just the EU-15 and Japan; *Exp2* is when emerging Asia is included. From **Table 4**, we see that from 1980 to 2000, the model fits the data for the current account better when emerging Asia is included. From 2000, however, the model with emerging Asia predicts a current account surplus for the U.S. This is because productivity growth in the home country is higher than in the U.S., implying an outflow of capital from the U.S. to the home country.

4.2.1 The pattern in ϕ_H

As noted above, with or without emerging Asia in the "rest of the world", our model misses much of the action in the evolution of the U.S. current account when we assume no change in global financial integration. We thus conduct the following counterfactual experiment: What would be the pattern in the financial liberalization in the "rest of the world", ϕ_H, if we are to match the evolution of the U.S. current account? Does this derived pattern accord with the actual financial liberation that has taken place?

The principle behind this accounting exercise is related to the Business Cycle Accounting (BCA) methodology suggested by Cole and Ohanian (2004), and Chari, Kehoe and McGrattan (2007)[9]. BCA starts with the premise that large classes of general equilibrium models are numerically equivalent to a prototype growth model with "wedges," where "wedges" distort the first order conditions, thus keeping the economy from reaching the first best outcome. BCA involves measuring these "wedges," given the data and then evaluating the importance of each wedge by feeding them one by one and in various combinations into the model to see which wedge best accounts for the data. To this end, we jointly feed in TFP and ϕ_H into our model and then extract the time path of ϕ_H relying on the principle that TFP and ϕ_H jointly would exactly account for the evolution of the current account.

The first step in constructing ϕ_H requires that we start with an initial guess of the stochastic process driving the evolution of ϕ_H. Our initial guess is the same as in previous experiments (outlined in matrices P and Q). We then iterate until our model predictions best match the data (**Figure 5**). We report the pattern in ϕ_H in **Figure 6-A.**

Is the pattern in ϕ_H plausible? First, note that ϕ_H starts to fall sharply from 1985 until 1991, and then stabilizes until about 1996. The decline in ϕ_H starting in 1985 corresponds to the financial liberalization that took place in Japan and in the United Kingdom in the mid-1980s. In both countries, entry into the commercial banking, insurance, and securities businesses were liberalized. Banks, insurance companies, and securities firms were allowed to lend to more sectors, including to foreigners. Starting in 1996, ϕ_H increases until 2000, corresponding to the Asian financial crisis, when collateral values of governments and financial institutions in emerging Asia were damaged, leading to a deterioration of lending to the U.S. Also, during this time, Japan was in the midst of its banking crisis, and Japanese bank lending to the U.S. deteriorated.

The sharp decline in ϕ_H starting in 2000 corresponds to the purchases of U.S. assets, particularly U.S. government bonds, by Japanese and emerging market governments, to prevent their local currencies from appreciating. This change in Asian reserve behavior, particularly by emerging market governments is captured by the sharp decline in ϕ_H from 2000. In our model, any change

[9] Devereux and Lahiri (2006) also apply the BCA procedure to evaluate the role played by G-6 countries in the deterioration of U.S. current account, although they do not consider emerging Asia, including China.

that makes it easier for the rest of the world to buy U.S. assets is represented by a fall in ϕ_H even if this change in buying U.S. assets is facilitated entirely by the home government.

Figures 6-A and **6-B** compare our derived measure of the cost of international lending (**6-A**) with an index of financial openness using the raw data provided by Chinn and Ito (2005) (**6–B**). Chinn and Ito's measure does not correspond directly to ours, since their measure also captures the liberalization of inward investment, as well as outward investment. For example, for Thailand, the Chinn and Ito measure captures how easy it is for foreigners to invest in Thailand; as well as how easy it is for Thai residents to invest abroad. Our derived measure of the decline in the cost of international lending only captures the ease of investing in the foreign (U.S.) country. In addition, while the Chinn and Ito measure is calculated from a careful reading of changes in regulations that made it easier for the "rest of the world" to invest in the U.S., that is, a *de jure* measure, ours is a *de facto* measure that captures the actual net capital flows from the "rest of the world" to the U.S., exclusive of the productivity shocks in the two countries.

Despite these differences, the pattern in our measure corresponds with Chinn and Ito's, especially between 1985 and 1994, when ϕ_H or cost of bond trading in our model is falling (or it is becoming more easy to invest in foreign financial markets) and the Chinn and Ito measure is rising (indicating increased financial openness). The Chinn and Ito financial openness measure declines from 1996 to 2000, which corresponds to a rise in our ϕ_H, owing to the Asian financial crisis. However, from 2000 to 2003, the two measure drift apart; while ϕ_H falls sharply, the Chinn-Ito index shows less openness. The Chinn and Ito index may be capturing capital inflow controls instituted by many emerging markets after the Asian currency crisis, while our ϕ_H , which focuses on capital outflows, cannot capture such capital inflow controls. For the entire period 1980 to 2003, the correlation coefficient between ϕ_H and the Chinn-Ito measure is -0.41; the two series are found to be cointegrated by the Johansen test with the correct sign (results available from the authors).

5 Conclusion

We show that a standard, equilibrium macroeconomic model, augmented to capture changes in financial liberalization in the "rest of the world," empirically explains well, the evolution of the U.S. current account from 1980 to 2003. Using our procedure, we derive a series for the cost of trading in international assets and compare it with other measures of financial liberalization in literature. Our series matches up well with existing measures, as well as with distinct, identifiable episodes in international financial liberalization.

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DATA APPENDIX

The world in our model is made up of two regions: United States (referred to as "*foreign*") and EU15 and Japan (Experiment 1) or EU15, Japan and Emerging Asia (Experiment 2) referred to as "*home*". The Emerging Asian region comprises of China, HongKong, Indonesia, Malaysia, Philippines, Singapore, South Korea, Taiwan and Thailand.

For our calculations, we need data on national income, employment, hours worked, population, capital stock, and the current accounts. The national income accounts data along with the data on population, employment and hours worked is calculated from the "Total Economy Database" and the "Industry Growth Accounting Database" that is maintained by the University of Groningen at the Growth and Development Center. The data on the capital stock is not available from the above dataset; and we collect it from the Kiel Institute database on capital stocks in the OECD countries. The data for China is from Dekle and Vandenbroucke (2006) and for Korea, capital data for some of the latter years are available from Korea Statistical Yearbooks. We use annualized data for the period 1980 to 2003. Given below is a description of the variables used and how they are constructed from our annualized data.

y_{it} : The per capita output in U.S. is calculated as aggregate GDP divided by the population. For the home country per capita output, we consider the weighted aggregate output of the EU-15 and Japan for experiment 1; and EU-15, Japan and emerging Asia in experiment 2; where the weights are calculated as the share of a country's GDP in the aggregate GDP of "the rest of the world" (ROW). The population of the home country is similarly calculated as the weighted average of the population of countries constituting our ROW, where the weights are calculated as the population of the constituent country divided by the aggregate population of the ROW. The output data is expressed in our dataset in millions of 1990 US dollars.

$\frac{k_{it-1}}{y_{it}}$: The capital output ratio for the home country is calculated as the share of the weighted capital stock to weighted output, where the weights are measured as before as the share of the variable of the constituent country to the aggregate of the ROW

l_{it} : Labor is calculated as:

$$l_{it} = \frac{E_{it}}{N_{it}} * \frac{H_{it}}{(50 * 100)}$$

where:

$\frac{E_{it}}{N_{it}}$: Weighted employment to weighted population ratio for home and aggregate employment to aggregate population ratio for the U.S.

$\frac{H_{it}}{(50*100)}$: Weighted average of annual hours worked to total hours, where total hours is assumed to be 50 hours per week and there are 100 work-weeks. For the U.S., instead of weighted hours we just take the annualized hours worked.

g_{it} : Per capita government expenditure. For our analysis, we need the time series of government expenditure from the U.S. that we collect from the U.S. Bureau of Economic Analysis. We arrive at the per capita figures by dividing aggregate government expenditures by the population.

current account share : Along with output, we try to match the current account share in output in the U.S.; where the data comes from Bureau of Economic Analysis. The current account balance is collected from the Bureau of Economic Analysis (BEA) that is in millions of dollars. To get the share of the current account balance in output, we divide the current account balance by GDP. The current account balance data of the U.S. with individual countries is limited, in particular data for emerging Asia including China is not available before 1999.

weights : To get the weights of the countries that comprise our rest of the world group, we take the GDP figures of individual countries from the Groningen data center which is expressed in millions of 1990 US$ (converted at Geary Khamis PPPs). The weights are then constructed by dividing the total GDP of each constituent country by the aggregate GDP of the group where the group comprises of the EU-15 and Japan in Experiment 1, and EU-15, Japan along with emerging Asia in Experiment 2.

index of financial openness : The index of financial openness was created by Chinn and Ito (2005)[10] as a proxy for international financial market liberalization. They compiled an index of the degree of capital account openness for 163 countries from 1970 to 2004. The index is calculated on the bases of dummy variables that codify the restrictions on cross-border financial transactions reported in the Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) from the IMF. The dummy variables reflect the four major categories on the restrictions on external accounts: presence of multiple exchange rates; restrictions on current account transactions; restrictions on capital account transactions; and requirements for firms to surrender a fraction of export proceeds. The index is the first standardized principal component of these four variables and it takes higher values for countries that are more open to cross-border capital transactions. For example, the U.S. that is calculated to be the most open economy in terms of financial openness has an index value of 2.602508 in Chinn and Ito (2005) estimates.

For our measure of financial openness (Figure 6-B), we take the index from Chinn and Ito (2005) for the group of countries that form our rest of the world, namely, EU-15, Japan, China and the rest of emerging Asia. We then calculate the weighted average of the index where the weights are given by the share of an individual country's GDP, in the aggregate GDP of the group.

[10] The data is downloadable from *http://www.ssc.wisc.edu/~mchinn/kaopen_2005.xls.*

TABLE 1: PARAMETER SPECIFICATIONS

Parameter description	Parameter symbols	Parameter Values
GROWTH RATE		
Technology	γ	2%
PREFERENCES		
Coefficient of risk aversion	σ	2
Discount factor	β	.99
Leisure weight	ψ	3.95
DEPRECIATION RATE		
Physical capital	δ	.1
INCOME SHARES		
Capital	θ	.33
Labor	$1-\theta$	.67
ADJUSTMENT COST		
(Extended Model)		
Capital	χ	.01

Note: The parameters are calibrated from the necessary first order conditions and the steady state values of the variables. We assume that both countries are ex-ante symmetric so we take the parameter values to be the same in both countries.

TABLE 2: STOCHASTIC PROCESS OF EXOGENOUS SHOCKS: BENCHMARK MODEL

$$\mathbf{P} = \begin{pmatrix} .95 & 0 & 0 & 0 \\ 0 & .95 & 0 & 0 \\ 0 & 0 & .91 & 0 \\ 0 & 0 & 0 & .91 \end{pmatrix}$$

$$\mathbf{Q} = \begin{pmatrix} .007\hat{\ }2 & 0 & 0 & 0 \\ 0 & .007\hat{\ }2 & 0 & 0 \\ 0 & 0 & .002\hat{\ }2 & 0 \\ 0 & 0 & 0 & .002\hat{\ }2 \end{pmatrix}$$

Note: We plot the parameters for the stochastic process of evolution of TFP shocks and shocks to cost of lending in our benchmark model. We assume a VAR process of order one for the TFP shocks and assume them to be uncorrelated across the two countries. Similarly, the shocks to cost of international lending are also assumed to be uncorrelated across the two countries as well as uncorrelated with productivity shocks.

TABLE 3: GROWTH RATE OF PRODUCTIVITY

	Home *(EU-15+Japan)*	**Home** *(EU-15+Japan+Asia)*	**Foreign** *(US)*
1980 : 1986	.84% (1.21)	−.24% (3.06)	−.14% (2.53)
1986 : 1991	.87% (1.64)	.15% (1.57)	−.79% (.88)
1991 : 2000	−1.35% (1.41)	−1.18% (1.88)	.02% (1.41)
2000 : 2003	−.56% (.23)	3.88% (3.67)	.62% (1.5)

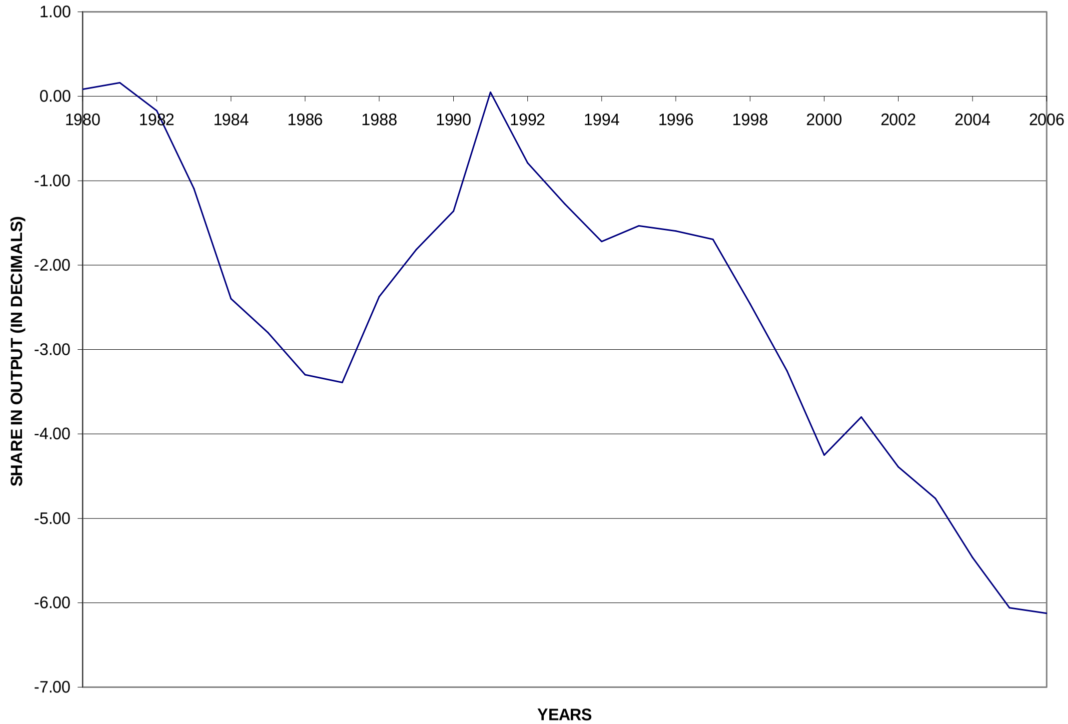
Note: Change in TFP measured as $\frac{\triangle A_{it}}{A_{it}}$ where A_{it} is measured as a Solow Residual. "Home" includes EU-15 and Japan or EU15, Japan along with emerging Asia while "Foreign" represents US. For each subperiod, we provide the average growth rate of A_{it} and the standard deviations are in brackets.

TABLE 4: CURRENT ACCOUNT AS A SHARE OF OUTPUT (DATA AND BENCHMARK MODEL)

	Data	**Exp1**	**Exp2**
1980 : 1986	−1.36% (1.46)	.25% (.95)	−.14% (1.43)
1986 : 1991	−2.03% (1.3)	.27% (.31)	.16% (.51)
1991 : 2000	−1.85% (1.21)	−.52% (.61)	−.71% (1)
2000 : 2003	−4.35% (.41)	−.89% (.97)	1.07% (2.21)

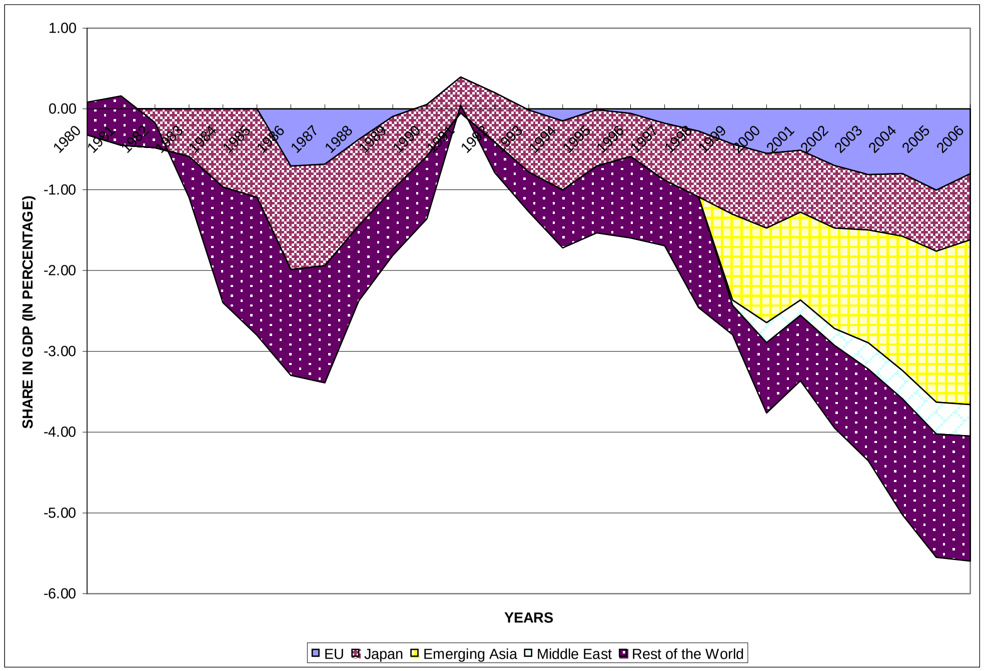
Note: The current account as a share of output in the U.S., feeding in productivity shocks where we only include the EU-15 and Japan in Exp.1, and also include Emerging Asia in Exp. 2.

FIGURE 1-A: The U.S. CURRENT ACCOUNT AS A SHARE OF GDP



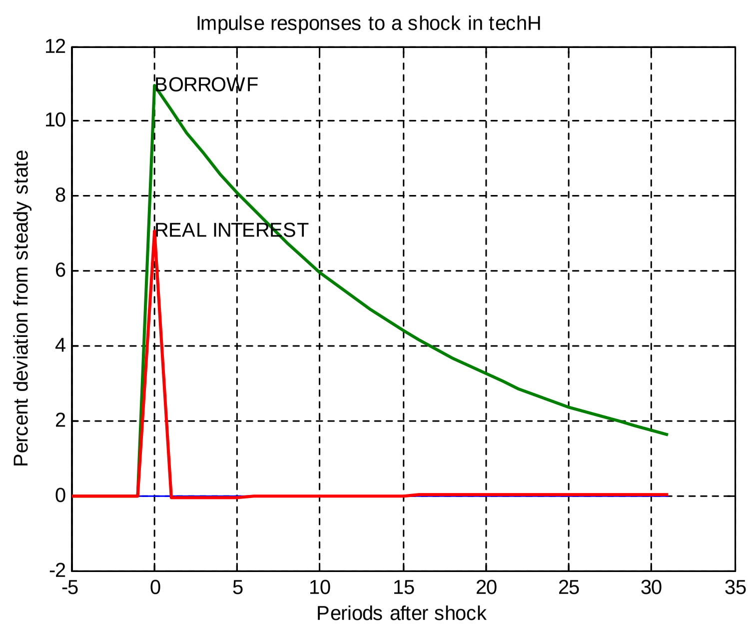
Note: The figure above depicts the current account of the United States as a share of GDP during the period 1980 to 2006. Note that for our empirical analysis, we will concentrate on the period 1980 to 2003.The data for the figure above is collected from BEA.

FIGURE 1-B: CURRENT ACCOUNT AS A SHARE OF GDP: U.S. TOTAL AND THE U.S. BALANCE WITH INDIVIDUAL COUNTRIES



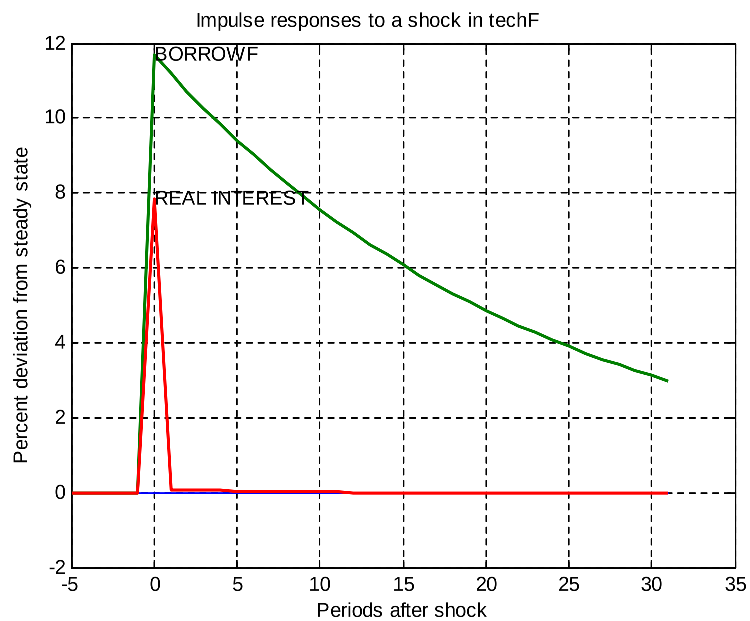
Note: In the above figure, we plot the share of the U.S. current account in GDP with its partners.The data is collected from the BEA. One limitation of the data is that we don't have US current account balance data with emerging Asia, including China before 1999. Nevertheless, we do note that the U.S. current account deficit with Emerging Asia, particularly with China as a share of U.S. output increases between 1999 and 2005, while that with Japan, the major source of US funds in the 1980s and early 1990s declines sharply.

FIGURE 2-A: IMPULSE RESPONSES TO A 1% NEGATIVE SHOCK TO HOME PRODUCTIVITY, A_H



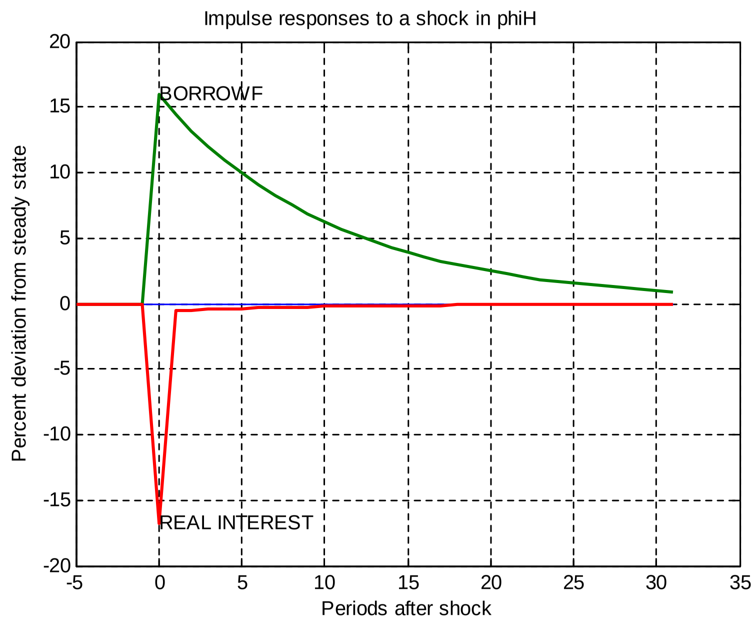
Note: The variables of interest are borrowings by the foreign country, BORROWF (or equivalently lending by the home country) and the real interest rate on international lending, REAL INTEREST.

FIGURE 2-B: IMPULSE RESPONSES TO A 1% POSITIVE SHOCK TO FOREIGN PRODUCTIVITY, A_F



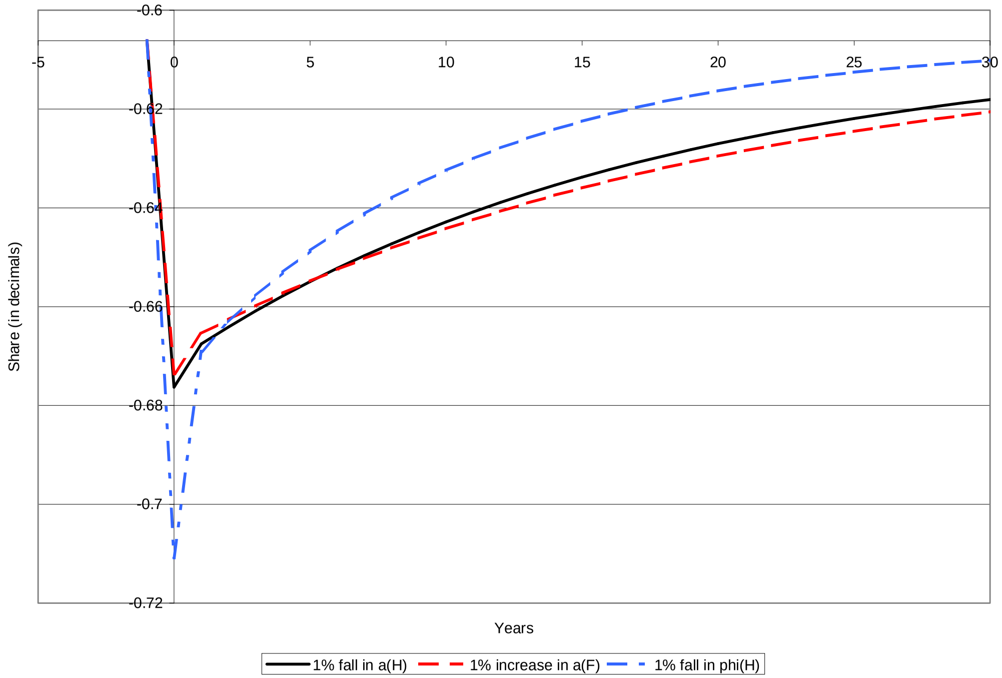
Note: The variables of interest are borrowings by the foreign country, BORROWF (or equivalently lending by the home country) and the real interest rate on international lending, REAL INTEREST.

FIGURE 2-C: IMPULSE RESPONSES TO A 1% NEGATIVE SHOCK TO COST OF INTERNATIONAL LENDING, ϕ_H



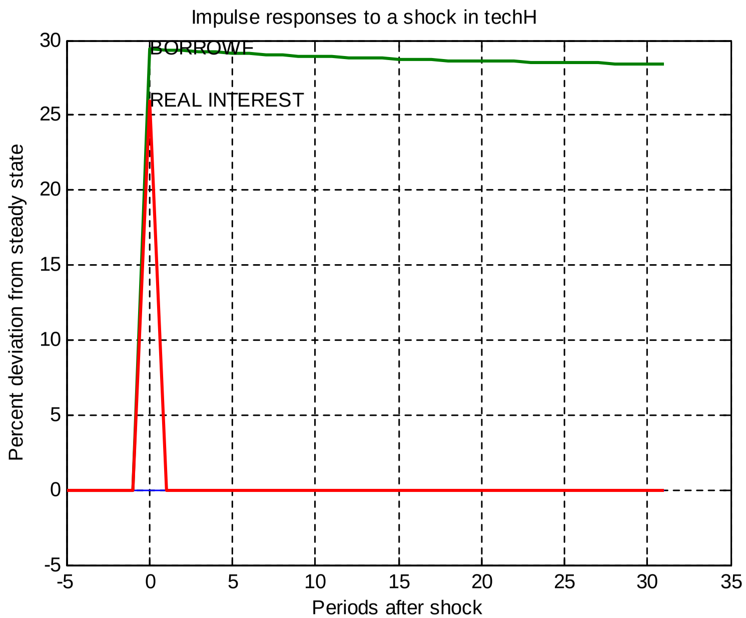
Note: The variables of interest are borrowings by the foreign country, BORROWF (or equivalently lending by the home country) and the real interest rate on international lending, REAL INTEREST.

FIGURE 2-D: THE IMPULSE RESPONSE OF THE U.S. CURRENT ACCOUNT SHARE TO PRODUCTIVITY AND LENDING COST SHOCKS



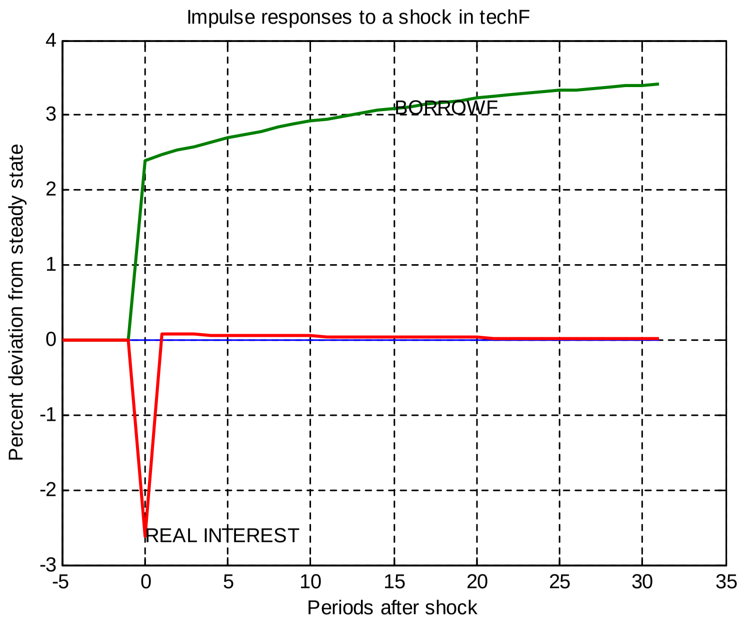
Note: We plot the transition dynamics of current account of United States as a share of output. The steady state value is taken as -2% (mean during 1980 to 2003). A negative sign denotes a current account deficit.

FIGURE 2-E: IMPULSE RESPONSES TO A 1% PERMANENT NEGATIVE SHOCK TO HOME PRODUCTIVITY, A_H



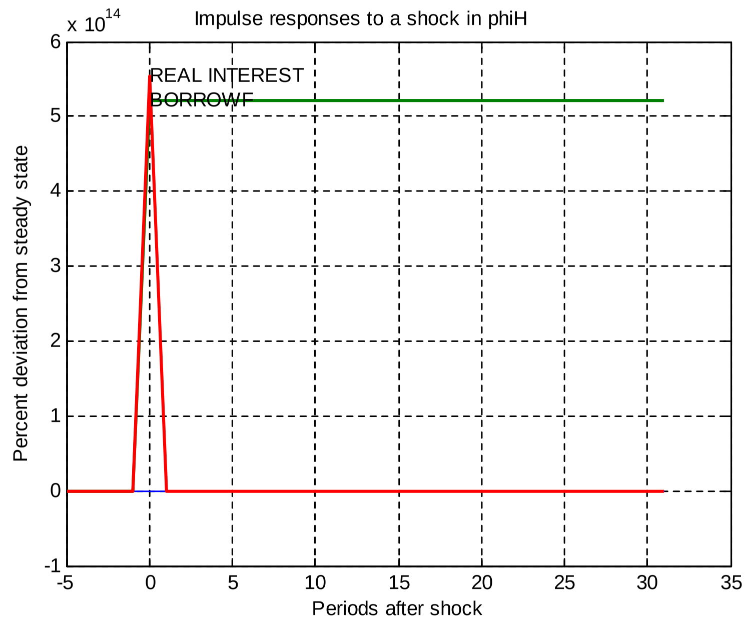
Note:The variables of interest are borrowings by the foreign country, BORROWF (or equivalently lending by the home country), and the real interest rate on international lending, REAL INTEREST.

FIGURE 2-F: IMPULSE RESPONSES TO A 1% PERMANENT POSITIVE SHOCK TO FOREIGN PRODUCTIVITY, A_F



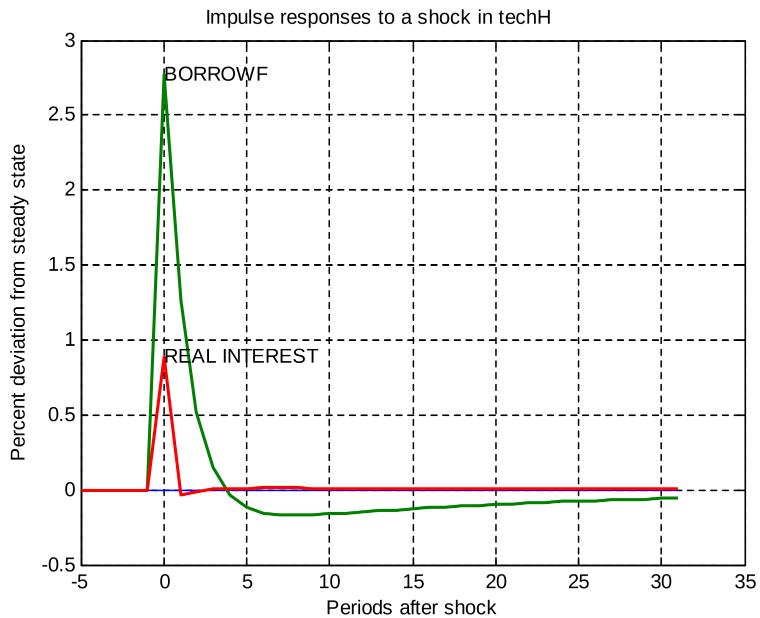
Note: The variables of interest are borrowings by the foreign country, BORROWF (or equivalently lending by the home country), and the real interest rate on international lending, REAL INTEREST.

FIGURE 2-G: IMPULSE RESPONSES TO A 1% PERMANENT NEGATIVE SHOCK TO THE COST OF INTERNATIONAL LENDING, ϕ_H



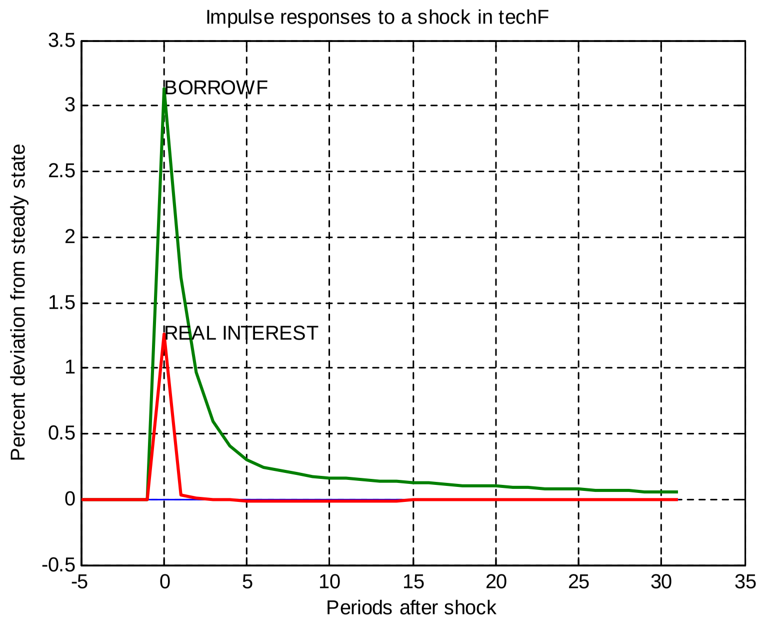
Note: The variables of interest are borrowings by the foreign country, BORROWF (or equivalently lending by the home country), and the real interest rate on international lending, REAL INTEREST.

FIGURE 2-H: IMPULSE RESPONSES TO A 1% VERY TRANSITORY (persistence, 0.5) NEGATIVE SHOCK TO HOME PRODUCTIVITY, A_H



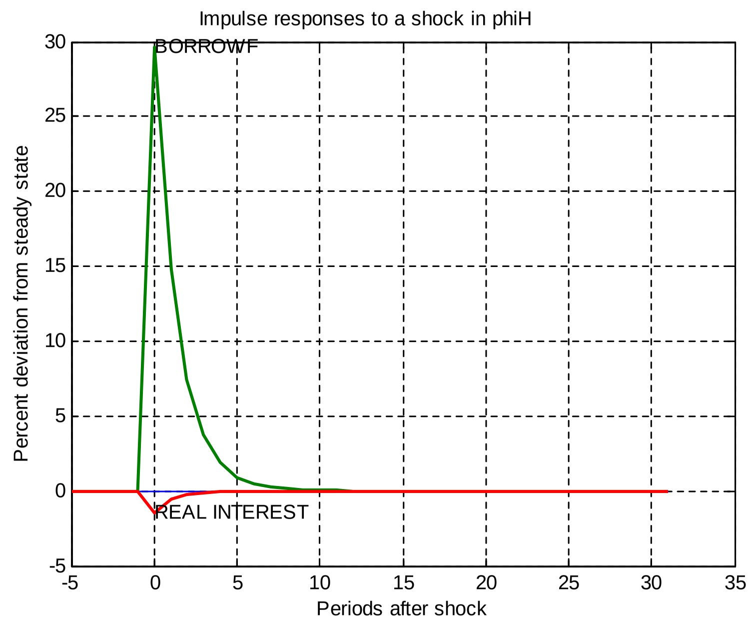
Note: The variables of interest are borrowings by the foreign country, BORROWF (or equivalently lending by the home country), and the real interest rate on international lending, REAL INTEREST.

FIGURE 2-I: IMPULSE RESPONSES TO A 1% VERY TRANSITORY (persistence, 0.5) POSITIVE SHOCK TO FOREIGN PRODUCTIVITY, A_F



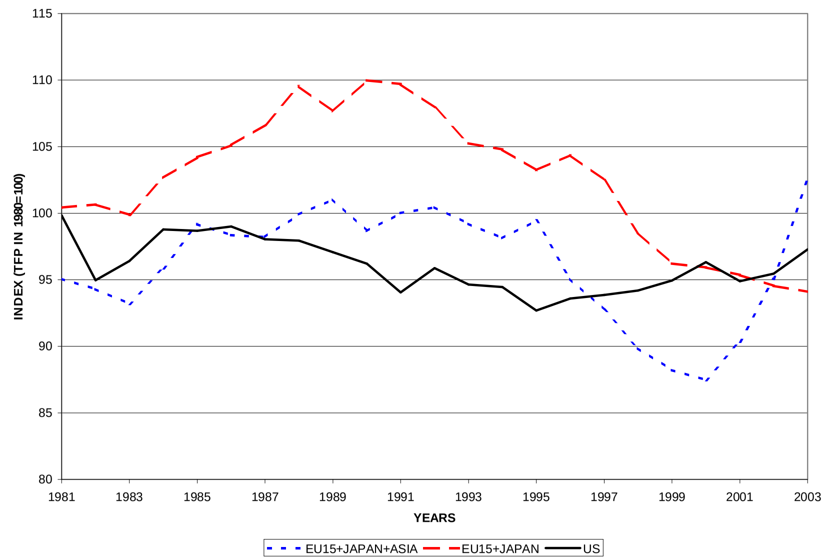
Note:The variables of interest are borrowings by the foreign country, BORROWF (or equivalently lending by the home country) and the real interest rate on international lending, REAL INTEREST.

FIGURE 2-J: IMPULSE RESPONSES TO A 1% VERY TRANSITORY NEGATIVE SHOCK (persistence, 0.5) TO THE COST OF INTERNATIONAL LENDING, ϕ_H



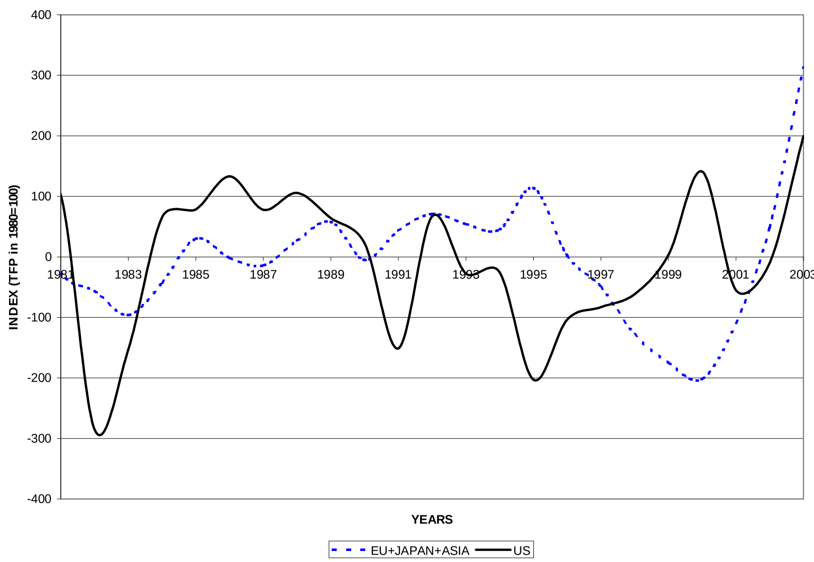
Note:The variables of interest are borrowings by the foreign country, BORROWF (or equivalently lending by the home country), and the real interest rate on international lending, REAL INTEREST.

FIGURE 3-A: TOTAL FACTOR PRODUCTIVITY AT HOME (REST OF THE WORLD) AND IN THE FOREIGN COUNTRY (U.S.)



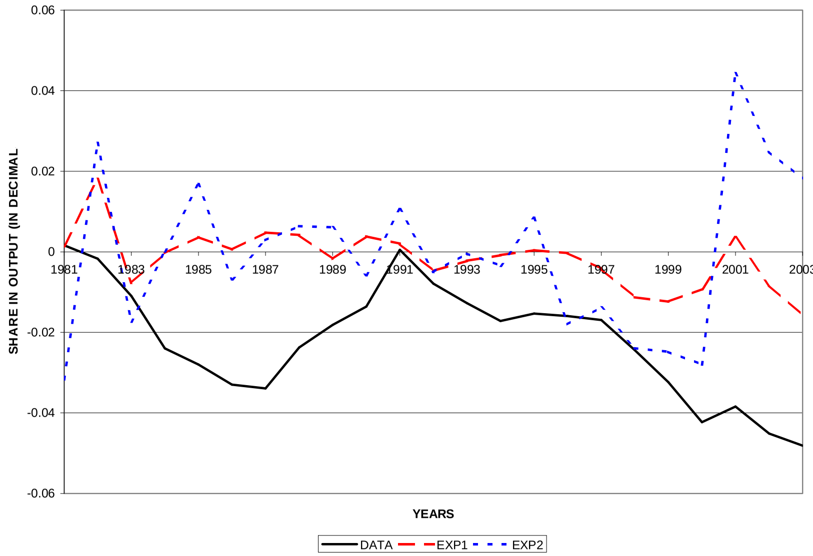
Note: We depict here the fluctuations of TFP around its steady state, where TFP in 1980 is normalized to 100. The TFP is calculated as the Solow Residual given the data on output, capital and labor. We plot the TFP fluctuations in United States and in rest of the world where rest of the world comprises of the EU-15 and Japan only (Experiment 1), and ther EU-15, Japan along with emerging Asia (Experiment 2).

FIGURE 3-B: TOTAL FACTOR PRODUCTIVITY AT HOME (REST OF THE WORLD) AND IN THE FOREIGN COUNTRY (U.S.) USING HP FILTERING



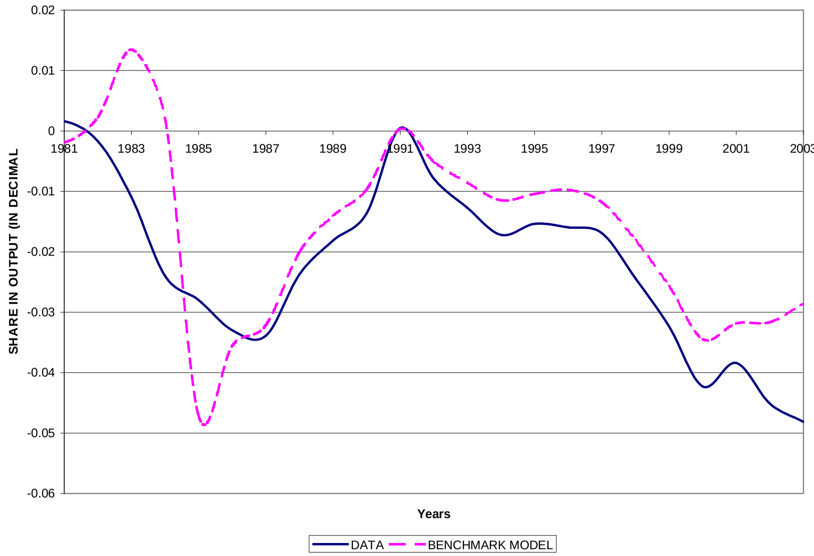
Note: We depict here the fluctuations of TFP, where TFP in 1980 is normalized to 100. The TFP is calculated as the Solow residual given the data on output, capital and labor. The data is smoothed for short term trends using the HP-filter.

FIGURE 4: CURRENT ACCOUNT SHARE (DATA AND MODEL)



Note: In Figure 4, we depict the data and model predictions of the current account as a share of output by feeding in TFP shocks in the home and foreign countries, assuming no change in the cost of bond trading. *Home* consists of the EU-15 and Japan in Experiment 1, and the EU-15 and Japan along with Emerging Asia in Experiment 2.

FIGURE 5: CURRENT ACCOUNT SHARE (DATA AND COUNTERFACTUAL EXPERIMENT)



Note: Figure 5 plots the current account share, feeding in TFP in unison with cost of bond trading (counterfactual experiment). Note that our counterfactual experiment is designed to determine ϕ_H, such that we match the *levels* of the current account, and not output. In the diagram, we plot current account as a share of output. To the extent that our counterfactual experiment does not yield perfect match to output, we see that the current account shares of the data, and the model do not coincide, even though the levels do coincide

FIGURE 6-A: COST OF INTERNATIONAL LENDING, ϕ_H

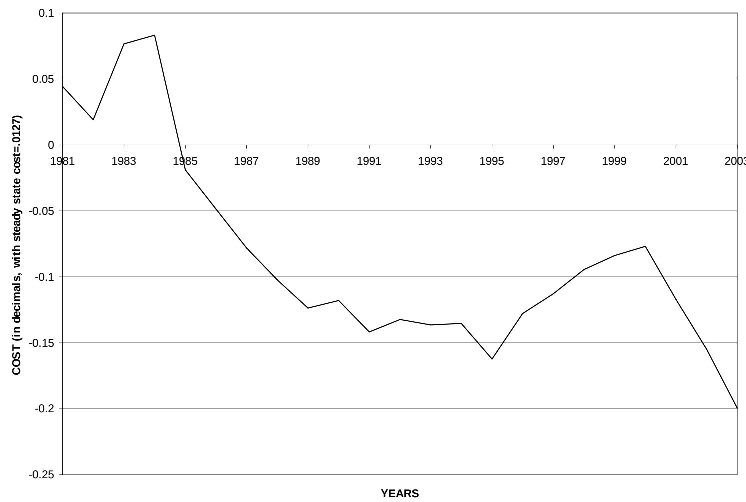
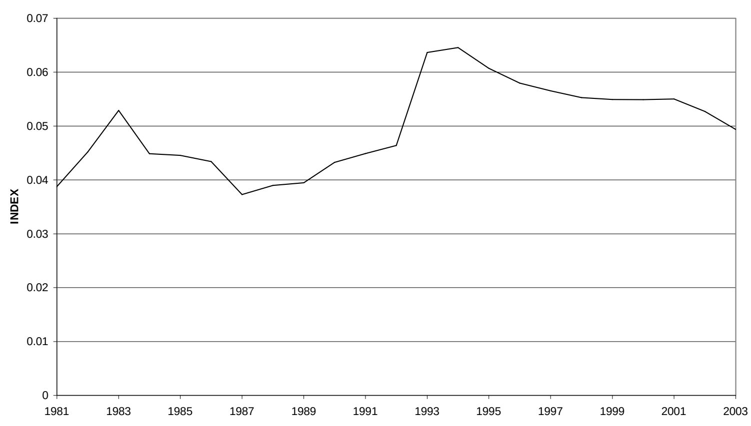


FIGURE 6-B: INDEX OF FINANCIAL OPENNESS



Note: In Figures 6-A and 6-B, we plot the time series of ϕ_H (constructed to match the current account level) and the Index of Financial Openness. The index is originally due to Chinn and Ito (2005) who created an index of the degree of capital account openness of 163 countries during the period 1970 to 2004. We modify it to include the weighted index of financial openness in the EU-15, Japan and Emerging Asia where the weights are the share of each constituent country's GDP in the aggregate GDP of the group. A reduction in the cost of bond trading is synonymous with increased openness.