Global Imbalances, Productivity Differentials and Financial Integration

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Abstract

We build a two-country model with differential productivity and financial frictions to quantitatively account for the recent increase in the U.S. current account deficit. An influential literature says that as U.S. productivity surged, capital was attracted to the U.S. to take advantage of the high returns to investment. We show, however, that when we include emerging Asia, the gap in productivity growth between the U.S. and the "rest of the world" cannot explain the U.S. current account deficits, especially since the 2000s. This is because on a GDP-weighted basis, the "rest of the world" actually had higher productivity growth during this period; and standard macroeconomic models would predict an outflow of funds from the U.S. to the "rest of the world," and a consequent *narrowing* of the U.S. current account deficit. We show that greater financial integration abroad can explain this anomaly. However, we still cannot explain why U.S. per capita output growth has been so low, despite the large inflow of capital.

JEL Codes: F32, F34, F36

Keywords: Current account deficit, productivity, financial integration, general equilibrium

1 Introduction

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**). 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 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

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East. Although because of data limitations, the decomposition that separates emerging Asia and the Middle East from the remaining countries 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 Engle 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, the productivity growth in the world, 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 (**Figure 1-C**). If the differential productivity view is correct, then the U.S. should have been running current account surpluses (or, at the least, experience a decline in the deficits), and funds should be flowing *out* from the U.S. in the 2000s, when it fact the opposite happened.

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," in the post-2000 period. 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 world." We interpret this "cost" as relating to regulatory and other changes in the global financial sector, and find that our model-derived "cost" of purchasing U.S. assets 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, such as the burst of the Japanese "bubble" in the early 1990s, and the Asian currency crisis of the late 1990s.

This paper extends Chakraborty and Dekle (2008a) by introducing adjustment costs to changing physical capital, and a government sector. These modifications allow for richer dynamics; and may help us resolve another puzzle:

[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.

why U.S. per capita output growth has been so low, despite the massive inflow of capital. We find that our extended model does a better job of matching the data on U.S. output per capita than in Chakraborty and Dekle (2008a), while accounting for the increase in the U.S. current account deficit. However our extended model still overpredicts the growth in U.S. per capita output as compared to the data. This leads us to conclude that while adjustment costs of capital investment and wasteful government spending are part of the explanation for low output growth, there are other reasons that need to be investigated if we are to solve the puzzle of why U.S. per capita output growth has been so low.

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. 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." To this, we introduce investment frictions by including a quadratic adjustment cost for investment in physical capital, and a government sector that taxes the representative agent and also provides transfers. Our intuition is that while increases in global financial integration have led to an influx of funds to the U.S., thereby leading to increasing deficits, the funds have not been fully utilized for production due to investment frictions embedded in the adjustment cost of capital. At the same time, taxation and wasteful government expenditures have also hampered the full channeling of capital inflows for productive purposes. These twin factors kept the US from fully realizing the gains from increased financial integration.

Impulse responses using our model show that when there is a positive productivity shock in the "rest of the world," capital flows abroad, and the U.S. current account deficit declines. We show, however, that this effect is offset when there is a negative shock to the cost of buying U.S. assets.The U.S. current account can expand if foreigners find that it is easier to invest in the U.S.

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). Mendoza, Quadrini, and Rios-Rull (2006), and Caballero, Farhi, and Gourinchas (2006) have both formally modelled this idea in a general equilibrium setup[2]. However, in contrast to our work, these papers are all theoretical, and do not perform the empirical exercise that we do here for the first time, taking

[2] 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).

the model to the data and 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, while not compromising the model's ability to match other real macroeconomic aggregates[3].

The rest of the paper is organized as follows. In Section 2, we present the extended 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. We also compare the extended model with the basic model in Chakraborty and Dekle (2008a), and see how the model in the current paper matches the U.S. current account deficit and output, as compared to our earlier study. Section 5 concludes

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2 The model

Our model builds on the incomplete financial markets framework developed by Baxter and Crucini (1995). In the Baxter and Crucini (1995) 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 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 restrictions on lending by foreign banks or taxes on the purchases of U.S. 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[4]. 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 the other country's bonds, where costs reflect the relative difficulty of international financial market access. Costs evolve according

[3] Choi, Mark, and Sul (2008) also use an imperfect assset market model to trace the actual time path of the U.S. current account. Like us, they too 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 of foreign residents.

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

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 international 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:

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

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. T_{it} denotes lumpsum taxes, and $m(k_{it},\ k_{it-1})$ denotes adjustment costs associated with investment in the physical capital stock. We use a quadratic specification for adjustment costs in capital such that:

$$m(k_{it},\ k_{it-1}) = \frac{\chi}{2}(\frac{k_{it} - \varsigma k_{it-1}}{k_{it-1}})^2 k_{it-1} \tag{3}$$

Apart from representative consumers and firms, we include the government in our extended model that balances its budget every period such that[5]:

$$g_{it} = T_{it} \tag{4}$$

Income is used to finance consumption c_{it}, physical capital investment, x_{it}, and for international net lending $s_{it} - s_{it-1}$. International net lending, or the purchasing (or selling) of the other country's bonds involves a cost, where $f(s_{it},\ \phi_{it})$ denotes the cost of purchasing bonds in terms of the final good. If buying or selling bonds 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 foreign country may have in lending to the home country. These impediments and frictions may include constraints on international lending such as foreign exchange controls, or bank minimum capital requirements, which restrict overseas bank lending. They may also include frictions arising from asymmetric

[5] We assume a balanced budget for the government. An alternative way to do our exercise would be to allow for budget deficits, and also allow government to trade in bonds along with households.

information that impair the ability of foreign lenders to costlessly acquire information about the behavior of home firms (the borrower). In many models, these asymmetric information problems will lead to additional monitoring costs for the foreign lender, raising the costs of lending (Bernanke, Gertler, and Gilchrist, 1995).

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

$$f(s_{it}, \phi_{it}) = \phi_{it} \tag{5}$$

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 foreign households to lend more, or to purchase more home country bonds, at lower costs.

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} :

$$y_{it} \leq F(A_{it},\ k_{it-1},\ l_{it}) \tag{6}$$

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 divert funds to investment opportunities outside the country, and thus accumulate the other country's bonds; the country experiencing a positive productivity shock would borrow funds from the "rest of the world" for investment, and consequently would run current account deficits.

Every period, the firm maximizes profits π_{it} subject to the production technology summarized in (6), where profits are given by:

$$\pi_{it} = y_{it} - w_{it}l_{it} - r_{it}^{k}k_{it-1} \tag{7}$$

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:

$$\sum_{i=H}^{F} (c_{it} + x_{it} + m(k_{it},\ k_{it-1}) + g_{it}) \leq \sum_{i=H}^{F} y_{it} \tag{8}$$

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

$$\sum_{i=H}^{F} s_{it} = 0 \tag{9}$$

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:

$$y_{it} - c_{it} - x_{it} - g_{it} - (R_t - 1)\, s_{it-1} \tag{10}$$

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

Given the budget constraint summarized in (2) and the definition of the current account as summarized in (10), we can express the current account in country i as:

$$s_{it} + \phi_{it} * s_{it} - s_{it-1} \tag{11}$$

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

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 (5)) and (2) the firm's profit maximization problem (summarized in (6) and (7)) , (3) the world resource constraint is satisfied (summarized in (8)) , and (4) the bond market clearing condition is satisfied (summarized in (9)).*

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 costs ϕ_{it}. Taking the U.S. as the home country, and the "rest of the world" as the foreign 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:

$$u(c_{it},\ l_{it}) = \frac{\left(c_{it} - \frac{\psi}{v} l_{it}^{v} (1+\gamma)^{t}\right)^{1-\sigma}}{1-\sigma} \tag{12}$$

The GHH preferences are widely used in the international macroeconomics literature (see Mendoza (2006)) as it better fits certain international business cycle facts as compared to Cobb-Douglas preferences.

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

$$F(A_{it},\ k_{it-1},\ l_{it}) = k_{it-1}^{\theta_i} \left(A_{it} l_{it} (1+\gamma)^{t}\right)^{1-\theta_i} \tag{13}$$

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, shown below. 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. 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 $\beta_i = .99$. The quadratic adjustment cost depends on two parameters, χ and ς. As in the literature, we assume that in the steady state, the adjustment cost is zero. We can ensure this by setting $\varsigma = .02$ to match the long term growth rate of the US economy. Note that in the literature where no balanced growth is assumed, ς is set to 1. We measure χ to be .01 to match the volatility of investment in the US.

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:

$$\left(c_{it} - \frac{\psi}{v} l_{it}^{v}\right)^{-\sigma} - \lambda_{it} = 0 \tag{14}$$

$$(1-\theta) y_{it} - \psi l_{it}^{v} = 0 \tag{15}$$

$$\left(\begin{array}{c} \lambda_{it+1} \left(\theta \frac{y_{it+1}}{k_{it+1}} + 1 - \delta_i + \frac{\chi}{2}(1+\gamma)^2 \left(\frac{k_{it+1}}{k_{it}}\right)^2 - \frac{\chi}{2}\varsigma \right) \\ -\frac{(1+\gamma)^{\sigma}}{\beta_i} \lambda_{it} \left(\chi(1+\gamma) \frac{k_{it}}{k_{it-1}} - \chi\varsigma \right) = 0 \end{array} \right) \tag{16}$$

$$\lambda_{it+1} R_{t+1} - \frac{(1+\gamma)^{\sigma}}{\beta_i} \lambda_{it} \left(1 + \phi_{it}\right) = 0 \tag{17}$$

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 (14) and (15) are standard. Equation (14) equates the marginal utility of consumption to its shadow price, and Equation (15) 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 (16) and (17) are the intertemporal conditions for investment in capital, and for international net lending. For our analysis, we assume that government expenditure is exogenous. The steady-state share of government expenditure is taken as 20% (the average for the period 1980 to 2003).

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:

$$\begin{bmatrix} \widetilde{A}_{Ht} \\ \widetilde{A}_{Ft} \\ \widetilde{\phi}_{Ht} \\ \widetilde{\phi}_{Ft} \\ \widetilde{g}_{Ht} \\ \widetilde{g}_{Ft} \end{bmatrix} = P \begin{bmatrix} \widetilde{A}_{Ht-1} \\ \widetilde{A}_{Ft-1} \\ \widetilde{\phi}_{Ht-1} \\ \widetilde{\phi}_{Ft-1} \\ \widetilde{g}_{Ht-1} \\ \widetilde{g}_{Ft-1} \end{bmatrix} + \begin{bmatrix} \widetilde{\epsilon}_{AHt} \\ \widetilde{\epsilon}_{AFt} \\ \widetilde{\epsilon}_{\phi Ht} \\ \widetilde{\epsilon}_{\phi Ft} \\ \widetilde{\epsilon}_{gHt} \\ \widetilde{\epsilon}_{gFt} \end{bmatrix} \tag{18}$$

where $\widetilde{A}_{it}$, and $\widetilde{g}_{it}$ $i \in \{H,\ F\}$denote the log deviation of productivity and government expenditures from their steady state. $\widetilde{\phi}_{it}$, $i \in \{H,\ F\}$ denotes the deviation of the cost of bond trading from its steady state. Epsilon or the error terms capture the shocks. For our numerical analysis, we assume that government expenditures are uncorrelated across the two countries, and with other variables. We estimate the parameters driving government expenditures from our data on U.S. government spending, and report the parameters in **Table 2**. P is a 6x6 matrix that summarizes the parameters underlying the stochastic process. The innovations are serially independent, multivariate normal random variables. The variance-covariance matrix of the innovations is summarized by another 6x6 matrix that we call Q. We initially assume no contemporaneous correlation of the innovations in the two countries[6].

For our analysis, we take the parameters determining the evolution of productivity from Kehoe and Perri (2002). 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.

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 $\{A_{it},\ \phi_{it}, g_{it}\}_{i=H,F}$, 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 (18).

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 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 F or foreign is the "rest of the world", and country H or home is the U.S.

[6] We could not detect any statistically significant correlation between our calculated "foreign" (European Union and Japan; and EU, Japan and emerging Asia respectively) and "home" (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.

While tracing the impulse responses, we are interested in the impact of three events: (1) a 1% positive shock to the productivity of the home country (A_H); (2) a 1% negative 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_F.

We are primarily interested in the impact of these three shocks on the current account of the U.S. that is, of the home country H. 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 F increasing the current account deficit of country H.

Therefore for our impulse responses, we chart the effect of shocks on US borrowing. We also trace the impact on real macroeconomic aggregates like output and consumption per capita.

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. However, in reality, U.S. real interest rates have 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).** Output in the home country increases under all three shocks. A fall in productivity in rest of the world lowers investment incentives in the foreign country leading to capital flows to the home country or the U.S., and an increase in investment and output in the U.S. A similar effect occurs when productivity in the home country increases. This attracts foreign capital flows into the U.S. market, and increases the inflow of funds to the U.S., thereby worsening the current account deficit.

A fall in the "rest of the world" (synonymous with financial liberalization in our model) sharply raises home (U.S.) output. A decline in the cost of lending makes it easier for foreign investors to invest in the U.S., thereby increasing capital inflows to the U.S., and the U.S. current account deficit expands sharply.

Our impulse responses also show increased consumption in the home country, thus supporting the conclusions reached by Mendoza, Quadrini and Rios-Rull (2006) that financial globalization has welfare enhancing effects for the borrower.

As for interest rate implications, shocks to productivities imply an *increase* in global real interest rates, which is at odds with the data. However, we do find that a 1% decline in ϕ_{Ft}, the cost of lending, generates a *decline* in global interest rates, along with an increase in the flow of funds to the home country (U.S.). This helps reconcile why global real rates have fallen, despite an increase in U.S. international borrowing. Increased financial liberalization in the "rest of the world" raised the supply of funds, and despite higher productivity growth in the U.S., lowered global interest rates.

One of our aims in this extended version was to improve our model's performance with respect to the data. If we compare the impulse responses traced here with that of Chakraborty and Dekle (2008a), the addition of adjustment costs to capital to our model *increases* the magnitude of the response of U.S. borrowing, but *lowers* the response of real macroeconomic aggregates to financial liberalization, which is closer to the data..

Below, we perform a quantitative exercise to see if given the paths of home and foreign total factor productivity (TFP) shocks, we can explain the path of the U.S. current account. We show that TFP shocks alone cannot explain U.S. current account deficits. Another factor, say changes in the ease of investing in U.S. assets, is necessary to explain the evolution of U.S. current account imbalances. We also show that including adjustment costs to capital, and wasteful government spending can help explain why U.S. per capita output growth has been so low, despite the increased access to global funds.

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 what the "rest of the world" stands for. In our two country model, country H or home represents the U.S. For country F or the foreign country representing the rest of the world, we consider two alternatives: (1) the "rest of the world" comprises of the EU-15 and Japan, and (2) the "rest of the world" comprises of the 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 try to match the current accounts and the GDPs per capita of the home country (U.S.) from 1980 to 2003. We show that while differences in TFP shocks do a good job of explaining the U.S. current account deficits in the late 1980s and the early 1990s, they do a poor job in explaining the U.S. current account deficits later on, particularly since 2000.

What is required for our model to explain the U.S. current account is for 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, and then *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 increase in our measure of financial frictions 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_F) from 1985 to 2003 is close to monotonic.

Although with non-monotonic financing frictions, we are able to describe the changes in the U.S. current account, we are still unable to account for the slow growth in U.S. per capita GDP, even in our extended model, with capital adjustment costs and "wasteful" government spending. The growth in per capita GDP simulated by our extended model considerably overshoots the actual growth in GDP per capita in the U.S. That is, given the rapid inflow of capital into the U.S., U.S. per capita GDP between 1985 and 1991, and between 2001 and 2003 should have been growing much faster than what is observed in the data.

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 foreign 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:

$$A_{it} = \frac{y_{it}}{k_{it-1}^{\theta_i} \left(l_{it}(1+\gamma)^t \right)^{1-\theta_i}} \tag{19}$$

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.

Thus calculated, we interpret changes in A_{it} as the deviation of TFP from its steady state, where in the steady state, global TFP is assumed to grow at 2%.[7] **Figure 3** depicts our estimated $A_{it}^{\prime}s$. 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,

[7] Following Choi, Mark, and Sul (2008), we also experimented with other de-trending procedures, including the HP-filter. We find that using alternative measures of long term trend growth rate like 1.5% or 2.15% do not alter our results. Nelson Mark pointed out that the results might be sensitive to HP-filtering. We find that while the pattern of TFP shocks changes with HP-filtering, the effects of the HP-filtered TFP shocks on the U.S. current account and other macroeconomic aggregates are essentially the same as the effects of our constant de-trended TFP shocks (results available upon request from the authors).

during the next subperiod (1986 to 1991), productivity grows at .79% below trend in the U.S., and .87% above trend in the 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 in the foreign country slightly improves in the last period (2000 to 2003), with TFP still growing slightly below trend at ($-.56\%$). In the home 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 in the "rest of the world," especially during the early 1980s, and during the 2000-2003 period. In contrast to the previous case when only the EU-15 and Japan are in the foreign country, adding emerging Asia results in TFP growing at .24% below trend during 1980 to 1986. Since the mid-1980s, foreign 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 foreign 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 in the 1980s and since 2000, when in fact the U.S. current account deficit rose. 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 foreign country.

4.2 Quantitative experiments

We conduct our experiments when the "rest of the world" includes the EU-15, Japan, and emerging Asia. We feed in the calculated annual changes in TFP in the foreign (EU-15 and Japan), and in the home (the U.S.) countries, assuming no change in financial liberalization. The results for the U.S. current account are shown in **Figure 4**. For the sake of comparison, we also depict the predicted current account share from our earlier model (Chakraborty and Dekle, 2008a). The earlier model, which we call "Basic," has no government sector and capital adjusts instantaneosly. Introducting capital adjustment in our "Extended" model presented here allows for richer dynamics.

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 that in the U.S. 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. Note that the results for the current account are almost identical for the basic and extended models.

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 the TFP growth differential between the "rest of the world" and the U.S. widens. Now given the very rapid TFP growth above trend in the foreign country (mainly China), the model predicts a current account *surplus* in the U.S., when we actually have a U.S. current account deficit. Our quantitative results are robust to different levels of persistence in the productivity shocks. We raised the persistence from our benchmark (0.95) to a random walk (1.0), and also lowered it to a serially uncorrelated process, but the simulated U.S. current account changed very little[8].

4.2.1 The pattern in ϕ_F

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_F, 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). The 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 in the model to see which wedge best accounts for the data, while keeping in mind that feeding in all wedges jointly would account exactly for the data (by construction).

As mentioned, ϕ_F or the cost of trading international assets, is intended to capture frictions in financial markets that include, but is not restricted to regulations, and the financial openness of country F. Thus, by its very nature, it is a broad concept of increased openness in financial markets for which we do not have an exact equivalent in the data.

Methodologically, we feed in TFP into our model and then extract the time path of ϕ_F relying on the principle that TFP and ϕ_F jointly would exactly account for the evolution of the current account. The first step in constructing ϕ_F requires that we start with an initial guess of the stochastic process driving

[8] For the sake of brevity, we do not present the results of assuming a random walk process here.

the evolution of ϕ_F. 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. To save space, we will only report the results of the extended model, since the pattern of the extracted ϕ_F in the extended model is almost identical to the pattern of ϕ_F in the basic model without capital adjustment costs and the government.

As mentioned, we also try to capture the patterns in U.S. output per capita. In general, both the basic and extended models overpredict the growth in U.S. per capita output (Figure 5), although the overprediction is much less for the extended model. This is because in the extended model, government spending is assumed to be wasteful, and part of the capital inflows from abroad is used as government spending, rather than as physical investment. The introduction of adjustment costs to physical investment also tends to lower per capita output growth.

Is the pattern in ϕ_F plausible? First, note that ϕ_F starts to fall sharply from 1985 until 1991, and then stabilizes until about 1996. The decline in ϕ_F 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 (Dekle, 1998). Starting in 1996, ϕ_F increases until 2000, corresponding to the Asian financial crisis, where 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 (Dekle and Kletzer, 2006).

The sharp decline in ϕ_F starting in 2000 corresponds to the purchases of U.S. assets, particularly U.S. government bonds, by the Japanese and emerging Asian, especially Chinese, governments, to prevent their local currencies from appreciating. This change in Asian foreign exchange reserve behavior, particularly by emerging market governments is captured by the sharp decline in ϕ_F from 2000. In our model, any change that makes it easier for the rest of the world to buy U.S. assets is represented by a fall in ϕ_F even if this change in buying U.S. assets is facilitated entirely by the foreign 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 both inward and 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 home (U.S.) country. In our model, the cost to U.S. residents of investing in the foreign country, ϕ_H, is assumed to be constant.

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_F or cost of bond trading in our model is falling (or it is becoming easier to invest in U.S. 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_F , which, as mentioned, is related to the Asian financial crisis. However, from 2000 to 2003, the two measure drift apart; while ϕ_F falls sharply, the Chinn-Ito index shows less openness. The Chinn and Ito index may be capturing the capital controls instituted by many emerging markets after the Asian currency crisis, while our ϕ_F , which focuses on capital outflows, cannot capture such capital inflow controls. For the entire period 1980 to 2003, the correlation coefficient between ϕ_F and the Chinn-Ito measure at -0.41 has the right sign; the two measures are found to be cointegrated by the Johansen test (with a trend and intercept term).

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. Our results are robust to the inclusion of permanent (random-walk) productivity shocks. Using our procedure, we derive a series for the cost of buying U.S. assets by foreigners, and compare it with other measures of financial liberalization in the literature. Our series also matches up well with distinct, identifiable episodes in international financial liberalization.

We show that the introduction of capital adjustment shocks and "wasteful" government spending explains partly the slow output growth in the US economy. However the predicted per capita output growth in the model is much higher than actual per capita output growth in the data for the U.S.

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DATA APPENDIX

The world in our model is made up of two regions: the United States (referred to as " $home$") and the EU-15 and Japan; or the EU-15, Japan and emerging Asia referred to as "$foreign$." The emerging Asian region comprises of China, Hong Kong, 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 the 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; and the EU-15, Japan and emerging Asia, 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 are 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 Geary-Khamis conversion method is popular in current international comparative studies as it has some desirable properties. 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 EU-15 and Japan; and the EU-15, Japan along with emerging Asia.

index of financial openness : The index of financial openness was created by Chinn and Ito (2005)[9] 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), 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

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

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.

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		
	ς	.02
	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

$$\mathbf{P} = \begin{pmatrix} .95 & 0 & 0 & 0 & 0 & 0 \\ 0 & .95 & 0 & 0 & 0 & 0 \\ 0 & 0 & .91 & 0 & 0 & 0 \\ 0 & 0 & 0 & .91 & 0 & 0 \\ 0 & 0 & 0 & 0 & .98 & 0 \\ 0 & 0 & 0 & 0 & 0 & .98 \end{pmatrix}$$

$$\mathbf{Q} = \begin{pmatrix} .007\hat{}2 & 0 & 0 & 0 & 0 & 0 \\ 0 & .007\hat{}2 & 0 & 0 & 0 & 0 \\ 0 & 0 & .002\hat{}2 & 0 & 0 & 0 \\ 0 & 0 & 0 & .002\hat{}2 & & \\ 0 & 0 & 0 & 0 & .02 & 0 \\ 0 & 0 & 0 & 0 & 0 & .02 \end{pmatrix}$$

Note: We assume the shocks to be uncorrelated across countries and with each other.

TABLE 3: GROWTH RATE OF PRODUCTIVITY

	Foreign *(EU15+Japan)*	Foreign *(EU15+Japan+Asia)*	Home *(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)

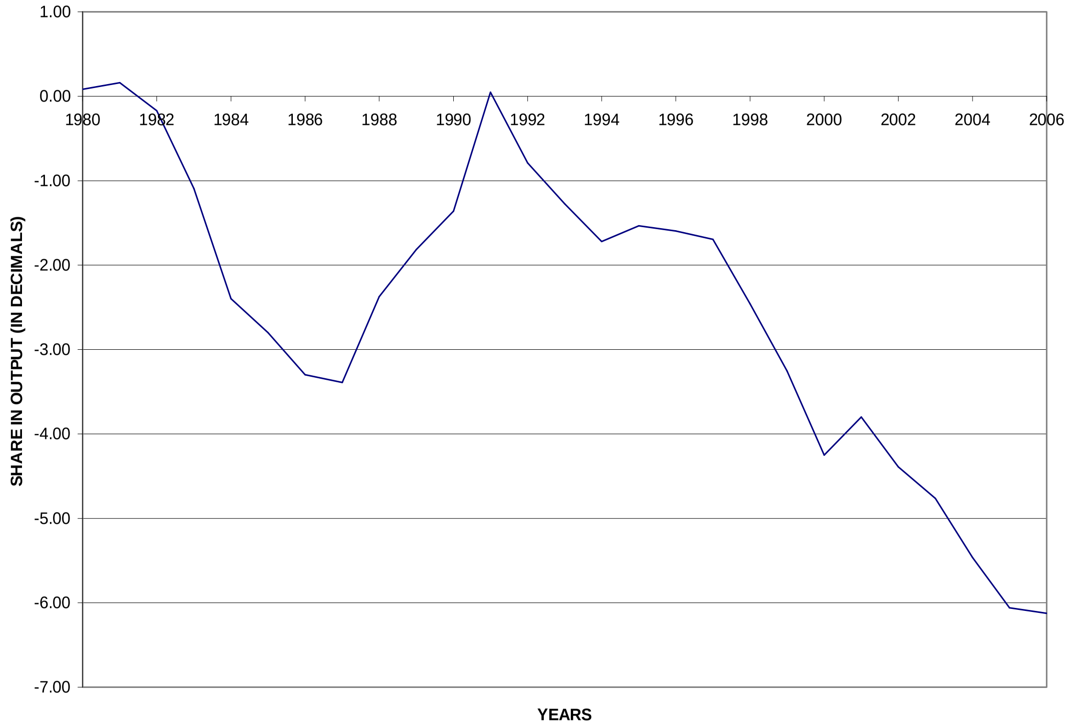
Note: Change in TFP measured as $\frac{\triangle A_{it}}{A_{it}}$ where A_{it} is measured as a Solow Residual. "Foreign" includes EU-15 and Japan or EU-15, Japan along with emerging Asia while "Home" represents the U.S. For each sub-period, we provide the average growth rate of A_{it}, and the standard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

TABLE 4: CURRENT ACCOUNT AND OUTPUT GROWTH (DATA, BASIC AND EXTENDED MODEL)

	Current account share			**Output growth**		
	Data	*Model*		*Data*	*Model*	
		Basic	*Extended*		*Basic*	*Extended*
1980 : 1986	−1.36% (1.46)	−.97% (2.25)	−.9% (2.05)	.29% (2.93)	4.6% (27.94)	2.1% (14.56)
1986 : 1991	−2.03% (1.3)	−1.85% (1.37)	−2.07% (1.41)	−.34% (1.76)	16.33% (21.05)	7.95% (11.18)
1991 : 2000	−1.85% (1.21)	−1.35% (1.01)	−1.82% (1.28)	.05% (1.41)	−1.09% (7.33)	−1.02% (3.53)
2000 : 2003	−4.35% (.41)	−3.16% (.24)	−4.17% (.18)	−.84% (1.16)	7.13% (11.69)	4.36% (5.41)

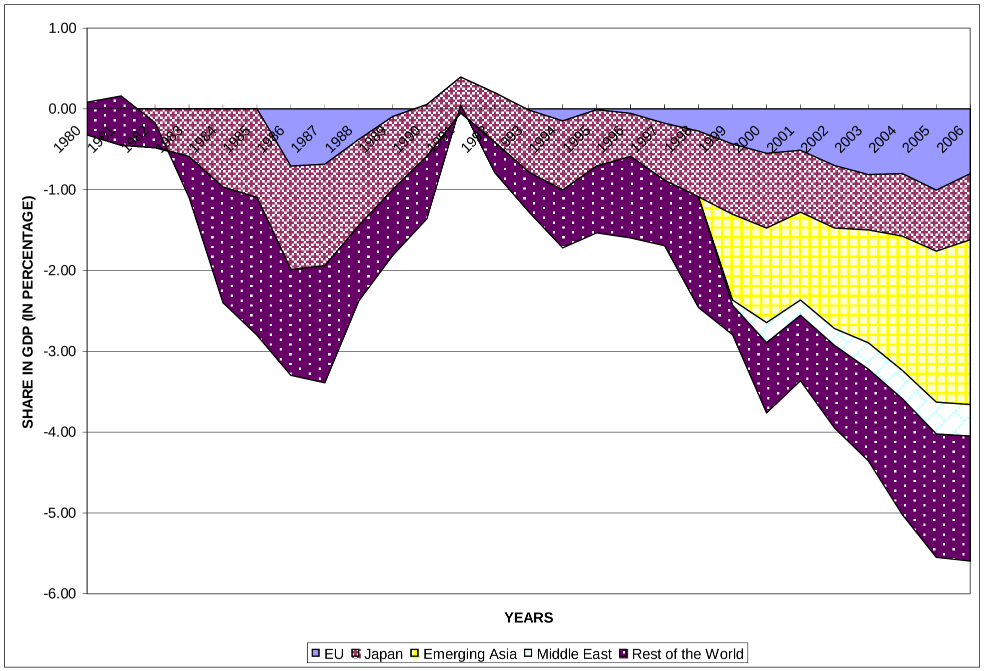
Note: Model predictions when ϕ_F is constructed so that model predictions of the current account *levels* match the data. In the Table, we plot the current account *as a share* of output. To the extent that our model does not match output exactly, we have a discrepency between the data and model generated current account share. We provide the results for the basic model (Chakraborty and Dekle, 2008a) and the extended model presented in this paper, where the extended model includes adjustment costs of capital and the government sector.

FIGURE 1-A: US CURRENT ACCOUNT AS A SHARE OF GDP



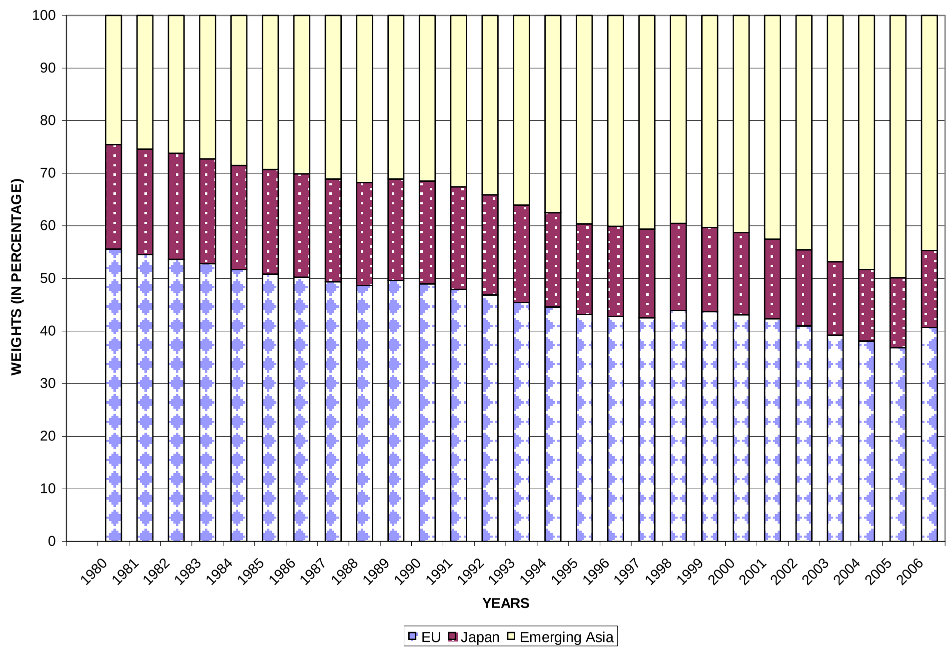
Note: The figure above depicts the current account of United States as a share of GDP during the period 1980 to 2006. Note that for our empirical analysis, we will concentrate on the period 1980 to 2003, because of data availability. The data for the figure above is collected from BEA.

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



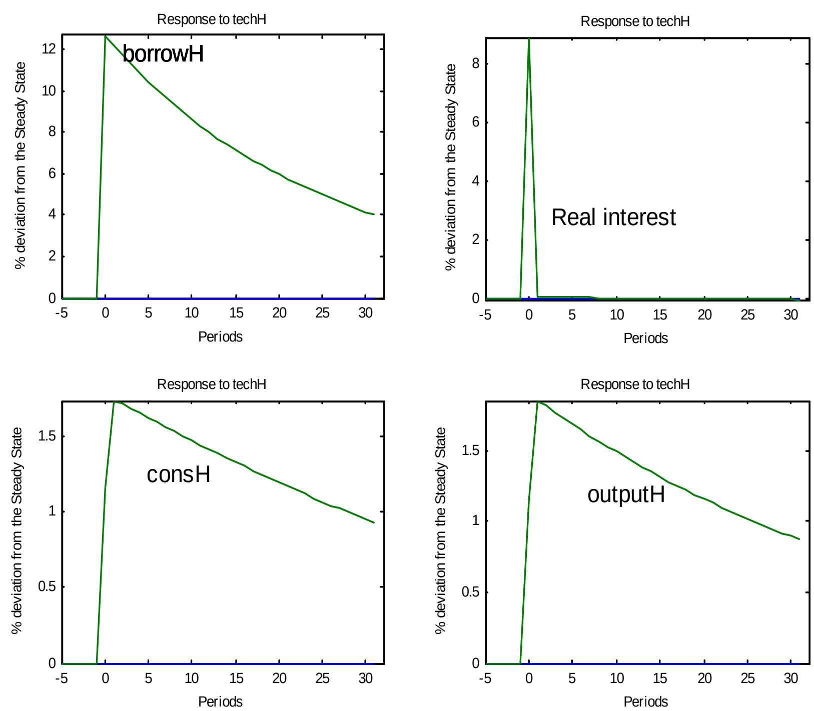
Note: In the above figure, we plot the share of U.S. current account in GDP with its partners including a set of individual countries or group of countries and the rest of the world. The data is collected from BEA. One limitation of the data is that we do not have U.S. current account balance data with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

FIGURE 1-C: SHARE OF A COUNTRY'S (EXCEPT USA) GDP IN THE AGGREGATE GDP OF REST OF THE WORLD



Note: In this graph we plot the changing weights of the countries in the rest of the world except USA. We measure the weights as the ratio of GDP of an individual country to the aggregate GDP of the rest of the world where ROW comprises EU-15, Japan and emerging Asia in our sample. Note that over the last two decades, and particularly since 2000, emerging Asia's (including China) share has increased. Japan was a major force upto 1991 however the weight has since then diminished.

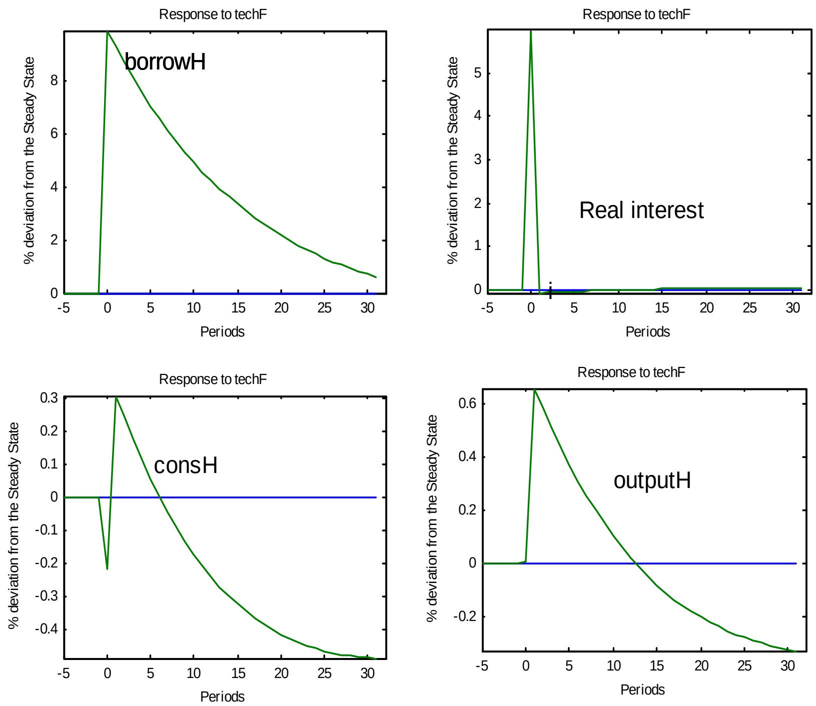
FIGURE 2-A: IMPULSE RESPONSES TO A 1% POSITIVE SHOCK TO HOME PRODUCTIVITY, A_H



Note: VARIABLE DESCRIPTION

The variables of interest are borrowings by the home country, borrowH (or equivalently lending by the foreign country); the real interest rate on international lending, Real interst; consumption of the representative agents of the home country that is the recipient of international funds, consH; and the output of the home country or outputH.

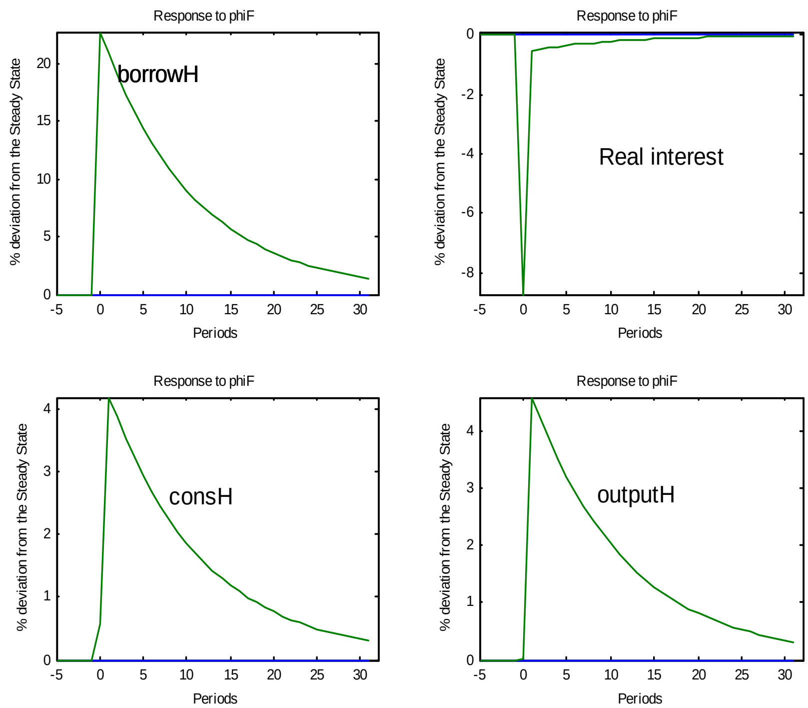
FIGURE 2-B: IMPULSE RESPONSES TO A 1% NEGATIVE SHOCK TO FOREIGN PRODUCTIVITY, A_F



Note: VARIABLE DESCRIPTION

The variables of interest are borrowings by the home country, borrowH (or equivalently lending by the foreign country); the real interest rate on international lending, Real interst; consumption of the representative agents of the home country that is the recipient of international funds, consH; and the output of the home country or outputH.

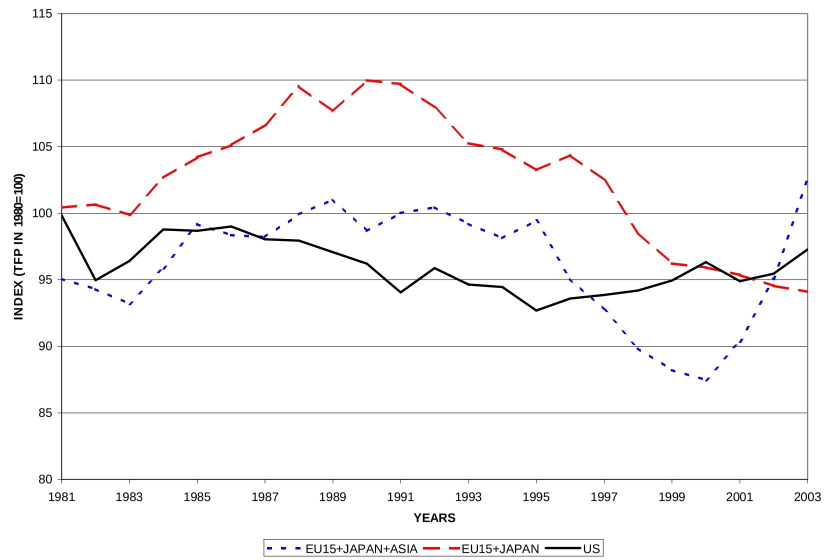
FIGURE 2-C: IMPULSE RESPONSES TO A 1% NEGATIVE SHOCK TO COST OF INTERNATIONAL LENDING, ϕ_F



Note: VARIABLE DESCRIPTION

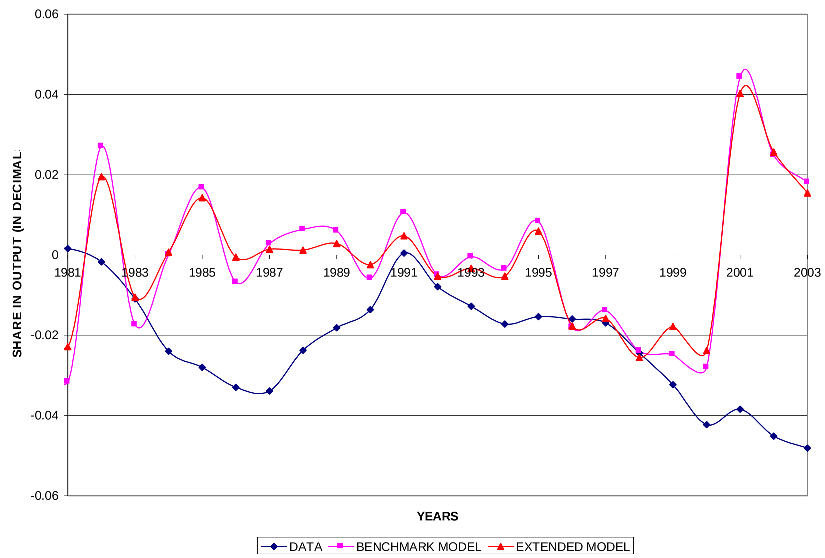
The variables of interest are borrowings by the home country, borrowH (or equivalently lending by the foreign country); the real interest rate on international lending, Real interst; consumption of the representative agents of the home country that is the recipient of international funds, consH; and the output of the home country or outputH.

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



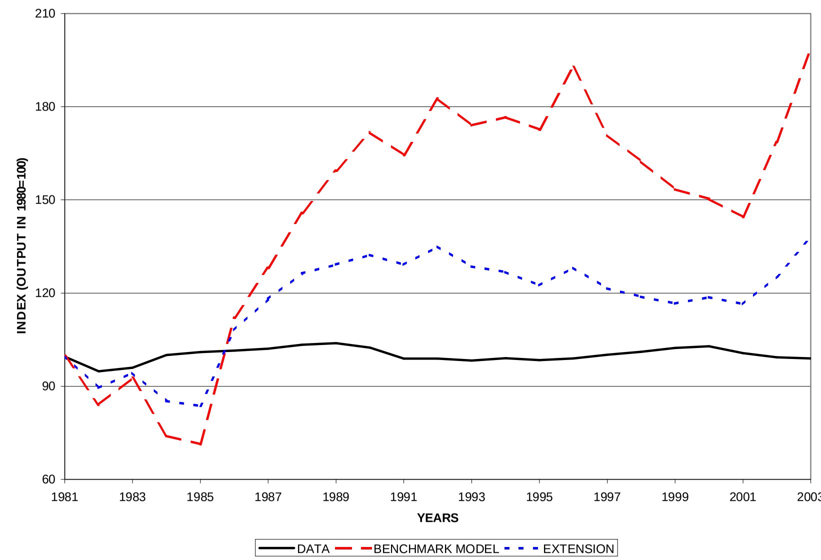
Note: We depict here the fluctuations of TFP around its steady state, where TFP in 1980 is normalized to 100. The TFP is calculated as the Solow Residual given the data on output, capital and labor. We plot the TFP fluctuations in the U.S. and in the "rest of the world" where the "rest of the world" comprises of only the EU-15 and Japan; and secondly, the EU-15, Japan and emerging Asia.

FIGURE 4: CURRENT ACCOUNT SHARE (DATA , BASIC AND EXTENDED MODELS)



Note: We depict the data and model predictions (basic and extended) of the current account as a share of output by feeding in TFP shocks at home and foreign assuming no change in cost of bond trading. "Foreign" consists of the EU-15, Japan and Asia. The figure shows that feeding in TFP shocks into our model does a poor job of replicating the U.S. current account, especially since 2000.

FIGURE 5: INDEX OF OUTPUT (DATA AND MODEL, BASIC AND EXTENDED)



Note: Figures 5 plots the per capita output feeding in TFP in unison with declines in cost of bond trading. The results are plotted for the basic (in Chakraborty and Dekle, 2008a), and the extended model where the extended model incorporates exogenous government expenditure and capital adjustment costs.

FIGURE 6-A: COST OF INTERNATIONAL LENDING, ϕ_F

Note: In Figures 6-A, we plot the time series of ϕ_F (constructed to match the current account level in our extended model).

FIGURE 6-B: INDEX OF FINANCIAL OPENNESS

Note: In Figure 6-B, we plot the time series of 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. The reduction in our measure of the cost of buying U.S. assets (by foreigners),ϕ_F, is synonymous with increased openness.