

Comparative Advantage, Service Trade, and Global Imbalances*

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Abstract

The large current account deficit of the U.S. is the result of a large deficit in the goods balance and a modest surplus in the service balance. The opposite is true for Japan, Germany and China. In this paper I explore a new explanation for global imbalances, based on the interplay between the U.S. comparative advantage in services and the asymmetric trade liberalization process in goods trade versus service trade that took place in the last 15 years. I use a structural gravity model to quantify the extent of this asymmetry. Then, I show that a simple two-period model can rationalize the emergence of current account deficits in the presence of such asymmetric liberalization. Finally, I explore the quantitative relevance of this explanation for global imbalances. On the time-series dimension, a multi-period version of the model generates a current account deficit of about 1% of GDP (roughly 20% of what was observed in the U.S. in 2006). On the cross-sectional dimension, I document a significant negative relationship between comparative advantage in services in 1995 and the current account balances in 2006 for a sample of 66 OECD and developing countries.

JEL classification: F1, F32, F40

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1 Introduction

The accumulation of current account deficits in the U.S., accompanied by the corresponding surpluses registered in Japan, Germany, China and other countries has generated the phenomenon known as “global imbalances,” described as “probably the most complex macroeconomic issue facing economists and policy makers” (Blanchard and Milesi-Ferretti, 2009). The emergence of such imbalances has also been recently suggested as one of the sources of the financial and economic crisis that began in 2007 (Obstfeld and Rogoff, 2009; Bernanke, 2009).

The motivation for this paper is best understood by exploring the composition of global imbalances. Figure 1 shows the U.S. current account disaggregated into its two main components: the trade balance and the income balance.¹ Clearly, the current account deficit tracks the trade balance very closely, indicating that trade might play an important role in global imbalances.

Further disaggregating the U.S. current account deficit reveals an interesting fact. Figure 2 shows the further disaggregation of the trade balance into its two components: the goods balance and the service balance. It is clear from the picture that the U.S. trade imbalance is due to a large deficit in the goods balance and a modest surplus in the service balance.

Figure 3 shows a similar disaggregation of Japan’s current account surplus. While there are visible fluctuations, Japan’s large trade surplus is the combination of a surplus in the goods balance and a deficit in the service balance. The same is true for Germany (Figure 4) and China (Figure 5).

Starting from this stylized fact, I propose a new explanation for the formation of global imbalances. The focus of this story is the interplay between the comparative advantage of the U.S. in services and the asymmetric trade liberalization process in goods trade versus service trade that took place in the last two decades, particularly since the mid-nineties.

¹The current account is net of transfers. The trade balance is the difference between the value of exports of goods and services and the imports of goods and services. The income balance is the difference between the payments from abroad and the payment to the foreigners for i) profits from fdi, ii) returns from portfolio investments (equities and bonds), and iii) interests on government bonds.

The conclusion of the Uruguay Round and the advent of the World Trade Organization (WTO) in 1995 spurred the liberalization of trade, especially in goods and agricultural products. At the same time, the General Agreement for Trade in Services (GATS) was signed. However, after more than fifteen years, the liberalization process in service trade does not seem to have made much progress (Adlung, 2009).

The first part of the paper establishes empirically both the presence of a revealed comparative advantage of the U.S. in services and the presence of an asymmetry in the trade liberalization of manufacturing versus service trade. A simple Balassa-type index of revealed comparative advantage (RCA) confirms that the U.S. is relatively specialized in services, while Germany, Japan and China display a revealed comparative advantage in goods. I then use the structural gravity model developed by Anderson and van Wincoop (2003) to document the presence of an asymmetry in the liberalization of goods trade versus service trade. I use the newly proposed concept of the constructed home bias index (CHB) developed by Anderson and Yotov (2010a) to quantify the extent of this asymmetry. The CHB index is the ratio of the realized internal trade in a given sector relative to the internal trade that would prevail in a frictionless world. This index is a pure number, so it can be compared across different sectors and an appropriately weighted average of this index captures the liberalization process in manufacturing versus service trade at the world level. While the index for manufacturing trade, available from 1994, is declining since the mid-nineties, the index for services is virtually flat. The extent of the asymmetry is of the order of 15% over the 12 years for which data are available.

In the second part of the paper, I show that a simple two-period model can rationalize the existence of current account deficits in the presence of such an asymmetric liberalization process. The structure of the model is minimal - endowment economies with complete specialization - to maximize transparency of the mechanisms and results. The anticipation of a future reduction of impediments to trade in services generates an increase in savings in the service-importing countries (like Japan, Germany, and China) due to an increase in the consumption-based real interest rate (intuitively, it is convenient to save for future times

when services will be available at cheaper prices). At the same time, the anticipation of future higher income and a relatively more expensive consumption basket generates a deficit in the service-exporting countries (like the U.S. or the UK) due to the combination of a lower consumption-based real interest rate and a positive wealth effect (intuitively, it is convenient to enjoy increased consumption of cheap manufactured goods today by borrowing against a future increase in income from higher future demand for services). These results hold both in a small- economy (partial equilibrium) version of the model and in a two-country (general equilibrium) version, provided that the intertemporal elasticity of substitution is sufficiently large. I solve the log-linear version of the two-country model analytically, and I show how the current account responds to changes in trade costs when these changes are asymmetric, thus showing that trade policy can indeed affect current account balances in dynamic settings where expectations play an important role.

Finally, in the third part of the paper, I evaluate the quantitative relevance of this explanation for global imbalances. In order to assess the quantitative relevance on the time-series dimension, I develop a multi-period version of the model and solve it (in levels) under perfect foresight, using as the exogenous driving forces a profile of reduction of trade costs analogous to what found in the empirical analysis. If the model is shocked with a symmetric trade liberalization process in both manufacturing and service trade, there is no change in the net foreign asset position of either country. When the model is shocked with the actual asymmetric liberalization process found in the data, it generates a current account deficit in the service-exporting country of about 1% of GDP, roughly 20% of U.S. current account at the peak of global imbalances (2006). On the cross-sectional dimension, I document a negative relationship between the revealed comparative advantage index in services in 1995 and the current account balance over GDP in 2006 for a sample of 66 OECD and developing countries. This negative relationship is strongly significant, robust after controlling for financial development, and able to explain approximately 45% of the cross-sectional variation in current account balances.

This paper is linked to several strands of the literature. First, it is related to the many

explanations for global imbalances that have been proposed. After Bernanke (2005) proposed the “savings glut” hypothesis, influential papers have emphasized the role of heterogeneity across countries in the ability to supply assets to savers (Caballero, Farhi and Gourinchas, 2008) or in different levels of financial development (Mendoza, Quadrini and Rios-Rull, 2009) as the key elements to global imbalances. I refer to these theories as “financial” explanations. Kamin and Gruber (2009), however, find little evidence that differences in financial sector development can explain the cross-sectional pattern of external balances. The explanation proposed in this paper is “real,” in that it focuses on the consequences of comparative advantage and (asymmetric) trade liberalization across goods and services.

This is not the first “real” story for global imbalances. Ju and Wei (2009) and Jin (2009) also explore trade channels that can potentially explain the emergence of external imbalances. Comparative advantage plays an important role, but the economic channels in these papers operate via the production side, while the key mechanisms of the model presented in this paper operate through the consumption side.

Other “real” explanations for global imbalances include the anticipation of a rising U.S. future share in world output (Engel and Rogers, 2006) and the productivity dynamics in the non-traded sector (Cova et al, 2005). Other stories for global imbalances include “dark matter” argument (Hausmann and Sturzenegger, 2005) and the Bretton Wood II hypothesis (Dooley, Folkerts-Landau, and Garber, 2003).² Blanchard and Giavazzi (2002), though not directly addressing the issue of global imbalances, find that greater real and financial integration can exacerbate the deficits of borrowing countries and increase the surpluses of creditor countries in the presence of growth differentials. Finally, there are also “behavioral” explanations for global imbalances, which include the asset prices boom of the late nineties and the associated perception of greater wealth by the American consumers (Laibson and Mollerstrom, 2010). None of these explanations focus on the service sector and the asymmetric trade liberalization of goods trade versus service trade.

²As pointed out by the authors, the Bretton Wood II Hypothesis relates more to the reason why Asian countries are willing to keep financing U.S. current account deficits than to the reason that determines the deficits themselves.

Second, the paper is linked to a vast literature on service trade. Mattoo, Stern, and Zanini (2008) and Francois and Hoekman (2010) provide an excellent overview. Mann (2004) provides an empirical analysis of the implications of service trade for the U.S. current account balance.

Finally, this paper is related to the literature that studies international macroeconomic models in the presence of trade costs. After the seminal contribution by Obstfeld and Rogoff (2001), several have explored the implications of introducing trade costs into international macroeconomic models. Courdiaceur (2009) is an example from which I borrow some modeling choices for the two-period model.

The paper is structured as follows. Section 2 presents the empirical analysis. Section 3 presents the two-period model in its partial equilibrium version. Section 4 presents the two-country model. Section 5 presents the multi-period model and the quantitative exercise. Section 6 concludes.

2 Empirical Evidence

The explanation for global imbalances explored in this paper is based on the interplay between U.S. comparative advantage in services and asymmetric trade liberalization process in goods trade versus service trade. The aim of this section is to provide empirical evidence of both these phenomena.

Before proceeding, a disclaimer is appropriate. Obviously, the service sector is extremely heterogenous. It encompasses very different activities such as construction services, transport services, financial services, insurance services, business services (such as legal, architectural, R&D, and advertisement services), educational services, and health services.³ I keep an aggregate perspective here partly for consistency with the models that will be introduced in the following sections and partly because of data limitations.⁴

³See Marchetti and Roy (2008) for a case-study approach.

⁴Repeating the exercises of the next subsections at a more disaggregated level would certainly represent a fruitful avenue for future research, even though the data constraints would likely become more stringent.

2.1 The U.S. Comparative Advantage in Services

I document the comparative advantage of the U.S. in the production and export of services using data from the World Development Indicators of the World Bank, which include extensive coverage of export and import of goods and services for a large sample of countries. The simplest way to assess the presence of comparative advantage is the revealed comparative advantage index (RCA), first introduced by Balassa (1965). The RCA index expresses the ratio of the export share of a given sector in country i relative to the export share of that sector in the world as a whole. Thus, the RCA is an index of relative export specialization and can be expressed as follows:

$$RCA_{i,k} = \frac{\frac{EXP_{i,k}}{\sum_k EXP_{i,k}}}{\frac{EXP_{WLD,k}}{\sum_k EXP_{WLD,k}}},$$

where i is a country and $k = \{Goods, Services\}$. A value of the RCA larger than 1 for a given sector k indicates that the country is relatively specialized in export in that sector, thus revealing the presence of a comparative advantage of the country in that sector.

Figure 6 reports the evolution of the RCA index in services for the U.S. and three other countries (Japan, China, and Germany), which are among the largest creditors of the US (they represent on average 52% of the total U.S. current account deficit for the period 2000-2008 and 63% in 2008). The RCA in services for the U.S. is larger than 1 and rising over time. On the other hand, the RCA indexes for services for China, Germany, and Japan are all smaller than 1. In the case of China, the RCA displays a clear downward trend. Germany and Japan do not display clear trends.

Not surprisingly, since I am considering a world where only two “goods” are produced and traded (goods and services), the picture for the RCA in goods (not shown) looks symmetrical, with the U.S. displaying an increasing revealed comparative disadvantage in the export of goods. On the other hand, Japan, Germany, and China report RCA indexes above 1 (and rising, in the case of China).

The results presented in this subsection are hardly surprising, but they motivate the

assumption that the U.S. has a comparative advantage in services.

2.2 Trade Liberalization in Service Trade and Manufacturing Trade

Establishing qualitatively a gap in the liberalization of trade in services compared to manufacturing trade is not difficult. If one wants to take a long-term perspective regarding international negotiations, for instance, one would immediately realize that the negotiations on liberalization of trade in goods started in the late forties with the General Agreement on Trade and Tariffs (GATT). Only in 1995, however, a negotiating framework for the liberalization of service trade was established with the GATS (General Agreement for Trade in Services), together with the institution of the World Trade Organization (WTO).

Even restricting the attention to the last fifteen years, however, reveals that little progress has been made in the liberalization of service trade. A recent WTO study, for example, concludes that “there has been virtually no liberalization under the GATS to date” (Adlung, 2009). Moreover, as stressed by Mattoo and Stern (2008), “in the negotiation under the Doha Development Agenda, services have received surprisingly little attention.”

Trying to quantify the extent of this asymmetry is a much more difficult task. As stressed by Deardorff and Stern (2008), while barriers to trade can be summarized in “tariff equivalent” measures in the case of trade in goods, things are more complicated for the case of services, since such simple measures do not exist. Barriers to service trade usually take the form of regulations, which are inherently more difficult to measure.

Moreover, services can be provided abroad through different modes. The GATS classifies four typical modes of provisions of services:

1. *Cross Border (mode 1)*. Examples could be a software service provided through e-mail or a call center placed abroad.
2. *Consumption Abroad (mode 2)*. Examples of this mode of provision are foreign students consuming education services or tourism.

3. *Commercial Presence (mode 3)*. Examples could be a financial firm or a consulting firm opening an affiliate in a foreign country through a foreign direct investment (FDI).
4. *Presence of Natural Person (mode 4)*. For example, a doctor moving to perform surgery in a different country or the employees of a multinational enterprise (MNE) moving on a temporary basis.

Not surprisingly, different types of possible restrictions correspond to different types of provision mode.

As Deardorff and Stern (2008) report, researchers have used a variety of methods to estimate empirically the barriers to trade in services. The most popular methods have been the use of indexes of restrictiveness, price-impact or quantity-impact studies in reduced form regressions, and the gravity model studies.⁵ In what follows, I propose a novel approach based on the structural gravity model and the constructed home bias (CHB) index developed by Anderson and Yotov (2010a).

The main advantage of the approach will be to give quantitative measures of trade restrictions that are conceptually comparable for manufacturing trade and service trade and are also time varying. The main disadvantage will be that, as all the indirect measures of trade restriction, these may include the effects of other (unidentified) frictions.

2.2.1 Structural Gravity

The structural gravity model is extremely successful at fitting bilateral trade data. Following Anderson and van Wincoop (2003), let X_{ij}^k be the total shipment from the origin country i to the destination country j in sector k , E_j^k the total expenditure in sector k in the destination country j , and Y_i^k the total output of sector k in the origin country i . The structural gravity model can be expressed as follows:

⁵See Deardorff and Stern (2008) and references therein.

$$X_{ij}^k = \frac{Y_i^k E_j^k}{Y^k} \left(\frac{t_{ij}^k}{P_j^k \Pi_i^k} \right)^{1-\theta_k}, \quad (1)$$

$$(\Pi_i^k)^{1-\theta_k} = \sum_j \left(\frac{t_{ij}^k}{P_j^k} \right)^{1-\theta_k} \frac{E_j^k}{Y^k}, \quad (2)$$

$$(P_j^k)^{1-\theta_k} = \sum_i \left(\frac{t_{ij}^k}{\Pi_i^k} \right)^{1-\theta_k} \frac{Y_i^k}{Y^k}. \quad (3)$$

in (1) Y^k represents the world output of sector k and t_{ij}^k represents the bilateral trade cost of shipping a unit of sector k good from country i to country j . P_j^k and Π_i^k are the inward and outward multilateral resistance terms. P_j^k summarizes the average resistance to inward trade of country j , as if country j were importing all the goods from a theoretical “international” market. Similarly, Π_i^k represents the average outward resistance to trade of country i , as if country i were exporting all the goods to the same theoretical “international” market.⁶ θ_k is the elasticity of substitution between goods in a given sector k .

Interestingly, the structural gravity model contains a prediction for the amount of bilateral trade that would prevail in a frictionless world. If $t_{ij}^k = 1$ for every country pair ij , in fact, $\Pi_i^k = P_j^k = 1$, and $X_{ij}^k = \frac{Y_i^k E_j^k}{Y^k}$.

The data source for the analysis is the Service Trade Database, developed by Francois et al (2009), which contains data on bilateral service trade flows for a large sample of countries for the period 1999-2005. Manufacturing trade data are from UN-COMTRADE. A data appendix contains more details.⁷

I estimate the gravity equation (1) for aggregate manufacturing and service trade in a sample of 23 OECD countries plus China⁸ for the period 1994-2005. For Services I can only

⁶Intuitively, what really matters are the bilateral trade costs relative to the average difficulty to trade. As an example assume that trade costs depend only on distance and take the example of Australia and New Zealand. While Australia and New Zealand are far from each other in absolute term, both of them are very far from all their other trading partners. This makes them “relatively close”.

⁷From now on I will focus on manufacturing trade as opposed to goods trade and exclude agricultural products and commodities. The reason is that in order to compute the internal trade I will need to include also gross output data, which are more readily available for manufacturing than for primary sectors.

⁸The reduction in the number of available countries is imposed by the need of gross output data. See the

study the period 1999-2005 because of data availability.

I estimate equation (1) in levels by generating a transformed dependent variable $dep_k = \frac{X_{ij}^k Y^k}{Y_i^k E_j^k}$ and then using Poisson pseudo maximum likelihood (PPML) as suggested by Santos-Silva and Tenreyro (2006).⁹ I use standard proxies for bilateral trade costs: population-weighted distance, dummies for common border, common language, common colonial past, common legal origin, and a dummy that is equal to 1 in case of internal trade.¹⁰ I include also exporter and importer fixed effects. Table 1 reports the results obtained for different years. The first two columns refer to manufacturing, the second two columns to total services and the third two columns to the a sub-sample of strictly tradeable services. I include in this sub-sample only business services (for instance consulting, legal or accounting services etc.), financial services and transportation services.¹¹

Three observations stand out. First, physical distance appears to be a more important determinant of manufacturing trade than service trade (and in both cases, its importance rises slightly over time). This is not surprising, considering the evolution of technology in the delivery of services across border. Second, the presence of a common colonial origin and a common legal system appear to be more important for service trade than manufacturing trade. The coefficients tend to fall over time, but more so in the manufacturing regressions than in the service ones. Third, the coefficient on the dummy for internal trade is larger for service trade than manufacturing trade. Moreover, consistent with intuition, the coefficient is slightly lower when considering only the sub-sample of strictly tradeable sectors. In both sectors, the coefficients decline over time, but also in this case more so in the manufacturing sector than in the service sector.

data appendix for details.

⁹I also used the simple OLS regressions for comparison. While the points estimates are inevitably different, the same qualitative results hold.

¹⁰ X_{ij}^k is defined as gross output value minus exports

¹¹In the U.S. the category of tradeable services accounts for about 30% of total service output. When using this sub-sample of service industries, I cannot include Poland, New Zealand and China in the analysis due to lack of output data.

2.2.2 The CHB Index: Asymmetric Trade Liberalization

Taking the estimated $(t_{ij}^k)^{1-\theta_k}$ of the first stage regressions, I can solve for the multilateral resistance terms P_j^k and Π_i^k using equations (2) and (3). To do so, I need to impose the normalization that $P_i^k = 1$ for each k , where i is a convenient country (in this case, Austria). After doing that, I finally can compute a constructed home bias index, equal to the ratio of internal trade to the internal trade that would prevail in a frictionless world:

$$CHB_{ik} = \left(\frac{t_{ii}^k}{P_i \Pi_i} \right)^{1-\theta_k}. \quad (4)$$

This index has the important property of being invariant to the elasticity of substitution θ_k .¹² This is an important reason to use the CHB to proxy for barriers in service trade. While estimates of the elasticity of substitution are available for several manufacturing sectors after the work by Broda, Greenfield and Weinstein (2006), to the best of my knowledge there are no reliable estimates for the service sector.¹³ Table 2 reports the results for the CHB in manufacturing and the service sector at the level of the single country for selected years.

The U.S. appears to be the most “open” country in the sample, in both manufacturing and services. Interestingly, the U.S. is the only country where the CHB in services is smaller than the CHB in manufacturing. In all the other countries the CHB in the service sector is higher than in manufacturing.

As for the time dimension, in the U.S. the CHB index is roughly constant both in the manufacturing sector and in the service sector. Other countries present very different patterns. In Germany, for example, the CHB grows slightly over time in the service sector and has an inverted-u shape in manufacturing. Japan is characterized by increasing levels of CHB in both manufacturing and services. China presents a significant reduction of the CHB in manufacturing (more than 60% between 1994 and 2005) and services (around 50% from 1999 to 2005). The levels of the Chinese CHB indexes, however, are several times higher the

¹²The reason is that the first stage regression identified $(t_{ij}^k)^{1-\theta_k}$, while solving the system (2)-(3) literally solves for $(\Pi_i^k)^{\theta_k-1}$ and $(P_i^k)^{\theta_k-1}$.

¹³This clearly represents another interesting avenue for future research. Of course, disclaimer about the level of heterogeneity in the service sector applies here as well.

corresponding figures for economies the U.S., Germany and Japan.

In order to have a global CHB index for manufacturing and services, I aggregate the results obtained for individual countries. Following Anderson and Yotov (2010b), I use as weights the frictionless internal trade shares. I'm hence able to express a world-level CHB index:

$$CHB_k = \sum_i \left(\frac{t_{ii}^k}{P_i \Pi_i} \right)^{1-\theta_k} \frac{\frac{Y_i^k E_i^k}{Y^k}}{\sum_i \frac{Y_i^k E_i^k}{Y^k}}. \quad (5)$$

Figure 7 reports the evolution of the CHB in manufacturing and services (considering both total services and the sub-sample of tradeable services). Two features stand out. First, the average level of CHB is higher in services than in manufacturing. Intuitively, the index obtained considering total services is higher than the one obtained using only tradeable services. Second, the CHB in services is almost entirely flat over the 1999-2005 period. On the contrary, the CHB in manufacturing is declining over the period 1994-2005, with an initial acceleration around 1996 (the year after the advent of the WTO).

Figure 8 normalizes the CHB indexes to 100 at the beginning of the period.¹⁴ From Figure 8, it is possible to quantify the asymmetry of the two liberalization processes to be roughly 15% of the initial values over the period considered.¹⁵

2.2.3 Caveats

Before proceeding, it is useful to qualify the results above with some caveats. The first concerns data availability. The Trade in Services Database (TSD) contains information from balance of payments statistics. This means that the trade data considered cover only modes 1 and 2 of provision of services. While mode 4 is almost irrelevant quantitatively, mode 3 (FDI) is certainly a very important way of providing services to another country. There is some coverage of this mode of provision in the TSD, but not the bilateral data necessary to perform the analysis of the previous sections. Francois et al (2009) suggest that mode

¹⁴1994 for manufacturing and 1999 for services

¹⁵The implicit assumption is obviously that the pattern of the CHB for services is flat in the period 1994-1999. While this appears a reasonable assumption, It is important to stress that it is an assumption.

3 accounts for roughly 35% of global service trade. In the case of the U.S., this share is larger (around 60%). So it is important to know that the analysis of the previous section miss an important part of the action.¹⁶ However, data on bilateral foreign affiliate sales in the service sector are virtually non-existent.¹⁷ Presumably, taking into account the sales of foreign affiliates would indicate a faster pace of liberalization in services than found in the previous section.

Second, the sample is limited to 23 OECD countries plus China. The reason for this limitation is the need of gross output data for manufacturing and services, which are not available for most countries. Expanding the sample of countries to include more developing countries would likely generate a stronger asymmetry in the pace of liberalization of manufacturing versus service trade. These extensions of the empirical analysis will be feasible when more data are available.

¹⁶In 2008, the U.S. total export of services was 518.3 billions while the total sales of U.S. foreign affiliates in the service sector were 761.5 billions

¹⁷they exists only at the aggregate level. Only the US records the data also by partner country, but bilateral data are needed in order to use a structural gravity model

3 A Simple Two Period Model: Partial Equilibrium

In this section, I develop a simple theoretical model that explains the channels through which the interaction between comparative advantage and asymmetric trade liberalization can explain the emergence of current account deficits. I start with a partial equilibrium setting in this section and move to general equilibrium in the next section.

A small open economy is populated by a representative household that lives for two periods with perfect foresight. Two goods are consumed: a home good (h) and a foreign good (f). The endowment of the home good for the two periods is Y_t^h with $t = \{1, 2\}$. The prices of the home goods is p_t^h . The foreign good is imported from the rest of the world at exogenous price p_t^{f*} , set to be the numeraire. The internal price of the imported good is $p_t^f = \tau_t^f p_t^{f*}$, where $\tau_t^f > 1$ is an iceberg trade cost that captures impediments to trade.

The household maximizes:

$$\frac{C_1^{1-\frac{1}{\sigma}}-1}{1-\frac{1}{\sigma}} + \beta \frac{C_2^{1-\frac{1}{\sigma}}-1}{1-\frac{1}{\sigma}},$$

where $\sigma > 0$ is the intertemporal elasticity of substitution and $\beta \in (0, 1)$ is the discount factor.

The consumption basket aggregates the home goods and foreign goods with unitary elasticity of substitution:

$$C_t = \left(\frac{C_t^h}{\nu} \right)^\nu \left(\frac{C_t^f}{1-\nu} \right)^{1-\nu}, \quad 0 \leq \nu \leq 1$$

The assumption of unitary elasticity of substitution allows me to obtain transparent closed-form solutions. The price index associated to the consumption basket can be written:

$$P_t = (p_t^h)^\nu \left(\tau_t^f p_t^{f*} \right)^{1-\nu}.$$

The representative household has access to a riskless saving instrument denominated in units of the world currency that yields a constant gross return $(1 + r^*)$. The budget constraints for period 1 and 2 imply the intertemporal budget constraint:

$$P_1 C_1 + \frac{P_2 C_2}{1 + r^*} = p_1^h Y_1^h + \frac{p_2^h Y_2^h}{1 + r^*}. \quad (6)$$

The household's maximization problem allows to express the following Euler equation for consumption:

$$C_1 = \beta^{-\sigma} \left((1 + r^*) \left(\frac{P_1}{P_2} \right) \right)^{-\sigma} C_2 \quad (7)$$

Equations (6) and (7) make it possible to solve for C_1 and C_2 . In particular:

$$P_1 C_1 = \frac{1}{1 + \beta^\sigma (1 + r^*)^{\sigma-1} \left(\frac{P_1}{P_2} \right)^{\sigma-1}} \left(p_1^h Y_1^h + \frac{p_2^h Y_2^h}{1 + r^*} \right). \quad (8)$$

The value of consumption in period 1 is a share of lifetime income. The share depends on the discount factor β , the intertemporal elasticity of substitution σ and the consumption-based real interest rate $(1 + r^*) \frac{P_1}{P_2}$. Since the model does not feature investment, the current account in period 1 equals savings:

$$CA_1 = p_1^h Y_1^h - \frac{1}{1 + \beta^\sigma (1 + r^*)^{\sigma-1} \left(\frac{P_1}{P_2} \right)^{\sigma-1}} \left(p_1^h Y_1^h + \frac{p_2^h Y_2^h}{1 + r^*} \right). \quad (9)$$

Equation (9) is the starting point for understanding the possible effects of asymmetric liberalization in trade of the two goods.

3.1 Asymmetric Trade Liberalization

Suppose that the two goods are “manufactured goods” (m) and “services” (s). A simple way to capture an asymmetric trade liberalization process is represented in Figure 9. At the beginning of period 1, impediments to trade in manufactured goods fall and stay low for both periods (dashed line). At the same time, it is known that the impediments to trade in services will fall only at the beginning of period 2 (solid line).

3.2 The Service-Importing Countries Perspective

Take now the perspective of service-importing countries (like Germany, Japan, or China) and consider the effect of the experiment described above. Adjusting appropriately¹⁸, the ratio of the price indexes between period 1 and 2 becomes:

$$\frac{P_1}{P_2} = \left(\frac{p_1^m}{p_2^m}\right)^\nu \left(\frac{\tau_1^s}{\tau_2^s}\right)^{1-\nu} = \left(\frac{\tau_1^s}{\tau_2^s}\right)^{1-\nu}, \quad (10)$$

where the second equality holds under the assumption that p_t^m is constant. Substituting equation (10) into equation (9) yields the following expression for the current account in period 1:

$$CA_1 = p_1^m Y_1^m - \frac{1}{1 + \beta^\sigma \left[(1 + r^*) \left(\frac{\tau_1^s}{\tau_2^s}\right)^{1-\nu} \right]^{\sigma-1}} \left(p_1^m Y_1^m + \frac{p_2^m Y_2^m}{1 + r^*} \right) \quad (11)$$

Inspection of equation (11) shows that $\frac{\partial CA_1}{\partial \tau_2^s} < 0$ if $\sigma > 1$. Anticipating a decrease in trade costs for services in the future pushes households to consume less and save more today (i.e., to run a current account surplus). The channel is best explained by Figure 10, where $Z1$ and $Z2$ are the endowments in the two periods in units of the consumption basket.¹⁹ Suppose the starting point is a situation where preferences and endowment are such that the small open economy would not save nor borrow (so where consumption for periods 1 and 2 is at point Z , coinciding each period with the endowment). A decrease in τ_2^s represents an increase in the consumption-based real interest rate. If the intertemporal elasticity of substitution is sufficiently large, this induces the households to delay consumption to enjoy lower prices in the future (so the consumption point becomes C while the endowment point is still Z).

Notice that the assumption $\sigma > 1$ is crucial for obtaining this result in this partial equilibrium context. While usually the empirically relevant values of σ are thought to be smaller than 1, recent research based on micro-level data found values of σ as high as 2

¹⁸The home good here is manufacturing, m , and the foreign good is services, s .

¹⁹Formally, $Z1 = \frac{p_1^m}{P_1} Y_1^m$ and $Z2 = \frac{p_2^m}{P_2} Y_2^m$

(Gruber, 2005).²⁰ I relax the assumption $\sigma > 1$ in the two-country general equilibrium model.

3.3 The Service-Exporting Countries

Take now the perspective of the service-exporting countries (like the U.S. or UK). The ratio of the price indexes in the two periods can now be expressed as:²¹

$$\frac{P_1}{P_2} = \left(\frac{p_1^s}{p_2^s}\right)^\nu \left(\frac{\tau_1^m}{\tau_2^m}\right)^{1-\nu} = \left(\frac{p_1^s}{p_2^s}\right)^\nu, \quad (12)$$

where the second equality follows from the fact that the trade cost for manufacturing is constant across periods. For these countries, the analogue to equations (9) and (11) is:

$$CA_1 = p_1^s Y_1^s - \frac{1}{1 + \beta^\sigma \left[(1 + r^*) \left(\frac{p_1^s}{p_2^s}\right)^\nu \right]^{\sigma-1}} \left(p_1^s Y_1^s + \frac{p_2^s Y_2^s}{1 + r^*} \right). \quad (13)$$

A reduction in the trade costs of exporting services in the future can generate an increase in the future internal price of services if the increase in demand abroad is strong enough. With $\sigma > 1$, an increase in p_2^s unambiguously generates a current account deficit at period 1. Figure 11 explain the economic channels, here a combination of a decrease in the consumption-based real interest rate and a positive wealth effect coming from the increase in the value of the endowments.²² Starting from a point like Z , where no international borrowing occurs, the decrease in the consumption-based real interest rate is making the budget constraint flatter while the wealth effect is increasing the value of future endowments. As a result, the new optimal allocation for consumption is C , and the country runs a current account deficit.

A natural question is whether the simple channels illustrated in Figures 10 and 11 would survive a more comprehensive treatment that considers the general equilibrium effects of the change in trade costs on all prices. To address this question, I illustrate the results of a comparably simple two-country, general equilibrium model of the world economy.

²⁰Moreover, Barro (2009) explains how $\sigma > 1$ is actually needed to explain features of asset price dynamics.

²¹Remember that now the Home good are services and the foreign good is manufacturing

²²Here $Z1 = \frac{p_1^s}{P_1} Y_1^s$ and $Z2 = \frac{p_2^s}{P_2} Y_2^s$

4 General Equilibrium

The world consists of two countries : Home and Foreign (with foreign variables denoted by *). Each country is populated by a representative household that lives for two periods. Two goods are consumed: a home good (services, s) and a foreign good (manufactured goods, m). The endowment of the home good is Y_t^s with $t = \{1, 2\}$. The endowment of the foreign good is Y_t^{m*} with $t = \{1, 2\}$. The price home good at Home is p_t^s . The price of the home good in Foreign is $p_t^{s*} = \tau_t^s p_t^s$, where $\tau_t^s > 1$ is an iceberg trade cost. The foreign good m is imported in Home from Foreign. The Home price of the foreign good is $p_t^m = \tau_t^m p_t^{m*}$, where p_t^{m*} is the price of the foreign good in Foreign (set to be the numeraire) and $\tau_t^m > 1$ is an iceberg trade cost.

In both countries, households maximize lifetime utility, given by:

$$\frac{X_1^{1-\frac{1}{\sigma}} - 1}{1-\frac{1}{\sigma}} + \beta \frac{X_2^{1-\frac{1}{\sigma}} - 1}{1-\frac{1}{\sigma}}$$

where $X = C$ or C^* depending on the country. The asset menu features only an international bond denominated in units of a common world currency. The first-period and second-period budget constraints are, respectively:

$$B_1 = p_1^s Y_1^s - P_1 C_1, \quad B_1^* = Y_1^{m*} - P_1^* C_1^*, \quad (14)$$

$$P_2 C_2 = p_2^s Y_2^s + (1 + r_1) B_1, \quad P_2^* C_2^* = Y_2^{m*} + (1 + r_1) B_1^*, \quad (15)$$

where B_1 and B_1^* are the net bond positions of Home and Foreign and r_1 is the riskless net rate of return in units of the *numeraire*.

The consumption basket aggregates home and foreign goods. Differently from the partial equilibrium setting, I assume here a C.E.S. aggregate with elasticity of substitution different from 1. The reason is that, as shown by Cole and Obstfeld (1991) and Corsetti and Pesenti (2001), in the presence of unitary elasticity of substitution between home and foreign goods, there are no intertemporal transfers of wealth across countries (i.e., no current account movements). Therefore, the consumption basket in the Home country is defined to be:

$$C_t = \left[(C_t^s)^{\frac{\theta-1}{\theta}} + (C_t^m)^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{1-\theta}},$$

where θ is the elasticity of substitution between goods and services, assumed to be larger than 1. C_t^s represents the consumption of home goods in Home at time t , while C_t^m is the consumption of foreign good in Home at time t . C_t^* , C_t^{s*} , and C_t^{m*} are defined in analogous fashion. The price indexes in Home and Foreign are respectively:

$$P_t = \left[(p_t^s)^{1-\theta} + (\tau_t^m)^{1-\theta} \right]^{\frac{1}{1-\theta}}, \quad P_t^* = \left[(\tau_t^s p_t^s)^{1-\theta} + 1 \right]^{\frac{1}{1-\theta}}. \quad (16)$$

The intertemporal optimization problem yields Euler equations for both Home and Foreign that are identical to equation (7):

$$C_1 = \beta^{-\sigma} \left((1+r_1) \left(\frac{P_1}{P_2} \right) \right)^{-\sigma} C_2 \quad C_1^* = \beta^{-\sigma} \left((1+r_1) \left(\frac{P_1^*}{P_2^*} \right) \right)^{-\sigma} C_2^*. \quad (17)$$

The intratemporal optimization decisions give the following demand equations for $t = \{1, 2\}$:

$$C_t^s = \left(\frac{p_t^s}{P_t} \right)^{-\theta} C_t, \quad C_t^{s*} = \left(\frac{\tau_t^s p_t^s}{P_t^*} \right)^{-\theta} C_t^*, \quad (18)$$

$$C_t^m = \left(\frac{\tau_t^m}{P_1} \right)^{-\theta} C_t, \quad C_t^{m*} = \left(\frac{1}{P_t^*} \right)^{-\theta} C_t^*. \quad (19)$$

To close the model, we must impose goods and bond market clearing conditions. The nature of the iceberg trade costs implies the following goods market clearing conditions:

$$Y_t^s = C_t^s + \tau_t^s C_t^{s*}, \quad (20)$$

$$Y_t^{m*} = \tau_t^m C_t^m + C_t^{m*}. \quad (21)$$

Finally, bond market clearing requires:

$$B_1 + B_1^* = 0. \quad (22)$$

We thus have 21 endogenous variables $(C_t, C_t^*, P_t, P_t^*, C_t^s, C_t^{s*}, C_t^m, C_t^{m*}, p_t^s, B_1, B_1^*, r_1)$ with $t = \{1, 2\}$. The 21 equations (13)-(19) and (21), together with the evolution of the exogenous variables Y_t^j and τ_t^j (with $t = \{1, 2\}$ and $j = h, f$) completely characterize the equilibrium of this economy.²³

Unfortunately, one cannot obtain closed-form solutions without unitary elasticity of substitution between home and foreign goods. To make the results transparent, instead of relying on numerical examples, I will present analytical results based on the log-linearized version of the model around a symmetric steady state.

4.1 A Symmetric Steady State

The analysis below is based on a log-linearization of the model around a symmetric steady state where $\bar{p}^s = \bar{p}^{m*} = 1$, $\bar{B}_1 = \bar{B}_1^* = 0$, $\bar{Y}^s = \bar{Y}^{m*} = \bar{Y}$, and $\bar{\tau}^s = \bar{\tau}^m = \tau$.

In this symmetric steady state, price indexes are equal:

$$\bar{P} = \bar{P}^* = (1 + \tau^{1-\theta})^{\frac{1}{1-\theta}}. \quad (23)$$

Moreover, we have:

$$\bar{C} = \bar{C}^* = \frac{\bar{Y}}{\bar{P}}, \quad (24)$$

$$\bar{C}^s = \bar{C}^{m*} = \bar{P}^\theta \bar{C}, \quad (25)$$

$$\bar{C}^m = \bar{C}^{s*} = \tau^{-\theta} \bar{P}^\theta \bar{C}. \quad (26)$$

Finally the Home share of consumption of the home good is equal to the Foreign share of consumption of the foreign good:

²³By Walras Law', the clearing of the bond and service markets implies the clearing of the manufacturing market.

$$\frac{\bar{C}^s}{\bar{C}^s + \tau \bar{C}^{s*}} = \frac{\bar{C}^{m*}}{\tau \bar{C}^m + \bar{C}^{m*}} = s_h = \frac{1}{1 + \tau^{1-\theta}}. \quad (27)$$

Notice that the foreign share of consumption of the home good includes also the amounts lost to trade costs. On the other hand, the Home share of consumption of the foreign good is:

$$\frac{\tau \bar{C}^m}{\tau \bar{C}^m + \bar{C}^{m*}} = \frac{\tau \bar{C}^{s*}}{\bar{C}^s + \tau \bar{C}^{s*}} = s_f = \frac{\tau^{1-\theta}}{1 + \tau^{1-\theta}} \quad (28)$$

Consistent with intuition, it is straightforward to check that $\frac{\partial s_h}{\partial \tau} > 0$ and $\frac{\partial s_f}{\partial \tau} < 0$. In other words, the introduction of the trade costs creates home bias in this setting even in absence of home bias in preferences.²⁴ Finally, symmetry implies that $s_h = 1 - s_f$. This property is extremely useful in the process of log-linearization.

4.2 The Log-Linear Model

I denote percentage deviations from the symmetric steady state with a hat. So $\hat{x} = \log\left(\frac{x}{\bar{x}}\right)$, where \bar{x} is the value of x at the symmetric steady state. The details of the log-linearization and the solution of the model are described in the appendix. To focus my attention on the effect of trade costs, from now on I assume that endowments are constant. The Euler equations take the log-linear form:

$$\hat{C}_1 = -\sigma(1 - \beta)\hat{r}_1 - \sigma\hat{P}_1 + \sigma\hat{P}_2 + \hat{C}_2, \quad (29)$$

$$\hat{C}_1^* = -\sigma(1 - \beta)\hat{r}_1 - \sigma\hat{P}_1^* + \sigma\hat{P}_2^* + \hat{C}_2^*. \quad (30)$$

The log-linear versions of the period-1 budget constraint in Home and Foreign are:

$$\hat{B}_1 = \hat{p}_1^s - \hat{P}_1 - \hat{C}_1, \quad (31)$$

$$\hat{B}_1^* = -\hat{P}_1^* - \hat{C}_1^*, \quad (32)$$

²⁴A point already made by Obstfeld and Rogoff (2001).

where importantly the current account the percentage deviation from the equilibrium output \bar{Y} .²⁵ The budget constraints for period 2 are:

$$\hat{C}_2 = \hat{p}_2^s - \hat{P}_2 + \frac{1}{\beta} \hat{B}_1, \quad (33)$$

$$\hat{C}_2^* = -\hat{P}_2^* + \frac{1}{\beta} \hat{B}_1^*. \quad (34)$$

Taking the difference between (31) and (32) and imposing the bond market clearing condition, we get the following expression for the current account of the Home country in period 1 (equivalent to the country's net foreign asset at the end of the period):

$$2\hat{B}_1 = \hat{p}_1^s - (\hat{P}_1 - \hat{P}_1^*) - (\hat{C}_1 - \hat{C}_1^*). \quad (35)$$

Equation (35) expresses the current account of the Home country as a function of the terms of trade (p_1^s), the real exchange rate and the consumption differential. Everything else equal, an improvement of the terms of trade would lead to a current account surplus and a real appreciation to a current account deficit. An increased consumption differential between the Home and the Foreign country would lead to a current account deficit at Home. Using the difference between (29) and (30) and the difference between (33) and (34), we can rewrite (35) as

$$\frac{2(1+\beta)}{\beta} \hat{B}_1 = \hat{p}_1^s - \hat{p}_2^s + (\sigma - 1) (\hat{P}_1 - \hat{P}_2) - (\sigma - 1) (\hat{P}_1^* - \hat{P}_2^*). \quad (36)$$

Equation (36) allows us to interpret the evolution of Home's current account as depending on four factors. The first two represent a wealth effect. All else equal, consumption smoothing tends to push the Home current account toward surplus (deficit) in case of an increase of the value of the home endowment relative to the foreign endowment in period 1 (period 2). The next two terms represent a substitution effect. All else equal, if the intertemporal elasticity of substitution is larger than 1, an increase of the home price index in period 2 relative to

²⁵This is necessary because net foreign asset are zero in the symmetric steady state

period 1 tends to push Home's current account toward deficit, as would a decrease in the foreign price index in period 2 relative to period 1. These channels are the analogues to those explored in the partial equilibrium model of the previous section.

Obviously, one must solve fully the model to have the impact of the different exogenous variables on the current account. While the appendix explains the procedure in detail, I will give only a quick sketch here. For both periods, I substitute the budget constraints into the demand functions for services, and then I use the goods market clearing conditions to solve for \hat{p}_t^s as function of the trade costs and \hat{B}_1 (imposing bonds market condition eliminates \hat{B}_1^* from the system). I then express all the four elements of equation (36) as functions of the trade costs and \hat{B}_1 . Finally, I substitute these functions back into equation (36). This allows me to express Home's current account only as function of the exogenous trade costs:

$$\hat{B}_1 = -\eta(\hat{\tau}_1^s - \hat{\tau}_1^m) + \eta(\hat{\tau}_2^s - \hat{\tau}_2^m) \quad (37)$$

where η is a function of the structural parameters of the model $(\beta, \theta, \sigma, \tau)$. η is a positive number as long as $\theta > 1$ and the elasticity of intertemporal substitution is sufficiently large.²⁶

Equation (37) is the key equation. It is important to notice that the relevant shock is the change in the trade cost the home good (services) *relative* to the change of the transport cost of the foreign good (manufacturing). Any symmetric trade liberalization in which the trade costs for manufacturing and services move in the same way would not have any impact on the current account. On the other hand, asymmetric trade liberalization processes for which $(\hat{\tau}_1^s - \hat{\tau}_1^m) > 0$ and/or $(\hat{\tau}_2^s - \hat{\tau}_2^m) < 0$ push the current account of the Home country into deficit.

More generally, equation (37) challenges the view that trade policies cannot influence the trade balance because they cannot affect savings and investment decisions.²⁷ While this is certainly true in static settings, things can be different in dynamic settings where the timing of the trade policy potentially matters for saving and investment (which are intertemporal

²⁶The requirement here is weaker than $\sigma > 1$. More precisely, it is sufficient that $\sigma > 1 - g(\beta, \theta, \tau)$. See the appendix for details.

²⁷see for instance Lamy (2010).

decisions).²⁸

5 Quantitative Relevance

This section evaluates the quantitative relevance of the explanation for global imbalances proposed in this paper. I will evaluate the quantitative relevance from both a time-series and a cross-sectional perspective.

5.1 Time Series

I begin by transforming the two-period model presented in Section 4 into a multi-period model by letting the time horizon of the model become infinite and replacing the flow budget constraints (14) and (15) with the following budget constraint:²⁹

$$B_t + \frac{\delta}{2}(B_t)^2 = (1 + r_{t-1})B_{t-1} + p_t^s Y_t^s - P_t C_t + T, \quad (38)$$

where $\frac{\delta}{2}(B_t)^2$ is an adjustment cost for bond holding that makes the model stationary (following Turnovsky, 1985). The adjustment cost is rebated in lump-sum fashion to households (so in equilibrium $T_t = \frac{\delta}{2}(B_t)^2$).³⁰

The exercise I perform consists of solving the model in levels under the assumption of perfect foresight and using the profile of reductions of the trade costs found in Section 2 as the exogenous driving force.

Table 3 reports the calibration that I use in the experiment. I set β to 0.96 to have a model at annual frequency. I set σ 1 and θ 1.5 (following Backus, Kehoe and Kydland, 1994). I set τ to get us a ratio of imports to GDP of 15%, implying $\tau = 2.7$. Although this might seem an extreme value for τ , it is exactly the value suggested by Anderson and Van Wincoop (2004). Importantly, notice that the value of the trade cost is calibrated in

²⁸Obviously here the point is made only for savings.

²⁹(38) is the budget constraint for Home. A similar constraint hold abroad.

³⁰The calibrated value for the parameter δ is 0.00025, to ensure that besides delivering stationarity, the bond adjustment cost does not interfere with any of the economically relevant dynamics of the model.

this exercise. It is only the profile of the reduction in the trade costs that is taken from the empirical evidence in Section 2.

I proceed first considering a symmetric reduction in the trade costs in both sectors equal to that observed for manufacturing for the period 1994-2005. Then I consider a situation where the trade cost in manufacturing follows the pattern I found in section 2 for the years 1994 to 2005, while the trade cost for services is fixed for the first 12 years and then follows the same pattern of decrease as the trade cost in manufacturing for the following 12 years.³¹

Figure 12 reports the result for key variables of the model in the case of a symmetric reduction in transport costs. Consistent with intuition, and with equation (37), there is no change in either the net foreign asset position or the net exports of either country. Consumption increases in both countries because of the reduction in the price indexes, and the only relative effect is a change in the allocation of consumption in both countries toward the good produced by the other country.

Figure 13 reports the results for the asymmetric liberalization process. The home country (whose goods are “liberalized” later) accumulates net foreign liabilities in anticipation of a future improvement of the relative price of its own good (an anticipated future improvement of its terms of trade). Net exports first decrease and then increase, when the home country experiences the export boom that follows the liberalization of trade in its own good. Consumption at Home initially increases and then starts declining slightly, while the consumption in Foreign country declines slightly at the beginning and starts increasing later, driven by the import boom generated by the reduction in the trade costs for the home good.

In order to gauge the quantitative relevance of this phenomenon, Figure 14 plots the results obtained for Home’s current account under the symmetric and asymmetric liberalization episodes and the current account deficit of the U.S. for the same period (both scaled by GDP). As the figure shows, with the asymmetric trade liberalization process, the model generates a current account deficit of about 1% of GDP for 2006 (when the U.S. deficit peaked), equal to roughly 20% of the data counterpart.

In Figure 15, I repeat the same exercise using different values for the intertemporal

³¹Obviously this is a strong assumption, but it is a reasonable way of capturing the evidence.

elasticity of substitution. Pushing σ up to 2 (the value found in Gruber, 2005, and recently proposed by Barro, 2009) the model generates a current account deficit to GDP ratio of 3.5%. Lowering σ to 0.5, the model is unable to generate a current account deficit.

While the exact extent of the current account deficit produced by the model is certainly sensitive to parameter values, I conclude that the story presented in this paper is potentially relevant not only qualitatively, but also quantitatively. Obviously, a more complex and realistic model would be necessary to evaluate the quantitative relevance of this explanation for global imbalances more carefully. I leave this for future research.

5.2 Cross Section

On the cross-sectional dimension, I evaluate whether the explanation proposed in this paper can shed light also on the cross-sectional distribution of current account balances. If the argument proposed in this paper is valid, we should expect a negative relation between comparative advantage in services and current account balances.

Figure 16 presents a scatter-plot for the 32 OECD countries plus Brazil, China, India, and Russia. The horizontal axis gives the revealed comparative advantage index in services in 1995. The vertical axis shows the current account balance over GDP in 2006. As the figure shows clearly, there is a negative relationship between the two variables. Out of 36 countries, in 29 cases we observe either a revealed comparative advantage in services in the mid-nineties associated with a current account deficit in 2006 (for instance, for the US, UK, Italy and France) or a comparative disadvantage in services in 1995 associated with a current account surplus in 2006 (Japan, China, and Germany, but also Russia and Brazil).

In Figure 17, I extend the sample to include another 30 developing countries (the upper-middle income countries according to the World Bank classification). The relationship between revealed comparative advantage in services and the current account is still negative, and highly significant.³² In Table 4 I analyze the relation in a regression framework. As

³²Notice the group of oil-producing countries displaying a comparative disadvantage in services and current account surpluses (Kuwait, Libya and Saudi Arabia) together with a group of smaller countries specialized in tourism and displaying current account deficits (Bahamas, Greece, and Cyprus).

evident from the first column, specialization in services in the mid-nineties alone can explain about 45% of the variation of the cross-sectional current account over GDP ratios in 2006. Moreover, as visible in columns (2)-(4), this negative relation is remarkably stable even after controlling for openness, GDP growth, GDP per capita, and financial development indicators such as private credit over GDP or stock market capitalization over GDP.

I conclude that there is *prima facie* evidence that the explanation for global imbalances proposed in this paper might be quantitatively relevant also in explaining the cross-sectional dimension of the data.

6 Conclusion

This paper has proposed a new explanation for the emergence of global imbalances. The focus is on the interplay between the comparative advantage of the U.S. in services and the asymmetric trade liberalization process in goods trade versus service trade that took place in the last two decades, particularly since the mid-nineties. This explanation complements existing ones by adding a quantitative non-negligible “real” piece to the global imbalances puzzle.

The first and most obvious policy implication of this paper is that liberalization of trade in services represents a possible margin of adjustment that might alleviate global imbalances without necessarily implying a large depreciation of the dollar.³³ A similar suggestion has recently been proposed by Claessens, Evenett, and Hoekman (2010) and Kowalski and Leshy (2010).

The second, indirect, policy implication is that, if one believes the asymmetry in the liberalization of service trade and manufacturing trade will continue³⁴, then there could be a case for a “return” of the U.S. to manufacturing.

There are several directions for future research. First, it would be interesting to study service trade at a more disaggregated level, thus taking better account of the heterogeneity

³³As suggested by the work of Blanchard, Giavazzi, and Sa (2005) and Obstfeld and Rogoff (2005).

³⁴Contrary to what assumed in the quantitative exercise performed in this paper.

between service industries.

Second, it would be interesting to study FDI in services both empirically and theoretically to evaluate how introducing FDI would affect the conclusions of this paper. The key constraint is the lack of data on bilateral foreign affiliate sales in the service sector.

Third, it would be important to develop a more complete model that might assess more carefully the quantitative relevance of the mechanisms proposed in this paper. I plan to pursue these avenues for research in future work.

A Appendix

A.1 Data

The data sources used in this paper are several. The data used for Figures 1-6 are taken from the World Bank World Development Indicators (WDI), namely the series for the GDP, the export and imports of goods and services and the income balance. In the empirical analysis of sections 2.2.1 and 2.2.2 the data on trade in services come from the Trade in Service Database, developed by Francois et al (2009) using OECD, Eurostat and IMF data. The data for trade in manufacturing are taken from the UN-Comtrade database. The distance data is the population-weighted data of the distance dataset of the CEPIL, while the data on common borders, language, legal origin and colonial origin are taken from Baranga (2009). Importantly, in the regressions enter also the “internal trade” (the *ii* elements), defined as production minus exports. The sample of countries includes 23 OECD countries plus China (Austria, Canada, China, Czech Republic, Germany, Denmark, Spain, Finland, France, Greece, Hungary, Iceland, Italy, Japan, Korea, Netherlands, Norway, New Zealand, Poland, Portugal, Slovakia, Sweden, UK, US). The sample is reduced because of the need for data on gross output at the sectoral level, available from the OECD-STAN database only for few countries. The output data at the sectoral level for China are available from the *China Statistical Yearbook* I-O tables, but only for 1997,2000,2002,2005. The data for the remaining years are imputed by multiplying the value added data (GDP at sector level, available from the national income account) by the output/value added ratio at the sectoral level found the nearest available year (so using the 1997 data for the period 1994-1998, the 2000 data for the period 1999-2001, the 2002 data for the period 2002-2003 and the 2005 data for the period 2004-2005). In section 5.2 I use data on 32 OECD plus 32 developing countries, including the BRIC (Brazil, India, China, Russia) and the other upper-middle income countries (with a real GDP per capita in 2006 of more than \$3940 Us dollars). All the variables used in that section come from the World Bank WDI.

A.2 Model

A.2.1 The Two-Country Model

Here are the 23 equations of the model:

$$C_2 = \beta^\sigma \left((1 + r_t) \left(\frac{P_1}{P_2} \right) \right)^\sigma C_1 \quad C_2^* = \beta^\sigma \left((1 + r_t) \left(\frac{P_1^*}{P_2^*} \right) \right)^\sigma C_1^* \quad (39)$$

$$B_1 = p_1^s Y_1^s - P_1 C_1 \quad B_1^* = p_1^{m*} Y_1^m - P_1^* C_1^* \quad (40)$$

$$P_2 C_2 = p_2^s Y_2^s + (1 + r_t) B_1 \quad P_2^* C_2^* = p_2^{m*} Y_2^f + (1 + r_t) B_1^* \quad (41)$$

$$P_t = \left[(p_t^s)^{1-\theta} + (\tau_t^m p_t^{m*})^{1-\theta} \right]^{\frac{1}{1-\theta}} \quad P_t^* = \left[(\tau_t^s p_t^s)^{1-\theta} + (p_t^{m*})^{1-\theta} \right]^{\frac{1}{1-\theta}} \quad (42)$$

$$C_t^s = \left(\frac{p_t^s}{P_t} \right)^{-\theta} C_t \quad C_t^{s*} = \left(\frac{\tau_t^s p_t^s}{P_t^*} \right)^{-\theta} C_t^* \quad (43)$$

$$C_t^m = \left(\frac{\tau_t^m p_t^{m*}}{P_t} \right)^{-\theta} C_t \quad C_t^{m*} = \left(\frac{p_t^{m*}}{P_t^*} \right)^{-\theta} C_t^* \quad (44)$$

$$Y_t^s = C_t^s + \tau_t^s C_t^{s*} \quad (45)$$

$$Y_t^{m*} = \tau_t^m C_t^m + C_t^{m*} \quad (46)$$

$$B_t + B_t^* = 0 \quad (47)$$

So we have 23 endogenous variables ($C_t, C_t^*, P_t, P_t^*, C_t^s, C_t^{s*}, C_t^m, C_t^{m*}, p_t^s, B_1, B_1^*, r_1$) with $t = [1, 2]$. The 23 equation (39)-(47), together with the evolution of the exogenous variables Y_t^j and τ_t^j (with $t = [1, 2]$ and $j = [s, m]$) completely characterize the equilibrium of this economy. I fix p_t^{m*} to be the *numeraire*. Finally, by Walras Law, I can eliminate the manufacturing goods market clearing conditions.

A.2.2 The Complete Log Linearized Model

I denote with \hat{x} the percentage deviations from the symmetric steady state. So $\hat{x} = \log\left(\frac{x}{x^*}\right)$, where x^* is the value of x at the symmetric equilibrium. Log-linearizing the model around the symmetric steady state described in the main texts gives us:

$$\hat{C}_2 = \sigma(1 - \beta)\hat{r}_1 + \sigma\hat{P}_1 - \sigma\hat{P}_2 + \hat{C}_1 \quad \hat{C}_2^* = \sigma(1 - \beta)\hat{r}_1 + \sigma\hat{P}_1^* - \sigma\hat{P}_2^* + \hat{C}_1^* \quad (48)$$

$$\hat{B}_1 = \hat{p}_1^s - \hat{P}_1 - \hat{C}_1 \quad \hat{B}_1^* = -\hat{P}_1^* - \hat{C}_1^* \quad (49)$$

$$\hat{C}_2 = \hat{p}_2^s - \hat{P}_2 + \frac{1}{\beta}\hat{B}_1 \quad \hat{C}_2^* = -\hat{P}_2^* + \frac{1}{\beta}\hat{B}_1^* \quad (50)$$

$$\hat{C}_t^s = -\theta\left(\hat{p}_t^s - \hat{P}_t\right) + \hat{C}_t \quad \hat{C}_t^{s*} = -\theta\left(\hat{p}_t^s + \hat{\tau}_t^s - \hat{P}_t^*\right) + \hat{C}_t^* \quad (51)$$

$$\hat{C}_t^m = -\theta\left(+\hat{\tau}_t^m - \hat{P}_t\right) + \hat{C}_t \quad \hat{C}_t^{m*} = \theta\hat{P}_t^* + \hat{C}_t^* \quad (52)$$

$$\hat{P}_t = s_h \hat{p}_t^s + s_f (\hat{\tau}_t^m) \quad \hat{P}_t^* = (1 - s_h) (\hat{p}_t^s + \hat{\tau}_t^s) \quad (53)$$

$$s_h \hat{C}_t^s + (1 - s_h) (\hat{\tau}_t^s + \hat{C}_t^{s*}) = 0 \quad (54)$$

$$\hat{B}_1 + \hat{B}_1^* = 0 \quad (55)$$

A.2.3 Solution

In order to solve the model, I plug into equation (54) the home and foreign version of equation (51) for period one. I then substitute in the resulting equation the Price indexes and the aggregate consumption levels using the period 1 budget constraints (49) and the Price index definitions (53). This gives me an equation in two unknowns, from which I derive an expression for \hat{p}_1^s as function of $\hat{\tau}_1^s$, $\hat{\tau}_1^m$ and \hat{B}_1 :

$$\hat{p}_1^s = \gamma_1 (\hat{\tau}_1^s - \hat{\tau}_1^m) - \beta \gamma_0 \hat{B}_1 \quad (56)$$

Where I defined the following parameters (some of the signs are valid only under the restriction $\theta > 1$):

$$\begin{aligned} \alpha_0 &= \frac{s_h - s_f}{\beta} > 0 \\ \alpha_1 &= s_f s_h (\theta - 1) > 0 \\ \alpha_2 &= 2\alpha_1 + s_f > 0 \\ \gamma_0 &= \frac{\alpha_0}{\alpha_2} > 0 \\ \gamma_1 &= -\frac{\alpha_1}{\alpha_2} < 0 \end{aligned} \quad (57)$$

Moreover, It is easy to show how:

$$\hat{P}_1 - \hat{P}_1^* = \gamma_2 (\hat{\tau}_1^s - \hat{\tau}_1^m) - (s_h - s_f) \beta \gamma_0 \hat{B}_1 \quad (58)$$

with $\gamma_2 = (s_h - s_f) \gamma_1 - s_f < 0$.

Repeating the same procedure for period two, I get a very similar expression:

$$\hat{p}_2^s = \gamma_1 (\hat{\tau}_2^s - \hat{\tau}_2^m) + \gamma_0 \hat{B}_1 \quad (59)$$

and

$$\hat{P}_2 - \hat{P}_2^* = \gamma_2 (\hat{\tau}_2^s - \hat{\tau}_2^m) + (s_h - s_f) \gamma_0 \hat{B}_1 \quad (60)$$

Plugging back equations (56)-(60) into equation (36) after rearranging and defining

$$\eta = -\frac{\beta(\gamma_1 + (\sigma - 1)\gamma_2)}{2(1 + \beta) + \beta\gamma_0(1 + \beta)[1 + (s_h - s_f)(\sigma - 1)]} > 0 \quad (61)$$

gives equation (37) in the main text. From Equation (61) is possible to derive the restriction on the intertemporal elasticity of substitution that makes η a positive number (given $\theta > 1$). In particular, it has to be $\sigma > 1 - \frac{\frac{\alpha_1}{\alpha_2}}{(s_h - s_f)\frac{\alpha_1}{\alpha_2} + s_f}$

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Table 1: PPML Results, Manufacturing and Service Trade

Industry	Manuf	Manuf	Total	Total	Business	Business
Year	1999	2005	Services	Services	Services	Services
distance	-1.009*** (0.083)	-1.145*** (0.086)	-0.830*** (0.141)	-0.858*** (0.096)	-0.826*** (0.170)	-0.829*** (0.103)
border	0.078 (0.244)	0.089 (0.178)	0.164 (0.475)	0.116 (0.297)	0.227 (0.503)	0.113 (0.275)
language	-0.208 (0.171)	-0.339** (0.138)	-0.025 (0.283)	-0.106 (0.175)	-0.111 (0.339)	-0.064 (0.159)
colonial	0.608*** (0.186)	0.461** (0.182)	1.086*** (0.205)	0.826*** (0.145)	1.127*** (0.192)	0.861*** (0.133)
legal	0.528*** (0.116)	0.340*** (0.103)	0.550*** (0.167)	0.584*** (0.120)	0.563*** (0.172)	0.567*** (0.121)
smctry	2.824*** (0.199)	2.095*** (0.195)	5.755*** (0.335)	5.371*** (0.230)	4.481*** (0.400)	4.221*** (0.237)
Imp FE	Yes	Yes	Yes	Yes	Yes	Yes
Exp FE	Yes	Yes	Yes	Yes	Yes	Yes
N	576	576	449	532	356	457

Standard Errors in Parenthesis

*, **, *** Statistically Significant at 10%, 5% and 1%

Table 2: CHB, Manufacturing and Services

Industry	Manuf	Manuf	Manuf	Total	Total	Business	Business
Year	1994	1999	2005	Services	Services	Services	Services
USA	3.2	2.9	3.3	2.3	2.4	2.1	2.2
JPN	3.8	5.1	6.3	5.9	8.0	6.5	8.6
DEU	9.5	10.0	9.7	12.2	13.3	11.0	11.3
GBR	20.2	17.9	19.2	15.3	14.0	13.0	12.0
FRA	15.0	14.6	13.2	17.0	15.6	14.8	13.0
ITA	16.5	15.1	14.0	20.7	19.0	20.6	17.9
CHN	17.8	11.1	6.0	43.4	21.4		
CAN	30.4	25.8	21.0	39.0	33.0	36.4	29.7
ESP	30.8	26.5	20.5	43.3	33.5	44.7	33.4
KOR	26.8	26.7	18.6	65.9	50.3	60.5	44.9
NLD	59.1	57.1	51.7	57.6	53.6	49.3	45.4
SWE	85.6	65.2	57.4	93.3	92.0	80.6	77.1
AUT	84.7	79.7	65.5	122.3	116.3	114.0	100.9
POL	129.3	88.8	59.1	161.6	122.0		
DNK	149.2	143.5	122.3	145.1	133.4	142.6	114.5
NOR	147.8	119.0	91.2	164.6	136.0	134.3	105.7
GRC	198.1	187.0	152.9	205.5	159.3	287.8	210.5
PRT	137.4	122.7	105.7	214.9	190.6	224.6	189.3
FIN	157.9	119.9	102.1	213.5	198.4	214.9	208.6
CZE	197.9	140.1	75.5	431.1	270.4	358.3	199.8
NZL	401.0	445.0	341.1	385.1	286.4		
HUN	283.0	207.0	120.2	558.2	336.0	537.7	296.9
SVK	448.5	313.8	152.2	1082.3	755.7	820.8	561.0
ISL	2538.7	1802.9	1334.4	3148.9	2068.0	3161.0	1851.2

Table 3: Calibration

Parameter	Meaning	Baseline
σ	Intertemp. Elast of substitution	1
β	Discount Factor	0.96
θ	Intratemp. Elast of substitution	1.5
τ	Trade Cost	2.7
δ	Bond Adj. cost	0.00025

Table 4: **Dependent Variable: Current Account/GDP in 2006**

	(1)	(2)	(3)	(4)
RCA_Serv_95	-0.096*** (0.013)	-0.102*** (0.013)	-0.097*** (0.012)	-0.092*** (0.020)
Openness		0.036 (0.023)	0.033 (0.021)	0.026 (0.023)
gdp_growth		0.491 (0.562)	0.292 (0.525)	0.621 (0.686)
gdp_pc_real		0.029 (0.019)	0.062*** (0.021)	0.015 (0.023)
credit_gdp			-0.090*** (0.028)	
mkt_cap_gdp				0.046 (0.030)
R-squared	0.459	0.498	0.569	0.307
N	67	66	65	58

Standard Errors in Parenthesis

*, **, *** Statistically Significant at 10%, 5% and 1%

Figure 1: Composition of the US Current Account Balance (I), Percentage of GDP

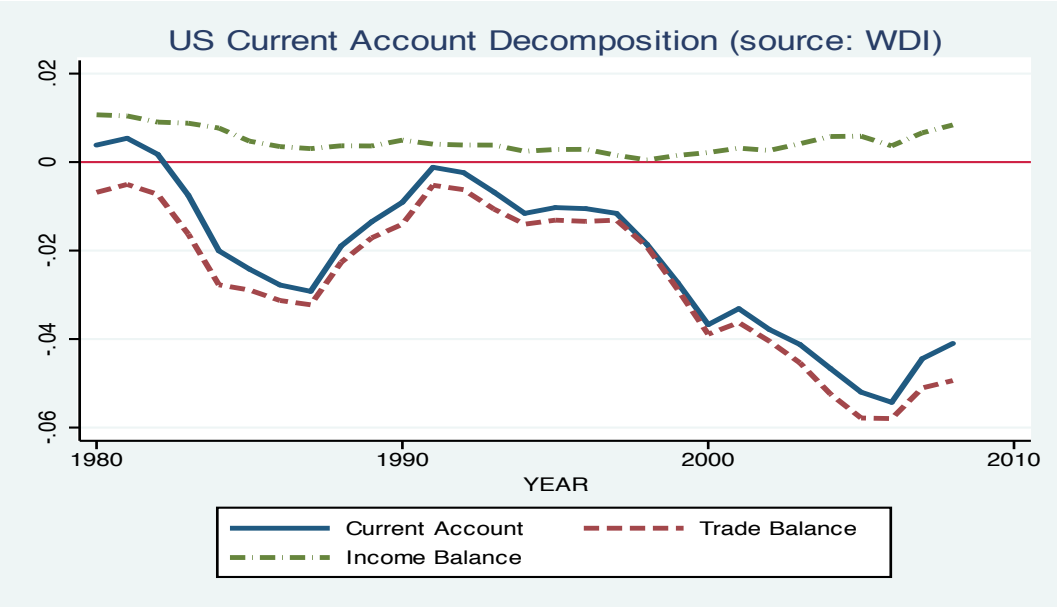


Figure 2: Composition of the US Current Account Balance (II), Percentage of GDP

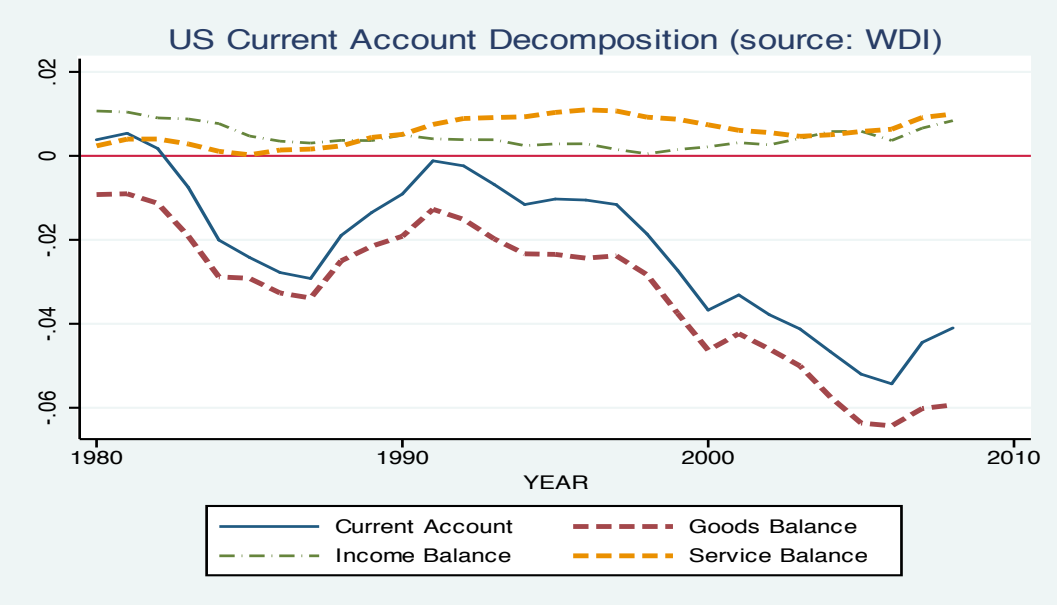


Figure 3: Composition of the Japan's Current Account Balance, Percentage of GDP

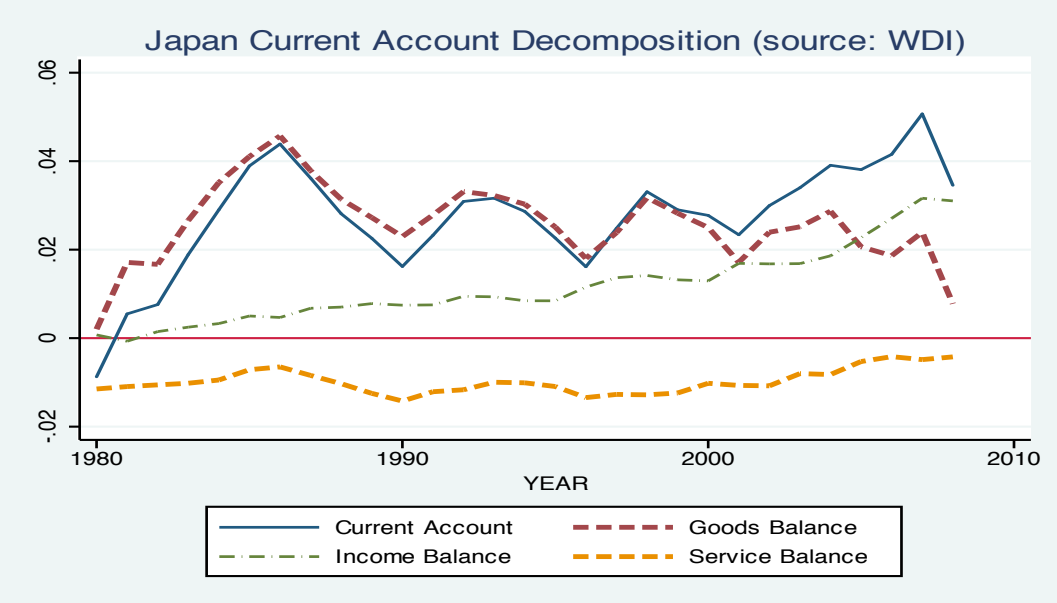


Figure 4: Composition of the Germany's Current Account Balance, Percentage of GDP

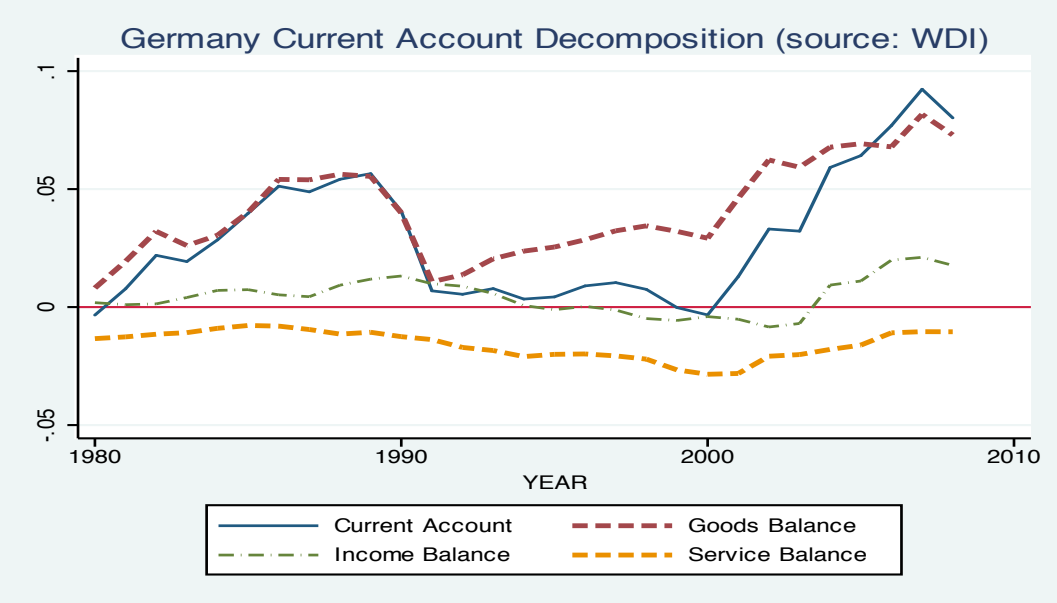


Figure 5: Composition of the China's Current Account Balance, Percentage of GDP

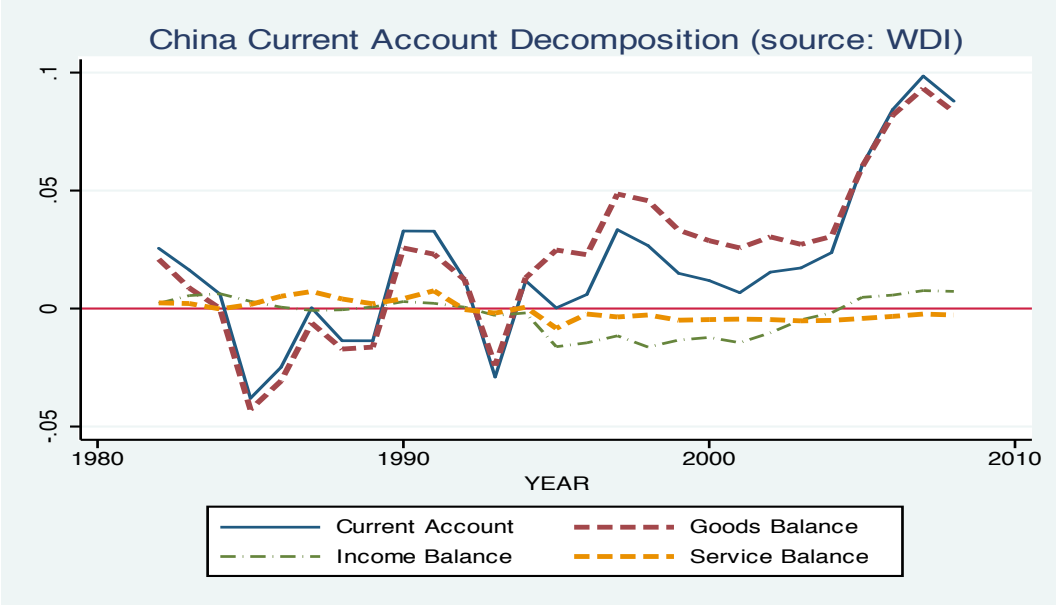


Figure 6: Revealed Comparative Advantage Index, Services, Selected Countries, 1994-2005

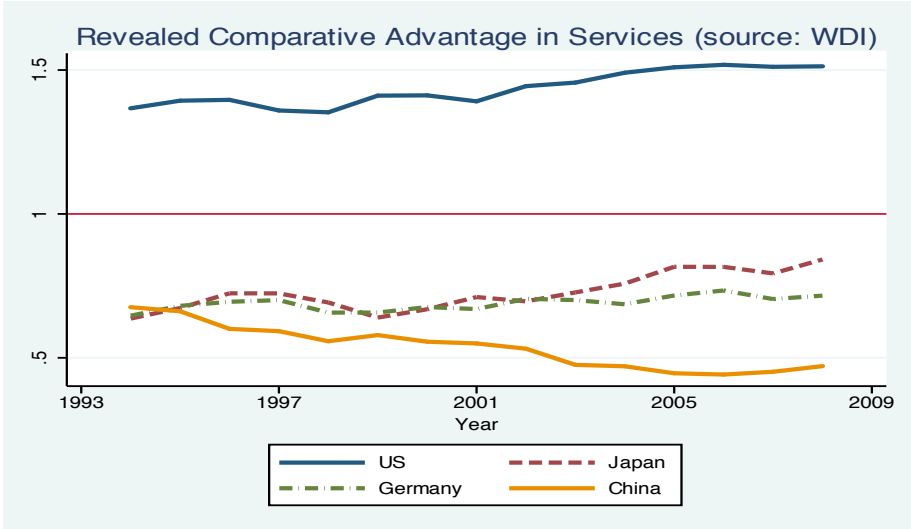


Figure 7: Constructed Home Bias World Index, Manufacturing (1994-2005) and Services (1999-2005)

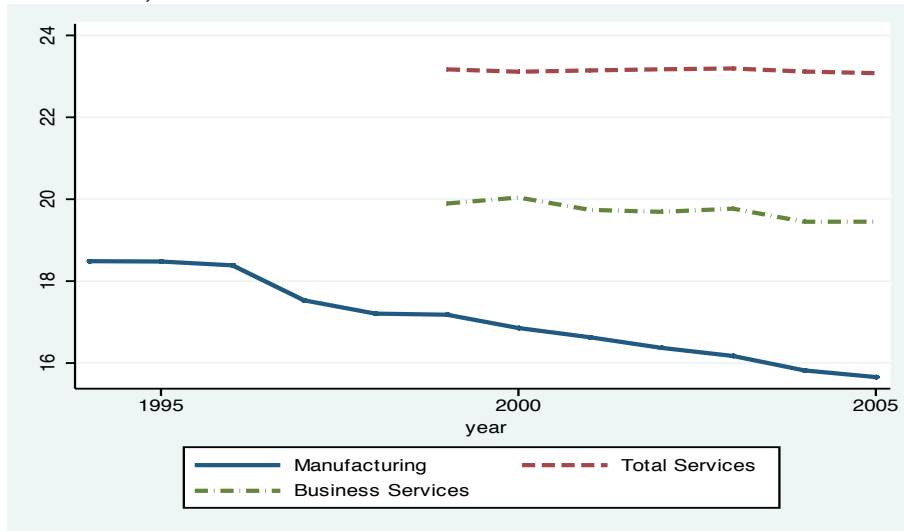


Figure 8: Constructed Home Bias World Index, Manufacturing (1994-2005) and Services (1999-2005). First year=100

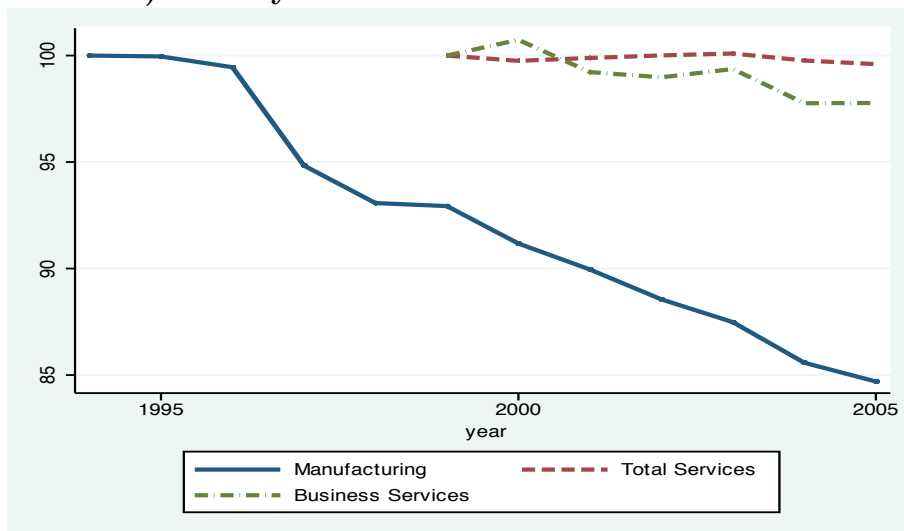


Figure 9: Goods Trade vs. Service Trade: An Asymmetric Trade Liberalization Process

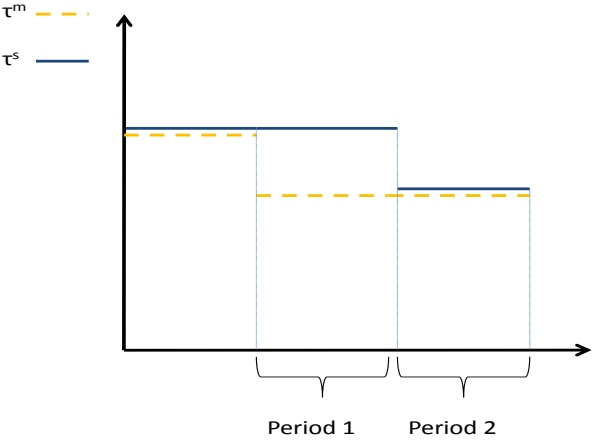


Figure 10: Asymmetric Trade Liberalization and Current Account: Service Importers

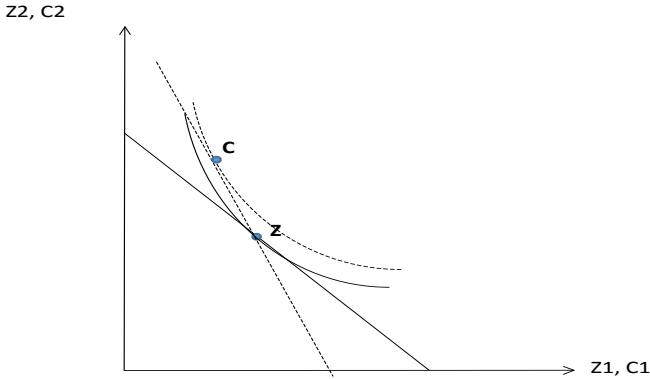


Figure 11: Asymmetric Trade Liberalization and Current Account: Service Ex-
porters

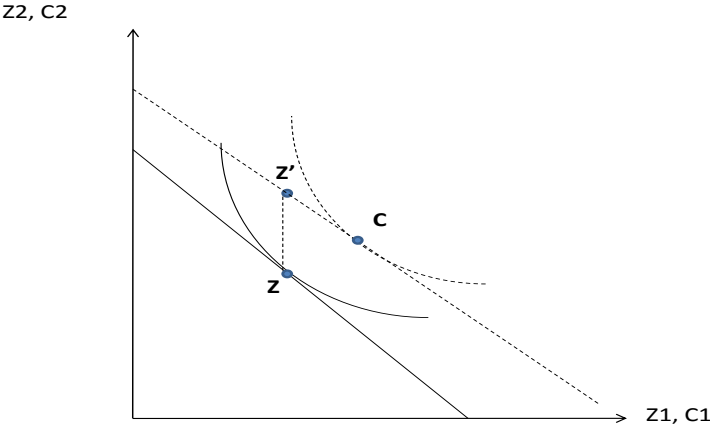


Figure 12: Model Simulations: Symmetric Trade Liberalization

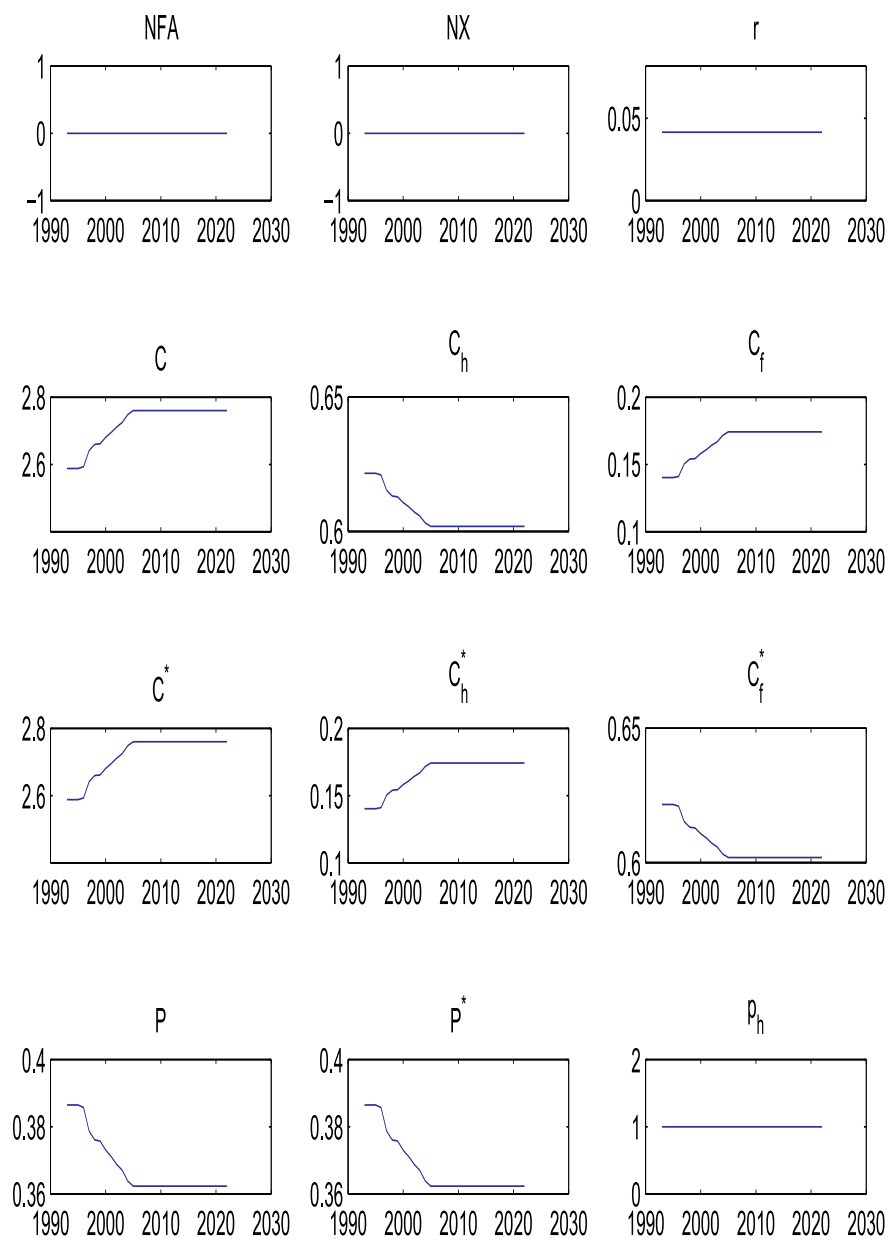


Figure 13: Model Simulations: Asymmetric Trade Liberalization

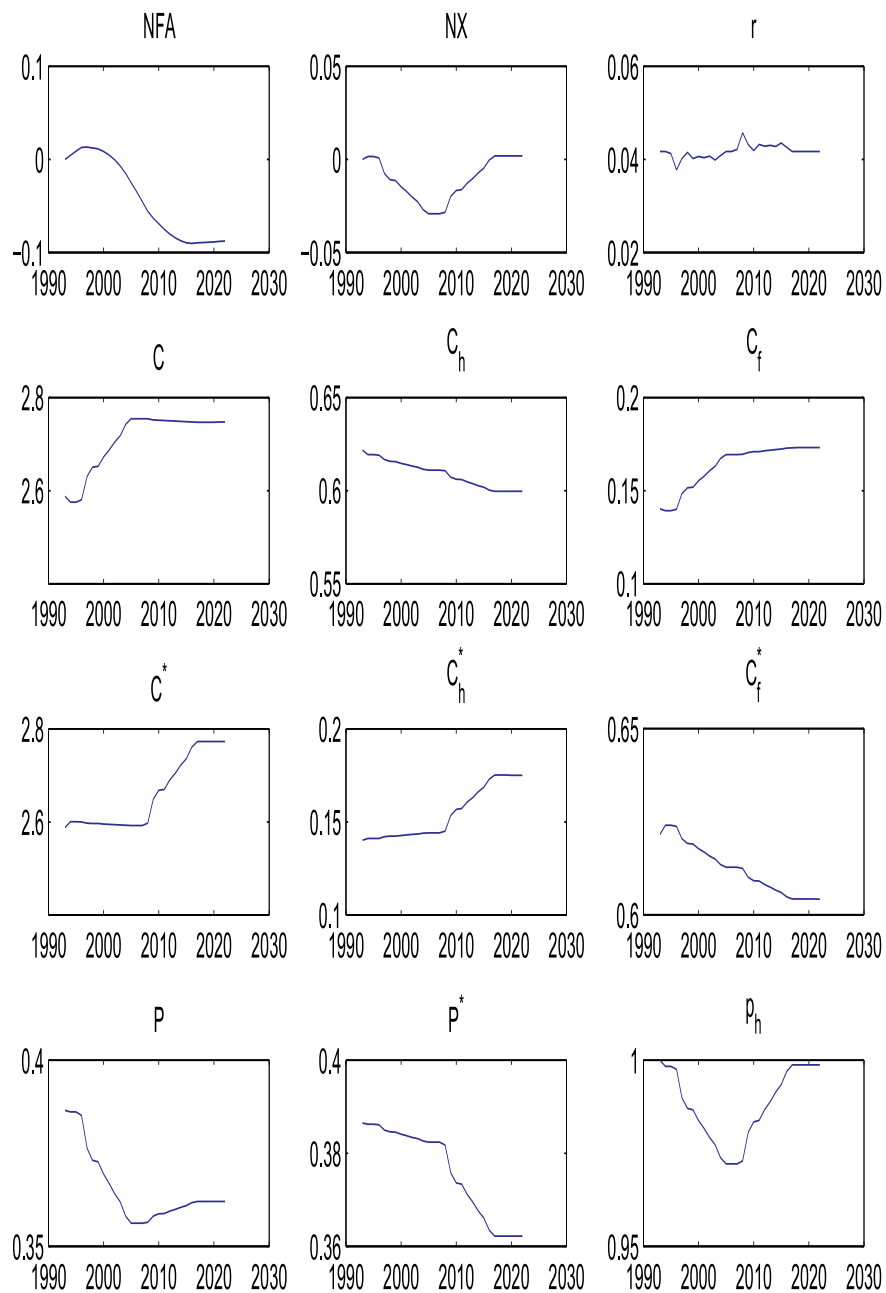


Figure 14: The Quantitative Relevance: Time Series (Baseline)

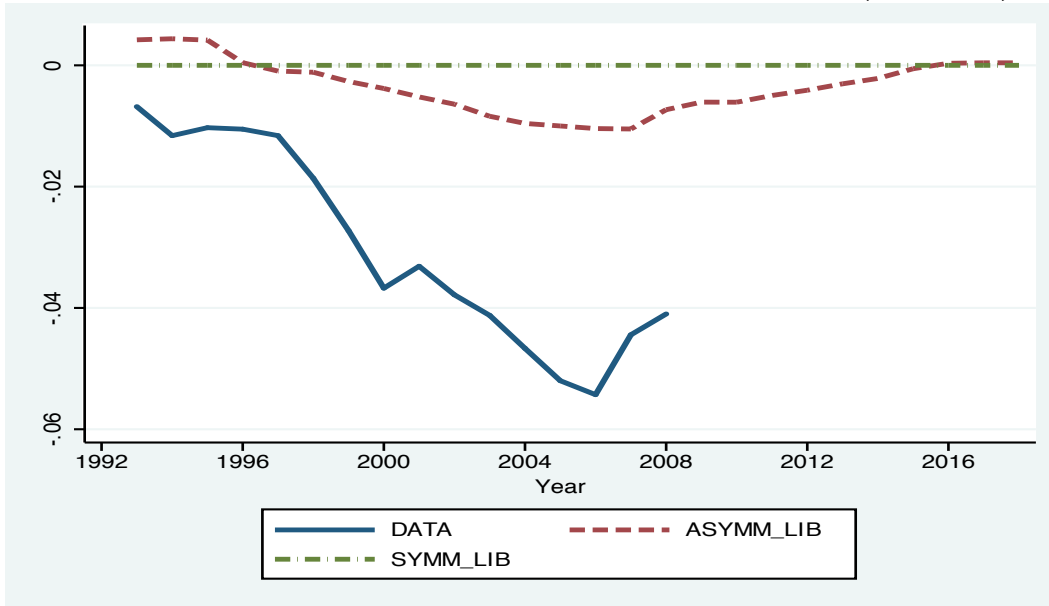


Figure 15: The Quantitative Relevance: Time Series (Sensitivity)

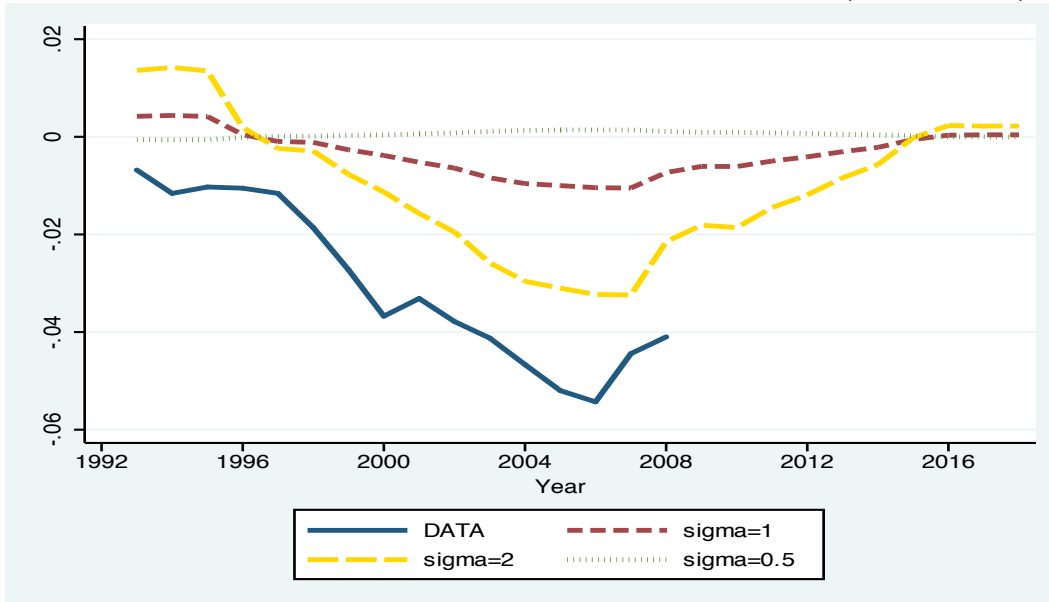


Figure 16: The Quantitative Relevance: Cross Section (I)

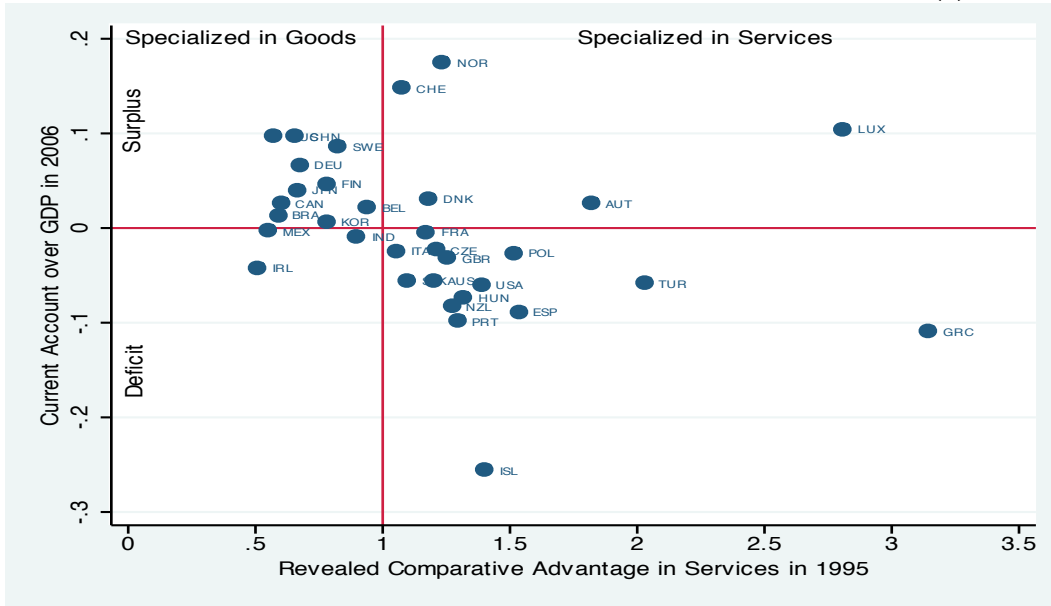


Figure 17: The Quantitative Relevance: Cross Section (II)

