Asymmetric Trade Liberalizations and Current Account Dynamics*

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Abstract

I show a strong positive relation between the share of manufacturing in value added in 2000 and current account balances in 2007 for the Euro area countries. I propose asymmetries in the timing of trade liberalizations as a new mechanism affecting the dynamics of current account. I build intuition using a simple model. Then, I use an international business cycle model to show how the asymmetric dynamics of trade costs in manufacturing and services in 2000-2007 can explain part of the raise of the German trade surplus. Lastly, I provide empirical support for the key predictions of the theory.

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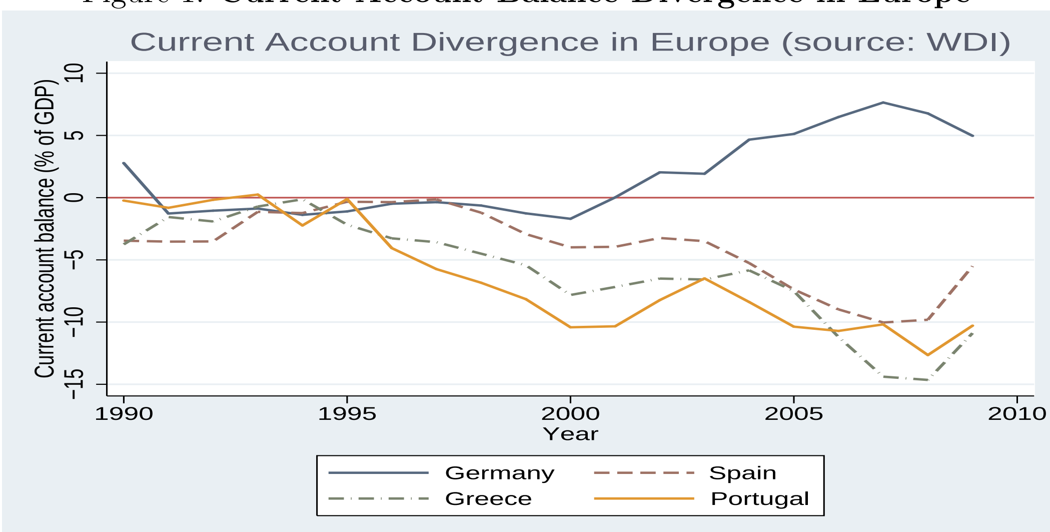
1 Introduction

Starting in the two-thousands, and up to the Great Recession, core northern European countries like Germany, Finland and the Netherlands started accumulating large current account surpluses, while southern European countries like Spain, Portugal and Greece, started displaying ever growing deficits (Figure 1). The building up of these imbalances played a key role in the unfolding of the European Crisis (Baldwin et al, 2015). These are well known facts.

Figure 1: **Current Account Balance Divergence in Europe**

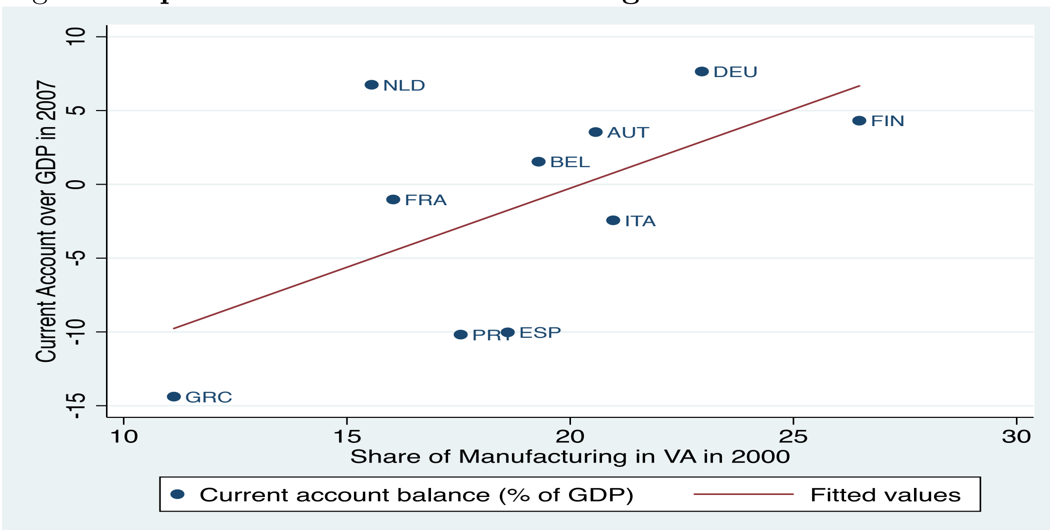


The motivation for this paper is the uncovering of two interesting and relatively unknown facts. First, considering the original members of the Euro area, there exists in the data a striking positive relation between the share of manufacturing in total value added in the early 2000 and the current account balances in 2007 (Figure 2).[1] Second, a simple decomposition of the aggregate trade balance into its goods trade and services trade components, reveals how for Germany the large trade surplus emerges from a trade surplus in goods, accompanied by a trade deficit in services, while Spain, Portugal, and Greece exhibit increasing trade deficits

[1]The scatter plot omits Ireland, which is the only country undergoing a significant structural change away from manufacturing into services in the period 2000-2007, and Luxembourg, due to its peculiarities as financial hub and headquarter of several multinational firms seeking a favourable fiscal treatment.

in goods, but surpluses in services.[2]

Figure 2: **Specialization in Manufacturing and the Current Account**



Starting from this motivating evidence, the contribution of this paper is to explore a new mechanism affecting the dynamics of the current account: the asymmetric timing of trade liberalizations. I start by outlining a simple theoretical model to build up intuition. I then propose a quantitative analysis of the German surplus using a 2 country international real business cycle model with trade costs, and I show how an asymmetry in the liberalization of manufacturing versus service trade, can explain a significant fraction of it. Finally, I propose some empirical evidence that broadly support the main predictions of the theory.

I proceed in three steps. First, I show how asymmetric trade liberalizations can affect current account dynamics using a simple model: an environment with two periods, two countries, no production, complete specialization, and exogenous trade costs. I propose a log-linear version of the model around a symmetric equilibrium and I show how the evolution of Home's current account depends purely on consumption smoothing. I solve explicitly for the current account only as a function of the exogenous endowments and trade costs, and I show how the relevant shock for current account dynamics is the change in the trade cost the home good *relative* to the change of the trade cost of the foreign good. Any symmetric trade

[2]The figures are available in an Online appendix.

liberalization in which the trade costs for the home and the foreign good move in the same way would not have any impact on the current account. On the other hand, asymmetric trade liberalization processes – where the *timing of trade liberalization* is different for the home and foreign goods – affect current account dynamics.[3]

Second, I propose a quantitative investigation of the German trade surplus. I first show that in Germany, in the period 2000-2007, the dynamics of trade costs and productivity in the service and manufacturing sectors have been highly asymmetric. I use the constructed home bias index (CHB), first proposed by Anderson and Yotov (2010), as a way of describing the timing of liberalization in manufacturing trade and service trade. The CHB, derived by the structural gravity model, is a pure number that indicates how much more a country trade with itself in a given sector *relative to* what it would do if the world were completely frictionless. I show that while this indicator is declining in the manufacturing sector in Germany over the period 2000-2007, it is essentially flat in services. Moreover, using data from EU-KLEMS, I show that in Germany in the period 2000-2007 productivity growth in the manufacturing sector was much higher than in services. I then use a 2-country 2-sector international real business cycle model, augmented with trade costs, to assess what fraction of the the German trade surplus can be reproduced by the asymmetric trade liberalization and the asymmetric productivity growth processes. I solve the model under perfect foresight. When I feed the model with the asymmetric trends of the trade costs and the productivity found for Germany, the model produces a trade surplus of around 6% of GDP at its peak, roughly the same order of what observed in the data (7.1%). Interestingly, if the model is fed only with asymmetric trade costs dynamics –and no changes in productivity– it still delivers a sizeable trade surplus. To the contrary, when the model is fed only with asymmetric productivity dynamics – and no changed in trade costs– it is unable to deliver a path for the trade balance consistent with what observed in the German data. The key to understand this results is the existence of an investment boom spurred by the increase in productivity that

[3]Present and future relative endowments in the two countries are also determinants of the current account. A relative increase in home output in period one leads home toward current account surpluses, while a relative increase in output at time two leads the home country towards current account deficits.

counterbalances the increase in savings induced by consumption smoothing, thus dampening the effect of asymmetric productivity dynamics on the net exports.

Third, I propose an empirical analysis that broadly support the main predictions of the simple model. I use two different datasets. First, I use a sample of 24 OECD countries plus the BRICS and focus on the asymmetric trade liberalization in goods and service trade. I use the CHB to proxy for the trade costs in manufacturing and services. I divide the sample of countries into those relatively specialized in the export of manufacturing and those relatively specialized in the export of services. I build *relative trade liberalization* measures, defined as the differences in the change of the average CHB faced in the export sector and the change of the CHB in the import sector. I show how, on average, Spain, Portugal and Greece were characterized by *high relative trade liberalizations* during the period 1995-2009. This means that the fall in the barriers to trade in the sector they tend to import (manufacturing) were on average larger than the fall of the trade barriers in the sector where they tend to export (services). Germany, on the contrary, exhibits, on average a *low relative trade liberalization*, meaning that the barriers to trade in the German export sector decreased by more than the barriers to trade in its import sector. I then explore the role of relative trade liberalizations as determinants of current account dynamics. Following the specification of the key equation of the model, I regress the change in the ratio of current account as a share of GDP on both the contemporaneous measure of relative trade liberalization and on some of its leads. Consistently with the theory, I find a negative a statistically significant coefficient on the contemporaneous relative trade liberalization measure (a country tends to experience a deficit when the restrictions to trade in its import sector fall by more than those in its export sector) while the coefficients on the leads of the same measure are positive and statistically significant (a country tends to experience a deficit if in the future it expects the impediments to trade in its export sector to fall by more than the impediments to trade in its import sector). These correlations are robust to the inclusion of several controls, including growth, openness, gdp and gdp per capita, as well as year and country fixed effects. Moreover, I formally test the equality of the coefficients on the contemporaneous and forward relative trade liberalization measures, as predicted by the model, and I am unable to reject it at any reasonable confidence level. Second, I repeat the same exercise, but focusing on a different set of developing countries, characterized by being highly relatively specialized in the exports of agricultural goods, and relatively specialized in the imports of manufacturing goods. I build relative trade liberalization measures using tariffs data for manufacturing and agricultural goods, which overcome possible endogeneity concerns. I verify how contemporaneous high relative trade liberalizations are correlated with deteriorations of the current account, while high future relative trade liberalizations are correlated with current account improvements. Also in this case, I cannot reject the hypothesis that the coefficients on present and future relative trade liberalizations are the same. Thus, I conclude that asymmetric trade liberalizations are indeed a driver of current account dynamics, which was previously at least partly overlooked.

Finally, while a straightforward policy implication of the paper would be that further liberalization in service trade might help a rebalancing in the European economy, I discuss in the conclusion how the passage from the theory and the evidence proposed in this paper to the reality of economic policies might be more subtle than it could at first appear.

This paper is linked to several strands of the literature. First, it is broadly linked to the literature on global imbalances. While the literature on global imbalances is extremely vast[4], a subset of papers have tried to specifically link trade reforms and industrial structures to current account dynamics. Ju and Wei (2012) presents a model where the interaction of Heschker-Ohlin forces and trade liberalization can affect current account dynamics. While the theoretical channels proposed by Ju and Wei (2012) are operating on the production side, the only force operating in the model proposed in this paper is consumption smoothing. Jin (2012) links industrial structure to capital flows (and hence to current account dynamics) in a model where the specialization in capital intensive sectors rises the demand for capital, and thus explain the emergence of current account deficits. However, Jin (2012) abstracts from trade cost, considering a world with no trade frictions.

Second, the paper is linked to the literature addressing the impact of tariffs on the current

[4]See for instance Blanchard and Milesi-Ferretti (2009), Caballero, Farhi and Gourinchas (2008), Engels and Rogers (2006), Hausman and Sturzenegger (2006), Mendoza, Quadrini and Rios-Rull (2009).

account. Engel and Kletzer (1986) show how the impact of tariff on current account depend on the capital intensity of the sector protected. Gavin (1991) examines the impact of a tariff on the current account in a model which emphasizes the fact that it takes time for the production sector of an economy to adjust to a change in relative prices. A much more recent example of this literature is the paper by Reyes-Heroles (2015), who uses a multi-country Ricardian model of trade to explain how the reduction in trade costs contributed to the insurgence of external imbalances in the last 40 years.[5]

Finally, this paper is linked to empirical literatures on the construction of trade restrictiveness measures (Anderson and Van Wincoop, 2003, Anderson and Yotov, 2010) and on the current account dynamics (see for instance Gruber and Kamin, 2003), with particular emphasis on the studies related to the external imbalances within Europe (Blanchard and Giavazzi, 2002; Lane, 2013; Siena, 2014; Kollmann et al, 2015).

None of these studies has proposed asymmetries in trade liberalizations as potential drivers of current account dynamics. Thus, I see this paper as proposing a new perspective, which is not a substitute, but a complement, to the vast amount of work previously done on these issues.

In Barattieri (2014), I examined the extent to which the asymmetry in the liberalization of service trade and manufacturing trade of the last decades can explain the current account dynamics of the U.S. Unlike in Barattieri (2014), in this paper I take into account also the dynamics of productivity in analyzing the dynamics of German surplus. Second, differently from Barattieri (2014), in this paper the CHB index is used in order to build relative liberalization measures and then to test the key prediction of the model. Lastly, I propose here a new empirical analysis based on a sample of developing countries specialized in the export of agricultural goods.

The paper is structured as follows. The next Section introduces the simple theoretical model. Section 3 contains the quantitative analysis of the German trade surplus. Section 4 contains the empirical analyzes while Section 5 concludes and includes some policy implications.

[5]See also Eaton et al (2015) for a multi-sector multi-country model with endogenous trade imbalances.

2 A Simple Two-Period Model

In this Section I lay out a simple model aimed at showing how asymmetric trade liberalizations can affect the dynamics of the current account.[6] 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 (h) and a foreign good (f). The endowment of the home good is Y_t^h with $t = \{1, 2\}$. The endowment of the foreign good is Y_t^{f*} with $t = \{1, 2\}$. The price of the home good at Home is p_t^h. The price of the home good in Foreign is $p_t^{h*} = \tau_t^h p_t^h$, where $\tau_t^h > 1$ is an iceberg trade cost. The foreign good f is imported in Home from Foreign. The Home price of the foreign good is $p_t^f = \tau_t^f p_t^{f*}$, where p_t^{f*} is the price of the foreign good in Foreign and $\tau_t^f > 1$ is an iceberg trade cost.[7]

In both countries, households maximize a standard two-period CRRA utility function, with discount factor β and intertemporal elasticity of substitution σ, subject to a standard intertemporal budget constraint. The only asset available is an international bond denominated in units of a common world currency. Denote B_1 and B_1^* as 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. I assume 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:

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

where θ is the elasticity of substitution between goods and services, assumed to be larger than 1. C_t^h represents the consumption of home goods in Home at time t, while C_t^f is the

[6] Since the model is relatively standard, I report most of the technical details to an online appendix.

[7] I set a world price index $P^W = P^{1/2} P^{*1/2} = 1$ to be the numeraire.

consumption of foreign good in Home at time t. The price indexes in Home and Foreign are respectively:

$$P_t = \left[\left(p_t^h\right)^{1-\theta} + \left(\tau_t^f p_t^{f*}\right)^{1-\theta} \right]^{\frac{1}{1-\theta}}, \qquad P_t^* = \left[\left(\tau_t^h p_t^h\right)^{1-\theta} + \left(p_t^{f*}\right)^{1-\theta} \right]^{\frac{1}{1-\theta}}.$$

The inter-temporal optimization problem yields standard Euler equations for both Home and Foreign countries, and the intra-temporal optimization decision gives the standard CES demand equations.

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:

$$\begin{aligned} Y_t^h &= C_t^h + \tau_t^h C_t^{h*}, \\ Y_t^{f*} &= \tau_t^f C_t^f + C_t^{f*}. \end{aligned}$$

Finally, bond market clearing requires:

$$B_1 + B_1^* = 0.$$

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 equilibrium.

2.1 The Log-Linear Model

The analysis below is based on a log-linearization of the model around a symmetric equilibrium where $\bar{p^h} = \bar{p^{f*}} = 1$, $\bar{B_1} = \bar{B_1^*} = 0$, $\bar{Y^h} = \bar{Y^{f*}} = \bar{Y}$, and $\bar{\tau^h} = \bar{\tau^f} = \tau$.

I denote percentage deviations from the symmetric equilibrium with a hat. So $\hat{x} = log\left(\frac{x}{\bar{x}}\right)$, where $\bar{x}$ is the value of x at the symmetric equilibrium.[8]

[8] The details of the symmetric equilibrium, the log-linerarization and the solution of the model are de-

Manipulating the log-linear version of the equations of the model and taking differences between the equations for Home and Foreign, it is possible to express the current account of the Home country at the end of period one (its savings) as follows:

$$\frac{2(1+\beta)}{\beta}\hat{B}_1 = \left(\hat{p_1^h} - \hat{p_1^{f*}}\right) - \left(\hat{p_2^h} - \hat{p_2^{f*}}\right) + \left(\hat{Y_1^h} - \hat{Y_1^{f*}}\right) - \left(\hat{Y_2^h} - \hat{Y_2^{f*}}\right) \\ + (\sigma-1)\left(\hat{P}_1 - \hat{P}_2\right) - (\sigma-1)\left(\hat{P}_1^* - \hat{P}_2^*\right). \tag{1}$$

Equation (1) allows us to interpret the evolution of Home's current account as depending on six factors. The first four 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 home endowment (or its price) relative to the foreign endowment in period 1 (period 2). The next two terms represent a substitution effect. All else equal, if the inter-temporal elasticity of substitution is larger than 1, an increase of the home price index in period 2 relative to 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.

Obviously, one must solve fully the model to have the impact of the different exogenous variables on the current account. I do that by expressing all the six elements of equation (1) as functions of the trade costs, the endowments and $\hat{B}_1$. Finally, I substitute these functions back into equation (1).[9] This allows me to express Home's current account only as function of the exogenous endowments and trade costs:

$$\hat{B}_1 = -\eta\left(\hat{\tau_1^h} - \hat{\tau_1^f}\right) + \eta\left(\hat{\tau_2^h} - \hat{\tau_2^f}\right) + \nu\left(\hat{Y_1^h} - \hat{Y_1^{f*}}\right) - \nu\left(\hat{Y_2^h} - \hat{Y_2^{f*}}\right) \tag{2}$$

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. ν is also a parameter depending on $(\beta, \theta, \sigma, \tau)$.[10] It is positive for a large range of plausible

scribed in the online appendix.

[9]The online appendix explains the procedure in detail.

[10]See the online appendix for details.

values of the parameters.

Equation (2) is the key equation. It is important to notice that the relevant shock is the change in the trade cost the home good *relative* to the change of the transport cost of the foreign good. Any symmetric trade liberalization in which the trade costs for the home and the foreign good move in the same way would not have any impact on the current account. On the other hand, asymmetric trade liberalization processes for which $\left(\hat{\tau_1^h} - \hat{\tau_1^f}\right) > 0$ and/or $\left(\hat{\tau_2^h} - \hat{\tau_2^f}\right) < 0$ push the current account of the Home country into deficit. Moreover, any permanent change of trade policy would not affect the current account, while temporary changes do.

More generally, equation (2) challenges the view that trade policies cannot influence the trade balance because they cannot affect savings and investment decisions.[11] 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 inter-temporal decisions).[12]

Finally, we see from equation (2) that also the endowment dynamics affects the current account, and in the usual way. Everything else equal, an increase in the endowment of the Home country relative to the foreign one in period 1 (period 2) pushes the Home country current account toward surplus (deficit). This points also to the potential importance of productivity dynamics in determining the current account.

3 A Quantitative Investigation of the German Surplus

While equation (2) provides a clear qualitative insight, a first order question is whether this insight is also quantitatively relevant. The aim of this Section is first documenting that in Germany both trade costs and productivity dynamics in the manufacturing and service sectors have been highly asymmetric in the period 2000-2007.[13] Second, I outline

[11]See for instance Lamy (2010).

[12]Obviously here the point is made only for savings.

[13]The choice of the period is partly motivated by Figure 1, where the German surplus starts growing in 2000 and peaks in 2007, partly motivated by some data limitations: productivity figures are available just

a standard 2-country international real business cycle model augmented with trade costs. Finally, I explore the ability of the model, fed with the asymmetric trends found in the data, to reproduce the dynamics of the German trade surplus.

3.1 Asymmetric Trade Costs and Productivity Dynamics

Trade Costs Dynamics. I follow here Barattieri (2014), where I propose the use of the constructed home bias index (CHB)[14] as a convenient way to capture the dynamics of trade costs in services and manufacturing. The CHB index is a pure number and it express how much more a country is trading with itself in a given sector, relative to what it would do if the world were frictionless. Obviously, this definition requires to define a benchmark of what would be trade in the case of a frictionless world. The structural gravity model contains such a prediction.

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, Y_i^k the total output of sector k in the origin country i and E_j^k the total expenditure in sector k in the destination country j (defined as output minus total exports plus total imports of country j in sector k). The structural gravity model can be expressed as follows:

$$X_{ij}^k = \frac{Y_i^k E_j^k}{Y^k} \left(\frac{t_{ij}^k}{P_j^k \Pi_i^k} \right)^{1-\theta_k} \tag{3}$$

where 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, which are in turn weighted averages of

until 2007 and service trade costs data are more reliable after 1999.

[14]First proposed by Anderson and Yotov (2010).

the bilateral trade costs t_{ij}^k.[15]

The equivalent expression for the internal trade would be:

$$X_{ii}^k = \frac{Y_i^k E_i^k}{Y^k} \left(\frac{t_{ii}^k}{P_i^k \Pi_i^k} \right)^{1-\theta_k}. \tag{4}$$

where X_{ii}^k is defined as output minus total exports. Equations (3) and (4) can be used to get a prediction of the amount of trade that would prevail in the absence of trade frictions. If $t_{ij}^k = 1$ for every country pair ij, in fact, then $\Pi_i^k = P_j^k = 1$, and $X_{ij}^k = \frac{Y_i^k E_j^k}{Y^k}$. In the case of internal trade, we get $X_{ii}^k = \frac{Y_i^k E_i^k}{Y^k}$.

Using (4), it is possible then to express the ratio of realized internal trade to the trade that would prevail in absence of friction as functions of observable variables:

$$CHB_{ik} = \frac{\frac{Y_i^k E_i^k}{Y^k} \left(\frac{t_{ii}^k}{P_i \Pi_i} \right)^{1-\theta_k}}{\frac{Y_i^k E_i^k}{Y^k}} = \left(\frac{t_{ii}^k}{P_i \Pi_i} \right)^{1-\theta_k} = \frac{X_{ii}^k Y^k}{Y_i^k E_i^k}. \tag{5}$$

In this paper I use (5) to calculate the CHB index, differently from Barattieri (2014).[16] The index has several advantages and some disadvantages. First, it is time varying. Second, the index allows the separation of the effects of changes in productivity (captured by the production data) from those determined by other frictions (such as transport costs and legal barriers). Third, the index is a number and thus invariant to the elasticity of substitution θ_k.[17] On the other hand, the index relies on the gravity model to determine the benchmark

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[15]Defined as follows:

$$\begin{aligned} \left(\Pi_i^k\right)^{1-\theta_k} &= \sum_j \left(\frac{t_{ij}^k}{P_j^k} \right)^{1-\theta_k} \frac{E_j^k}{Y^k}, \\ \left(P_j^k\right)^{1-\theta_k} &= \sum_i \left(\frac{t_{ij}^k}{\Pi_i^k} \right)^{1-\theta_k} \frac{Y_i^k}{Y^k}. \end{aligned}$$

[16]This method of calculating the CHB includes the measurement error in the data, so it does not have the virtue of the fitted gravity regression method. It is similar in spirit to the tetrads method of Head, Mayer and Ries (2010). The two way of measuring the CHB, however, gives similar results. The correlation between the CHB in Manufacturing computed under the alternative methodologies (which in both cases was constructed for the period 1994-2009) is 0.90.

[17]I'm not aware of reliable estimates of θ_k the for the service sector.

trade in case of no friction.

Figure 3: **Constructed Home Bias Index, Germany, Manufacturing and Services (2000=1)**

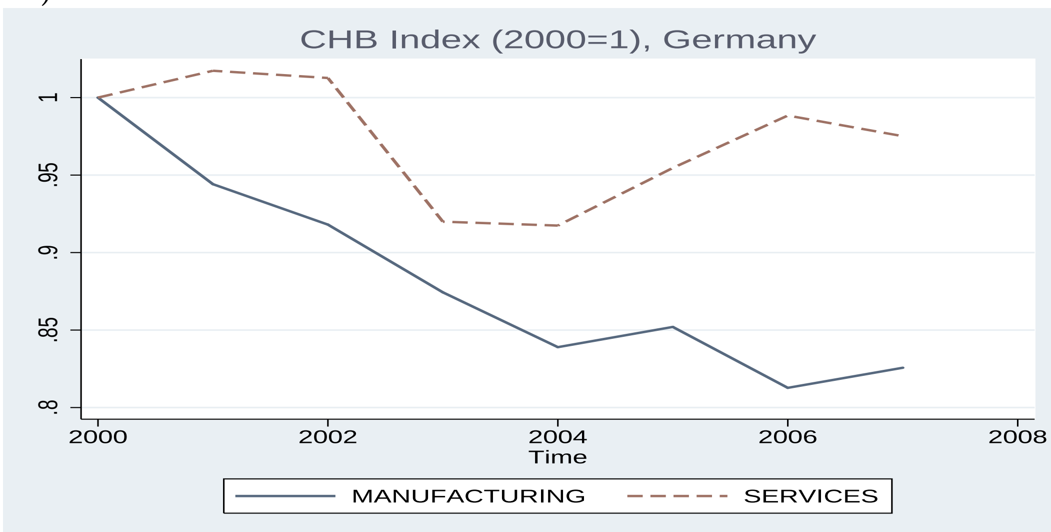
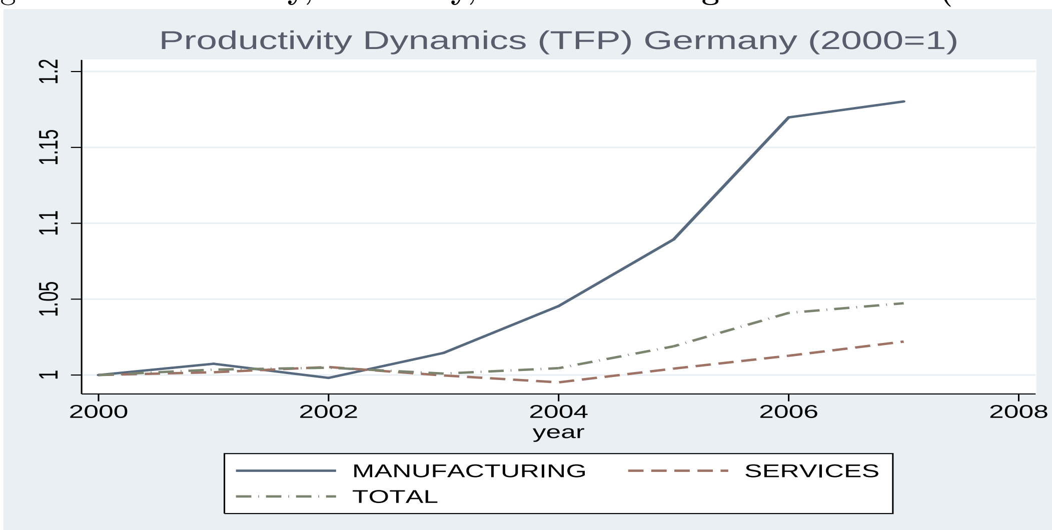


Figure 3 reports the evolution of the CHB in manufacturing and services for Germany for the period 2000-2007, normalized to 1 in 2000. As the Figure clearly shows, there is a clear trend of the CHB in the manufacturing sector, while the CHB in the services sector first decline and then increases again, with no clear trend. This lack of dynamism in the liberalization of the service sector in Germany has been recently studied by Arentz et al (2014) in a report commissioned by the UK department for Business, Innovation and Skills. In the report, the authors show how the OECD indexes of liberalization in professional services are essentially flat in Germany in the period 2003-2013, and they underline the potential benefit from further liberalization in a variety of services sectors. This can be gauged also by looking at the OECD Product Market Regulation (PMR) indexes for network services. After three decades of liberalization, the pace of liberalization in the german network service sectors effectively stopped starting in 2000.[18]

[18]The result, not shown, is available upon request. Moreover, anecdotal evidence about the lack of dynamism in the liberalization in services in Germany can be found also in the business press, for instance in the articles by the Economist (2012) and by Wolff (FT, 2013).

Productivity Dynamics. I use EU-KLEMS data to describe the dynamics of the total factor productivity in the manufacturing and service sectors in Germany over the period 2000-2007. Figure 4 reports the results for TFP evolution in these sector, normalizing them to 1 in 2000. The Figure clearly shows an asymmetric dynamics. Productivity grew in the manufacturing sector of abut 18% in the period considered while productivity in the service sector grew by only about 3%. [19]

Figure 4: **Productivity, Germany, Manufacturing and Services (2000=1)**



3.2 A 2-Country International Real Business Cycle Model

I develop in this Section a standard 2-sector 2-country model in the spirit of Backus, Kehoe and Kydland (1994). I assume away uncertainty, while adding exogenous trade costs.

The environment. There are two countries, 1 and 2. Under perfect foresight, in each country i, a representative consumer maximizes her lifetime utility function:

$$Max \sum_{t=0}^{\infty} \beta^t U(c_{it}, 1 - n_{it}),$$

[19]The dynamics of productivity in Services is an average of the dynamics in construction, retail, hotels, transport and communication, finance, insurance and real estate, personal services, education, health services. Restricting the attention only to transport, finance and communication services gives a slightly higher but similar result.

where $U(c,1-n)=\frac{\left[c^{\mu}(1-n)^{1-\mu}\right]^{\gamma}}{\gamma}$. c_{it} and n_{it} are consumption and hours worked in country i. There is complete specialization in one intermediate good. Country 1 produces good a, while country 2 produces good b. The goods are produced with capital, k, and labor, n, according to the following technology:

$$y_{it}=A_{it}k_{1t}^{\alpha}n_{it}^{1-\alpha} \tag{6}$$

where A_{it} is the total factor productivity of country $i=\{1,2\}$. Importantly, I'm here assuming that productivity is non-stochastic. Both consumption and investments are composite of foreign and domestic goods:

$$c_{it}+i_{it}=h_{it} \tag{7}$$

where

$$h_{1t}=\left[\omega_1(a_{1t})^{\frac{\theta-1}{\theta}}+\omega_2(b_{1t})^{\frac{\theta-1}{\theta}}\right]^{\frac{\theta}{\theta-1}} \qquad h_{2t}=\left[\omega_1(b_{2t})^{\frac{\theta-1}{\theta}}+\omega_2(a_{2t})^{\frac{\theta-1}{\theta}}\right]^{\frac{\theta}{\theta-1}} \tag{8}$$

Where a_{1t} is the use of good a in the production of the composite consumption and investment good in country 1, while b_{2t} is the usage of good b in the production of the composite consumption and investment good in country 2. θ represents the intra-temporal elasticity of substitution. The law of motion for physical capital are standard:

$$k_{it+1}=(1-\delta)k_{it}+i_{it} \tag{9}$$

There are common iceberg-type trade costs for the two goods: τ_{1t} and τ_{2t}. τ_{1t} units of goods a have to be shipped from country 1 to country 2 in order to have one unit of usable input in country 2. Hence, the resource constraints can be expressed as:

$$y_{1t}=a_{1t}+\tau_{1t}a_{2t} \qquad y_{2t}=b_{2t}+\tau_{2t}b_{1t} \tag{10}$$

The Planner's problem. A world planner maximizes a weighted sum of the utility of both countries[20]:

$$Max \sum_{t=0}^{\infty} \beta^t \left\{ \Omega_1 U(c_{1t}, 1-n_{1t}) + \Omega_2 U(c_{2t}, 1-n_{2t}) \right\},$$

Substituting equations (6) into (10) and equations (8) and (9) into (7), it is possible to express the constraints faced by the planner in the following way:

$$\left[\omega_1 (a_{1t})^{\frac{\theta-1}{\theta}} + \omega_2 (b_{1t})^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}} = c_{1t} + k_{1t+1} - (1-\delta) k_{1t} \tag{11}$$

$$A_{1t} k_{1t}^{\alpha} n_{1t}^{1-\alpha} = a_{1t} + \tau_{1t} a_{2t} \tag{12}$$

$$\left[\omega_1 (b_{2t})^{\frac{\theta-1}{\theta}} + \omega_2 (a_{2t})^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}} = c_{2t} + k_{2t+1} - (1-\delta) k_{2t} \tag{13}$$

$$A_{2t} k_{2t}^{\alpha} n_{2t}^{1-\alpha} = b_{2t} + \tau_{2t} b_{1t} \tag{14}$$

Let λ_1, q_1, λ_2 and q_2 be the multipliers on constraints (11) to (14). $\{c_i, n_i, k_i, a_i, b_i\}$, with $i = \{1, 2\}$, are the choice variables for the planner. The first ten order conditions for the planning problem,[21] together with equations (11)-(14), constitute a system of 14 equations and 14 unknowns (10 choice variables and 4 multipliers), which together with the four exogenous variables $(\tau_1, \tau_2, A_1, A_2)$ complete the description of the model. In the absence of aggregate uncertainty, the model can be solved as a nonlinear forward looking deterministic system using a Newton method. This method simultaneously solves all equations for each period, without relying on local approximations.

Trade Balance. I measure the trade balance in the model as presented in the data, which is expressed as the ratio of net exports to output:

[20] I will assume equal weights.

[21] Listed in the appendix A.

$$NX_{1t} = \frac{\tau_{1t} a_{2t} - TOT_{1t} b_{1t}}{y_{1t}} \tag{15}$$

In (15), TOT_{1t} represent the terms of trade of country 1, defined as the domestic price of imports over the price of exports. Since the multipliers q_1 and q_2 represent the shadow prices of goods a and b, the terms of trade of country 1 can be defined as:

$$TOT_{1t} = \frac{\tau_{2t} q_{2t}}{q_{1t}} \tag{16}$$

Importantly, the terms of trade now feature the presence of the trade costs on the imported good. A similar expression can also be found by computing the terms of trade as the marginal rate of transformation between the two goods in each country.[22]

Calibration. I use standard parameter values to calibrate the model. Following BKK (1994), I set $\gamma = -1$, corresponding to an inter-temporal elasticity of substitution of 0.5. α is set to 0.36, while $\mu = 0.34$, and gives a steady state level of hours equal to roughly one third of available time. θ is set to 1.5, while β is 0.96 and δ 0.1 to calibrate the model to annual frequencies. The trade costs are assumed to be initially equal to 2.7, which is the value suggested by Anderson and Van Wincoop (2004). ω_1 and ω_2 are calibrated to give an initial ratio between imports to output of about 0.33, as observed in Germany in 2000.

3.3 The German Surplus: Data vs. Models

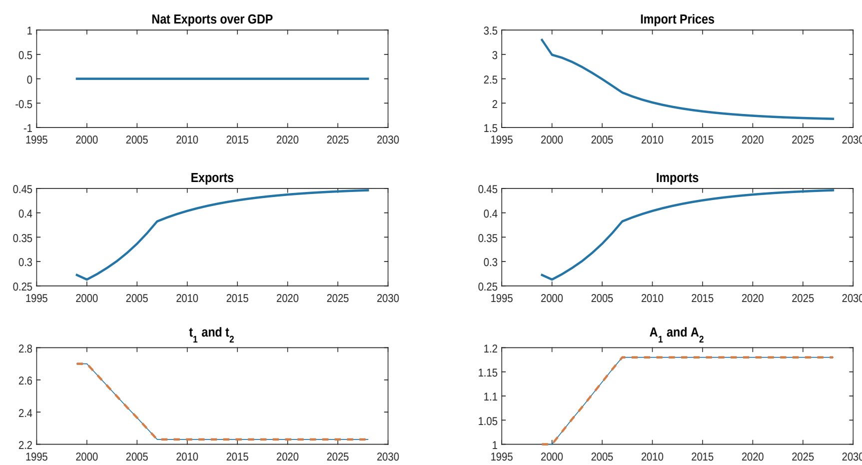
I solve the model under two alternative assumptions: i) a symmetric reduction in trade costs and a symmetric increase in productivity and ii) an asymmetric reduction in trade costs and an asymmetric increases in productivity. In the case of the symmetric trade costs and productivity dynamics, I assume that both τ_1 and τ_2 decline for 8 years at a constant rate, equal to the trend observed for the CHB in manufacturing in Figure 3 and both A_1 and A_2 grow at the a constant rate, equal to the trend found for German manufacturing TFP in Figure 4. In the asymmetric case, I assume that τ_1, the trade cost for good a, declines for 8

[22]See the Appendix A for details.

years at the same trend as the manufacturing CHB and then remains flat, while τ_2, the trade cost for good b, remains flat for the first 8 years and then declines at the same trend of the CHB in manufacturing until it reaches the level of τ_1. Moreover, in this case A_1 grows for the first 8 years at the same rate as German TFP in manufacturing, and then it stays flat, while A_2 stays flat for the first 8 years, and then start growing at the same rate of A_1. In the experiment, hence, country 1 would represent Germany, whose productivity grows faster than the other country in the first 8 years and whose trade cost falls first.

Figure 5 reports the path of some of the endogenous variables of country 1 in the case of a symmetric trade liberalization and productivity growth processes. Intuitively, the symmetric reduction of impediments to trade does not affect the trade balance. A symmetric reduction of the import prices in country 1 and 2 leads to an equal increase in exports and imports in each country. As a result, the trade balance does not move in either country.

Figure 5: **Selected Endogenous Variable Dynamics, Symmetric Trade Liberalization and Productivity Increase**



On the other hand, asymmetric trade liberalization and productivity growth do affect the trade balance, as reported in Figure 6. The country whose good becomes liberalized first (country 1 in the experiment) experiences a decrease in the relative price of imports later that the country whose goods becomes liberalized second (country 2). As a result, the exports in country 1 rise more in the first years, and then decline when the imported good price is decreasing. As a consequence, the trade balance of country 1 goes into surplus and then starts declining only when the liberalization of good b takes off.

Figure 6: **Selected Endogenous Variable Dynamics, Asymmetric Trade Liberalization and Productivity Increase**

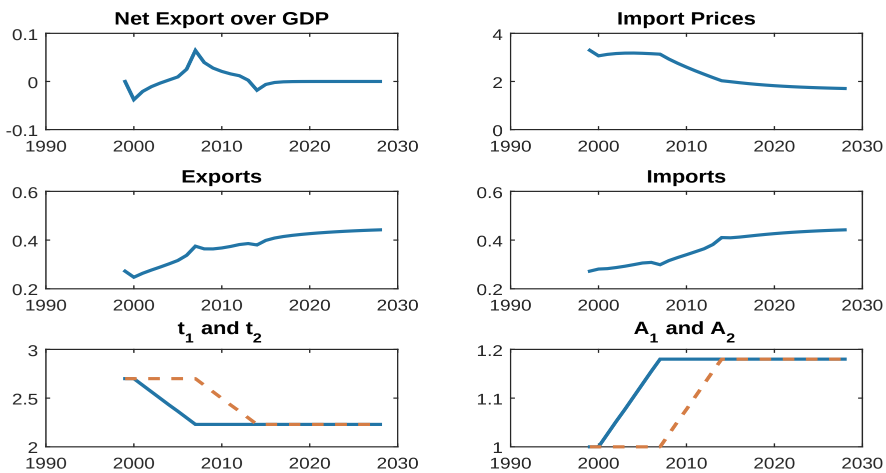


Figure 7 reports on the same graph the German trade balance over GDP and the corresponding object obtained with the model simulations for the years 2000-2015. While the timing of the increasing of the German trade balance is not well captured by the model under the asymmetric trade liberalization experiment, the correlation between the two series is considerably high (0.84). Moreover, the model is able to generate a peak of trade surplus of about 6% of GDP, fairly close to what was observed in Germany in 2007 (7.1%).

Furthermore, Figure 8 reports the trade balance dynamics obtained under two other alternative experiments: i) an asymmetric reduction in the trade costs, with no changes in productivity in either sector (solid line), and ii) an asymmetric increase in productivity, with no changes to the trade costs in both sectors (dash-dotted line). For ease of comparison, I also report the benchmark result with asymmetric dynamics in both productivity and trade costs (dashed line). The peak of the trade surplus obtained under the scenario with no change in productivity in either sector is in fact now higher than what obtained under productivity growth only due to a denominator effect (growing GDP). More interestingly, though, the model is unable to reproduce a dynamic consistent with the German data, when only fed with an asymmetric productivity process, with no changes to the trade costs. The key to understand the difference in the two cases, is the dynamics of investment, which initially decreases in the first case but increase in the second. In the case of an asymmetric reduction of trade costs, in fact, a consumption smoothing motives makes the agents only wait to consume in the future to wait enjoying lower prices. In the case of a present increase in productivity, instead, on the one hand there is the same tendency to smooth consumption, which would tend to an increase in savings, but on the other hand there is also an investment motive, which has an opposite effect on the trade balance. Quantitatively these two effects balance out, as we see in Figure 8.

I conclude that indeed the asymmetric trade liberalization process between manufacturing and services might potentially explain an important part of the dynamics of the German surplus in the period 2000-2007.

Figure 7: **Trade Balance, German Data and Model**

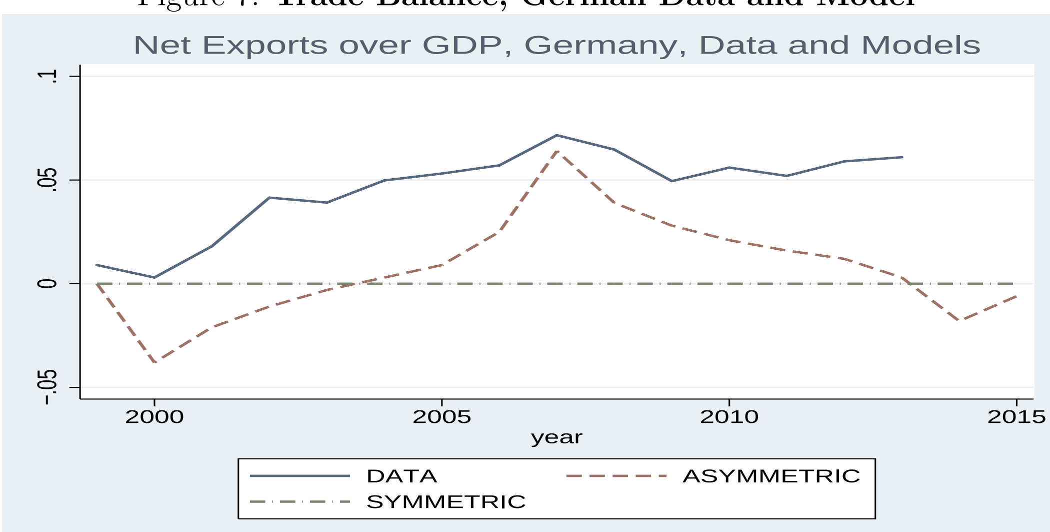
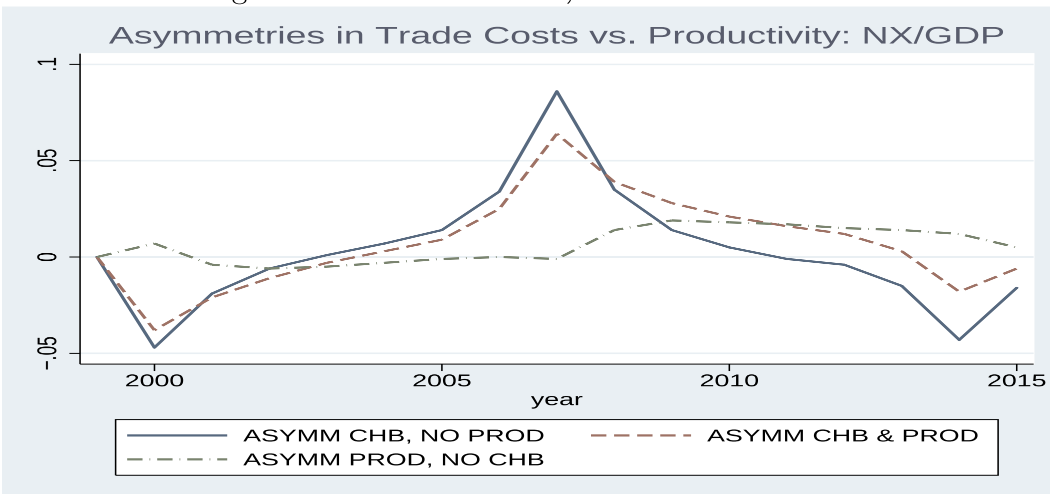


Figure 8: **Trade Balance, Different Models**



4 Empirical Evidence

The aim of this Section is to provide empirical support to the theory presented in Section 2. Since the insight of equation (2) is a general one, I will apply it here to two different contexts. First, I propose an analysis based on the asymmetry between the liberalization of trade in manufacturing versus services that I explored in Barattieri (2014). Second, I analyze the current account dynamics of a sample of developing countries highly specialized in the export of agricultural goods and the import of manufacturing. Finally, I present evidence from a specific case of anticipated future trade liberalization.

4.1 Manufacturing versus Services

The first empirical analysis I propose exploit the asymmetry in the liberalization of manufacturing and service trade for a sample of 24 OECD countries plus the BRICS.[23] The empirical strategy here can be thought of consisting of two stages.

[23]The countries included are Austria, Brazil, Canada, Switzerland, China, Czech Republic, Germany, Denmark, Spain, Finland, France, Greece, Hungary, India, Ireland, Israel, Italy, Japan, Korea, Mexico, Norway, New Zealand, Poland, Portugal, Russia, South Africa, Sweden, UK, US. See the appendix B for details.

Stage 1: Relative Trade Liberalization Measures. In the first stage, I need to construct proxies for the terms $\left(\hat{\tau_t^h} - \hat{\tau_t^f}\right)$ that appear in equation (2). I use the CHB introduced in Section 3.1 to proxy for $\hat{\tau}$ in both services and manufacturing. The Online Appendix contains the results obtained by using (5) to build CHB indexes for service and manufacturing for 24 OECD countries and the BRICS. I report the level of the CHB in manufacturing and services in 1995 and 2008, as well as their percentage change over the period. Two main observations stand out. First, both services and manufacturing CHB indexes decline over time in most countries. Notable exceptions are the U.S., which however has the lower level of CHB in both sectors, Japan and Germany. Second, the decline of CHB in manufacturing is greater than that of services in most countries.

I then use the CHB to build *relative trade liberalization measures.* In order to compute these measures, I first divide the countries of my sample in two groups: the "goods-oriented" and the "service-oriented" countries. In order to do so, I use an average of the Revealed Comparative Advantage in Services (RCA_SERV). RCA_SERV is simply an measure of relative export specialization, computed as the ratio of the service share in total export in a given country i divided by the service share in total export for the world as a whole. Clearly, an $RCA\_SERV > 1$ reveals a relative specialization in the export of services, while an $RCA\_SERV < 1$ would signal the contrary. Countries like Greece, Spain, Portugal or the UK display high levels of revealed comparative advantage in the export of services, while countries like Mexico, Germany and Canada exhibit levels of RCA_SERV far below one.[24] While the classification of countries is based on averages over the entire period, it is important also to look at the dynamics of this indicator, which might in fact be endogenous. I report in the online appendix the evolution of RCA_SERV over the period 1994-2009 for five selected European Countries. While Germany displays a RCA_SERV consistently below one, Spain, Portugal and Greece's RCA_SERV is always above one. Ireland, instead, displays a rising RCA_SERV, which range from being below one in the mid nineties to be well above one in the mid two-thousands. I control how the results of the empirical analysis change when I exclude from the regression the countries that "switched" from an $RCA\_SERV > 1$ to an

[24] See the online appendix for a complete description of the data.

$RCA\_SERV < 1$ or viceversa. The results turn out to be stronger when excluding these countries.

I then compute for each country i a *relative liberalization measure* as the difference between the change in an average CHB of the sector where country i exports are concentrated and the change in country i CHB in the sector where it concentrates its imports:

$$(\hat{\tau}_t^h - \hat{\tau}_t^f) = \Delta \left[\sum_i \omega_i CHB_i^h \right]_t - \Delta CHB_{it}^f \tag{17}$$

where h and f are respectively the sectors where exports and imports are concentrated. For instance for Germany, a goods-oriented country, h would be manufacturing while f would be services. For Spain, instead, a service-oriented country, h would be services and f would be manufacturing. ω_i are weights computed as the output shares of country i in total world output. Notice that this indicator is a difference between two changes. For a country i, it is the difference between the change of the trading partners' CHB in the sector of export specialization of country i and the change in the country i CHB in its importing sector. Hence, a positive number can reflect *either* that the CHB of the trading countries in the export sector of country i *increased by more* than country i own CHB in its importing sector, *or* that the country i own CHB in the importing sector *decreased by more* than the CHB of the trading countries in the export sector of country i. In both cases, a positive number signal a *high relative trade liberalization*. Conversely, a negative number indicates a *low relative trade liberalization*.[25] Interestingly, Spain, Portugal and Greece all features on average a high relative trade liberalization, while Germany display, on average, a low relative trade liberalization.[26]

Stage 2: Current Account Dynamics. After having obtained an estimate of the $(\hat{\tau}_t^h - \hat{\tau}_t^f)$, I then use it to explore the relation expressed by equation (2) between current account

[25] A negative number can reflect either that the CHB of the trading countries in the export sector of country i *increased by less* than country i own CHB in its importing sector, *or* that the country i own CHB in the importing sector *decreased by less* than the CHB of the trading countries in the export sector of country i

[26] See the online appendix for a related picture.

dynamics and asymmetric trade liberalization. I use the following econometric specification (in its more complete form):

$$\Delta \frac{CA}{GDP}_{it} = \eta_0 + \eta_1(\hat{\tau}_t^h - \hat{\tau}_t^f) + \sum_{s=1}^{S} \eta_{s+1}(\hat{\tau}_{t+s}^h - \hat{\tau}_{t+s}^f) + \psi Z_{it} + \delta_i + \delta_t + \epsilon_{it} \qquad (18)$$

where I use the current relative trade liberalization indexes $(\hat{\tau}_t^h - \hat{\tau}_t^f)$ and S of its leads. Z_{it} is a set of time varying country level controls including growth (to take into account of the other elements in equation 2), openness, GDP and per capita GDP, and a proxy for financial development. δ_i and δ_t are country and time fixed effects, aimed at controlling for fixed unobserved characteristics at country level and common trends over time. Finally, ϵ_{it} is an error term, which can be interpreted as measurement error in the dependent variable, supposed to be i.i.d. normally distributed with mean zero and variance σ_ϵ^2. The empirical prediction of the model outlined in Section 2 would be to find $\eta_1 < 0$ and $\eta_s > 0$. Moreover, the model has a precise testable implication, namely that $\eta_1 + \sum_{s=1}^{S} \eta_{s+1} = 0$.

Table 1 reports the results obtained using equation (18). In the first column, I regress the change in the ratio of the current account over GDP on the contemporaneous relative trade liberalization measure. The coefficient, as predicted by the model, is negative, and highly statistically significant: a country tends to experience a deficit when the restrictions to trade in its import sector fall by more than those in its export sector. In the second column I use as a regressor only one leads of the relative trade liberalization, and as expected the coefficient is positive and statistically significant: a country tends to experience a deficit if in the future it expects the impediments to trade in its export sector to fall by more than the impediments to trade in its import sector. In the third column, I include both the current and up to three leads of the relative trade liberalization measure. The coefficient on the current measure is negative, while the coefficients on all the three leads are positive. However, only the first two leads display statistically significant coefficients. In the spirit of the model, I test whether I can reject the hypothesis that $\eta_1 + \eta_2 + \eta_3 = 0$, and I cannot reject it. The overall R-squared of the regression is modest (0.127), but non-negligible. In the fourth column, I insert time varying country level control, and the main results do not change substantially. The degree of openness displays a positive and statistically significant coefficient, while the coefficient on the the per capita gdp growth is negative and statistically significant (as predicted by equation (2)). Once controlling for these two factors, the GDP, the GDP per capita and a measure of financial development do not seem to be strongly correlated with the change in the ratio of current account over GDP. In the fifth column I present the results obtained by inserting also time and country fixed effects. Again, there are no major changes to the core result.[27]

While highly suggestive, the results reported in the first five columns of Table 1 are not immune by concerns about the truly exogenous nature of the proxies used to build the relative trade liberalization measures. I try to address this potential endogeneity issue by using an IV strategy. I follow conceptually the nearest neighbour matching estimator proposed by Abadie and Imbens (2002) and use as instrument for the relative trade liberalization index the corresponding index for the country which is closet in terms of economic development (measured as per capita GDP) and specialization in services (measured as average RCA index). I use current level of the nearest-neighbour and its leads as instruments.[28] The seventh column of Table 1 reports the results obtained. The contemporaneous relative trade liberalization index still display a negative coefficient, which however looses its significance. On the other hand the first lead is still positive and highly significant, and we fail to reject the hypothesis that these two coefficients are the same. The coefficients for openness, gdp per capita and growth maintain the signs and significances obtained with the OLS estimation in column 4. In general, the fact that the estimates become much less precise is likely due to the lack of a very strong first stage (the correlation between the relative trade liberalization measure and its instrument is only about 0.2).

[27] I also run the regression of column 5 excluding those countries whose specialization in export changed significantly over the period considered. The "switchers" countries are Czech Republic, Finland, Hungary, India, Ireland, Italy, Poland and Sweden. Interestingly, while the main message contained in column 5 goes through, the coefficients on the current and future relative trade liberalizations appears to be larger in this case. This is not surprising, since we are now focusing on the countries for which our division into "goods-oriented" and "service-oriented" is better targeted. Even in this last case, however, we cannot reject the hypothesis that the coefficients of the leads of the relative trade liberalization measures sum up to the coefficient of the current relative trade liberalization measure.

[28] I match countries using as reference year 2007, but results are robust to using other reference years.

Table 1: **Relative Trade Liberalization and Current Account, 24 OECD countries + BRICS**

Dep. var: $\Delta \frac{CA}{GDP}_t$	(1)	(2)	(3)	(4)	(5)	(6)
$(\hat{\tau}^h - \hat{\tau}^f)_t$	-4.906***		-5.826***	-4.478***	-4.103***	-1.324
	(0.918)		(0.960)	(1.025)	(1.173)	(4.824)
$(\hat{\tau}^h - \hat{\tau}^f)_{t+1}$		2.477***	3.666***	3.912***	3.864***	10.386**
		(0.953)	(1.039)	(1.024)	(1.107)	(5.120)
$(\hat{\tau}^h - \hat{\tau}^f)_{t+2}$			1.928*	2.524***	2.274**	-5.675
			(1.024)	(0.955)	(1.023)	(4.609)
$(\hat{\tau}^h - \hat{\tau}^f)_{t+3}$			0.609			
			(0.966)			
OPENNESS				0.906**	3.949***	1.435**
				(0.430)	(1.497)	(0.590)
Real P.C. GDP				-0.096	-5.050	-0.216
				(0.117)	(4.287)	(0.152)
Real GDP				0.233**	5.123	0.322**
				(0.106)	(4.299)	(0.141)
GROWTH				-0.162***	-0.272***	-0.257**
				(0.047)	(0.068)	(0.111)
CREDIT				-0.004	-0.009	-0.004
				(0.002)	(0.006)	(0.003)
Time + Country FE	No	No	No	No	Yes	No
N	433	404	346	369	369	329
Adj R-squared	0.060	0.014	0.117	0.139	0.135	0.094
Log-Likelihood	-917.859	-843.780	-706.129	-742.967	-722.109	-709.073
Sargan-Hansen stat						0.033
p-value						0.856
Endog $(\hat{\tau}^h - \hat{\tau}^f)_s$						5.962
p-value						0.113
P-value of Test						
$\eta_1 + \eta_2 + \eta_3 = 0$			0.87	0.24	0.31	0.62

Standard Errors in Parenthesis

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

The Sargan-Hansen test confirms the validity of the instruments used. Interestingly, explicitly testing whether the current and future relative liberalization indexes can be used as exogenous regressors, I fail to reject the null hypothesis that indeed they are exogenous regressors. While this last result is partly reassuring, as an alternative way to address the issue of endogeneity, I propose also a second empirical analysis, where by switching focus to manufacturing and agriculture, and thus relying directly on tariff data, the concerns about endogeneity are mostly overcome.

4.2 Agriculture versus Manufacturing

Since nothing in the model presented in Section 2 sharply characterizes the home and foreign goods to be represented by a specific industry, I propose here an analysis of the current account dynamics of a sample of developing countries who share the following characteristics: 1) they all are highly relatively specialized in the export of agricultural goods, 2) they are all specialized in the import of manufacturing products, 3) they report data on their custom duties for the period 1995-2012. These three criteria limit the countries available to thirteen.[29]

In this case it is simpler to build relative liberalization measures $\left(\hat{\tau_t^h} - \hat{\tau_t^f}\right)$ by using directly tariff data for agricultural goods ($\hat{\tau_t^h}$) and manufacturing goods ($\hat{\tau_t^f}$).[30] Once obtained the relative trade liberalization measures, I can use the specification expressed in equation (18).

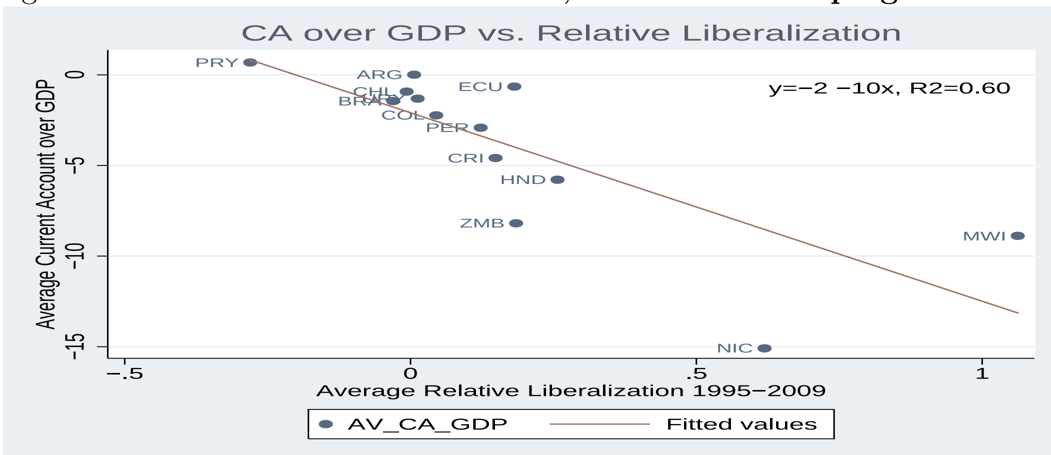
Figure 9 reports a scatterplot of the average current account over GDP for the period 1995-2009 (vertical axis), against the average relative trade liberalization measure $\left(\hat{\tau_t^h} - \hat{\tau_t^f}\right)$ over the same period (horizontal axis). The Figure present a stark negative relation between the two variables (a regression with an R^2 of 0.6), thus showing that, on average, those countries who tended to liberalize more in their import sector than in their export sector were characterized by lower current account balances.

Table 2 reports the results obtained when using the specification (18). The first column reports only the contemporaneous relative trade liberalization measure, and as expected the

[29]The countries included are Argentina, Brazil, Chile, Colombia, Ecuador, Guatemala, Honduras, Malawi, Nicaragua, Paraguay, Peru, Uruguay, Zambia. See the appendix B for details.

[30]See the appendix for details.

Figure 9: **Current Account over GDP, Selected Developing Countries**



coefficient is negative and statistically significant. The second column includes also three leads of the relative trade liberalization measure, and the coefficients attached to them are all positive. In the case of the second lead, the coefficient is also highly statistically significant. A formal test of equality to zero of the sum of the coefficient cannot reject the hypothesis that indeed the coefficients are equal, as predicted by the model. Columns three and four add as additional control variables the real GDP, real GDP per capita, GDP growth and Provate Credit to GDP (column 3), and country and year fixed effects (column 4). The results do not change, while the fit of the regression unsurprisingly increases.

Albeit the overall explanatory power of the relative trade liberalization is modest, I conclude from the results presented in the Tables 1 and 2 that asymmetric trade liberalizations are indeed a driver of current account dynamics, which was at least partly neglected to date.

Table 2: **Relative Trade Liberalization and Current Account, 13 Developing Countries**

Dep. var: $\Delta\frac{CA}{GDP}_t$	(1)	(2)	(3)	(4)
$(\hat{\tau}^h - \hat{\tau}^f)_t$	-0.372**	-0.268*	-0.272*	-0.299*
	(0.144)	(0.138)	(0.141)	(0.156)
$(\hat{\tau}^h - \hat{\tau}^f)_{t+1}$		0.070	0.056	0.073
		(0.143)	(0.147)	(0.164)
$(\hat{\tau}^h - \hat{\tau}^f)_{t+2}$		0.374**	0.357**	0.465***
		(0.151)	(0.156)	(0.172)
$(\hat{\tau}^h - \hat{\tau}^f)_{t+3}$		-0.193	-0.220	0.018
		(0.162)	(0.160)	(0.181)
ln(Real GDP)			0.078	11.284
			(0.238)	(9.055)
ln(Real P.C. GDP)			-0.327	-6.275
			(0.461)	(9.960)
Growth			-0.161**	-0.188*
			(0.067)	(0.096)
Credit			-0.003	-0.041
			(0.017)	(0.038)
Country FE	No	No	No	Yes
Year FE	No	No	No	Yes
R-squared	0.032	0.071	0.105	0.259
N	201	193	193	193
P-value of Test				
$\eta_1 + \eta_2 + \eta_3 + \eta_4 = 0$		0.96	0.83	0.55

Standard Errors in Parenthesis

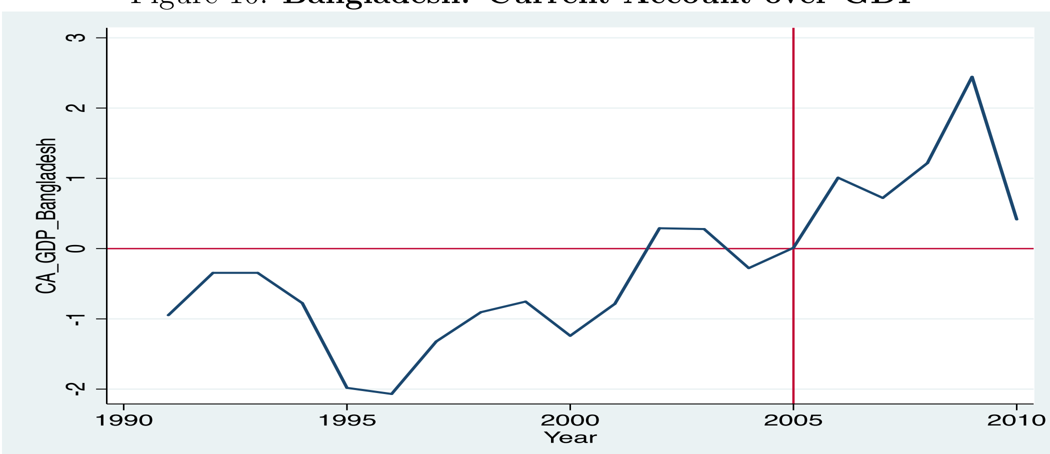
*,**,*** Statistically Significant at 10%, 5% and 1%

4.3 The Case of an Anticipated Future Trade Liberalization

As a further way to provide some evidence about the mechanism proposed in this paper, we can look at a case where a clear anticipation of a future trade liberalization materialized. The textile industry offers an excellent example. In 1995, with the advent of WTO, developed and developing countries agreed to a 10 years phase out period for a set of quotas affecting the textile and clothing industry (the so-called Multi-fiber agreement, or MFA). The quotas were totally lifted in January 2005 (Nauman, 2006). This is, hence, an example of a predictable increase in market access, especially for those countries who are highly specialized in the production and export of textile.

Figure 10 reports the evolution of the current account over GDP for Bangladesh, a country where textile and clothing represent by far the most important share of export and large shares of employment and production.[31] As the Figure shows, the current account of Bangladesh sharply declined in 1995 and 1996 and then improved gradually to get to a surplus around the mid two thousands, when the quotas were lifted. A rigorous analysis of the current account implications of the phase-out from the MFA is clearly beyond the scope of this paper. It is interesting, however, to note how the mechanism presented in the paper might possibly explain also part of the current account dynamics of Bangladesh in those years.

Figure 10: **Bangladesh: Current Account over GDP**



[31]The data are taken from the IMF World Economic Outlook database.

5 Conclusion

In this paper, I propose a theoretical model where asymmetric trade liberalization can affect current account dynamics. Using the case of the asymmetric trade liberalization in manufacturing and service trade I show how this channel is potentially relevant in explaining the dynamics of the German trade surplus over the period 2000-2007. Finally, I show empirical evidence that broadly support the main predictions of the model, both using a sample of OECD countries and BRICS, concentrating mode on the asymmetries between manufacturing and services, and using a sample of developing countries, concentrating more on the asymmetries between manufacturing and agriculture.

This paper has some policy implications for the process of global rebalancing in general, and for the rebalancing in Europe in particular. A further liberalization of trade in services might help countries like Spain, Portugal, Greece and the UK, to fully exploit their comparative advantage in the provision of services and thus helping their rebalancing process without the need to resort solely on draconian austerity measures, as the one implemented in the period 2010-2013. A service directive aimed at liberalizing the cross-border provision of services within the EU has indeed entered into force in the period 2006-2009. However, there is still a large scope for further and deeper liberalizations in the trade of services in Europe (see Monteagudo et al, 2012).

While this is a fairly general insight, more research is clearly needed to clarify which particular services sectors might help the rebalancing process of deficit countries. These are likely to be different for the UK than for Portugal, Spain or Greece. An important point to stress is that there is not necessarily a direct link between the relative trade liberalization measures computed in Section 4.1 and specific policy action of specific countries. Take for example Germany and the case of tourism, where Germany exhibit a deficit with Greece, Spain and Portugal. Lowering the barriers to export of services in this particular case (every dollar of spending of a German tourist in Greece is an export of services from Greece to Germany) is not likely to involve more action from the German authorities than it could require it from the Greek authorities (for instance, in terms of fostering the learning of

German in the operators of the tourism sector in Greece). This particular example makes clear how the passage from the theory and the evidence proposed in this paper to the reality of economic policies might be more subtle than it could at first appear.

This paper leaves open several research questions. First, it would be interesting to be able to move to a fully bilateral specification of the testable equation of the model proposed in this paper. The limit here is the relative scarcity of data on bilateral current account balances. This limit, however, might be overcome in the future. Second, it is important to study more the evidence for relative trade liberalization using finer disaggregated data, thus moving beyond the aggregate approach used in this paper. Lastly, it would be important to incorporate in the analysis also the study of foreign direct investments and foreign affiliate sales. I plan to pursue these venues of research in the future.

A Model Appendix

I list here the first order conditions of the planner's problem for the two-country model illustrated in Section 3.2. λ_i and q_i, $i \in \{1,2\}$ are the multipliers of the planner's constraints (11)-(14).

The F.O.C. with respect to c_1 and c_2 read:

$$\Omega_1 \mu c_{1t}^{\mu-1} \left[c_{1t}^{\mu}(1-n_{1t})^{1-\mu}\right]^{\gamma-1} = \lambda_{1t} \tag{19}$$

$$\Omega_2 \mu c_{2t}^{\mu-1} \left[c_{2t}^{\mu}(1-n_{2t})^{1-\mu}\right]^{\gamma-1} = \lambda_{2t} \tag{20}$$

The F.O.C. with respect to n_1 and n_2 read:

$$\Omega_1(1-\mu)(1-n_{1t})^{-\mu} \left[c_{1t}^{\mu}(1-n_{1t})^{1-\mu}\right]^{\gamma-1} = q_{1t}(1-\alpha)A_{1t}k_{1t}^{\alpha}n_{1t}^{-\alpha} \tag{21}$$

$$\Omega_2(1-\mu)(1-n_{2t})^{-\mu} \left[c_{2t}^{\mu}(1-n_{2t})^{1-\mu}\right]^{\gamma-1} = q_{2t}(1-\alpha)A_{2t}k_{2t}^{\alpha}n_{2t}^{-\alpha} \tag{22}$$

These are the F.O.C. with respect to k_1 and k_2:

$$\lambda_{1t} = \beta E\left[(1-\delta)\lambda_{1t+1} + q_{1t+1}\alpha A_{1t+1}k_{1t+1}^{\alpha-1}n_{1t+1}^{1-\alpha}\right] \tag{23}$$

$$\lambda_{2t} = \beta E\left[(1-\delta)\lambda_{2t+1} + q_{2t+1}\alpha A_{2t+1}k_{2t+1}^{\alpha-1}n_{2t+1}^{1-\alpha}\right] \tag{24}$$

The F.O.C. with respect to a_1 and b_1 are:

$$q_{1t} = \lambda_{1t}\left[\omega_1(a_1)^{\frac{\theta-1}{\theta}} + \omega_2(b_1)^{\frac{\theta-1}{\theta}}\right]^{\frac{1}{\theta-1}} \omega_1 a_1^{-\frac{1}{\theta}} \tag{25}$$

$$\tau_{2t}q_{2t} = \lambda_{1t}\left[\omega_1(a_1)^{\frac{\theta-1}{\theta}} + \omega_2(b_1)^{\frac{\theta-1}{\theta}}\right]^{\frac{1}{\theta-1}} \omega_2 b_1^{-\frac{1}{\theta}} \tag{26}$$

Finally, the F.O.C. with respect to a_2 and b_2 are:

$$\tau_{1t}q_{1t} = \lambda_{2t}\left[\omega_1(b_2)^{\frac{\theta-1}{\theta}} + \omega_2(a_2)^{\frac{\theta-1}{\theta}}\right]^{\frac{1}{\theta-1}} \omega_2 a_2^{-\frac{1}{\theta}} \tag{27}$$

$$q_{2t} = \lambda_{2t}\left[\omega_1(b_2)^{\frac{\theta-1}{\theta}} + \omega_2(a_2)^{\frac{\theta-1}{\theta}}\right]^{\frac{1}{\theta-1}} \omega_1 b_2^{-\frac{1}{\theta}} \tag{28}$$

Taking the ratio of equations (28) to (27) one gets the TOT_{1t} as in equation (16) in the main text.

B Data Appendix

B.1 Manufacturing versus Services

The data sources used for this part of the paper are several. The data used for Figures 1-5 are taken from the World Bank World Development Indicators (WDI). WDI is the source also for the controls used in the empirical analysis: the GDP, the real gdp per capita, the gdp per capita growth, the real gdp the private credit over GDP. In order to build the CHB indicators, I used production as well as trade data for services and manufacturing. The data on trade in services come from the Trade in Service Database, developed by Francois and Pindyuk (2013) using OECD, Eurostat and IMF data. The data for trade in manufacturing are taken from the UN-Comtrade database. The data on gross output at the sectoral level, from the OECD-STAN database, is available only for few countries. The output data at the sectoral level for the BRICS are obtained using OECD-STAN input output matrices in order to convert value added into output values for manufacturing and total services. Using the same procedure for Germany, Japan and the United States, I obtained estimates of the output values whose correlation with the raw data is of the order of 0.98.

These data constraints limit the sample of countries to 24 OECD countries plus the BRICS reported in footnote (22).

B.2 Agriculture versus Manufacturing

The data source for this part of the paper are also several. I used WTO trade statistics data to compute Relative export specialization indexes in manufacturing, agricultural goods and services for a large sample of over 180 countries for the period 1980-2012. The same data have been used to compute relative import specialization in manufacturing. Tariffs data are taken from TRAINS. I then selected the countries belonging to the first quartile of the distribution of agricultural exporters, who were also above the median relative import specialization in manufacturing and had valid tariffs data in both manufacturing and agricultural goods for the period 1995-2012. Applying these criteria leaves me with a sample of thirteen countries, eleven Latin American and two African countries listed in footnote (28).

$\hat{\tau_t^h}$ is extracted by TRAINS using the program WITS. For each reporting country, it corresponds to the change in the weighted average of the applied ad valorem custom duty for the Agricultural, Forestry and Fishery products (Category 0 in the SIC) where the partner country considered is the World. $\hat{\tau_t^f}$ is the change in the weighted average of the applied ad valorem custom duty for the Manufactured products (Category 2 in the SIC) where the partner country considered is the World.

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Asymmetric Trade Liberalizations and Current Account Dynamics

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ONLINE APPENDIX - NOT FOR PUBLICATION

December 15, 2015

1 Content

This appendix contains some supplementary material that I did not insert in the main text due to space constraints. Moreover, it includes the technical details of the model presented in Section 2.

2 Two-Period Model

2.1 Set-up

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:

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$$B_1 = p_1^h Y_1^h - P_1 C_1, \qquad B_1^* = p_1^{f*} Y_1^{f*} - P_1^* C_1^*, \tag{1}$$

$$P_2 C_2 = p_2^h Y_2^h + (1 + r_1) B_1, \qquad P_2^* C_2^* = p_2^{f*} Y_2^{f*} + (1 + r_1) B_1^*, \tag{2}$$

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 inter-temporal optimization problem yields standard Euler equations for both Home and Foreign:

$$C_1 = \beta^{-\sigma} \left((1 + r_1) \left(\frac{P_1}{P_2} \right) \right)^{-\sigma} C_2 \qquad C_1^* = \beta^{-\sigma} \left((1 + r_1) \left(\frac{P_1^*}{P_2^*} \right) \right)^{-\sigma} C_2^*. \tag{3}$$

The intra-temporal optimization decision gives the following demand equations for $t = \{1, 2\}$:

$$C_t^s = \left(\frac{p_t^h}{P_t} \right)^{-\theta} C_t, \qquad C_t^{h*} = \left(\frac{\tau_h^h p_t^h}{P_t^*} \right)^{-\theta} C_t^*, \tag{4}$$

$$C_t^f = \left(\frac{\tau_t^f p_t^{f*}}{P_t} \right)^{-\theta} C_t, \qquad C_t^{f*} = \left(\frac{p_t^{f*}}{P_t^*} \right)^{-\theta} C_t^*. \tag{5}$$

2.2 A Symmetric Equilibrium

I consider a symmetric equilibrium where $\bar{p^h} = \bar{p^{f*}} = 1$, $\bar{B_1} = \bar{B_1^*} = 0$, $\bar{Y^h} = \bar{Y^{f*}} = \bar{Y}$, and $\bar{\tau^h} = \bar{\tau^f} = \tau$.

In this symmetric equilibrium, price indexes are equal:

$$\bar{P} = \bar{P^*} = \left(1 + \tau^{1-\theta} \right)^{\frac{1}{1-\theta}}. \tag{6}$$

Moreover, we have:

$$\bar{C} = \bar{C*} = \frac{\bar{Y}}{\bar{P}}, \tag{7}$$

$$\bar{C^h} = \bar{C^{h*}} = \bar{P}^{\theta}\bar{C}, \tag{8}$$

$$\bar{C^f} = \bar{C^{f*}} = \tau^{-\theta}\bar{P}^{\theta}\bar{C}. \tag{9}$$

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

$$\frac{\bar{C^h}}{\bar{C^h} + \tau\bar{C^{h*}}} = \frac{\bar{C^{f*}}}{\tau\bar{C^f} + \bar{C^{f*}}} = s_h = s_f^* = \frac{1}{1+\tau^{1-\theta}}. \tag{10}$$

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:

$$\frac{\tau\bar{C^f}}{\tau\bar{C^f} + \bar{C^{f*}}} = \frac{\tau\bar{C^{h*}}}{\bar{C^h} + \tau\bar{C^{h*}}} = s_f = s_h^* = \frac{\tau^{1-\theta}}{1+\tau^{1-\theta}} \tag{11}$$

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.[1] Finally, symmetry implies that $s_h = 1 - s_f$. This property is extremely useful in the process of log-linearization.

2.3 The Complete Log Linearized Model

I denote with a ˆ 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 equilibrium described above gives us:

$$\hat{C}_2 = \sigma(1-\beta)\hat{r_1} + \sigma\hat{P}_1 - \sigma\hat{P}_2 + \hat{C}_1 \qquad \hat{C}_2^* = \sigma(1-\beta)\hat{r_1} + \sigma\hat{P}_1^* - \sigma\hat{P}_2^* + \hat{C}_1^* \tag{12}$$

[1] A point already made by Obstfeld and Rogoff (2001).

$$\hat{B}_1 = \hat{p_1^h} + \hat{Y_1^h} - \hat{P}_1 - \hat{C}_1 \qquad \hat{B}_1^* = \hat{p_1^{f*}} + \hat{Y_1^{f*}} - \hat{P}_1^* - \hat{C}_1^* \tag{13}$$

$$\hat{C}_2 = \hat{p_2^h} + \hat{Y_2^h} - \hat{P}_2 + \frac{1}{\beta}\hat{B}_1 \qquad \hat{C}_2^* = \hat{p_2^{f*}} + \hat{Y_2^{f*}} - \hat{P}_2^* + \frac{1}{\beta}\hat{B}_1^* \tag{14}$$

$$\hat{C_t^h} = -\theta\left(\hat{p_t^h} - \hat{P}_t\right) + \hat{C}_t \qquad \hat{C_t^{h*}} = -\theta\left(\hat{p_t^h} + \hat{\tau_t^h} - \hat{P}_t^*\right) + \hat{C}_t^* \tag{15}$$

$$\hat{C_t^f} = -\theta\left(\hat{p_t^{f*}} + \hat{\tau_t^f} - \hat{P}_t\right) + \hat{C}_t \qquad \hat{C_t^{f*}} = -\theta\left(\hat{p_t^{f*}} - \hat{P}_t^*\right) + \hat{C}_t^* \tag{16}$$

$$\hat{P}_t = s_h\hat{p_t^h} + s_f\left(\hat{p_t^{f*}} + \hat{\tau_t^f}\right) \qquad \hat{P}_t^* = (1-s_h)\left(\hat{p_t^h} + \hat{\tau_t^h}\right) + (1-s_f)\hat{p_t^{f*}} \tag{17}$$

$$\begin{aligned} s_h\hat{C_t^h} + (1-s_h)\left(\hat{\tau_t^h} + \hat{C_t^{h*}}\right) &= \hat{Y_t^h} && (18)\\ s_f(\hat{C_t^f} + \hat{\tau_t^f}) + (1-s_f)\hat{C_t^{f*}} &= \hat{Y_t^{f*}} && (19)\\ \hat{B}_1 + \hat{B}_1^* &= 0 && (20) \end{aligned}$$

2.4 Two-Period Model Solution

In order to solve the model, the strategy is to derive all the elements that appear in equation (1) as functions of relative trade costs, the endowments, and $\hat{B}_1$, and then find an explicit solution for $\hat{B}_1$. I plug into equation (18) the home and foreign version of equation (15) for period one. I then substitute in the resulting equation the Price indexes and the aggregate consumption levels using the period 1 budget constraints (13) and the Price index definitions (17). This allows me to express:

$$\hat{p_1^h} - \hat{p_1^{f*}} = -\frac{\alpha_1}{\alpha_2}\left(\hat{\tau_1^h} - \hat{\tau_1^f}\right) - \beta\frac{\alpha_0}{\alpha_2}\hat{B}_1 - \frac{s_f}{\alpha_2}\left(\hat{Y_1^h} - \hat{Y_1^{f*}}\right) \tag{21}$$

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

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

Moreover, It is easy to show how:

$$\hat{P}_1 - \hat{P}_1^* = (s_h - s_f)(\hat{p_1^h} - \hat{p_1^{f*}}) - s_f\left(\hat{\tau_1^h} - \hat{\tau_1^f}\right) \tag{22}$$

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

$$\hat{p_2^h} - \hat{p_2^{f*}} = -\frac{\alpha_1}{\alpha_2}\left(\hat{\tau_2^h} - \hat{\tau_2^f}\right) + \frac{\alpha_0}{\alpha_2}\hat{B}_1 - \frac{s_f}{\alpha_2}\left(\hat{Y_2^h} - \hat{Y_2^{f*}}\right) \tag{23}$$

and

$$\hat{P}_2 - \hat{P}_2^* = (s_h - s_f)(\hat{p_2^h} - \hat{p_2^{f*}}) - s_f\left(\hat{\tau_2^h} - \hat{\tau_2^f}\right) \tag{24}$$

Plugging back equations (21)-(24) into equation (1) after rearranging and defining

$$\eta = \frac{\frac{\alpha_0}{\alpha_2} + (\sigma - 1)\left[(s_h - s_f)\frac{\alpha_1}{\alpha_2} + s_f\right]}{(1+\beta)\left[\frac{2}{\beta} + \frac{\alpha_0\beta}{\alpha_2}\right] + (1+\beta)\left[(\sigma - 1)(s_h - s_f)\frac{\alpha_0}{\alpha_2}\right]} > 0 \tag{25}$$

and

$$\nu = \frac{1 - \frac{s_f}{\alpha_2} - (\sigma - 1)(s_h - s_f)\frac{s_f}{\alpha_2}}{(1+\beta)\left[\frac{2}{\beta} + \frac{\alpha_0\beta}{\alpha_2}\right] + (1+\beta)\left[(\sigma - 1)(s_h - s_f)\frac{\alpha_0}{\alpha_2}\right]} > 0 \tag{26}$$

gives equation (2) in the main text. From Equation (25) is possible to derive the restriction on the intertemporal elasticity of substitution that makes η a positive number (given

$\theta > 1$). In particular, a sufficient condition for $\eta > 0$ is $\sigma > 1 - \frac{\frac{\alpha_1}{\alpha_2}}{(s_h - s_f)\frac{\alpha_1}{\alpha_2} + s_f}$. From equation (26) we see that ν is instead positive as long as $\sigma < 1 + \frac{2s_h(\theta-1)}{(s_h-s_f)}$.

3 Supplementary Material

Table 1: **CHB, Manufacturing and Services**

Sector	MANUF	MANUF	MANUF	SERV	SERV	SERV
Time	1995	2008	Δ%	1995	2008	Δ%
AUT	63.01	40.91	-0.35	99.86	112.08	0.12
BRA	33.87	27.02	-0.20	32.09	31.44	-0.02
CAN	24.46	23.57	-0.04	43.42	35.26	-0.19
CHE	47.55	37.56	-0.21	74.91	76.19	0.02
CHN	13.78	4.00	-0.71	41.78	10.58	-0.75
CZE	200.51	56.64	-0.72	417.64	203.34	-0.51
DEU	7.33	6.74	-0.08	10.32	13.89	0.35
DNK	84.81	52.38	-0.38	130.80	113.09	-0.14
ESP	30.24	23.28	-0.23	42.86	32.14	-0.25
FIN	110.14	91.45	-0.17	198.65	175.50	-0.12
FRA	12.66	13.03	0.03	15.55	16.13	0.04
GBR	14.95	16.20	0.08	20.02	13.72	-0.31
GRC	192.71	157.32	-0.18	199.27	141.30	-0.29
HUN	278.33	52.28	-0.81	538.44	300.42	-0.44
IND	49.00	25.29	-0.48	82.94	36.43	-0.56
IRL	87.40	76.97	-0.12		101.15	
ISR	182.56	143.13	-0.22		206.42	
ITA	14.77	14.30	-0.03	21.83	20.32	-0.07
JPN	4.13	7.71	0.87	4.96	11.66	1.35
KOR	22.46	18.45	-0.18	57.02	55.38	-0.03
MEX	49.54	28.30	-0.43	96.46	61.68	-0.36
NOR	142.09	107.53	-0.24	165.69	120.60	-0.27
NZL	283.67	281.00	-0.01	336.92	344.93	0.02
POL	125.12	44.11	-0.65	204.08	96.94	-0.53
PRT	130.43	122.36	-0.06	220.62	214.17	-0.03
RUS		29.78		62.18	30.12	-0.52
SWE	58.18	48.99	-0.16	90.85	88.68	-0.02
USA	3.37	3.93	0.16	2.93	3.00	0.02
ZAF	128.28	118.54	-0.08	155.14	142.92	-0.08

Table 2: **Average Reveled Comparative Advantage in Services**

Country	AV. RCA. SERV.
GRC	3.175
GBR	1.575
ESP	1.563
DNK	1.526
ISR	1.501
AUT	1.436
USA	1.390
IND	1.378
PRT	1.360
IRL	1.310
NZL	1.249
NOR	1.170
CHE	1.154
FRA	1.090
SWE	1.072
POL	0.992
ITA	0.978
HUN	0.956
FIN	0.889
CZE	0.889
JPN	0.732
ZAF	0.730
KOR	0.729
DEU	0.696
CAN	0.638
BRA	0.611
RUS	0.538
CHN	0.529
MEX	0.399

Figure 1: **Decomposition of the Trade Surplus of Germany**

Figure 2: **Decomposition of the Trade Deficit of Spain**

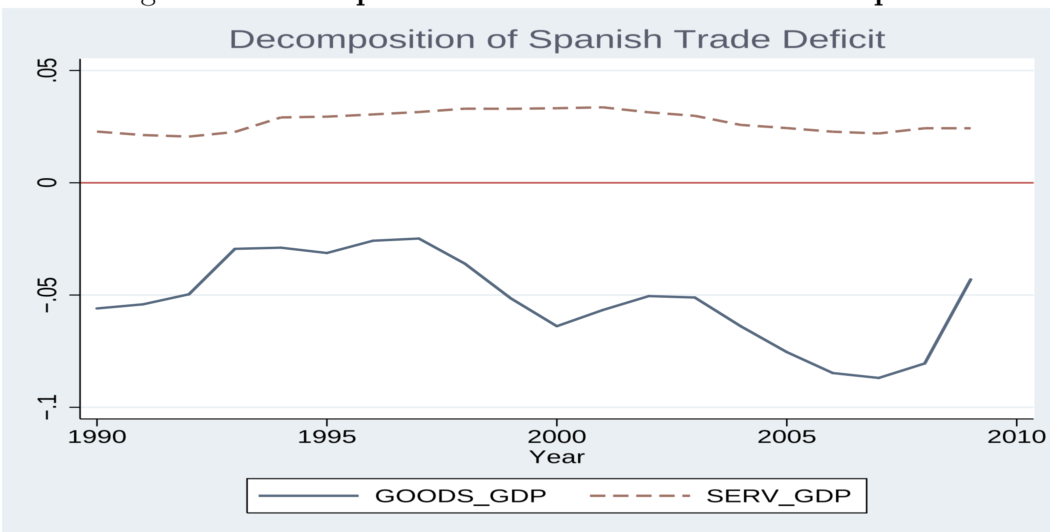

Figure 3: **Decomposition of the Trade Deficit of Portugal**

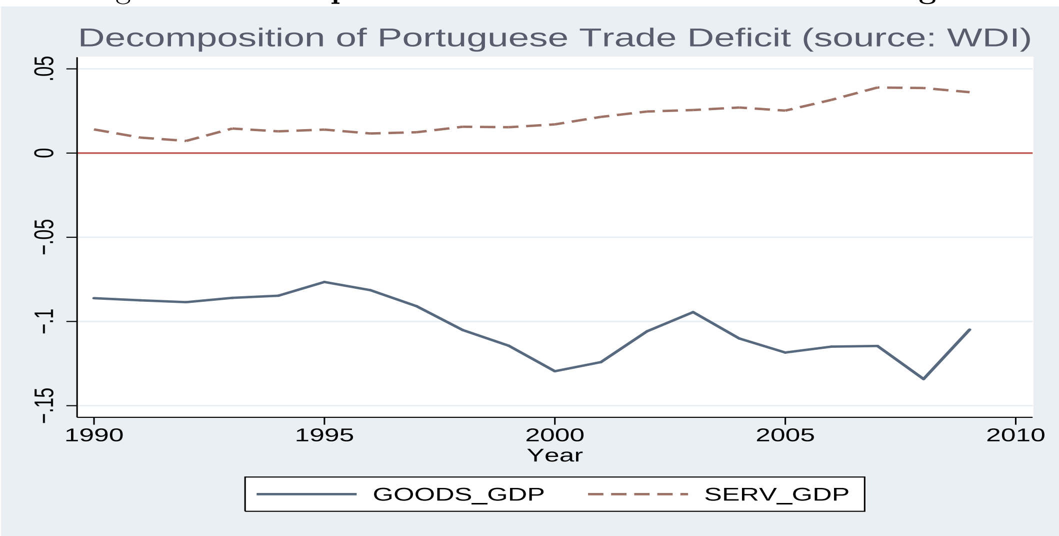

Figure 4: **Decomposition of the Trade Deficit of Greece**

Figure 5: **Revealed Comparative Advantage in Services, Selected Countries**

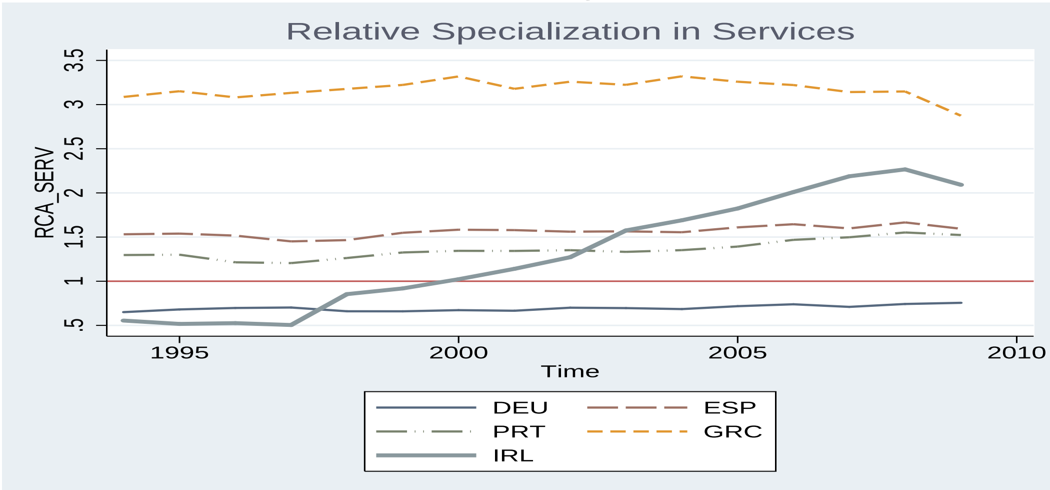

Figure 6: **Change in Relative Protection, Average 1995-2009**