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Asymmetric Trade Liberalizations and Current Account Dynamics

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Abstract

In this paper, I show a strong positive correlation between the value-added share of manufacturing 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 the 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 partially explain the rise in the German surplus. Lastly, I provide broad empirical support for the key predictions of the theory.

***Keywords**:* Current Account Dynamics, Relative Trade Liberalization Measures

Jel codes: F1, F32, F40

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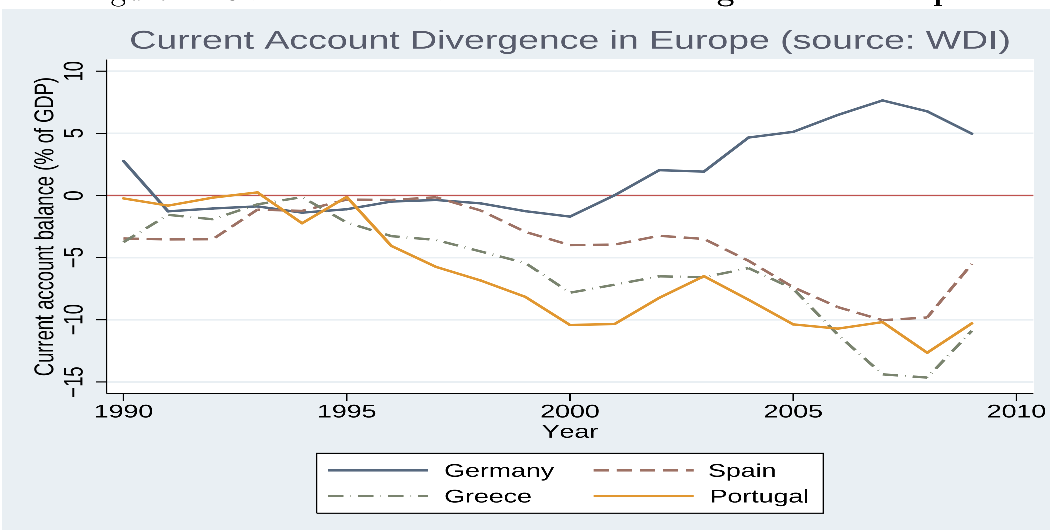
1 Introduction

Starting in the early 2000s, and up to the Great Recession, core northern European countries, such as Germany, Finland, and the Netherlands, started accumulating large current account surpluses, while southern European countries, such as Spain, Portugal, and Greece, started displaying ever-growing deficits (Figure 1). It is well known that the growth in these imbalances played a key role in the unfolding of the European Crisis (Baldwin et al, 2015).

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

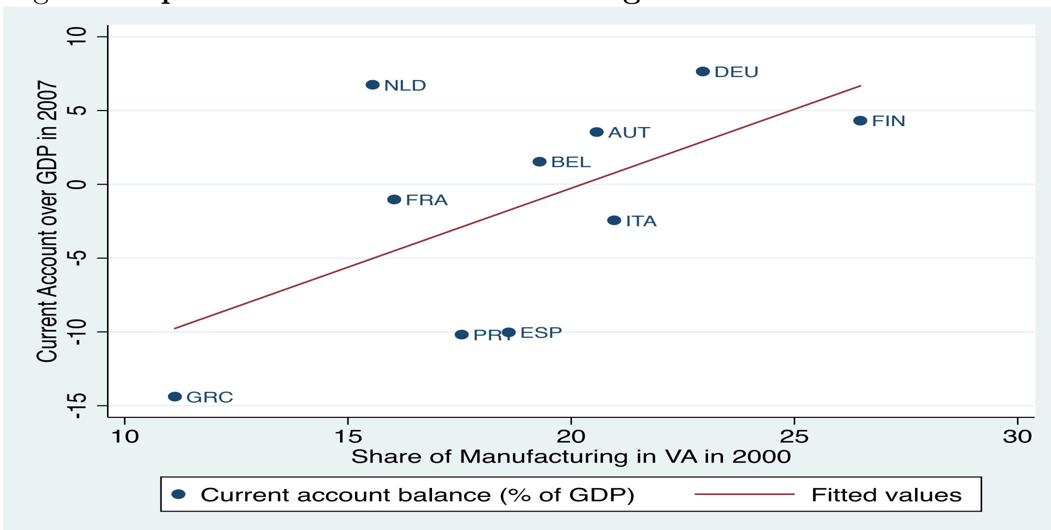


The motivation for this paper is the discovery of two interesting and lesser-known facts. First, for the original members of the Euro area, the data shows a strikingly positive correlation between the share of manufacturing (in total value added) in the early 2000 and the current account balances in 2007 (Figure 2).[1] Second, a simple decomposition of the aggregate trade balance into its goods trade and services trade components reveals the following: (a) the German trade surplus emerges from a surplus in goods accompanied by a deficit in services, while (b) Spain, Portugal, and Greece exhibit increasing trade deficits in goods, but surpluses in services.[2]

[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 both as a financial hub and headquarter of several multinational firms seeking a favorable fiscal treatment.

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

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



Starting from the motivating evidence above, 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 incomplete markets and trade costs, and I show how the asymmetry in the liberalization of manufacturing versus service trade can explain a significant portion of the surplus. Finally, I propose some empirical evidence that broadly support the main predictions of the theory.

I proceed in three steps. Firstly, 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 the Home's current account depends purely on consumption smoothing. I explicitly solve 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 of the home good *relative* to the change in the trade 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 impact 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]

Secondly, I propose a quantitative investigation of the German current account surplus. I first show that in Germany, during the period between 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 trades with itself in a given sector *relative to* what it would do if the world was completely frictionless. I show that while this indicator is declining in the German manufacturing sector over the period of 2000-2007, it is essentially flat in services. Moreover, using data from EU-KLEMS, I show that in Germany during 2000-2007, productivity growth in the manufacturing sector was much higher than in services. Then, I use a 2-country 2-sector international real business cycle model with incomplete markets, augmented with trade costs, to assess what portion of the German 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 current account surplus of around 5% of GDP at its peak, which is roughly the same order of what was observed in the data (6.7%). Interestingly, if the model is fed only with asymmetric trade costs dynamics and no changes in productivity, it still delivers a sizeable current account surplus. On the contrary, when the model is fed only with asymmetric productivity dynamics and no changes in trade costs, it is unable to deliver a path for the current accout consistent with what was observed in the German data. The key to understanding these results is the existence of an investment boom spurred by the increase in productivity that counterbalances the increase

[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 the Home country towards current account surpluses, while a relative increase in output at period two leads the Home country towards current account deficits.

in savings induced by consumption smoothing, and thus dampens the effect of asymmetric productivity dynamics on the current account.

Thirdly, I propose an empirical analysis that broadly supports 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 the manufacturing and services sectors. 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 that, on average, Spain, Portugal, and Greece were characterized by *high relative trade liberalizations* during the period between 1995-2009. This means that the reduction in the barriers to trade in the sector they tend to import (i.e. manufacturing) was larger on average than the reduction in the trade barriers in the sector where they tend to export (i.e. services). Germany, on the contrary, exhibits a *low relative trade liberalization* on average, 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 the current account dynamics. Following the specification of the key equation of the model, I regress the change in the ratio of the current account as a share of GDP on both the contemporaneous measure of relative trade liberalization and on some of its leads. Consistent with the theory, I find a negative 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. In this case as well, 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 overlooked.

This paper is linked to several strands of the literature. First, it is broadly linked to the literature on global imbalances. While the volume of 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) present 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, in this paper consumption smoothing plays the key role. Jin (2012) links industrial structure to capital flows (and hence to current account dynamics) in a model where the specialization in capital intensive sectors causes an increase in the demand for capital, and thus explains 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 account. Engel and Kletzer (1986) show how the impact of a tariff on the current account depends on the capital intensity of the sector protected. Gavin (1991) examines the impact of

[4]See for instance Blanchard and Milesi-Ferretti (2009), Caballero, Farhi, and Gourinchas (2008), Gete (2015), Engels and Rogers (2006), Hausman and Sturzenegger (2006), Mendoza, Quadrini, and Rios-Rull (2009).

a tariff on the current account in a model that places emphasis on the fact that it takes time for the production sector of an economy to adjust to a change in relative prices. A more recent example of this literature is the paper by Reyes-Heroles (2016), 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 the empirical literature 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). [6]

None of these studies has proposed asymmetries in trade liberalizations as potential drivers of current account dynamics. A notable exception are the recent papers by Alessandria and Choi (2016) and Alessandria, Choi and Lu (2016). They investigate several possibile determinants of the trade balance dynamics of, respectively, the U.S. and China, including a possibly asymmetric pace of trade liberalization. While the spirit of their exercise differs in many respects from the analysis proposed in this paper, one of their findings is that asymmetric trade cost dynamics can help explaining trade balance dynamics.

In previous work, I examined the extent to which the asymmetry in the liberalizations of service trade and manufacturing trade of the last decades can explain the current account dynamics of the U.S. (Barattieri, 2014). This paper substantially improves on Barattieri (2014). Firstly, I propose a closed form solution for a model where asymmetric trade liberalizations affect the dynamics of the current account. Second, within a two country model with incomplete markets, I explicitly explore the role of asymmetric productivity dynamics and their interactions with trade cost asymmetries. Lastly, I build relative liberalization measures and then use them to test the key prediction of the theory, and I propose a new empirical analysis based on a sample of developing countries. Overall, I see this paper as

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

[6] In recent work, Kehoe et al (2016) study how the US trade deficit can affect goods versus services employment dynamics.

proposing a new potential driver for current account dynamics. It should not to be considered as a substitute, but rather as a complement to the vast amount of work done in the area.

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

2 A Simple Two-Period Model

In this Section I present a simple model aimed at showing how asymmetric trade liberalizations can affect the dynamics of the current account.[7] 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.[8]

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 for this is that, as shown by Cole and Obstfeld (1991) and Corsetti and Pesenti (2001), in the presence of unitary elasticity of

[7]Due to space constraints, I report most of the technical details of the model in an online appendix.

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

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 consumption of foreign good in Home at time t. The price indices 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, the bond market clearing requires:

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

Unfortunately, one cannot obtain closed-form solutions without unitary elasticity of substitution between the home and foreign goods. To ensure the results are 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.[9]

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:

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

Equation (1) allows us to interpret the evolution of the 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 towards a surplus (deficit) in case of an increase of the home endowment (or its price) relative to the foreign endowment (or its price) 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 in the home price index in period 2 relative to period 1 tends to push the Home's current account towards a deficit, as would a decrease in the foreign price index in period 2 relative to period 1.

Obviously, one must fully solve the model to obtain the impact of the different exogenous variables on the current account. I achieve this 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).[10] This allows me to express the Home's current account only as a function of the exogenous endowments and trade costs:

[9] The details of the symmetric equilibrium, the log-linerarization, and the solution of the model are described in the online appendix.

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

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

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 $(\beta, \theta, \sigma, \tau)$.[11] It is positive for a large range of plausible values of the parameters.

Equation (2) is the key equation. It is important to note that the relevant shock is the change in the trade cost of 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 impact the current account. On the other hand, asymmetric trade liberalization processes for which $\left(\hat{\tau_1^h - \tau_1^f}\right) < 0$ and/or $\left(\hat{\tau_2^h - \tau_2^f}\right) > 0$ push the current account of the Home country into a surplus.[12] Moreover, any permanent change of the trade policy would not affect the current account, while temporary changes would.

More generally, equation (2) challenges the view that trade policies cannot influence the trade balance because they cannot affect savings and investment decisions.[13] 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 investments, which are inter-temporal decisions.[14]

Finally, we see from equation (2) that the endowment dynamics also affects the current account, and in the usual way. All else equal, an increase in the endowment of the Home country relative to that of the Foreign's in period 1 (period 2) pushes the Home country current account towards a surplus (deficit). This also emphasizes the potential importance of productivity dynamics in determining the current account.

[11]See the online appendix for details.

[12]The condition $\left(\hat{\tau_1^h - \tau_1^f}\right) < 0$ arises if the trade cost faced by the home good falls by more (or increases by less) than the trade cost faced by the foreign good.

[13]See for instance Lamy (2010).

[14]In this instance, the point is made only for savings.

3 A Quantitative Investigation of the German Surplus

While equation (2) provides a clear qualitative insight, the first question that follows is whether this insight is also quantitatively relevant. The aim of this section is in three-fold. First, I document that in Germany, both trade costs and productivity dynamics in the manufacturing and service sectors have been highly asymmetric in the period between 2000-2007.[15] Second, I outline a 2-country international real business cycle model featuring incomplete markets and augmented with trade costs. Finally, I explore the ability of the model to reproduce the dynamics of the German surplus, when fed with the asymmetric trends found in the data.

3.1 Asymmetric Trade Costs and Productivity Dynamics

Trade Costs Dynamics. In this section, I follow Barattieri (2014), where I propose the use of the constructed home bias index (CHB)[16] as a convenient way to capture the dynamics of trade costs in services and manufacturing. The CHB index is a pure number and it expresses how much more a country is trading with itself in a given sector, relative to what it would do if the world was frictionless. Obviously, this definition requires a benchmark of what trade would be 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:

[15] The chosen period is partly motivated by Figure 1, where the German surplus starts growing in 2000 and peaks in 2007, and partly motivated by some data limitations: productivity figures are available just until 2007 and service trade costs data are more reliable after 1999.

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

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

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, respectively, the inward and outward multilateral resistance terms, which are in turn weighted averages of the bilateral trade costs t_{ij}^k.[17]

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 obtain a prediction of the amount of trade that would prevail in the absence of trade frictions. In fact, if $t_{ij}^k = 1$ for every country pair ij, 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 then possible to express the ratio of realized internal trade to the trade that would prevail in the 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, differently from Barattieri (2014), I use (5) to calculate the CHB index.[18]

[17] Defined as follows:

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

[18] 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.

The index has several advantages and some disadvantages. First, it is time varying. Second, the index allows for 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.[19] However, the index does rely on the gravity model to determine the benchmark trade in the case of no friction.

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

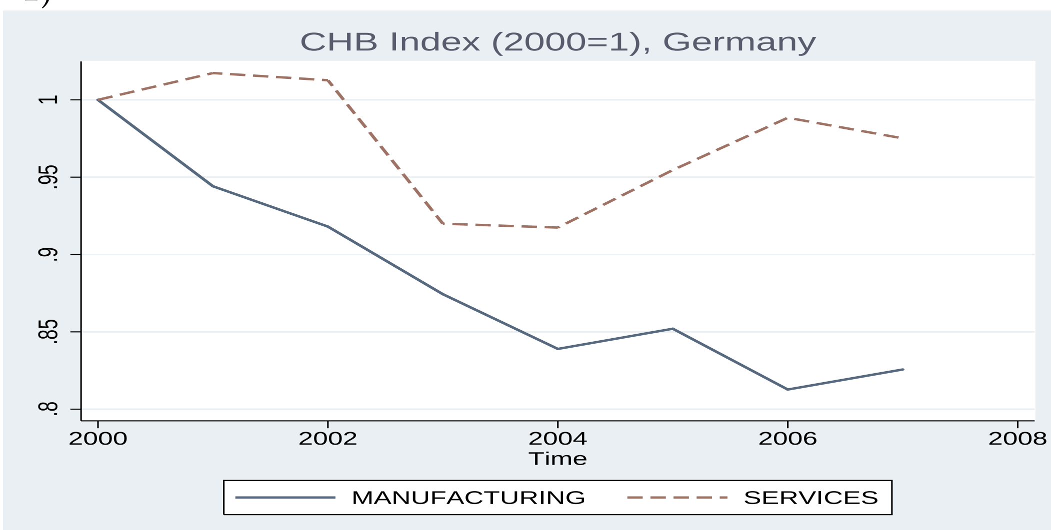


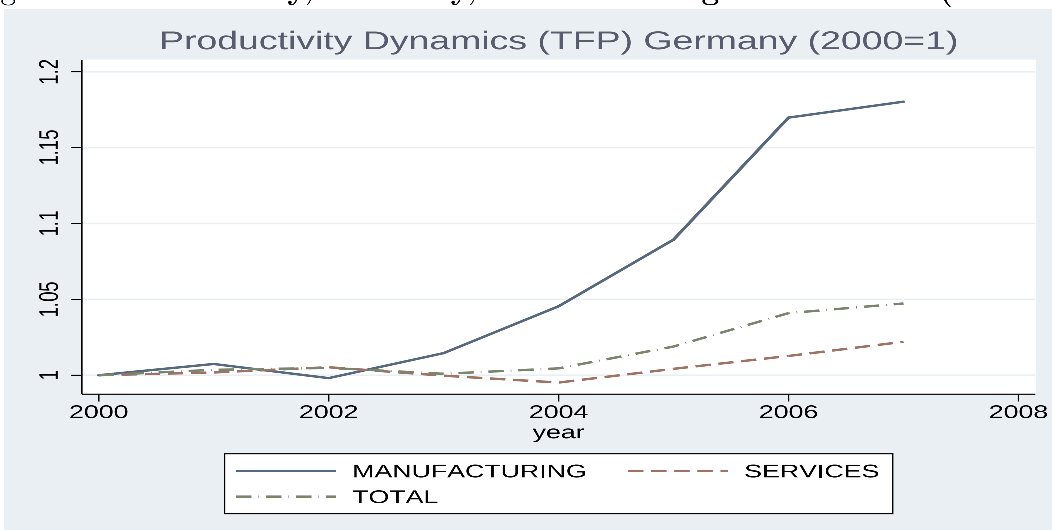
Figure 3 reports the evolution of the CHB in manufacturing and services for Germany for the period 2000-2007, normalized to 1 in 2000. As the Figure clearly shows, there is a clear trend of the CHB in the manufacturing sector, while the CHB in the services sector first declines and then increases again, 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 indices 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 service sectors. This can be

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

gauged also by looking at the OECD Product Market Regulation (PMR) indices for network services. After three decades of liberalization, the pace of liberalization in the German network service sectors effectively stagnated, which was observed from 2000 onwards.[20]

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 sectors, normalizing them to 1 in 2000. The Figure clearly shows an asymmetry in the dynamics. Productivity in the manufacturing sector grew about 18% in the period considered, while productivity in the service sector grew by only about 3%.[21]

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



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

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

3.2 A 2-Country International Real Business Cycle Model

In this section, I develop a 2-sector 2-country model in the spirit of Backus, Kehoe, and Kydland (1994), but featuring incomplete markets (to be closer to the simpler model introduced in Section 2). I assume away uncertainty, while adding exogenous trade costs.

Technology. There are two countries, 1 and 2. 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 assume here that productivity is non-stochastic. Both consumption and investment are composite of foreign and domestic goods:

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

where

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

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 laws 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.

The Firms' problem. Perfectly competitive firms maximize their profit subject to the production technology (6):

$$Max \qquad \rho_{it}^{D} y_{it} - w_{it} n_{it} - r_{it}^{k} k_{it}$$

where w_{it} is the wage rate, r_{it}^{k} is the rental rate of capital, and ρ_{it}^{D} is the price of the good produced relative to the price of the consumption and investment bundle in country i (P_i). In Appendix A, I provide the first order conditions for this problem.

It is also useful to define the relative export price ρ_{it}^{X}, which is the export price (including the trade costs) relative to the price of the consumption and investment bundle of the other country:

$$\rho_{1t}^{X} = \frac{\tau_{1t} \rho_{1t}^{D}}{Q_t} \qquad \rho_{2t}^{X} = Q_t \tau_{2t} \rho_{2t}^{D} \tag{10}$$

where $Q_t = \frac{P_2}{P_1}$ is the real exchange rate.

The Consumers' problem. In both countries, consumers maximize a CRRA utility function. They supply inelastically one unit of labor n_i. They can save in domestic capital, k_i, in a bond issued by country 1 (B_i) or in a bond issued by country 2 (B_i^{*}) . In country 1, the consumer solves the following problem:

$$max \sum_{t=0}^{\infty} \beta^{t} \frac{c_{1t}^{1-\sigma}}{1-\sigma}$$

subject to

$$\begin{aligned} k_{1t+1} + B_{1t+1} + Q_t B_{1t+1}^{*} + c_{1t} + \frac{\eta}{2} B_{1t+1}^{2} + Q_t \frac{\eta}{2} B_{1t+1}^{*2} &= r_{1t} B_{1t} + Q_t r_{2t} B_{1t}^{*} + r_{1t}^{k} k_{1t} \\ &\quad + w_{1t} n_{1t} + (1-\delta) k_{1t-1} + T_{1t} \end{aligned}$$

where the budget constraint is defined in units of the consumption and investment bundle in country 1. I adopt as a stationarity inducing device a small adjustment cost of bond holdings η, which is fully rebated to the household in equilibrium with a transfer T_{1t}.[22] Q_t is the real exchange rate, as defined before. r_{it} is the return of the bonds B and B^* in the units of the respective countries' consumption and investment bundles. In Appendix A, I report the first order conditions associated with this problem.

Market Clearing. Given the existence of trade costs, the output market clearing conditions can be expressed as:

$$y_{1t} = a_{1t} + \tau_{1t} a_{2t} \qquad y_{2t} = b_{2t} + \tau_{2t} b_{1t} \tag{11}$$

On the other hand, the labor market clearing conditions read:

$$n_{1t} = 1 \qquad n_{2t} = 1 \tag{12}$$

Finally, the bonds' market clearing conditions are:

$$B_{1t+1} + B_{2t+1} = 0 \qquad B^*_{1t+1} + B^*_{2t+1} = 0 \tag{13}$$

Current Account. The current account in this model can alternatively be measured as the change in net foreign asset position or the sum of the net exports and the income account:

$$CA_{1t} = \Delta NFA_{1t} = (B_{1t+1} - B_{1t}) + Q_t \left(B^*_{1t+1} - B^*_{1t}\right) \tag{14}$$

$$CA_{1t} = NX_{1t} + (r_{1t} - 1) B_{1t} + Q_t (r_{2t} - 1) B^*_{1t} \tag{15}$$

with the net exports defined as exports minus imports:

$$NX_{1t} = Q_t \rho^X_{1t} a_{2t} - \rho^X_{2t} b_{1t} \tag{16}$$

In what follows, I will report results for the ratio of the current account to the GDP,

[22] This is to say that $T_{1t} = \frac{\eta}{2} B^2_{1t+1} + Q_t \frac{\eta}{2} B^{*2}_{1t+1}$.

which, in this economy, can be computed as the sum of consumption, investment, and the net exports.

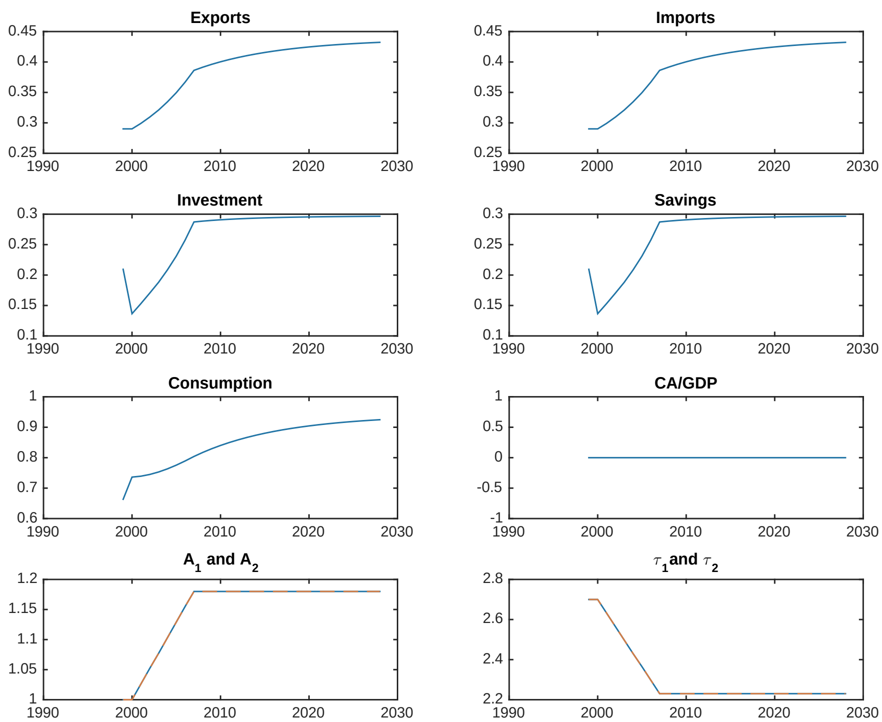
Calibration. I use standard parameter values to calibrate the model. Following BKK (1994), I set $\sigma = 2$, corresponding to an inter-temporal elasticity of substitution of 0.5. α is set to 0.36. θ is set to 1.5, while β is 0.96, and δ 0.1, in order to calibrate the model to annual frequencies. η is set to an arbitrary small value: 0.0025. The trade costs are assumed to be initially equal to 2.7, which is the value suggested by Anderson and Van Wincoop (2004). ω is 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 increase 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 increase at 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 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 as 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 starts growing at the same rate of A_1. Hence, in the experiment, country 1 would represent Germany, whose productivity grows faster than the other country in the first 8 years and whose export sector 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 current account. A symmetric reduction of the trade costs in country 1 and 2 leads to an equal increase in exports and imports in each country. As a result, the trade balance (and the current account) does not move in either country. Savings and investments also rise, after an initial drop, which is due to a rise in consumption.

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 current account, as reported in Figure 6. The country whose good becomes liberalized first (country 1 in the experiment) experiences an export boom in the first years, while imports do not move much, until the liberalization also starts for the importing good. Also, since investments depend on the foreign good, investment does not rise as fast in country

1, as seen in the case of a symmetric reduction in the trade costs. As a consequence, the current account of country 1 heads towards a 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**

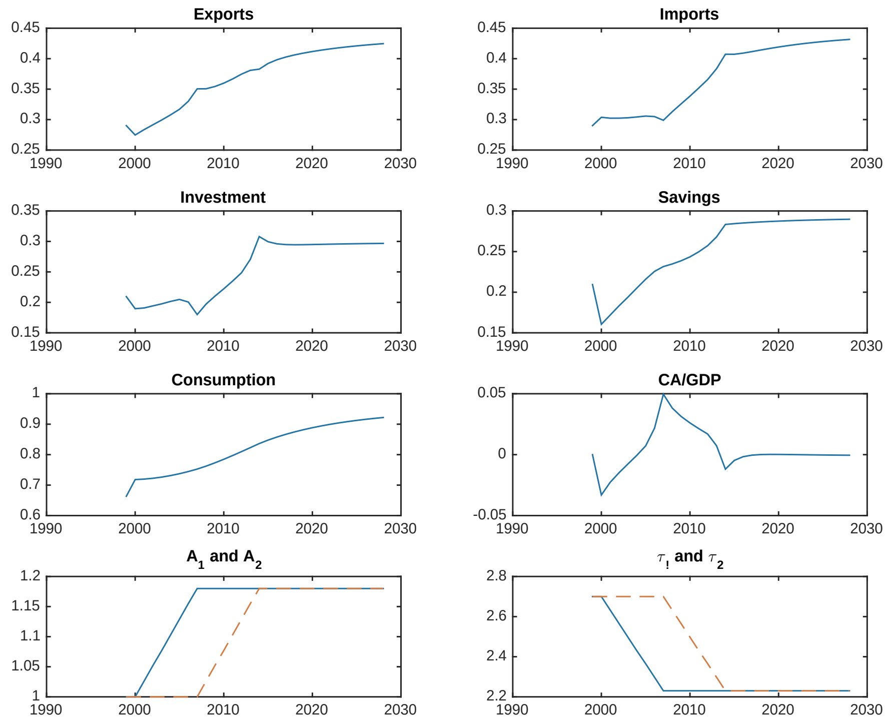
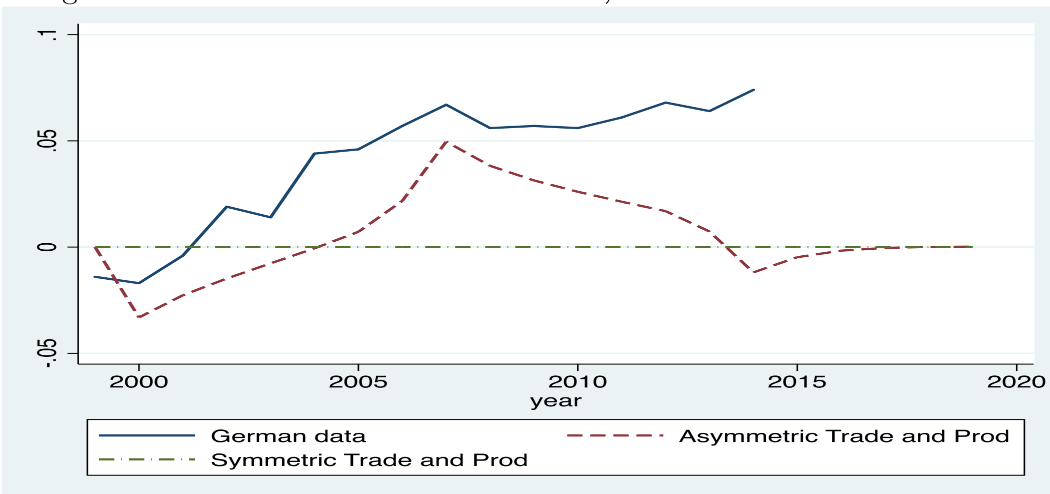


Figure 7 reports, on the same graph, the German current account over GDP and the corresponding object obtained with the model simulations for the years 2000-2020. While the timing of the increases in the German current account is not exactly captured by the model under the asymmetric trade liberalization experiment, the correlation between the two series is considerably high (0.84). Moreover, the model is able to generate a peak in the current account surplus of about 4.9% of GDP, which is fairly close to what was observed in Germany in 2007 (6.7%).

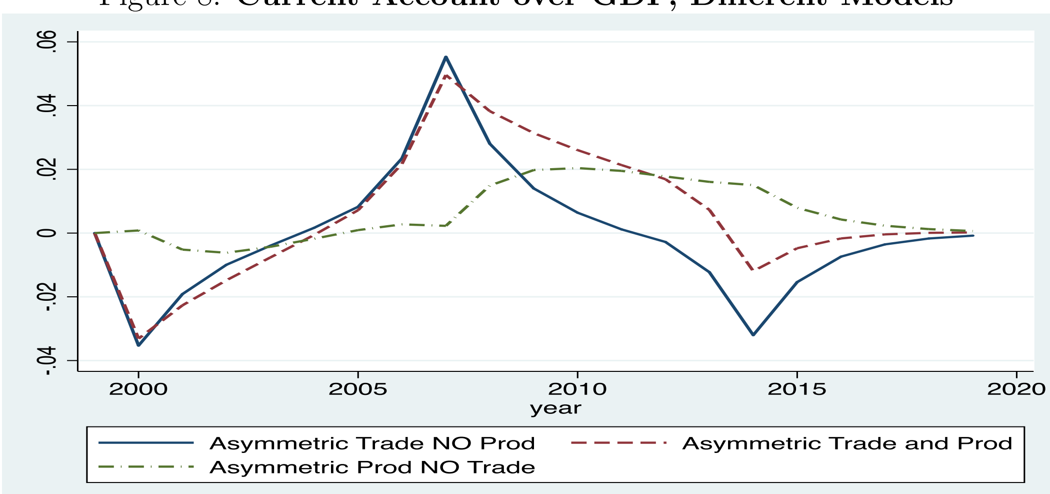
Furthermore, Figure 8 reports the current account dynamics obtained under two other

Figure 7: **Current Account over GDP, German Data and Model**



alternative experiments: i) an asymmetric reduction in the trade costs, with no changes in productivity in either sector (depicted by the solid line), and ii) an asymmetric increase in productivity, with no changes to the trade costs in both sectors (depicted by the dash-dotted line). For ease of comparison, I also report the benchmark result with asymmetric dynamics in both productivity and trade costs (depicted by the dashed line).

Figure 8: **Current Account over GDP, Different Models**



The peak of the trade surplus obtained under the scenario with no change in productivity in either sector is higher than what was obtained under productivity growth only due to a denominator effect (growing GDP). More interestingly, though, when fed only with an asymmetric productivity process and no changes to the trade costs, the model is unable to reproduce a dynamic consistent with the German data. The key to understanding the difference in the two cases is the dynamics of investment, which initially decreases in the first case but increases in the second.[23] In fact, in the case of an asymmetric reduction of trade costs, a consumption smoothing motive only motivates the agents to defer their consumption to a future period, in anticipation of benefiting from 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 tends to cause an increase in savings; but, there is also an investment motive, which has an opposite effect on the current account. Quantitatively, these two effects balance out, as we see in Figure 8.

I conclude that 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.

4 Empirical Evidence

The aim of this section is to provide empirical support for 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 in 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.

[23]See the online appendix for the evolution of the endogenous variables reported in Figures 5 and 6 for these alternative scenarios.

4.1 Manufacturing versus Services

The first empirical analysis I propose exploits the asymmetry in the liberalization of manufacturing and service trade for a sample of 24 OECD countries plus the BRICS.[24] The empirical strategy here consists of two stages.

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 indices 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. From this, two main observations stand out. First, both services and manufacturing CHB indices 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 from the sample into 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 a measure of relative export specialization, computed as the ratio between the service share in total export in a given country i and 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 indicate the contrary. Countries such as Greece, Spain, Portugal, and the UK display high levels of revealed comparative advantage in the export of services, while countries such as Mexico, Germany, and Canada exhibit levels of RCA_SERV far below one, indicating that they are "good-oriented".[25] While the classifica-

[24]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 Appendix B for details.

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

tion of countries is based on averages over the entire period, it is also important to examine the dynamics of this indicator, which might in fact be endogenous. In the online appendix, I report 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_SERVs are always above one. Ireland, however, 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 by excluding from the regression the countries that "switched" RCA_SERV direction. This yielded stronger results.

Then, for each country i, I compute 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, on the other hand, 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 signals a *high relative trade liberalization*. Conversely, a negative number indicates a *low relative trade liberalization*.[26] Interestingly, Spain, Portugal, and Greece all

[26]A negative number can reflect either that the CHB of the trading countries in the export sector of

feature a high relative trade liberalization on average, while Germany displays a low relative trade liberalization on average.[27]

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 the current account dynamics and asymmetric trade liberalization.

I use the following econometric specification (in its more complete form):

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

where I use the current relative trade liberalization indices $(\hat{\tau}_t^h - \hat{\tau}_t^f)$ 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 $\eta_1 + \sum_{s=1}^{S} \eta_{s+1} = 0$.

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 only one leads of the relative trade liberalization as a regressor, and, as expected, the coefficient is positive and statistically significant: a country tends to experience a deficit if

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.

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

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 per capita GDP growth is negative and statistically significant (as predicted by equation (2)). Once these two factors are controlled for, 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 also inserting time and country fixed effects. Again, there are no major changes to the core result.[28]

While highly suggestive, the results reported in the first five columns of Table 1 are not immune to concerns about the truly exogenous nature of the proxies used to build the relative trade liberalization measures. I attempt to address this potential endogeneity issue by using an IV strategy. I conceptually follow the nearest matching estimator proposed by Abadie and Imbens (2002), and use the corresponding index for the country which is closest in terms of economic development (measured as per capita GDP) and specialization in services (measured as average RCA index) as instrument for the relative trade liberalization index. I use the current level of the nearest-neighbor and its leads as instruments.[29]

[28] 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 appear 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.

[29] I match countries using the year 2007 as reference, 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 seventh column of Table 1 reports the results obtained. The contemporaneous relative trade liberalization measure still displays a negative coefficient, which however loses 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).

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

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 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, and 3) they report data on their custom duties for the period 1995-2012. These three criteria limit the eligible countries to thirteen.[30]

In this case it is simpler to build relative liberalization measures $\left(\hat{\tau_t^h} - \hat{\tau_t^f}\right)$ by using direct tariff data for agricultural goods $(\hat{\tau_t^h})$ and manufacturing goods $(\hat{\tau_t^f})$.[31] Once the relative trade liberalization measures are obtained, I can use the specification expressed in equation (18).

Figure 9 reports a scatterplot of the average current account over GDP for the period

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

[31]See the Appendix B for details.

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 presents a stark negative correlation between the two variables (a regression with an R^2 of 0.6); thus, showing that, on average, those countries who tend to liberalize more in their import sector than in their export sector are characterized by lower current account balances.

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

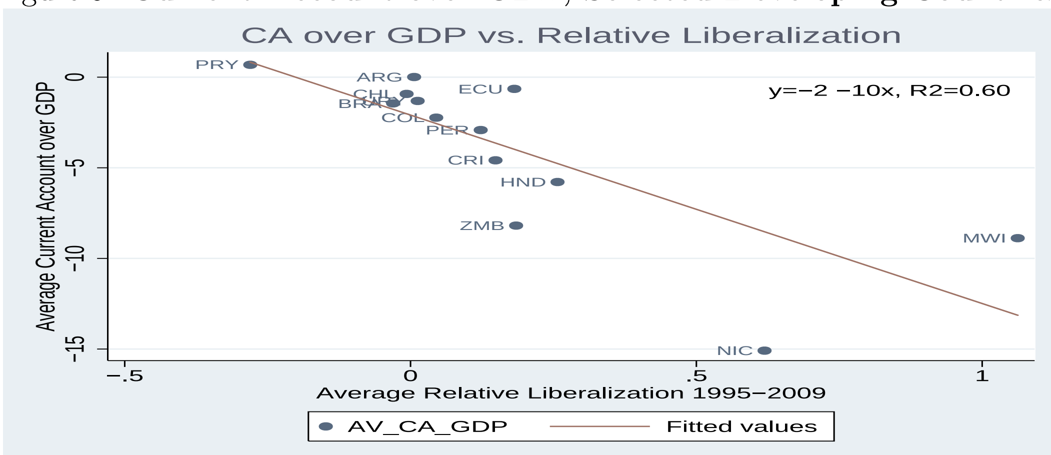


Table 2 reports the results obtained when using the specification (18). The first column reports only the contemporaneous relative trade liberalization measure, and, as expected, the coefficient is negative and statistically significant. The second column includes three leads of the relative trade liberalization 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 coefficients cannot reject the hypothesis that the coefficients are indeed equal, as predicted by the model. Columns three and four add the following 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.

Although the overall explanatory power of the relative trade liberalizations is modest, using the results presented in Tables 1 and 2, I conclude that asymmetric trade liberalizations indeed are a driver of current account dynamics that was not explored 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%

5 Conclusion

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

This paper provides some policy implications for the process of global rebalancing in general, and also for the rebalancing of the European economies 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 helps their rebalancing process without the need to resort solely on draconian austerity measures, such as the ones actually implemented in the period between 2010-2013. A service directive aimed at liberalizing the cross-border provision of services within the EU has indeed been entered into force in the period between 2006-2009. However, there remains a large scope for further and deeper liberalizations in the trade of services in Europe that can be deployed (see Monteagudo et al, 2012).

While this is a general insight, more research is clearly needed to clarify which particular service sectors might help the rebalancing process of deficit countries. These are likely to be different for the UK than for say, Portugal, Spain, or Greece. An important point to emphasize is that there is not necessarily a direct link between the relative trade liberalization measures computed in Section 4.1 and specific policy actions of specific countries. To illustrate the point, consider Germany and the case of tourism, where Germany exhibits a deficit with Greece, Spain, and Portugal. Lowering the barriers to export in this particular case (every dollar spent by 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 from the Greek authorities (for instance, fostering the learning of German in the operators of the tourism sector in Greece). This particular example clarifies 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 first appear.

Finally, this paper gives rise to several research questions. First, it would be interesting to be able to approach 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 diminish in the future. Second, it is important to further study 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 also incorporate in the analysis the study of foreign direct investments and foreign affiliate sales. I plan to pursue these avenues of research in the future.

A Model Appendix

I list here the first order conditions of the firms and consumers problems in the model outlined in Section 3.2. Firms first order conditions read:

$$w_{it} = (1-\alpha)\rho_{it}^{D}\frac{y_{it}}{n_{it}} \qquad (19)$$

$$r_{it}^{k} = \alpha\rho_{it}^{D}\frac{y_{it}}{k_{it}} \qquad (20)$$

The consumers first order conditions (with respect to the home and foreign bonds, and to capital) in country 1 read:

$$(1+\eta B_{1t+1})c_{1t}^{-\sigma} = \beta r_{1t}c_{1t+1}^{-\sigma} \qquad (21)$$

$$(1+\eta B_{1t+1}^{*})c_{1t}^{-\sigma} = \beta r_{2t}c_{1t+1}^{-\sigma}\frac{Q_{t+1}}{Q_t} \qquad (22)$$

$$c_{1t}^{-\sigma} = \beta c_{1t+1}^{-\sigma}(r_{1t+1}^{k}+1-\delta) \qquad (23)$$

While the first order conditions for the consumer of country 2 read:

$$(1+\eta B*_{2t+1})c_{2t}^{-\sigma} = \beta r_{2t}c_{2t+1}^{-\sigma} \qquad (24)$$

$$(1+\eta B_{2t+1})c_{2t}^{-\sigma} = \beta r_{1t}c_{2t+1}^{-\sigma}\frac{Q_t}{Q_{t+1}} \qquad (25)$$

$$c_{2t}^{-\sigma} = \beta c_{2t+1}^{-\sigma}(r_{2t+1}^{k}+1-\delta) \qquad (26)$$

Moreover, due to the form of the consumption bundles (8), and using the relative price definitions (10), we can express the demands for a_{it} and b_{it} as follows:

$$a_{1t} = (1-\omega)(\rho_{1t}^{D})^{-\theta}h_{1t} \qquad (27)$$

$$a_{2t} = \omega(\rho_{1t}^{X})^{-\theta}h_{2t} \qquad (28)$$

$$b_{2t} = (1-\omega)(\rho_{2t}^{D})^{-\theta}h_{2t} \qquad (29)$$

$$b_{1t} = \omega(\rho_{2t}^{X})^{-\theta}h_{1t} \qquad (30)$$

Equations (19)-(30) and (6)-(16) represent a system of 34 equation for 34 endogenous variables ($r_1, r_2, r_1^k, r_2^k, w_1, w_2, Q, \rho_1^D, \rho_2^D, \rho_1^X, \rho_2^X, CA_1, NX_1, \Delta NFA_1, c_1, c_2, y_1, y_2, h_1, h_2, k_1, k_2, i_1, i_2, n_1, n_2, a_1, a_2, b_1, b_2, B_1, B_2, B_1^*, B_2^*,$) which together with the four exogenous variables (τ_1, τ_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.

B Data Appendix

B.1 Manufacturing versus Services

The data sources used for this part of the paper are several. The balance of payment data 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 (23).

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 (29).

$\hat{\tau_t^h}$ 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

April 20, 2016

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:

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

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

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:

$$\bar{C} = \bar{C*} = \frac{\bar{Y}}{\bar{P}}, \quad (7)$$

$$\bar{C^h} = \bar{C^{h*}} = \bar{P}^{\theta}\bar{C}, \quad (8)$$

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

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

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

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:

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

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:

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

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

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

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

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

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

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

$$s_h\hat{C_t^h} + (1-s_h)\left(\hat{\tau_t^h} + \hat{C_t^{h*}}\right) = \hat{Y_t^h} \tag{18}$$

$$s_f(\hat{C_t^f} + \hat{\tau_t^f}) + (1-s_f)\hat{C_t^{f*}} = \hat{Y_t^{f*}} \tag{19}$$

$$\hat{B}_1 + \hat{B}_1^* = 0 \tag{20}$$

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 $\theta > 1$):

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

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**

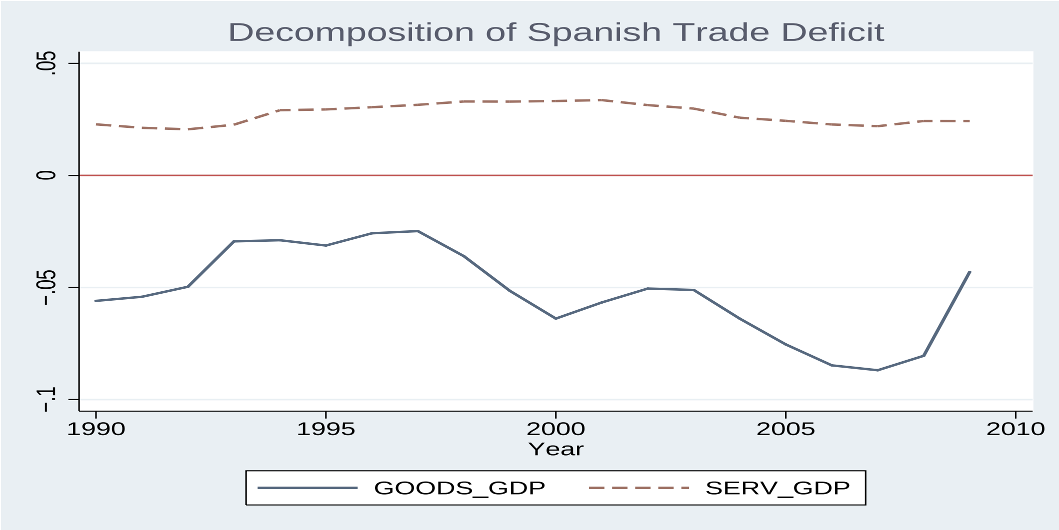

Figure 3: **Decomposition of the Trade Deficit of Portugal**

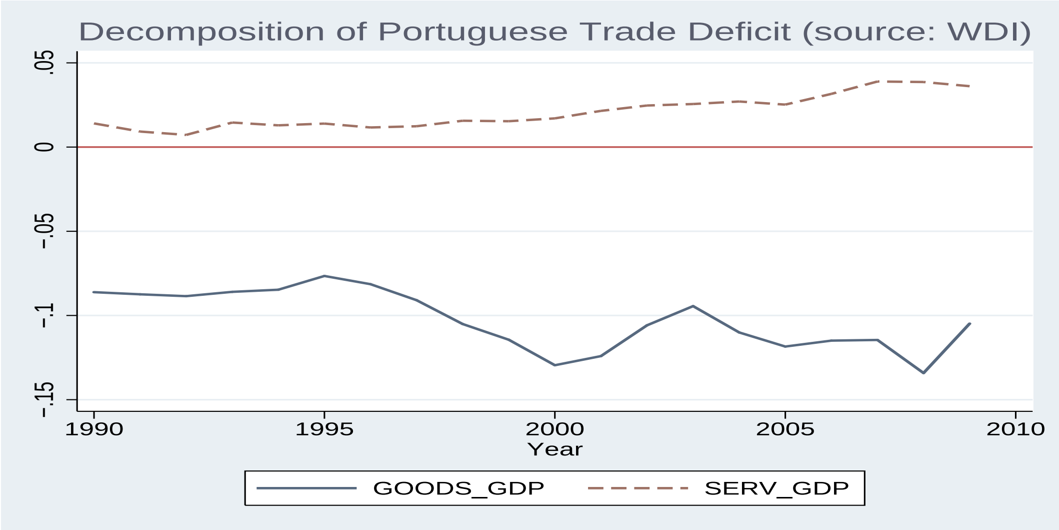

Figure 4: **Decomposition of the Trade Deficit of Greece**

Figure 5: **Endogenous Variables - Asymmetric trade costs dynamics but no changes in productivity**

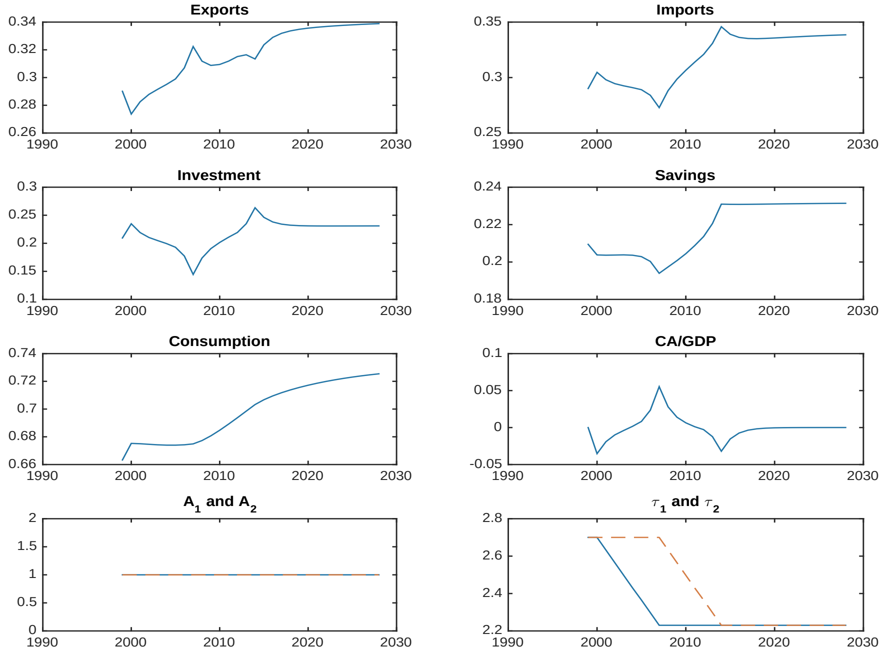

Figure 6: **Endogenous Variables - Asymmetric productivity dynamics but no changes in trade costs**

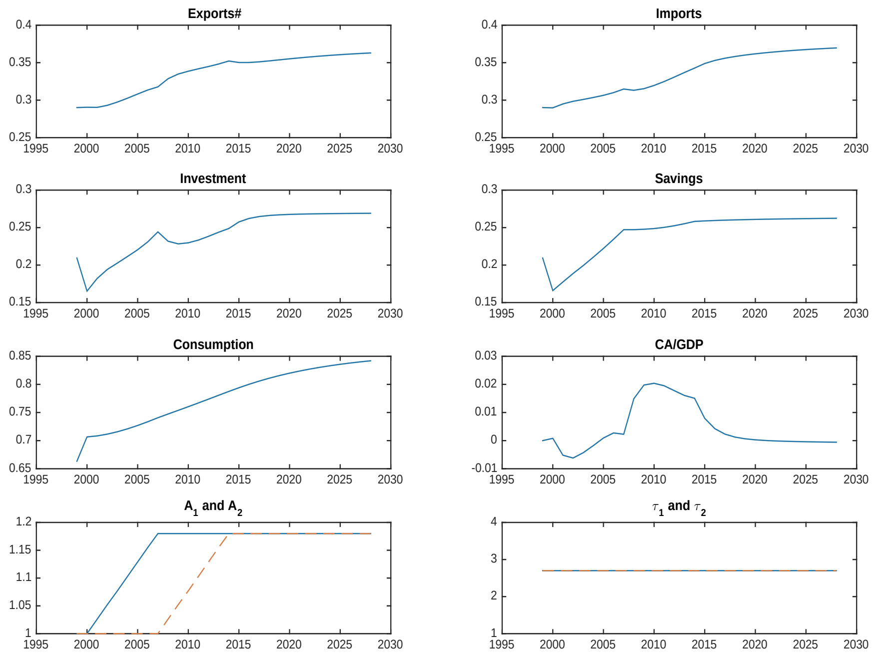

Figure 7: **Revealed Comparative Advantage in Services, Selected Countries**

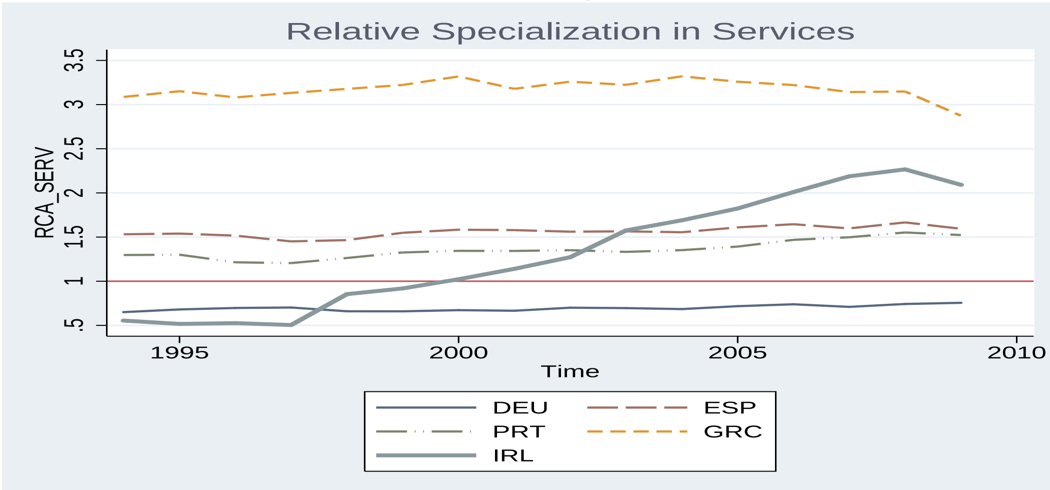

Figure 8: **Change in Relative Protection, Average 1995-2009**