Asymmetric Trade Liberalizations and Current Account Dynamics*

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Abstract

The rising current account surplus of Germany in the early two thousands can be decomposed into an increasing surplus in goods trade and a stable deficit in service trade. Spain, Portugal and Greece had surpluses in services, but large and increasing deficits in goods trade. Starting from this evidence, I propose asymmetric trade liberalizations as a new potential determinant of the current account. First, I develop a simple model where the current account depends on present and future relative changes in trade costs. A differential timing in the changes of trade costs affects inter-temporal prices, and thereby the current account. Second, I provide empirical evidence supporting the key predictions of the model. I build relative trade liberalization measures, and show that current (future) high relative trade liberalizations tend to decrease (increase) the current account. Finally, I propose a quantitative investigation of the German surplus based on the asymmetric dynamics of both productivity and the trade costs in manufacturing and services. I develop a 2-country international real business cycle model augmented with trade costs. When fed with the actual asymmetric trends found in the German data, the model can generate a current account surplus of about 4.5% of GDP.

JEL classification: F1, F32, F40

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1 Introduction

Starting in the early 2000s, and up to the Great Recession, core European countries, such as Germany, 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 over GDP, Selected EU Countries](image)

The motivation for this paper is the discovery of a lesser-known fact, shown in Figure 2. 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 an increasing surplus in goods accompanied by a stable deficit in services, while (b) Greece exhibits increasing trade deficits in goods, but slightly rising surpluses in services.¹

Starting from this motivating evidence, the contribution of this paper is to explore a new mechanism affecting the dynamics of the current account: asymmetric trade liberalizations

¹Spain and Portugal trade deficit decompositions are similar to the one of Greece. The figures are available in the online appendix.
(ATL). ATL are a natural (yet overlooked) factor potentially affecting the dynamics of the current account. A differential timing in the change of trade costs, in fact, can have an impact on inter-temporal prices, which in turn affect savings and investment decisions, and thereby the current account.

I start by outlining a simple theoretical model to build up intuition. I then provide empirical evidence that broadly support the main predictions of the theory. Finally, I propose a quantitative analysis of the German surplus.

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—in this simple setting—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.\(^2\)

Second, I propose an empirical analysis that broadly supports the main predictions of the model. I use a sample of 29 developed and developing countries and focus on the asymmetric trade liberalization in the manufacturing and services sectors. 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 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. On average, Spain, Portugal, and Greece were characterized by high relative trade liberalizations. 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 mea-

\(^2\)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.
sure (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. I conclude that asymmetric trade liberalizations are indeed a potential driver of current account dynamics, which was previously overlooked.

Finally, I propose a quantitative investigation of the German current account surplus. I first show that in Germany the dynamics of trade costs and productivity in the service and manufacturing sectors have been highly asymmetric during the early two-thousands. As for productivity, using data from EU-KLEMS, I show that in Germany productivity growth in the manufacturing sector was much higher than in services. Moreover, I show that while the CHB indicator declined in the German manufacturing sector, it has been essentially flat for 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 in the German data, the model produces a current account surplus of around 4.5% of GDP at its peak, roughly 60% of what was effectively observed in Germany (7.6%). 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 account consistent with what was observed in the data. The
key to understanding these results is the existence of an investment boom spurred by the increase in productivity that counterbalances the increase in savings induced by consumption smoothing, and thus dampens the effect of asymmetric productivity dynamics on the current account.

The general insight from this paper is that asymmetries in trade liberalizations can affect the external balances. At a time where protectionism is often advocated as a potential solution to trade deficits, it important to entertain the hypothesis that not an excess of globalization, but the presence of important asymmetries within it, might be at the origin of the external imbalances currently characterizing the world economy.\textsuperscript{3}

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\textsuperscript{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, 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, Faruqee and Lee, 2009), with particular emphasis on the studies related to the external imbalances within Europe (Blanchard and Giavazzi, 2002; Lane, 2013; Siena, 2014; Kollmann et al,

\textsuperscript{3}See Barattieri, Cacciator, and Ghironi (2018) for an in depth empirical and theoretical analysis of the macroeconomic effects of protectionism.

Finally, the paper is linked to the literature addressing the impact of trade costs 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 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. Eaton et al (2016) propose a multi-sector multi-country model with endogenous trade imbalances to explore the evolution of trade during the global recession of 2008-2009.

None of these studies has proposed asymmetries in trade liberalizations as potential drivers of current account dynamics. Two notable exceptions are the recent papers by Alessandria and Choi (2016) and Alessandria, Choi and Lu (2017). They investigate several possible 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. Another paper closely connected to this one is Barattieri (2014), who studies 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. This paper improves on Barattieri (2014) along several dimensions. Firstly, I propose a closed form solution for a two-country general equilibrium model where asymmetric trade liberalizations affect the dynamics of the current account. Second, and most crucially, I build relative liberalization measures and then use them to test the key prediction of the theory. Lastly, within a two country model with incomplete markets, I explicitly explore the role of asymmetric productivity dynamics

5Two partially related papers are also Kehoe et al (2016), who study how the US trade deficit can affect goods versus services employment dynamics, and Costinot et al (2014), who analyze capital controls as an inter-temporal trade policy instrument.
and their interactions with trade cost asymmetries.

The paper is structured as follows. The next section introduces the simple theoretical model. Section 3 contains the empirical analysis. Section 4 contains the quantitative analysis of the German surplus, 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.\(^6\) The world consists of two countries: Home and Foreign (with foreign variables denoted by \(^\ast\)). 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 \(Y_{ht}\) with \(t = \{1, 2\}\). The endowment of the foreign good is \(Y_{ft}^\ast\) with \(t = \{1, 2\}\). The price of the home good at Home is \(p_{ht}\). The price of the home good in Foreign is \(p_{ht}^\ast = \tau_{ht}p_{ht}\), where \(\tau_{ht} > 1\) is an iceberg trade cost. The foreign good \(f\) is imported in Home from Foreign. The Home price of the foreign good is \(p_{ft} = \tau_{ft}p_{ft}^\ast\), where \(p_{ft}^\ast\) is the price of the foreign good in Foreign and \(\tau_{ft} > 1\) is an iceberg trade cost.\(^7\)

In both countries, households maximize a standard two-period CRRA utility function, with discount factor \(\beta\) and intertemporal elasticity of substitution \(\sigma\), 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 \(B_1^\ast\) 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 \(\theta > 1\). 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 substitution between home and foreign goods, there are no intertemporal transfers of wealth across countries (i.e., no current account movements). The price indices in Home and Foreign

\(^6\)Due to space constraints, I report most of the technical details of the model in an online appendix.

\(^7\)I set a world price index \(P_W = P_1^{1/2}P_\ast^{1/2} = 1\) to be the numeraire.
are respectively:

\[ P_t = \left[ (p^h_t)^{1-\theta} + \left( \tau_t^f p^*_t \right)^{1-\theta} \right]^{\frac{1}{1-\theta}}, \quad P^*_t = \left[ (p^{h^*_t})^{1-\theta} + \left( p^*_t \right)^{1-\theta} \right]^{\frac{1}{1-\theta}}. \]

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.

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 where \( p^h = p^f = 1 \), \( B_1 = B^*_1 = 0 \), \( Y^h = Y^f = \bar{Y} \), and \( \tau^h = \tau^f = \tau \).

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.\(^8\)

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 (in the absence of capital accumulation, its saving) as follows:

\[
\frac{2(1+\beta)}{\beta} \hat{B}_1 = \left( \hat{p}_1 - \hat{p}^*_1 \right) - \left( \hat{p}^h - \hat{p}^f \right) + \left( \hat{Y}_1^h - \hat{Y}^f \right) - \left( \hat{Y}_2^h - \hat{Y}_2^f \right) + (\sigma - 1) \left( \hat{P}_1 - \hat{P}_2 \right) - (\sigma - 1) \left( \hat{P}^*_1 - \hat{P}^*_2 \right). 
\] (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

\(^8\)The details of the symmetric equilibrium, the log-linearization, and the solution of the model are described in the online appendix.
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 therefore express all the six elements of equation (1) as functions of the trade costs, the endowments, and $\hat{B}_1$, and I substitute these functions back into equation (1).

This allows me to express the Home’s current account only as a function of the exogenous endowments and trade costs:

$$
\hat{B}_1 = -\eta \left( \tau_{1h}^h - \tau_{1f}^f \right) + \eta \left( \tau_{2h}^h - \tau_{2f}^f \right) + \nu \left( Y_{1h}^h - Y_{1f}^f \right) - \nu \left( Y_{2h}^h - Y_{2f}^f \right)
$$

where $\eta$ is a function of the structural parameters of the model ($\beta, \theta, \sigma, \tau$). $\eta$ is a positive number as long as $\theta > 1$ and the elasticity of intertemporal substitution is sufficiently large. $\nu$ is also a parameter depending on ($\beta, \theta, \sigma, \tau$). 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 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. Moreover, a permanent change in the trade costs would not affect the current account. On the other hand, asymmetric trade liberalization processes for which $\eta \left( \tau_{1h}^h - \tau_{1f}^f \right) < 0$ and/or $\eta \left( \tau_{2h}^h - \tau_{2f}^f \right) > 0$ push the current account of the Home country into a surplus.

The condition $\eta \left( \tau_{1h}^h - \tau_{1f}^f \right) < 0$ 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. In the foreign country it’s cheaper to buy the home good today, and hence the home country runs a surplus. On the other hand, the condition $\eta \left( \tau_{2h}^h - \tau_{2f}^f \right) > 0$ arises if in the future it is expected a stronger fall in the trade costs of the foreign good. Then, the Home country increases its saving,

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9 The online appendix explains the procedure in detail.

10 See the online appendix for details.
waiting for future cheaper prices (and hence it runs a surplus today).

Equation (2) challenges the view that trade policies cannot influence the current account because they cannot affect savings and investment decisions.\textsuperscript{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 investments, which are inter-temporal decisions.\textsuperscript{12}

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.

3 Empirical Evidence

The aim of this section is to provide empirical support for the theory presented in the previous Section. I propose an analysis based on the asymmetry between the liberalization of trade in manufacturing versus services in a sample including 24 OECD countries plus the BRICS.\textsuperscript{13} The empirical strategy consists of three stages.

Stage 1: The constructed home bias index (CHB). As a starting point, I need to construct proxies for $\hat{\tau}$ in both services and manufacturing. I use the constructed home bias index (CHB)\textsuperscript{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 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. Costinot

\textsuperscript{11}See for instance Lamy (2010).
\textsuperscript{12}In this instance, the point is obviously made only for saving.
\textsuperscript{13}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 A for details.
\textsuperscript{14}First proposed by Anderson and Yotov (2010).
and Rodriguez Claire (2016) point out how the gravity equation is consistent with a variety of underlying economic models, which would include a suitable extended multi-country version of the simple model outlined in Section 2.

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:

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

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 $\Pi_i^k$ are, respectively, the inward and outward multilateral resistance terms, which are in turn weighted averages of the bilateral trade costs $t_{ij}^k$.\footnote{Following here the notation by Anderson and Van Wincoop (2003), the multilateral resistance terms are defined as follows:}

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

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

The equivalent expression for the internal trade would be:

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

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 friction.
that would prevail in the absence of friction as functions of observable variables:

$$CHB_{ik} = \frac{Y^k E_i^k}{Y^k} \left( \frac{t_i^h}{P_i E_i^k} \right)^{1-\theta_k} = \left( \frac{t_i^h}{P_i E_i^k} \right)^{1-\theta_k} = \frac{X^k Y^k}{Y^k E_i^k}. \quad (5)$$

I use equation (5) to calculate the CHB index.\(^{16}\) 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 \(\theta_k\).\(^{17}\) On the other side, the index relies on the gravity model to determine the benchmark trade in the case of no frictions, and therefore it is important to stress that the index captures overall trade frictions, which can go well beyond the legal barriers to trade.\(^{18}\)

**Stage 2: Relative Trade Liberalization Measures.** I use the CHB to build *relative trade liberalization measures*, which I will use as proxies for the terms \(\left( \tau_i^h - \tau_i^l \right)\) that appear in equation (2). 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

\(^{16}\)This method is similar in spirit to the tetrads method of Head, Mayer, and Ries (2010).

\(^{17}\)I’m not aware of reliable estimates of \(\theta_k\) the for the service sector.

\(^{18}\)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.
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”. While the classification 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 $RCA_{SERV}$ for five selected European Countries. While Germany displays a $RCA_{SERV}$ consistently below one, Spain, Portugal, and Greece’s $RCA_{SERV}$s are always above one. Some cases, such as Ireland, however, display 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.

For each country $i$, I then 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:

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

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. $\omega_i$ are weights computed as the output shares of country $i$ in total world output. Figure 3 reports the average relative trade liberalization in Germany, Spain, Portugal and Greece for the period 1995-2009.

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 country $i$ own CHB in the importing sector decreased by more than the CHB of the trading countries in the export sector of country

\footnote{See the online appendix for a complete description of the data.}
Figure 3: Relative Trade Liberalization Measure, Average 1995-2009

20A negative 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 less than the CHB of the trading countries in the export sector of country \( i \).
where I regress the change in the ratio of current account over GDP (corresponding to $\hat{B}_1$ in equation (2)) on the current relative trade liberalization indices ($\hat{\tau}_t^h - \hat{\tau}_t^f$) and $S$ of their leads. $Z_{it}$ is a set of standard time-varying country level controls. I include in $Z_{it}$ openness (exports plus imports over GDP), real GDP and real per capita GDP, real per capita GDP growth (to take into account of the other elements in equation 2), a measure of inflation differential (CPI inflation minus the average CPI inflation of the overall sample of countries), a proxy for financial development (credit extended to the economy over GDP) and the age dependency ratio. $\delta_i$ and $\delta_t$ are country and time fixed effects, aimed at controlling for fixed unobserved characteristics at country level and common trends over time. Finally, $\epsilon_{it}$ 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 $\sigma^2_{\epsilon}$. 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 (7). 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 lead 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 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. 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, inflation differentials, the measure of financial development and the age dependency ratio 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.\(^{22}\)

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.\(^{23}\) The sixth 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).

\(^{22}\)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.

\(^{23}\)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, 1995-2009

<table>
<thead>
<tr>
<th>Dep. var: $\Delta \frac{\text{CA}<em>{t}}{\text{GDP}</em>{t}}$</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$(\hat{\tau}^h - \hat{\tau}^f)_t$</td>
<td>-4.906***</td>
<td>-5.826***</td>
<td>-4.466***</td>
<td>-4.078***</td>
<td>-1.238</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.918)</td>
<td>(0.960)</td>
<td>(1.034)</td>
<td>(1.175)</td>
<td>(4.942)</td>
<td></td>
</tr>
<tr>
<td>$(\hat{\tau}^h - \hat{\tau}^f)_{t+1}$</td>
<td>2.477***</td>
<td>3.666***</td>
<td>3.887***</td>
<td>3.662***</td>
<td>10.422**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.953)</td>
<td>(1.039)</td>
<td>(1.029)</td>
<td>(1.124)</td>
<td>(5.247)</td>
<td></td>
</tr>
<tr>
<td>$(\hat{\tau}^h - \hat{\tau}^f)_{t+2}$</td>
<td>1.928*</td>
<td>2.526***</td>
<td>2.034*</td>
<td>-5.708</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.024)</td>
<td>(0.958)</td>
<td>(1.043)</td>
<td>(4.637)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$(\hat{\tau}^h - \hat{\tau}^f)_{t+3}$</td>
<td>0.609</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.966)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPENNESS</td>
<td>0.924**</td>
<td>3.804**</td>
<td>1.307**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.450)</td>
<td>(1.517)</td>
<td>(0.588)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real p.c. GDP</td>
<td>-0.084</td>
<td>-2.634</td>
<td>-0.228</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.123)</td>
<td>(4.758)</td>
<td>(0.156)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real GDP</td>
<td>0.235**</td>
<td>0.859</td>
<td>0.308**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.108)</td>
<td>(5.352)</td>
<td>(0.140)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GROWTH</td>
<td>-0.156***</td>
<td>-0.266***</td>
<td>-0.267**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.050)</td>
<td>(0.070)</td>
<td>(0.114)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CREDIT</td>
<td>-0.004</td>
<td>-0.008</td>
<td>-0.005</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.006)</td>
<td>(0.003)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DELTA INFL.</td>
<td>0.002</td>
<td>0.006</td>
<td>0.002</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.009)</td>
<td>(0.011)</td>
<td>(0.011)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AGE DEP.</td>
<td>0.004</td>
<td>-0.105</td>
<td>-0.019</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td>(0.084)</td>
<td>(0.022)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year + Country FE</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>N</td>
<td>433</td>
<td>404</td>
<td>346</td>
<td>369</td>
<td>369</td>
<td>329</td>
</tr>
<tr>
<td>Adj R-squared</td>
<td>0.062</td>
<td>0.017</td>
<td>0.127</td>
<td>0.158</td>
<td>0.251</td>
<td></td>
</tr>
<tr>
<td>Sargan-Hansen stat p-value</td>
<td>0.039</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endog $(\hat{\tau}^h - \hat{\tau}^f)_s$ p-value</td>
<td>0.844</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P-value of Test $\eta_1 + \eta_2 + \eta_3 = 0$</td>
<td>0.87</td>
<td>0.24</td>
<td>0.43</td>
<td>0.61</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Standard Errors in Parenthesis. *, **, *** Statistically Significant at 10%, 5% and 1%.

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, which is at least partially reassuring. Although the overall explanatory
power of the relative trade liberalizations is modest, based on the results presented in Table 1, I conclude that asymmetric trade liberalizations indeed are a driver of current account dynamics.

4 A Quantitative Investigation

While up to now I provided a new qualitative insight and empirical evidence supporting a new channel affecting current account dynamics, a first order question is whether this channel is also quantitatively relevant. The aim of this section is threefold. 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. The choice of the period is motivated both by the fact that the German surplus started growing only in 2000 (see Figure 1) and by the desire to exclude the Great Recession period from the analysis. 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.

4.1 Asymmetric Trade Costs and Productivity Dynamics

Trade Costs Dynamics. Figure 4 reports the evolution of the CHB in manufacturing and services for Germany, normalized to 1 in 2000. As the Figure clearly shows, there is a downward 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
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 from 2000 onwards.\textsuperscript{24}

Figure 4: Constructed Home Bias Index, Germany, Manufacturing and Services (2000=1)

In the online appendix, I report the corresponding figure for Spain, Portugal and Greece. In the case of manufacturing, in all the cases we see important decreases of the CHB. Differently from Germany, we can observe a decline in the CHB also in services for these three southern European countries.

Productivity Dynamics. I use EU-KLEMS data to describe the dynamics of the total factor productivity in the manufacturing and service sectors. Figure 5 reports the results for TFP evolution in these sectors, normalizing them to 1 in 2000, in Germany. The Figure clearly shows asymmetric dynamics in the two sectors. Productivity in the manufacturing sector grew about 21\% in the period considered, while productivity in the service sector was essentially flat. The dynamics of productivity in services is an average of the dynamics

\textsuperscript{24} 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).
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.

Figure 5: **Total Factor Productivity, Germany, Manufacturing and Services (2000=1)**

![Graph showing Total Factor Productivity](image)

In the online appendix, I report a similar figure for Spain (the EU-KLEMS data do not report TFP measures at sectoral level for Portugal and Greece). The asymmetric productivity dynamics is observed also in the case of Spain. Manufacturing productivity grew less than in Germany (roughly by about 14%), while the productivity in services and even the total TFP fell over the period 2000-2007.

### 4.2 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:

\[
y_{it} = A_{it}k_{1t}^\alpha n_{it}^{1-\alpha} \quad (8)
\]

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:

\[
c_{it} + i_{it} = h_{it} \quad (9)
\]

where

\[
h_{1t} = \left( (1 - \omega) \frac{1}{\phi} (a_{1t})^{\frac{1}{\phi} - 1} + \omega \frac{1}{\phi} (b_{1t})^{\frac{1}{\phi} - 1} \right)^{\frac{\phi}{\phi - 1}} \quad h_{2t} = \left( (1 - \omega) \frac{1}{\phi} (b_{2t})^{\frac{1}{\phi} - 1} + \omega \frac{1}{\phi} (a_{2t})^{\frac{1}{\phi} - 1} \right)^{\frac{\phi}{\phi - 1}} \quad (10)
\]

\( a_{1t} \) 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. \( \theta \) represents the intra-temporal elasticity of substitution. The laws of motion for physical capital are standard:

\[
k_{it+1} = (1 - \delta)k_{it} + i_{it} \quad (11)
\]

There are common iceberg-type trade costs for the two goods: \( \tau_{1t} \) and \( \tau_{2t} \). \( \tau_{1t} \) 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 (8):

\[
Max \quad \rho_{it}^D y_{it} - w_{it}n_{it} - r_{it}^k k_{it}
\]

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

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

\[
\rho_{X}^{1t} = \frac{\tau_{1t} \rho_{1t}^{D}}{Q_t} \quad \rho_{X}^{2t} = Q_t \tau_{2t} \rho_{2t}^{D}
\]

(12)

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

\[
k_{1t+1} + B_{1t+1} + Q_t B_{1t+1}^* + c_{1t} + \frac{\eta}{2} B_{1t+1}^2 + Q_t \frac{\eta}{2} B_{1t+1}^2 = r_{1t} B_{1t} + Q_t r_{2t} B_{1t}^* + r_{1t}^k k_{1t} \\
+ \omega_{1t} n_{1t} + (1 - \delta) k_{1t-1} + T_{1t}
\]

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 \( \eta \), which is fully rebated to the household in equilibrium with a transfer \( T_{1t} \).\(^{25}\) \( Q_t \) is the real exchange rate, as defined before. \( r_{1t} \) is the return of the bonds \( B \) and \( B^* \) in the units of the respective countries’ consumption and investment bundles. In Appendix B, I report the first order conditions associated with this problem.

\(^{25}\)This is to say that \( T_{1t} = \frac{\eta}{2} B_{1t+1}^2 + Q_t \frac{\eta}{2} B_{1t+1}^2 \).
**Market Clearing.** Given the existence of trade costs, the output market clearing conditions can be expressed as:

\[ y_{1t} = a_{1t} + \tau_{1t}a_{2t} \quad y_{2t} = b_{2t} + \tau_{2t}b_{1t} \]  

(13)

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

\[ n_{1t} = 1 \quad n_{2t} = 1 \]  

(14)

Finally, the bonds’ market clearing conditions are:

\[ B_{1t+1} + B_{2t+1} = 0 \quad B_{1t+1}^* + B_{2t+1}^* = 0 \]  

(15)

**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:

\[ CA_{1t} = (B_{1t+1} - B_{1t}) + Q_t (B_{1t+1}^* - B_{1t}^*) \]  

(16)

\[ CA_{1t} = NX_{1t} + (r_{1t} - 1) B_{1t} + Q_t (r_{2t} - 1) B_{1t}^* \]  

(17)

with the net exports defined as exports minus imports:

\[ NX_{1t} = Q_t X_{1t} - \rho_{1t} X_{2t} - \rho_{2t} b_{1t} \]  

(18)

In what follows, I will report results for the ratio of the current account to the GDP, 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. \( \alpha \) is set to 0.36. \( \theta \) is set to 1.5, while \( \beta \) is 0.96, and \( \delta \) 0.1, in order to calibrate the model to annual
frequencies. \( \eta \) 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). \( \omega \) is calibrated to give an initial ratio between imports to output of about 0.33, as observed in Germany in 2000.

### 4.3 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 \( \tau_1 \) and \( \tau_2 \) decline for 8 years at a constant rate, equal to the trend observed for the CHB in manufacturing in Figure 4, and both \( A_1 \) and \( A_2 \) increase at a constant rate, equal to the trend found for German manufacturing TFP in Figure 5. In the asymmetric case, I assume that \( \tau_1 \), the trade cost for good \( a \), declines for 8 years at the same trend as the manufacturing CHB and then remains flat, while \( \tau_2 \), 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 \( \tau_1 \). 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 \( A_1 \).\(^{26}\) 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.\(^{27}\)

Figure 6 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

\(^{26}\)These are admittedly quite strong assumptions. The simplicity of the model, however, requires to start and end at a symmetric equilibrium.

\(^{27}\)The simplifying assumption of complete specialization, following BKK (1994), allows using data for trade costs and productivity only for one country (in this case, Germany).
move in either country. Savings and investments also rise, after an initial drop, which is due to a rise in consumption.

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

On the other hand, asymmetries in trade liberalizations and productivity growth affect the current account, as reported in Figure 7. The country whose good’s trade costs fall 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 7: Selected Endogenous Variable Dynamics, Asymmetric Trade Liberalization and Productivity Increase

Figure 8 reports, on the same graph, the German current account over GDP and the corresponding object obtained with the model simulations. 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 (0.82). Moreover, the model is able to generate a peak in the current account surplus of about 4.5% of GDP, about 60% of what was observed in Germany in 2007 (7.6%).

Obviously, given the nature of the exercise, in the model the current account reverts towards zero as the liberalization in the importing sector kicks in and its productivity (abroad) rises. This is not what we observed in Germany after the crisis, where the current account kept rising. However, it is fair to say that from 2008 onwards so many shocks hit the world
economy, and Europe in particular, that it would be clearly beyond the scope of this paper to give a full account of what happened in those years.

It is more instructive, instead, to explore the relative contribution of the asymmetry in productivity dynamics versus trade cost dynamics in delivering the results of a current account surplus. Figure 9 reports the current account dynamics obtained under two other 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).

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.\footnote{See the online appendix for the evolution of the endogenous variables reported in Figures 6 and 7 for}
trade costs, consumption smoothing motivates the agents to defer their consumption to a future period, in anticipation of benefiting from lower prices. In the case of an 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 9. This interesting result highlights the fact that trade cost and productivity do not have isomorphic effects on the dynamics of the current account in models featuring investment and capital accumulation.

5 Conclusion

In this paper, I propose a theoretical model where asymmetric trade liberalizations can affect current account dynamics and I provide empirical evidence that broadly supports the main predictions of the model. Moreover, I show how this channel is potentially relevant in explaining the dynamics of the German surplus in the early two thousands.

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 these alternative scenarios.
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 3 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 at first appear.

Finally, this paper gives rise to several research questions. First, 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. Second, it would be also important to 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 Data Appendix

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, the age dependency ratio and the relative CPI. 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 (14).
B  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:

\[
    w_{it} = (1 - \alpha)\rho_D^t \frac{y_{it}}{n_{it}} \tag{19}
\]

\[
    r^{k}_{it} = \alpha \rho_D^t \frac{y_{it}}{k_{it}} \tag{20}
\]

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

\[
    (1 + \eta B_{1t+1})c_{1t}^{-\sigma} = \beta r_{1t} c_{1t}^{-\sigma} \tag{21}
\]

\[
    (1 + \eta B^{*}_{1t+1})c_{1t}^{-\sigma} = \beta r_{2t} c_{1t}^{-\sigma} \frac{Q_{t+1}}{Q_t} \tag{22}
\]

\[
    c_{1t}^{-\sigma} = \beta c_{1t+1}^{-\sigma}(r^{k}_{1t+1} + 1 - \delta) \tag{23}
\]

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

\[
    (1 + \eta B^{*2t+1})c_{2t}^{-\sigma} = \beta r_{2t} c_{2t}^{-\sigma} \tag{24}
\]

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

\[
    c_{2t}^{-\sigma} = \beta c_{2t+1}^{-\sigma}(r^{k}_{2t+1} + 1 - \delta) \tag{26}
\]

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:

\[
    a_{1t} = (1 - \omega)(\rho_D^{1t})^{-\theta} h_{1t} \tag{27}
\]

\[
    a_{2t} = \omega(\rho_X^{1t})^{-\theta} h_{2t} \tag{28}
\]

\[
    b_{2t} = (1 - \omega)(\rho_D^{2t})^{-\theta} h_{2t} \tag{29}
\]

\[
    b_{1t} = \omega(\rho_X^{2t})^{-\theta} h_{1t} \tag{30}
\]

Equations (19)-(30) and (8)-(18) represent a system of 33 equation for 33 endogenous variables \((r_1, r_2, r^{k}_1, r^{k}_2, w_1, w_2, Q, \rho_D^{1t}, \rho_D^{2t}, \rho_X^{1t}, \rho_X^{2t}, CA_1, NX_1, c_1, c_2, y_1, y_2, h_1, h_2, k_1, k_2, i_1, i_2, n_1, n_2, a_1, a_2, b_1, b_2, B_1, B_2, B^{*1}, B^{*2})\) which together with the four exogenous variables \((\tau_1, \tau_2, A_1, A_2)\) 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.
References


Asymmetric Trade Liberalizations
and Current Account Dynamics

Alessandro Barattieri

ONLINE APPENDIX - NOT FOR PUBLICATION
August 20 2018

A 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.

B Two-Period Model

B.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 consumption basket in the Home country is defined to be:

$$C_t = \left[ \left( C_t^h \right)^{\frac{\sigma-1}{\sigma}} + \left( C_t^f \right)^{\frac{\sigma+1}{\sigma}} \right]^{\frac{\sigma}{1-\sigma}},$$
where $\theta$ is the elasticity of substitution between goods and services, assumed to be larger than 1. $C^h_t$ represents the consumption of home goods in Home at time $t$, while $C^f_t$ is the consumption of foreign good in Home at time $t$. An analogous expression describes the consumption basket in the foreign 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:

$$B_1 = p^h_1 Y^h_1 - P_1 C_1, \quad B^*_1 = p^*_1 Y^f_1 - P^*_1 C^*_1,$$

$$P_2 C_2 = p^h_2 Y^h_2 + (1 + r_1) B_1, \quad P^*_2 C^*_2 = p^*_2 Y^f_2 + (1 + r_1) B^*_1,$$

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:

$$C_1 = \beta^{-\sigma} \left( (1 + r_1) \left( \frac{P_1}{P^*_2} \right) \right)^{-\sigma} C_2, \quad C^*_1 = \beta^{-\sigma} \left( (1 + r_1) \left( \frac{P^*_1}{P^*_2} \right) \right)^{-\sigma} C^*_2.$$

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

$$C^*_t = \left( \frac{p^*_t}{P^*_t} \right)^{-\theta} C^*_t, \quad C^*_t = \left( \frac{\tau^*_t p^h_t}{P^*_t} \right)^{-\theta} C^*_t,$$

$$C^*_t = \left( \frac{\tau^*_t p^*_t}{P^*_t} \right)^{-\theta} C^*_t, \quad C^*_t = \left( \frac{p^*_t}{P^*_t} \right)^{-\theta} C^*_t.$$

To close the model, we must impose goods and bond market clearing conditions. The nature of the iceberg trade costs implies the following goods market clearing conditions:
\[ Y_t^h = C_t^h + \tau_t^h C_t^{h*}, \]
\[ Y_t^{f*} = \tau_t^f C_t^f + C_t^{f*}. \]

Finally, the bond market clearing requires:

\[ B_1 + B_1^* = 0. \]

**B.2 A Symmetric Equilibrium**

I consider a symmetric equilibrium where \( \bar{p}^h = p^{f*} = 1, \bar{B}_1 = \bar{B}_1^* = 0, \bar{Y}^h = \bar{Y}^{f*} = \bar{Y}, \) and \( \bar{\tau}^h = \bar{\tau}^{f} = \tau. \)

In this symmetric equilibrium, price indexes are equal:

\[ \bar{P} = \bar{P}^* = (1 + \tau^{1-\theta})^{\frac{1}{1-\theta}}. \]  \hspace{1cm} (A-6)

Moreover, we have:

\[ \bar{C} = \bar{C}^* = \frac{\bar{Y}}{\bar{P}}, \] \hspace{1cm} (A-7)
\[ \bar{C}^h = \bar{C}^{f*} = \bar{P}^\theta \bar{C}, \] \hspace{1cm} (A-8)
\[ \bar{C}^{f} = \bar{C}^{h*} = \tau^{-\theta} \bar{P}^\theta \bar{C}. \] \hspace{1cm} (A-9)

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

\[ \frac{\bar{C}^h}{C^h + \tau C^{h*}} = \frac{\bar{C}^{f*}}{\tau C^{f} + C^{f*}} = s_h = s_f^* = \frac{1}{1 + \tau^{1-\theta}}. \] \hspace{1cm} (A-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:

$$\frac{\tau C^f}{\tau C^f + C^f} = \frac{\tau \hat{C}^h}{\tau \hat{C}^h + \tau \hat{C}^h} = s_f = s_f^* = \frac{\tau^{1-\theta}}{1 + \tau^{1-\theta}}$$  \hspace{1cm} (A-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.

### B.3 The Complete Log Linearized Model

I denote with $\hat{\cdot}$ 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:

$$\hat{C}_2 = \sigma(1 - \beta)\hat{r}_1 + \sigma\hat{P}_1 - \sigma\hat{P}_2 + \hat{C}_1 \quad \hat{C}_2^* = \sigma(1 - \beta)\hat{r}_1 + \sigma\hat{P}_1^* - \sigma\hat{P}_2^* + \hat{C}_1^*$$  \hspace{1cm} (A-12)

$$\hat{B}_1 = \hat{p}_1^h + \hat{Y}_1^h - \hat{P}_1 - \hat{C}_1 \quad \hat{B}_1^* = \hat{p}_1^{h*} + \hat{Y}_1^{h*} - \hat{P}_1^* - \hat{C}_1^*$$  \hspace{1cm} (A-13)

$$\hat{C}_2 = \hat{p}_2^h + \hat{Y}_2^h - \hat{P}_2 + \frac{1}{\beta} \hat{B}_1 \quad \hat{C}_2^* = \hat{p}_2^{h*} + \hat{Y}_2^{h*} - \hat{P}_2^* + \frac{1}{\beta} \hat{B}_1^*$$  \hspace{1cm} (A-14)

$$\hat{C}_t^h = -\theta \left( \hat{p}_t^h - \hat{P}_t \right) + \hat{C}_t \quad \hat{C}_t^{h*} = -\theta \left( \hat{p}_t^{h*} + \hat{r}_t^h - \hat{P}_t^* \right) + \hat{C}_t^*$$  \hspace{1cm} (A-15)

$$\hat{C}_t^f = -\theta \left( \hat{p}_t^{f*} + \hat{r}_t^f - \hat{P}_t \right) + \hat{C}_t \quad \hat{C}_t^{f*} = -\theta \left( \hat{p}_t^{f*} - \hat{P}_t^* \right) + \hat{C}_t^*$$  \hspace{1cm} (A-16)

\(^1\)A point already made by Obstfeld and Rogoff (2001).
\[
\hat{P}_t = s_h \hat{p}^h_t + s_f \left( \hat{p}^{f*}_t + \hat{\tau}^f_t \right) \\
\hat{P}^*_t = (1 - s_h) \left( \hat{p}^h_t + \hat{\tau}^h_t \right) + (1 - s_f) \hat{p}^{f*}_t 
\]
(A-17)

\[
s_h \hat{C}^h_t + (1 - s_h) \left( \hat{\tau}^h_t + \hat{C}^{h*}_t \right) = \hat{Y}^h_t 
\]
(A-18)

\[
s_f (\hat{C}^f_t + \hat{\tau}^f_t) + (1 - s_f) \hat{C}^{f*}_t = \hat{Y}^{f*}_t 
\]
(A-19)

\[
\hat{B}_1 + \hat{B}^*_1 = 0
\]
(A-20)

**B.4 Two-Period Model Solution**

In order to solve the model, the strategy is to derive all the elements that appear in equation (A-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 (A-18) the home and foreign version of equation (A-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 (A-13) and the Price index definitions (A-17). This allows me to express:

\[
\hat{p}^h_t - \hat{p}^{f*}_t = -\frac{\alpha_1}{\alpha_2} \left( \hat{\tau}^h_t - \hat{\tau}^{f*}_t \right) - \frac{\alpha_0}{\alpha_2} \hat{B}_1 - \frac{\alpha_1}{\alpha_2} \left( \hat{Y}^h_t - \hat{Y}^{f*}_t \right) 
\]
(A-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:
\[ \hat{P}_1 - \hat{P}^*_1 = (s_h - s_f)(\hat{p}^h_1 - \hat{p}^{f*}_1) - s_f\left(\hat{\tau}^h_1 - \hat{\tau}^f_1\right) \quad (A-22) \]

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

\[ \hat{p}^h_2 - \hat{p}^{f*}_2 = -\frac{\alpha_1}{\alpha_2}\left(\hat{\tau}^h_2 - \hat{\tau}^f_2\right) + \frac{\alpha_0}{\alpha_2}\hat{B}_1 - \frac{s_f}{\alpha_2}\left(\hat{Y}^h_2 - \hat{Y}^{f*}_2\right) \quad (A-23) \]

and

\[ \hat{P}_2 - \hat{P}^*_2 = (s_h - s_f)(\hat{p}^h_2 - \hat{p}^{f*}_2) - s_f\left(\hat{\tau}^h_2 - \hat{\tau}^f_2\right) \quad (A-24) \]

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

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

and

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

gives equation (2) in the main text. From Equation (A-25) is possible to derive the restriction on the intertemporal elasticity of substitution that makes \( \eta \) a positive number (given \( \theta > 1 \)). In particular, a sufficient condition for \( \eta > 0 \) is \( \sigma > 1 - \frac{\alpha_1}{(s_h - s_f)\frac{\alpha_1}{\alpha_2} + s_f} \). From equation (A-26) we see that \( \nu \) is instead positive as long as \( \sigma < 1 + \frac{2s_h(\theta - 1)}{(s_h - s_f)^2} \).
### Supplementary Material

Table A.1: CHB, Manufacturing and Services

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

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Figure A.1: Decomposition of the Trade Deficit of Portugal

Figure A.2: Decomposition of the Trade Deficit of Spain
Figure A.3: Revealed Comparative Advantage in Services, Selected Countries

Figure A.4: Constructed Home Bias Index, Selected Countries, Manufacturing (2000=1)
Figure A.5: **Constructed Home Bias Index, Selected Countries, Services (2000=1)**

![Graph showing the CHB_SERV_TOT index for different countries from 2000 to 2008.](image1)

Figure A.6: **Total Factor Productivity, Spain, Manufacturing and Services (2000=1)**

![Graph showing total factor productivity for Spain in manufacturing, services, and total sectors from 2000 to 2008.](image2)
Figure A.7: Endogenous Variables - Asymmetric trade costs dynamics but no changes in productivity
Figure A.8: **Endogenous Variables - Asymmetric productivity dynamics but no changes in trade costs**