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Tradability of Output and the Current Account: An Empirical Investigation for Europe

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Abstract

We put forward the hypothesis that increasing specialisation in the production of non-tradable output has a negative impact on the current account balance. This tradability hypothesis is directly derived from a two-sector inter-temporal current account model. To test it empirically we develop a value-added based tradability index which captures the tradability of a country's output. Applied to a large sample of European countries, our empirical model provides strong evidence for a positive relationship between the current account balance and the tradability index. The main policy implication is that the anxieties about 'de-industrialisation' in large parts of Europe seem justified with a view to growing external imbalances.

Keywords: current account, tradability index, tradable goods, structural change, value added exports

JEL classification: F41, F32, F10, F14

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1. Introduction

Current account imbalances in Europe are a recurring issue that attracts the interest of policy-makers and academics alike (e.g. Gaulier and Vicard, 2012; Lane and Pels, 2012; Ca'Zorzi et al., 2012; Blanchard and Giavazzi, 2002). Among the various potential determinants of the current account, this paper focuses on the role of the production structure. In particular, we put forward the hypothesis that a country's specialisation in production matters for its current account position when the sectors of the economy differ with regards to the tradability of the output they produce. This suggests that the tradability of output is an important determinant of the current account. We show that the positive relationship between specialising in more tradable sectors and the current account position is implied by a standard two-sector inter-temporal model of the current account featuring a tradable and a non-tradable sector. In order to test the 'tradability hypothesis' econometrically we develop an indicator which we label tradability index *(TI)*[1]. Reflecting an economy's entire economic structure, this index allows for a comprehensive examination of the relationship between countries' specialisation patterns and the current account.

The tradability hypothesis is closely linked to the debate about the de-industrialisation in Europe and its consequences. Losses of the manufacturing sector in terms of employment or value added – be they relative or absolute – are generally viewed as an unfavourable and worrying development. One reason why such a development, observable in several European countries, is worrisome is that it becomes more difficult for a country to earn the necessary export revenues to pay for its imports. In other words, it puts pressure on the current account. European countries are exposed to different degrees to these deindustrialisation tendencies with several economies remaining largely unaffected[2]. The resulting structural divergence, according to the tradability hypothesis, implies growing external imbalances within Europe: Countries with shrinking manufacturing sectors will run current account deficits while countries with more robust manufacturing sectors will accumulate current account surpluses.

The logic of this narrative relies on the fact that the manufacturing sector is the main tradable goods producing sector. Therefore the actual relationship to be studied is the one between the current account and the production of tradable output rather than manufactures. This is what we intend to do with the TI. The TI is a more adequate indicator for testing the tradability hypothesis than the value added share of manufacturing for three reasons. First of all, instead of focusing only on the manufacturing sector or any other sector that is suspected to be particularly important for the external balance, the TI is a comprehensive measure which reflects an economy's entire economic structure. Therefore the TI is capable of capturing basically all structural phenomena such as de-industrialisation (respectively the lack of industrialisation) or booms in the construction sector (as analysed in Gehringer, 2015). Second, the TI is more directly linked to theoretical models of the current account because the essential distinction in these models is typically between tradables and non-tradables rather than between the manufacturing sector and the services sector. This allows being more specific on the channel through

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1 Zeugner (2013) uses a measure of country-specific value added in trade to evaluate the tradability of sectors in the context of calculating unit value costs.

2 This is particularly true for the members of the 'Central European Manufacturing Core' (Stöllinger, 2016; IMF, 2013).

which the current account is affected, i.e. the tradability, whereas in the case of the manufacturing share a positive relationship with the current account position may also be due to increasing returns to scale or other features of the sector. Third, the TI avoids applying a dichotomous classification of sectors into tradable and non-tradable sectors (as for example in De Gregorio et al., 1994) which requires the choice of a discretionary threshold for the attribute that defines a sector as either tradable or non-tradable.

We use the TI for testing econometrically the effect of the tradability of output on the current account position in a European-wide context. The sample comprises 46 European countries which are observed over the period 1995-2014. Hence, our sample goes well beyond the euro area which has attracted a lot of interest in the recent current account literature (see e.g. Blanchard and Giavazzi, 2002; Gaulier and Vicard, 2012). A major advantage of a European wide sample is that it results in a sufficiently large number of observations for a cross-country analysis.

The contribution of this paper to the literature is threefold. Firstly, we develop a tradability index based on value added exports which makes use of the World Input-Output Database (WIOD). Secondly, we analyse the effects of structural shifts in an inter-temporal current account model by way of simulations and show that the tradability hypothesis emerges as a predictions of this model for plausible parameter constellations. Thirdly, we use cross-section and panel estimation techniques to determine the empirical relevance of the tradability hypothesis for a large sample of European countries. The results suggest that the tradability of production, properly measured by the tradability index, is highly relevant for the current account position. Establishing the tradability index as a new determinant of the current account obviously has important policy implications.

The rest of the paper is structured as follows. Section 2 discusses some of the related literature. Section 3 derives the tradability hypothesis from a standard inter-temporal model of the current account. Section 4 explains the construction of the tradability index and presents some descriptive results. Section 5 discusses the empirical model and the data while section 6 contains the estimation results. Section 7 concludes with some policy implications of our findings.

2. Related literature

There is no shortage of explanations for why current account imbalances are a recurring phenomenon. Authors have related these imbalances to fiscal policy and budgetary discipline (e.g. Schnabl and Wollmershäuser, 2013), productivity shocks (Cova et al., 2009; Fournier and Koske, 2010; Coricelli and Wörgötter, 2012) and wage policies (Kerdrain et al., 2010). Other contributions highlight the development of financial markets (Mendoza et al., 2009), the degree of financial integration (Blanchard and Giavazzi, 2002) or the existence of safe assets available to people with savings (Caballero et al. ,2008) as being decisive for current account positions and imbalances.

Another potential explanation is the production structure respectively changes thereof. An appropriate framework for tracking changes in the current account following shifts in the production structure is an inter-temporal two-sector model of the current account featuring a tradable and a non-tradable sector (Ostry and Reinhart, 1991; Obstfeld and Rogoff, 1996). The current account balance in these models is ultimately determined by the difference between savings and investment as the mirror image of the capital account[3]. Nevertheless, the simple two-sector framework allows analysing the implications of a wide range of shocks, including those relating to the production structure, for the current account balance. The results of these models are typically driven by adjustments in consumption over time by utility maximising consumers.

In an extension of this model that incorporates production and export specialisation, Jin (2012) combines inter-temporal trade with intra-temporal factor-proportions-based trade. This combination introduces a composition effect which works against the traditional convergence effect[4]. The composition effect suggests that the current account balance depends (among other things) on the capital intensity of the output produced in a country. Since in a Heckscher-Ohlin framework richer (more capital-abundant) countries specialise in the production of capital-intensive goods, investment will be higher in these countries and they tend to run current account deficits. As a result capital will flow from capital-poor to capital-rich countries, a fact that is observable for example in US-China relations. Nedoncelle (2014) studies a trade-cost augmented partial equilibrium version of the Jin model and tests for a joint effect of capital intensity and trade costs on the current account. He finds that a reduction in trade costs worsens the current account of countries specialised in the production of capital-intensive goods.

Barateri (2014) extends the model by Obstfeld and Rogoff (2000) in which all goods are tradable but differ with regards to the associated trade costs. The main point here is that in an environment of asymmetric trade liberalisation, the current account balance is driven by comparative advantages (which themselves are determined by factor endowments). Countries specialised in the production of the goods with lower trade costs (i.e. more tradable goods like manufactures) will postpone the consumption of the

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3 This is because inter-temporal models of the current account are extensions of the absorption approach (see Alexander, 1952).

4 The convergence effect refers to the fact that international capital is predicted to flow from relatively capital intensive countries to countries where the effective capital-labour ratio is relatively lower. Therefore countries with lower GDP per capita will borrow internationally against future growth are expected to run current account deficits.

less tradable good (e.g. services) that they have to import in expectation of lower trade costs in the future[5]. For the period after 1995, Baraterri (2014) also provides some empirical evidence that countries with revealed comparative advantages in services tend to run current account deficits.

The empirical literature referring to the inter-temporal approach to the current account has followed two directions. One strand uses various estimation techniques to establish evidence in favour of the theoretical baseline model, the other strand attempts to identify determinants of the current account which emerge from a broader class of models (see Bussière et al., 2006). This paper belongs to the latter by suggesting the tradability index as a new determinant of the current account, although the tradability hypothesis emerges as a direct prediction of the two-sector current account model. In addition, however, it builds heavily on the existing empirical current account literature such as Debelle and Faruqee (1996) and Chinn and Prasad (2003). These papers incorporate a large number of factors influencing the current account position. A prominent example is the convergence effect which is one of the testable predictions that the inter-temporal current account model delivers. It predicts that countries which are below their steady state equilibrium will run current account deficits because there is an incentive to borrow against future income (Obstfeld and Rogoff, 1996). This mechanism is particularly relevant in a European context, where capital still flows in ‘the right direction’, i.e. from more advanced to catching-up economies. Blanchard and Giavazzi (2002), for example, suggest that in the EU current account positions are increasingly related to countries’ income per capita, i.e. that the convergence effect gains importance. This convergence effect or stages of development effect is also argued for by Debelle and Faruqee (1996). However, their cross-country results provide no evidence for the convergence effect in their sample of industrialised countries[6]. Chinn and Prasad (2003) do find a convergence effect globally but not for developing countries. There is a large number of additional determinants of the current account that have been tested in the literature and which we will also include in our empirical model such as the dependency ratio (e.g. Chinn and Prasad, 2003; Ca’Zorzi et al., Lane and Pels, 2012) and the real exchange rate (e.g. Brissimis et al., 2010).

Ehmer (2014) and Gehringer (2015) are two examples that emphasise the relationship between specialisation patterns and the current account. They test directly the impact of the value added share of manufacturing respectively construction on the current account balance. Ehmer (2014) reports a positive effect of the manufacturing share on the current account for euro area countries, while Gehringer (2015) finds a worsening effect of an expanding construction sector in the peripheral crisis-stricken countries of the euro area. In contrast, her results do not suggest a significant relationship between the share of the manufacturing and the current accounts in any subset of EU countries.

5 This result depends on the assumption that the inter-temporal rate of substitution is large (greater than 1).

6 The authors explain the lack of significance with potential multicollinearity between income per capita and the capital-output ratio which is also included in the regression.

3. Theoretical framework

In this section we show that the tradability hypothesis can be derived from a two-sector inter-temporal current account model featuring a tradable and a non-tradable sector. The scenario to be studied is a shift in the production structure (or the endowments) that brings about changes in the tradability of output. In the simple case of a two-period endowment economy this can be modelled as a decrease in the production of the non-tradable good and a simultaneous increase in the tradable good by the same amount. As is often the case in this model framework, the effect on the current account of such a structural shift towards non-tradable is theoretically ambiguous but for plausible parameter values it is in line with the tradability hypothesis.

To keep things as simple as possible, we assume that there are only two periods and a two-sector endowment economy with exogenous output of the tradable good, Y_t^T, and the non-tradable good, Y_t^N, in each of the two periods, *t=1,2*. The corresponding prices of the two goods are P_t^T and $\tilde{P}_t^N$. For the tradable good the law of one price holds, so that its price is pinned down by international competition and therefore fixed. P_t^T will serve as the numeraire and we can define the price of the non-tradable good relative to the tradable good as $P_t^N = \frac{\tilde{P}_t^N}{P_t^T}$.

In this two-sector framework the tradability index is simply the share of the value of tradable output ($Y_t^T \cdot P_t^T$) in the total value of output $Y_t \cdot P_t$.

The main adjustment mechanism in such a simple inter-temporal endowment economy is consumption decisions made by the welfare maximising, representative consumer. Again to simplify matters, we assume preferences that are characterised by a constant inter-temporal elasticity of substitution (IES), $\frac{1}{\sigma}$. The IES governs the allocation of consumption over time whereas the intra-temporal elasticity of substitution governs the allocation of income on the tradable and the non-tradable good within each period. The intra-temporal elasticity of substitution we will set to 1 implying a fixed consumption expenditure shares of the tradable good, γ, and the non-tradable good, $1-\gamma$. A final assumption is that the interest rate *(r)* is determined by the world market and therefore exogenous to the country in question[7].

The current account (*CA*) in period 1 is simply the difference between the economy's endowments with tradable goods and the consumption of tradable goods (C^T):

$$CA_1 = Y_1^T - C_1^T$$

With all the assumptions made above, the current account equation can be rewritten as[8]:

[7] All the assumptions made imply the small open economy case.

[8] See Appendix 4 for details.

$$CA_1 = Y_1^T - \frac{Y_1^T + \frac{Y_2^T}{1+r}}{1 + \beta^{\frac{1}{\sigma}} \cdot (1+r)^{\frac{1-\sigma}{\sigma}} \cdot \left(\frac{Y_2^N}{Y_1^N}\right)^{\frac{(1-\gamma)\cdot(1-\sigma)}{1-\gamma+\gamma\sigma}}}$$

This expression states the current account position as a function of the endowments in the tradable and the non-tradable good, the inter-temporal elasticity of substitution, the consumption expenditure share of the tradable-good, γ, (which is assumed to be constant), the interest rate and the discount factor (β). This equation is used to examine the effects of an endowment-neutral structural shock on the current account and the tradability index. The endowment-neutral structural shock consists of an increase in the economy's endowment with the non-tradable good Y^N and a simultaneous decrease in its endowment with the tradable good Y^T in period 2 by the same amount. This allows highlighting the impact of the structural effect by switching off the wealth effect which would arise if only Y^T or Y^N were to change.

The effect of such a structural shift towards non-tradables on the current account position is theoretically ambiguous as it depends on the inter-temporal and the intra-temporal elasticity of substitution as well as the initial endowments[9]. Therefore we rely on simulations to show the relationship between the tradability of output and the current account for plausible values of the expenditure shares γ and $1-\gamma$, the initial endowments Y_1^T and Y_2^N and the inter-temporal elasticity of substitution σ.

Let the initial situation be characterised by a balanced current account with the following parameterisation:

Parameters		
γ	*expenditure share tradables*	0.2000
σ	*inverse of the IES*	2.0000
(1+r)	*interest rate*	1.0500
β	*discount factor*	0.9524
Endowments		
Y^T	*tradable goods*	100.00
Y^N	*non-tradable good*	400.00

Table 1 shows the effect on the tradability index, $Y_t^T \cdot P_t^T / Y_t \cdot P_t$, and the current account of a structural shock in period 2 consisting of a decline in Y_2^T by 20 unit and an increase in Y_2^N of equal size. In the initial situation the current account is balanced in both periods. Given that the expenditure share on the tradables is 0.2 and the tradable good's share in the economy's total endowment is also 0.2, the prices of the tradable and the non-tradable goods are both equal to 1 in both periods and the price index is equal to 1.65 in both periods.

The consequence of the structural shock in period 2 is a current account surplus in period 1 and a corresponding deficit in period 2. The surplus in period 1 is explained by two effects.

9 See Appendix 5 for details.

Table 1 / Effects of a structural shock on the current account and the tradability index

	Period 1					Period 2				
	Y^T	Y^N	P	TI	CA	Y^T	Y^N	P	TI	CA
country with no shock (initial situation)	100	400	1.65	0.20	0.00	100	400	1.65	0.20	0.00
country with structural shock $\Delta Y_2^T = -20$; ΔY_2^N=+20	100	400	1.54	0.21	8.32	80	420	1.44	0.18	-8.32

Note: CA = current account; TI = tradability index; P = price index.

First, there is a *structural consumption adjustment effect*. This structural adjustment effect stems from the fact that the consumer maximises utility when she consumes the tradable and the non-tradable good exactly in the proportions dictated by the expenditure share. In the above example this is a ratio of 1 to 4. The structural shock that hits in period 2 reduces the tradables to non-tradables ratio in terms of endowments to a much lower level. This creates an incentive to shift some of the tradable good consumption from period 1 to period 2 because the two goods are desired to be consumed in fixed proportions over time. The extra utility gained in period 2 (ΔC_2) from this shift exceeds the loss in aggregate consumption in period 1 (ΔC_1). Second, there is an *income effect* which stems from the fact that the price index is declining over time because the endowment of the non-tradable good increases in period 2. The declining price index represents an increase in the consumption-based interest rate and is therefore an incentive for the consumer to postpone consumption until period 2. This second effect also contributes to the current account surplus in the first period. Due to the terminal condition, the resulting current account position in period 2 is a corresponding deficit.

The magnitude of both effects is determined by the extent to which consumption is postponed which in turn depends on the IES. If the IES is large, relatively more consumption will be shifted into period 2 as the consumer is relatively more prepared to accept fluctuations in the consumption path over time. Note that these results are not due to a wealth effect, which is neutralised by simultaneously increasing the endowment of the non-tradable good and reducing the endowment with the tradable good by the same amount (i.e. $\Delta Y_2^N = -\Delta Y_2^T$ with $\Delta Y_2^N > 0$).

Importantly, the resulting pattern for the current account position is that at the time when the structural shock materialises, i.e. period 2, the TI declines as does the current account balance. This can be seen by comparing the outcomes for a country experiencing a structural shock in period 1 (before the shock) and period 2 (after the shock). Similarly, when focusing on the time when the shock has been realised, i.e. period 2, a country that suffers from such a structural shock will have a lower TI and a worse current account position than a country that does not experience such a shock. From this the following proposition can be derived:

> ***Proposition (tradability hypothesis).*** *There is a positive relationship between the tradability index and the current account position over time as well as across countries.*

This tradability hypothesis is going to be tested empirically for a large sample of European countries using a tradability index which is developed in the following section.

4. Tradability index

A natural benchmark for the tradability of goods and services is to what extent they are actually traded (De Gregorio et al., 1994)[10]. De Gregorio et al. (1994) consider a sector as tradable if more than 10 percent of total output is exported. We will depart from this approach by switching from a dichotomous classification of sectors into either tradable or non-tradable to a continuous measure of sectors' tradability. This gradual approach gives due credit to the fact that basically all goods and increasingly also services are potentially tradable though to a different extent. The extent to which a sector's output is tradable is labelled 'tradability score' which is a continuous measure ranging from 0 to 1.

We define the tradability score as the sector-specific ratio between global value added exports (VAX) by industry and global value added by industry[11]. Intuitively, the value added exports of a particular industry and country is the value added created by that country and industry which is absorbed in other countries (see Johnson and Noguera, 2012). Hence, the ratio between the sector-level VAX and value added reflects the sector's dependence on exports which we interpret as tradability. Formally, the tradability score of sector *i* is defined as:

$$TS_i = \frac{\sum_t \sum_j VAX_{i,t}^j}{\sum_t \sum_j VA_{i,t}^j} = \frac{VAX_i^{global}}{VA_i^{global}}$$

where the subscript *t* is the time index ranging from 1995 to 2011 and *j* is the country index.

Note that by summing up over time we make the implicit assumption that the tradability of output does not change over time[12]. Moreover, the aggregation over countries is essential because it makes the measure independent of a country's exports and hence of country size and – to a large degree – of its trade policies.

The tradability scores are derived for 14 broad sectors[13]. The resulting tradability scores for these 14 sectors are shown in Figure 1. The ranking of the sectors is very intuitive. Mining and manufacturing emerge as the sectors producing by far the most tradable output with a tradability score of 0.51 and 0.41 respectively. They are followed by the transport and communication sector and the agricultural sector. At the bottom of the ranking are the health services and public administration which are both characterised by a very low tradability score amounting to 0.006 and 0.014 respectively.

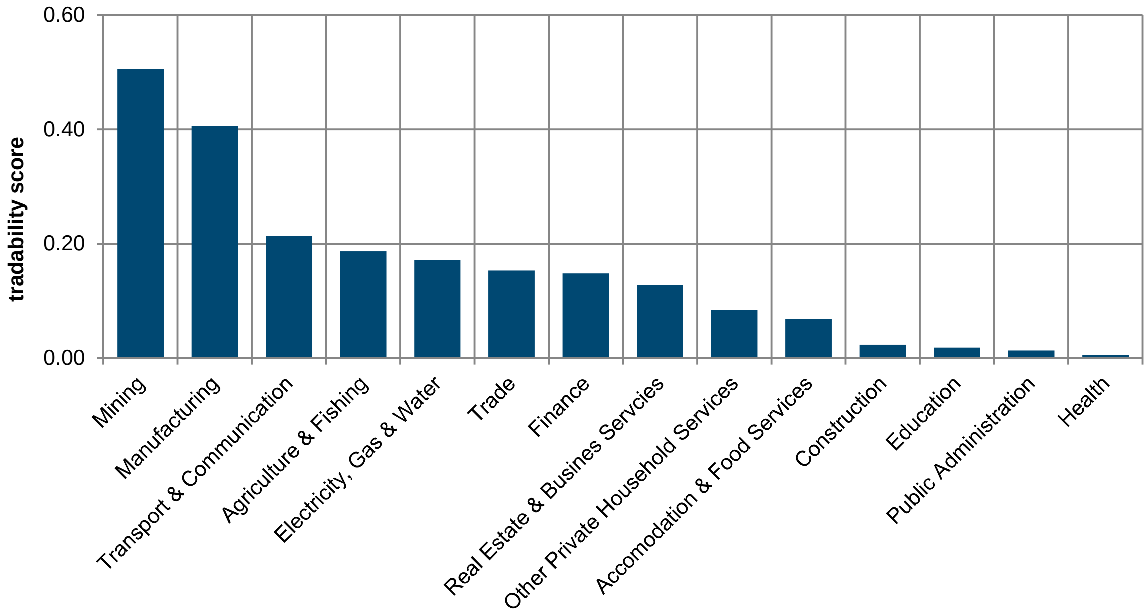
10 An alternative approach to capture the tradability of goods (or sectors) is to look at tariffs or trade barriers more generally. The difficulty is that the magnitude of such trade barriers is hard to identify. While the trade costs for merchandise can be estimated with gravity models (see e.g. Anderson and Wincoop, 2004), this approach is harder to implement for services.

11 The tradability score can equally be calculated as the ratio between gross exports and value added and (see Bykova and Stöllinger, 2017). Our preferred metric of the tradability score, however, is the one based on value added exports. See Appendix 3 for the methodological details of calculating the value added exports.

12 It is equally possible to calculate time-varying tradability scores. See Bykova and Stöllinger (2017).

13 For the list of the resulting 14 sectors and the corresponding NACE Rev. 1 and NACE Rev. 2 industry codes see Appendix 2.

Figure 1 / Global tradability scores (TS) of sectors



Note: Tradability score based on value added exports (TSvax).
Source: WIOD, author's own calculations.

The tradability score is the first component required for the calculation of the country-level tradability index. The second component is a country's sectoral value added shares which are used as weights for aggregating the sector-specific tradability scores to the country level.

Formally, the TI of country *j* in any year *t* is then calculated as:

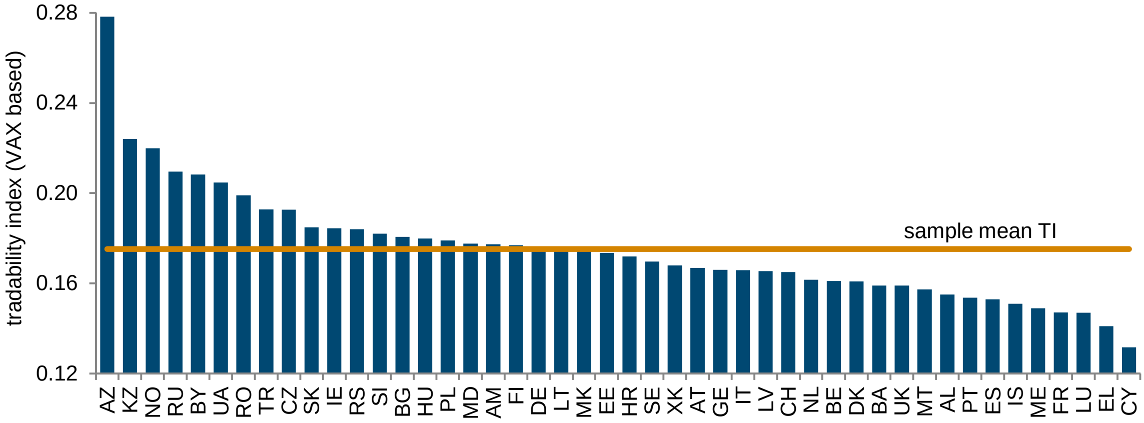
$$TI_t^j = \sum_i \frac{VAX_i^{global}}{VA_i^{global}} \cdot \frac{VA_{i,t}^j}{\sum_i VA_{i,t}^j}$$

where $VA_{i,t}^j$ is the sector-specific value added of sector *i* in country *j* at time *t*. As discernible from this definition, the tradability index is retrieved by calculating the weighted sum of the tradability scores over all industries *i*.

The tradability index can be interpreted as the predicted export openness given a country's production structure. The advantage of this index is that it reflects the entire composition of production of each country. This makes it a proper summary variable for an investigation of the nexus between the tradability of output and the current account.

Figure 2 presents the ranks all countries in the sample by their tradability index. There is quite some variation in the index across countries ranging from 0.278 for Azerbaijan to a mere in 0.131 in Cyprus. Next to Azerbaijan mainly other oil and commodity exporters are found at the top of the ranking. The bottom ranks are all occupied by EU countries which are Cyprus Greece, Luxembourg and France. The sample average of the tradability index is 0.176 which is about the value found for Lithuania. A country with a TI of 0.176 implies that, given its production structure, this country is expected to export 17.6% of its value added to other countries. For this reason, the TI can also be seen as the predicted openness of a country its economic structure.

Figure 2 / Tradability index across countries, value added based (average 1995-2014)



Note: Tradability index based on value added exports.
Source: WIOD, author's own calculations.

Most importantly, this TI is the proper indicator to investigate the tradability hypothesis derived in the previous section.

5. Empirical Model and Data

5.1. EMPIRICAL MODEL

By construction the TI does not contain a country's own trade flows and therefore eliminates an important source of endogeneity that plagues the use of conventional openness measures in empirical work. This feature of the TI is a great advantage for the econometric analysis because it strongly reduces the reverse causality running from the current account to the economic structure and hence to the tradability index. As a consequence we choose a simple econometric approach that consists of using the tradability index directly as an explanatory variable in our current account model.

In addition to the tradability index the empirical model encompasses a large number of control variables which have been identified by the literature as determinants of the current account. In our choice of control variables we draw heavily on the contributions by Debelle and Faruqee (1996), Chinn and Prasad (2003) and Ca'Zorzi et al. (2012).

The general econometric approach consists of regressing the current account balance expressed in per cent of GDP, *ca*, on the TI and a set of control variables. Our first approach is to investigate the 'long run' relationship[14] between the tradability of output and the current account. To this end we follow Debelle and Faruqee (1996) by taking the average of all variables over the sample period and run a cross-country regression of the form:

(1) $$ca_j = \alpha + \beta \cdot TI_j + \mathbf{X}_j \cdot \gamma + \varepsilon_c$$

where ***X*** is a vector of control variables, ε is the error term and *j* is the country index. The tradability hypothesis predicts β to be positive.

In addition we also exploit the panel structure of our data which has the advantage that a part of the potential omitted variable bias can be eliminated by including country and time effects. The regression equation takes the following form:

(2) $$ca_{j,t} = \alpha + \beta \cdot TI_{j,t} + \mathbf{X}_{j,t} \cdot \gamma + \mu_j + \delta_t + \varepsilon_{j,t}$$

where the subscript t indicates the time index and μ_j and δ_t denote country and time fixed effects respectively. The panel model in equation (2) is estimated for 3-year averages which result in 5 periods[15].

When working with panel data it is imperative to screen the data for the presence of unit roots. For this we rely mainly in the Im-Pesaran-Shin (IPS) test (Im et al., 2004) with the lag structure being determined

[14] The term long run here refers to the fact that a relatively long time span is covered. It is not meant in an econometric sense.

[15] The period 1995-1997 is omitted in all specifications in order to have the same sample period across all specifications, some of which contain variables in first differences. The year 2014 is omitted in order to ensure periods of equal length.

by the Akaike-information-criterion (AIC). The null-hypothesis of the IPS test is that all panels contain a unit root against the alternative hypothesis that some panels are stationary. This unit root tests reject the null hypothesis for the current account balance and the TI as well as most control variables with the exception of the net foreign assets, the dependency ratio and the domestic credit. Therefore our baseline panel model will be in levels, except for the three controls mentioned above which will enter the model in first differences[16]. The control variables are discussed below. Since the alternative hypothesis in the IPS test is that at least one panel is stationary it could still be the case that some of the panels have a unit root. For these reasons we also estimate the entire panel in first differences though qualitatively this does not alter the results[17].

5.2. DATA

The analysis covers basically the whole of Europe resulting in a sample of 46 countries[18]. The countries are a mix of developed and emerging countries as well as economies in transition. Since there is a debate to what extent transition of the former Socialist countries has already been accomplished (see e.g. Shleifer and Treisman, 2014), these countries will, together with Turkey and the countries of former Yugoslavia, be referred to as ‘emerging Europe’[19]. The sample period generally stretches from 1995 to 2014 though the fact that the sample comprises basically all European countries implies that the sample will be slightly unbalanced as for countries that have gained independence more recently, such as Montenegro, data is not available back until 1995.

The primary sources for the current account and the sector-level value added data are the wiiw Annual Database (wiiw ADB) and Eurostat. For the countries covered by neither of these databases we turn to IMF data (International Financial Statistics – IFS and the World Economic Outlook Database – WEO) in case of the current account and the United Nations SNA database for the sector-level value added data.

As explained in the previous section, the calculation of the tradability index requires inter-country input-output data which we get from the World Input-Output Database (WIOD). The WIOD contains information for 40 countries and the rest of the world for the period 1995-2011 (see Timmer et al., 2015). The international inter-industry linkages are available for 35 industries.

While the current account developments of European countries are very heterogeneous, a noticeable feature is the large number of countries which run persistent current account surpluses during the entire sample period (e.g. Germany, the Netherlands, Sweden) or permanent deficits such as several of the Balkan countries. A first inspection of the relationship between the current account and the TI in European countries reveals a slightly positive correlation between the two as depicted in Figure 3. This relationship will be investigated econometrically taking into account the effects of other determinants of the current account.

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16 The details of the unit root tests are found in Appendix 7.

17 See Appendix 8.

18 Exceptions are Lichtenstein, Monaco, San Marino and the Vatican. See Appendix 1 for the list of countries.

19 Except for those that the IMF classifies as developed countries, e.g. Czech Republic, Estonia or Slovenia. See Appendix 1.

Figure 3 / Current account positions and the tradability of output, 1995-2014

Note: Tradability index based on value added exports. Panel excludes Azerbaijan (AZ) and Montenegro (ME) for reasons of scaling.
Source: WIOD, wiiw ADB, Eurostat, IMF IFS, IMF WEO, OECD SNA database, World Bank (WDI), author's own calculations.

The following control variables will be included in the regression models.

Real GDP growth. In the inter-temporal model of the current account, countries with high growth rates (*gdp growth*) tend to run current account deficits. This is because they will borrow from abroad against their higher future income. Therefore a negative sign for the coefficient of *gdp growth* is expected although the results for the GDP growth variable in the literature are mixed. The data for real GDP growth is taken from wiiw ADB, Eurostat, national sources and the World Bank's WDI database.

Relative per capita income. Assuming that poorer countries are further away from their steady state and therefore less capital-abundant, the interest rate will be higher and they attract foreign capital spurring the convergence process (e.g. Calderon et al., 2002). Therefore poorer countries (which are also predicted to grow faster) tend to run current account deficits to finance their catch-up process. The proxy used will be GDP per capita expressed relative to the average of the sample (*rel gdpcap*). GDP per capita will also enter in quadratic form (*rel gdpcap sq*) in order to capture the possibility that this income effect levels off as countries grow richer and approach the average level of GDP per capita. The theoretical predictions of stages of developments models make us expect a positive sign for the income level and a negative sign for the quadratic term as the convergence effect typically levels off as a country grows richer. The data sources are wiiw ADB and Eurostat as well as national sources in the case of Armenia, Azerbaijan, Georgia and Moldova.

Government balance. In the absence of full Ricardian equivalence, public expenditure and taxation affect the current account balance due to its impact on savings. In case of a budget deficit (surplus), the government uses up (adds to) domestic savings, which tends to worsen (improve) the current account balance (see for example Debelle and Faruqee, 1996). This is the famous twin-deficit hypothesis. The government balance (*gov bal*) enters the empirical model expressed in per cent of GDP. As with our main variables, the data for the government balance comes from various sources, mainly the wiiw ADB and Eurostat supplemented with data from national sources in the case of Armenia, Azerbaijan, Moldova and Georgia and in the latter case also from the CIS database.

Net foreign asset position. The net foreign asset (NFA) position is tightly connected to the current account position through the fact that the current account balance equals the trade account plus the (positive or negative) return on the stock of foreign assets. Therefore the NFA is an important initial condition for future current account balances because countries with large negative NFAs have to pay interest (or dividends) on the assets owned by foreigners which contributes negatively to the current account balance. This suggests a positive relationship between the current account position and the NFA position. The NFA position will also enter the empirical model in relative terms, i.e. expressed as a percentage of GDP (*nfa*) and we expect a positive sign. We use the net international investment positions (IIP) as reported by the IMF IFS. For the more distant years for which IIPs are not reported we use the estimates from the External Wealth of Nations database assembled by Lane and Milesi-Ferretti and described in Lane and Milesi-Ferretti (2007).

Dependency ratios. The age structure of the population may affect the current account through the savings rate too. Old and young people do not earn income and therefore cannot save[20]. Therefore, high dependency ratios are expected to reduce the aggregate saving rate. Consequently, the dependency ratio should affect the current account position negatively. Following Blanchard and Giavazzi (2002) the overall dependency ratio, comprising old and young people, is defined as the ratio of population to the labour force. The dependency ratios (*dep ratio*) are taken from the World Bank's World Development Indicators (WDI) and national sources in the case of Kosovo.

Investment intensity. The investment intensity, defined as the ratio of gross fixed capital investment to GDP, influences the current account via the composition effect. As suggested in the model by Jin (2012), countries that specialise in the production of capital intensive goods will have higher investment demand. By definition, a higher investment demand reduces the current account balance. This fact, that more capital-intensive countries may run current account deficits is referred to as composition effect. The data comes from the wiiw ADB, Eurostat supplemented with data from the United Nations SNA database as well as national data in the case of Moldova.

Financial depth. We follow Rajan and Zingales (1998) in using domestic credit *(dom cred)* provided by private banks relative to GDP as indicator for financial depth. Since private credit booms are often associated with housing bubbles or other bubbles in non-tradable sectors, periods of rapidly expanding domestic credit funds are predominantly channelled into non-tradables. This will drive up prices of non-tradables, leading to an appreciation of the real exchange rate and consequently to a worsening of the current account balance. At the same time, there is also the view that financial deepening may increase the savings rate (e.g. Chinn and Prasad, 2003) which tends to improve the current account. The effect of

[20] They need to draw down on their wealth or rely on their parents respectively.

domestic credit on the current account is therefore ambiguous. The data for this variable comes from the World Bank WDI.

Oil exporter. This is a dummy variable taking the value one for oil exporting countries and zero otherwise. We define as oil exporters countries with more than 20% export revenues stemming from oil exports[21]. This threshold defines Azerbaijan, Kazakhstan, Norway and Russia as oil exporters. With the inclusion of a dummy for oil exporters we attempt to exclude the possibility that the results for the relationship between the tradability index and the current account balance is driven uniquely by the high export proceeds from oil of petroleum exporting countries.

Euro area membership. Given the strong interest in current account imbalances in the euro area, the empirical model will include a dummy variable for the members of the euro area *(EA MS)*. This dummy variable is expected to be positive as it reflects monetary and financial integration.

Real exchange rate. A complicated determinant of the current account is the real effective exchange rate. Due to its importance for the analysis we use three alternative measures for relative prices. These are countries' price level of consumption (*pl_con*), obtained from the Penn World Tables version 8.1 (PWT 8.1), unit labour costs based real effective exchange rates (*REER_ulc*), which come mainly from Eurostat complemented with information from the World Bank's WDI, and the measure of undervaluation or overvaluation of the exchange rate (*over_eval*) suggested by Dollar (1992)[22]. A high real exchange rate or an overvalued exchange rate makes domestic exports relatively more expensive and tends to worsen the current account balance. Since it turns out to be the more relevant indicator, the results presented in the main text include changes in the REER as the real exchange rate measure[23]. The REER is a common measure for countries' international competitiveness, with low values indicating high cost competitiveness and vice versa. Because the real effective exchange rate is only available as an index it only makes sense to work with changes in this index.

21 We rely on the export of crude oil (HS Code 2709). The data is obtained from UN Comtrade database accessed via the World Bank's WITS download tool.

22 We follow the approach by Rodrik (2008) in estimating the expected real effective exchange rate (or relative price level) by regressing the log of the price level of consumption on the log of GDP per capita controlling for time fixed effects. The difference between the actual price level and the predicted price level is the degree to which the real exchange rate is overvalued (*over_eval*). A value greater than 0 indicates that a country's real exchange rate is overvalued, values smaller than 0 indicate an undervalued real exchange rate.

23 Further results and a discussion of the exchange rate are found in Appendix 6.2.

6. Results

This section reports the main results obtained for both the cross-section and the panel regression model. Further results are found in Appendix 6.

6.1. CROSS-SECTION RESULTS

The estimation results for the cross-section model in equation (1) are based on the average value for each country over the sample period (1995-2014). They are summarised in Table 2.

Table 2 / Cross-section regression results

Dependent variable:	**Current Account Position in % of GDP**					
	(1)	(2)	(3)	(4)	(5)	(6)
TIvax	0.6124*	1.4642***	0.9029***	0.7658***	0.5961***	0.5267***
	(0.3302)	(0.2370)	(0.1899)	(0.1536)	(0.1983)	(0.1802)
gdp growth		-0.9815***	-0.9091***	-0.7083***	-0.8178***	-0.6908***
		(0.3310)	(0.2112)	(0.1926)	(0.2190)	(0.2313)
rel gdpcap		0.0648***	0.0498***	0.0453***	0.0491***	0.0506***
		(0.0216)	(0.0076)	(0.0073)	(0.0103)	(0.0098)
rel gdpcap sq.		0.0027				
		(0.0055)				
gov bal			0.1578	0.2272*	0.1087	0.0999
			(0.1571)	(0.1336)	(0.1749)	(0.1694)
nfa			0.0485***	0.0527***	0.0533***	0.0542***
			(0.0085)	(0.0080)	(0.0081)	(0.0075)
dep ratio				-0.0134***	-0.0127***	-0.0151***
				(0.0042)	(0.0040)	(0.0040)
capital intensity				-0.1972	-0.1430	-0.0946
				(0.1335)	(0.1255)	(0.1251)
dom cred				-0.0040	-0.0060	-0.0106
				(0.0076)	(0.0085)	(0.0086)
oil					0.0240	0.0317
					(0.0204)	(0.0207)
EA MS					-0.0100	-0.0130
					(0.0146)	(0.0139)
ΔREERulc						-0.0261*
						(0.0130)
Observations	46	46	46	46	46	46
R-squared	0.0623	0.7592	0.8953	0.9175	0.9223	0.9278
R-squared adj.	0.041	0.736	0.882	0.900	0.900	0.904
F-test	3.44	42.15	67.99	55.58	39.59	37.45

Note: TI = tradability index based on value added exports. EA MS=euro area members. Robust standard errors in parentheses. ***, **, and * indicate statistical significant at the 1%, 5% and 10% level respectively. All regressions include a constant. Regressions based on reporters' sample averages.

Specification (1) starts off with a univariate regression of the current account position on the tradability index. This yields a coefficient of 0.61 which is weakly statistically significant at the 10% level. In terms of magnitude, this result suggests that a 1 percentage point increase in the tradability of output (say from 0.18 to 0.19) improves the current account balance in percent of GDP by 0.61 percentage points.

This may be regarded as a relatively large effect but it should be considered that a one percentage point change in the tradability index is associated with a relatively large change in the production structure. Assume that the tradability index increases from 0.18 – which is approximately the sample average – to 0.19 due to shift of production towards manufacturing. By how much must the manufacturing sector expand in order to arrive at this 1 percentage point change in the TI? Given that the tradability score of the manufacturing sector is about 0.4 and assuming that the initial share of the manufacturing sector in GDP was 20% and that resources were shifted out of a sector with a tradability score of about 0.18 (e.g. agriculture), the share of the manufacturing sector would need to increases by approximately 5 percentage points (≈(0.40-0.19) x ((0.20+0.25)/2).

In specification (2) the growth rate and GDP per capita, the latter including a squared term, are added as control variables. Note first, that these additional controls greatly improve the explanatory power of the regression with the adjusted coefficient of determination going up to 0.74. Specification (2) shows that by controlling for the growth rate and GDP per capita, both the size and the magnitude of the tradability index increases considerably. This is expected as the convergence effect and the tradability hypothesis work in opposite directions. The inclusion of GDP growth and the per capita income therefore disentangles the structural effect and the convergence effect. This result is reassuring because it indicates that the tradability index really picks up the structural effect. The coefficient of the growth rate itself is negative (-0.98) confirming the hypothesis that higher growth rates tend to worsen the current account balance because of increased import demand. The coefficient of the growth rate is statistically significant at the 1% level in our model, even though it does not belong to the most likely determinants of the current account according to the Bayesian model selection approach of Ca'Zorzi et al. (2012). The relative GDP per capita is estimated to be positive and also highly statistically significant. The finding is in line with the expectations and also with the results in Debelle and Faruqee (1996) and Chinn and Prasad (2003) who report a positive effect of relative income in their cross-section results for their global sample. In terms of magnitude of the coefficients, the 0.065 we obtain are in a similar range as those in Chinn and Prasad (2003) who find a coefficient of 0.11 in their full sample. Overall, the positive coefficient of the GDP per capita variable that we obtain confirms the conclusion in Blanchard and Giavazzi (2002) and Lane and Pels (2012) that in Europe capital continues to flow from rich to poor countries (though their sample is limited to the euro area and the EU plus EFTA respectively). What we cannot establish, however, is that this positive effect of income per capita diminishes as countries grow richer because the quadratic term turns out to be not statistically significant. For this reason we exclude the quadratic term from the model though this does not affect the results.

For the government balance (specification 3) we do not obtain a significant coefficient reflecting the outcome in Debelle and Faruqee (1996) for their global sample. Hence, there is no evidence for the twin deficit hypothesis in a European context in the long run. On the contrary, Chinn and Prasad (2003) do find that government deficits go together with current account deficits in both their full sample results and the results for industrialised countries. The latter result we can confirm when estimating the model for sub-groups of European countries which are reported in Appendix 6.1. Differentiating by country groups we find evidence for the twin deficit hypothesis for the developed countries in Europe and the EU

Member States. The government balance is also one of the explanatory variables identified as frequently relevant in current account models according to the selection criteria in Ca’Zorzi et al. (2012).

Another important control variable is the net foreign asset position. This implies that countries with positive NFA positions tend to have, ceteris paribus, higher current account surpluses respectively more moderate deficits. The rationale behind this is that countries with accumulated positive foreign assets earn interest on these assets.

The next controls that are introduced are the dependency ratio, the capital intensity and the domestic credit (specification 4). The dependency ratio yields a negative coefficient (-0.013) that is significant at the 1 percent level. This reflects the fact that children and retired people do not save – or at least have lower savings rates than the active part of the population. In terms of magnitudes, however, the effect is not very large. In fact it is much smaller than those found for example by Ca’Zorzi et al. (2012) who distinguish between the dependency ratio of old people and that of young people.

The negative coefficient obtained for the capital intensity is in line with the prediction of the above mentioned model by Jin (2012) if one assumes that the specialisation in relative capital intensive sectors is reflected in comparatively high investment intensities. However, it is not statistically significant at conventional levels of significance. One reason for this may be the correlation between GDP per capita and the capital intensity. Of little relevance according to our cross-section model is the amount of domestic credit. This mirrors the result in Chinn and Prasad (2003) for their industrialised country sample though they do not find an effect in their analysis for their full sample.

Next, we include dummy variables for oil exporting countries and the members of the euro area (specifications 4 and 5). The euro area dummy turns out to have little impact on the results, but the effect of the oil exporter dummy is noteworthy. While not statistically significant itself, the oil exporter dummy reduces the size of the coefficient of the TI considerably – from 0.766 in specification (4) to 0.596 in specification (5). This is not entirely surprising given that a high endowment with oil resources is an important structural feature of an economy. In essence, the structural effect due to oil endowments is so to speak ‘deducted’ from the structural effect captured by the tradability index. What is important to see, is that the tradability index is capable of explaining parts of the variation in the current account apart from the particularities of oil exporting countries. In other words, we can be confident that the positive relationship between the tradability index and the current account is not due to oil exporters.

Finally, specification (5) adds changes in the real exchange rate *(ΔREERulc)* to the model. There is definitely a complex and important interaction between changes in the production structure and the development of the real exchange rate. However, since this constitutes a correlation between two explanatory variables we can still integrate the exchange rate developments directly into the regression model. The expectation is that a higher relative price level, respectively an appreciation of the real exchange rate, worsens the current account. The main interest, however, is not with the sign of the real exchange rate (or changes thereof) but how its inclusion affects the coefficient of the tradability index. More precisely, if the specialisation patterns and resulting production structures were predominantly the result of relative prices, the real exchange rate should pick up this effect rendering the TI variable superfluous. In other words the inclusion of a measure for the real exchange rate acts as a robustness check ruling out the possibility that the tradability index only captures changes in relative prices. With the reported results in specification (5) this possibility can be safely ruled out as the statistical significance of the TI remains fully intact and also in terms of magnitude the coefficient is reduced only by a small amount from 0.60 to 0.53.

To summarise, we find that – in line with the tradability hypothesis – the specialisation in the production of more tradable output seems to improve the current account balance. According to the estimation results obtained for the coefficient of the TI, which varies somewhat over the different specifications, we would see the effect range from about 0.52 to 0.77. This implies that a one unit higher TI would improve the current account balance by about half to three-quarters of a percentage point.

6.2. PANEL RESULTS

The estimation results for the model in equation (2) are shown in Table 3 and Table 4. The model is estimated with four panel estimators. These are a pooled model, a random effects model, a fixed effects model and the generalised method of moments (GMM) model using the Arellano-Bond estimator (Arellano and Bond, 1991).

We first estimate a bivariate model including the current account balance as the dependent variable and the TI as the explanatory variable[24]. The estimation results in Table 3 confirm the positive relationship between the TI and the current account established in a cross-section context. The explanatory power of the fixed effects model is very high while the pooled model still explains 12% of the variation in the current account position.

Table 3 / Panel regression results (bivariate model)

Dependent variable:	**ΔCurrent Account Position in % of GDP**			
	'full model'			
	(1)	(2)	(3)	(4)
	(POOLED)	(RE)	(FE)	(XTA)
TIvax	0.9686***	2.0564***	3.0824***	2.7038***
	(0.2695)	(0.3729)	(0.5708)	(0.3540)
Δca (t-1)				0.2171*
				(0.1284)
country fixed effects	no	yes	yes	yes
time fixed effects	no	yes	yes	yes
Observations	227	227	227	179
R-squared	0.1239		0.8229	
R-squared adj.	0.120	.	0.773	.
F test	12.92	.	11.56	.

Note: POOLED= pooled panel regression; RE= random effects regression; FE=fixed effects regression; XTA=Arellano-Bond fixed effects estimator. TI = tradability index based on value added exports. Robust standard errors in parentheses. ***, **, and * indicate statistical significant at the 1%, 5% and 10% level respectively. All regressions include a constant.

24 In case of the Arellano-Bond estimator also the lag of the dependent variable is included as explanatory variable.

Table 4 / Panel regression results

Dependent variable:	**Current Account Position in % of GDP**							
	'full model'				*'parsimonious model'*			
	(1')	(2')	(3')	(4')	(1'')	(2'')	(3'')	(4'')
	(POOLED)	(RE)	(FE)	(XTA)	(POOLED)	(RE)	(FE)	(XTA)
TIvax	1.3746***	1.7067***	3.1735***	3.3314***	1.4937***	1.7335***	2.4064***	1.8081***
	(0.2148)	(0.2204)	(0.6527)	(0.5126)	(0.2053)	(0.2480)	(0.4337)	(0.3422)
gdp growth	-0.1890	-0.1608	-0.2875*	-0.3037**	-0.1331	-0.0063	0.0063	0.0279
	(0.2085)	(0.1579)	(0.1468)	(0.1517)	(0.1682)	(0.1219)	(0.1660)	(0.1178)
rel gdpcap	0.0745***	0.0896***	0.1342	0.0849	0.0791***	0.0926***	0.1286*	0.1116
	(0.0180)	(0.0281)	(0.1044)	(0.1023)	(0.0142)	(0.0263)	(0.0752)	(0.0805)
rel gdpcap sq	-0.0019	-0.0063	-0.0434	-0.0179	-0.0031	-0.0061	-0.0353	-0.0131
	(0.0055)	(0.0077)	(0.0420)	(0.0450)	(0.0040)	(0.0070)	(0.0268)	(0.0323)
gov bal	0.3261**	0.1808	0.1983	-0.1268	0.1071	-0.0476	-0.0770	-0.2196
	(0.1262)	(0.1400)	(0.1540)	(0.2097)	(0.1193)	(0.1480)	(0.1470)	(0.1675)
cap_int	-0.4580***	-0.6165***	-0.5340***	-0.5210***	-0.4345***	-0.5605***	-0.5453***	-0.7758***
	(0.1321)	(0.2011)	(0.1174)	(0.1053)	(0.1197)	(0.1804)	(0.1266)	(0.0868)
Δnfa (t-1)	0.0207	0.0072	0.0126	-0.0117				
	(0.0180)	(0.0116)	(0.0095)	(0.0113)				
Δdep ratio	0.0389	0.1001	0.1390**	0.1128*				
	(0.0533)	(0.0642)	(0.0635)	(0.0611)				
Δdom cred	-0.0394**	-0.0214*	-0.0196*	-0.0159				
	(0.0190)	(0.0127)	(0.0109)	(0.0114)				
ΔREER_ulc	0.0106	0.0360	0.0545	0.0554	-0.0245	0.0141	0.0399	0.0065
	(0.0477)	(0.0477)	(0.0399)	(0.0350)	(0.0419)	(0.0326)	(0.0330)	(0.0302)
Δca (t-1)				0.2225				0.2925**
				(0.1794)				(0.1256)
country fixed effects	no	no	yes	yes	no	no	yes	yes
time fixed effects	no	yes	yes	yes	no	yes	yes	yes
Observations	165	165	165	120	226	226	226	178
R-squared	0.6969		0.9061		0.6521		0.8638	
R-squared adj.	0.671	.	0.856	.	0.634	.	0.819	.
F test	17.44	.	12.12	.	40.81	.	8.933	.

Note: POOLED= pooled panel regression; RE= random effects regression; FE=fixed effects regression; XTA=Arellano-Bond fixed effects estimator. TI = tradability index based on value added exports. Robust standard errors in parentheses. ***, **, and * indicate statistical significant at the 1%, 5% and 10% level respectively. All regressions include a constant.

The next step is to estimate the panel model with a set of control variables as in the cross-section model (Table 4). Regarding the choice of the appropriate estimator, we sympathise with Chinn and Prasad (2003) as well as Ca'Zorzi et al. (2012) who argue in favour of the pooled specification because the explanatory variables capture more of the cross-country variation in the data. However, we also perform a model selection test. First we run a Hausman test which rejects the random effects specification. A joint F-test for the significance of the country fixed effects decides for the inclusion of fixed country effects. For this reason we consider the fixed effects model as the appropriate one. These tests are based on the 'parsimonious model' in Table 4. This model excludes the variables which enter in first differences due to the unit root issue, but has the advantage that it preserves a much higher number of observations due to missing data in these variables[25].

Qualitatively, there is little difference between the 'full' model and the 'parsimonious' model with regards to the positive and statistically significant coefficient of the TI. Quantitatively, the parsimonious model delivers smaller coefficients of the TI though they are still very large. The reason for the large size of the coefficients is again the fact that a one unit change in the TI already reflects a considerable structural change. Since the model is estimated for 3-year periods the movement in the TI between periods is also modest. In 'parsimonious model' the Arellano-Bond estimator (specification 4'') yields a coefficient of 1.8 which is indeed large but considerable smaller than the one obtained from the fixed effects model. The Arellano-Bond estimator is recommendable in case of the 'parsimonious' model because the lagged value of the current account turns out to be statistically significant. The fact that it is positive suggests that current account surpluses (or deficits) are correlated with surpluses in the preceding period.

Apart from the lagged value of the current account, the panel model also assigns great importance to the capital intensity. It has the expected negative sign as predicted by the composition effect in the current account model by Lin (2012). In contrast, for the remaining control variables, many of which were found to be significant in the cross-country model, no significant effect on the current account can be identified. This is partly explained by the fact that the fixed effect models exploit the within-country variation instead of the cross-country variation. This can also be seen for example in the case of the relative GDP per capita which is statistically significant in the pooled model (specification 1'') but not in the fixed effects specifications.

There is admittedly a very wide range of the estimated coefficients. We would consider the coefficient obtained from the fixed effects estimation of the full model (specification 3'), i.e. 3.17 as the upper bound and the 1.81 obtained from the Arellano-Bond estimator in the parsimonious model as the lower bound. The key message, however, is that the tradability hypothesis holds in the panel model irrespective of the choice of the estimator and control variables.

6.3. COMPARING STRUCTURAL INDICATORS

In this section we provide a robustness check which consists of re-estimating our empirical current account model with an alternative measure of the tradability index on the one hand and with the conventional value added share of manufacturing on the other hand.

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25 Further results for sub-groups of countries can be found in Appendix 6 and Appendix 8.

The alternative TI is a variant of the tradability index as it was used in this paper so far. The difference is that instead of using the value added exports for the calculation, the alternative TI is based on gross exports[26]. To distinguish the two we will label the former *TIvax* and the latter *TIx*.

Table 5 demonstrates that in the cross-section model all three structural indicators deliver similar qualitative results. Also, the control variables show very robust patterns across the three structural indicators.

Table 5 / Cross section regressions, different tradability measures

Dependent variable:	**Current Account Position in % of GDP**					
	TI - value added exports		*TI - gross exports*		*manufacturing share*	
	(1)	(2)	(1')	(2')	(1")	(2")
TIvax	0.6124*	0.5443***				
	(0.3302)	(0.1898)				
TIx			0.4080*	0.2260**		
			(0.2343)	(0.0868)		
share mf					0.2038	0.1806**
					(0.2092)	(0.0745)
gdp growth		-0.6554***		-0.5061**		-0.4046
		(0.2357)		(0.2291)		(0.2417)
rel gdpcap		0.0460***		0.0451***		0.0442***
		(0.0070)		(0.0070)		(0.0074)
gov bal		0.1633		0.1758		0.1920
		(0.1491)		(0.1455)		(0.1467)
nfa		0.0538***		0.0532***		0.0536***
		(0.0080)		(0.0079)		(0.0080)
dep ratio		-0.0155***		-0.0146***		-0.0150***
		(0.0043)		(0.0041)		(0.0041)
cap int		-0.1214		-0.1314		-0.1189
		(0.1184)		(0.1281)		(0.1249)
dom cred		-0.0102		-0.0102		-0.0106
		(0.0085)		(0.0085)		(0.0086)
oil		0.0287		0.0471***		0.0618***
		(0.0205)		(0.0135)		(0.0111)
ΔREER_ulc		-0.0237*		-0.0245*		-0.0265*
		(0.0123)		(0.0131)		(0.0138)
Observations	46	46	46	46	46	46
R-squared	0.062	0.926	0.080	0.927	0.028	0.927
R-squared adj.	0.041	0.904	0.0594	0.906	0.00622	0.905
F-test	3.44	42.22	3.033	45.44	0.950	45.42

Note: TIvax = tradability index based on value added exports. Tx= tradability index based on gross exports. shmanuf = value added share of manufacturing. Robust standard errors in parentheses. ***, **, and * indicate statistical significant at the 1%, 5% and 10% level respectively. All regressions are based on actual sample averages used in the regression. All regressions include a constant.

When comparing the magnitude of the coefficients of the tradability indices on the one hand and the share of manufacturing on the other hand one has to bear in mind, that the variation in the former tends

[26] See Bykova and Stöllinger (2016) for details.

to be smaller because it reflects the whole structure of the economy. As mentioned before a one percentage point increase in the manufacturing share would trigger a much smaller change in the TI.

Another interesting aspect is the fact that the dummy variable for oil exporting countries is not significant in the specification with the *TIvax* while it is for the other two measures. The explanation for this result is that the *TIvax* captures better the entire structural features which include the possibility of large endowment with oil and an important petroleum industry. Certainly, one could also make the argument that it is preferable to control for the particularities of oil production separately (which is done anyway in Table 5) but our preference is a comprehensive TI measure.

In any case, Table 5 shows that the positive association between the tradability of output does not depend on the particular choice of the index, i.e. whether it is based on value added exports or gross exports. The use of the share of the manufacturing sector in GDP also yields similar results but of course it captures only partially the tradability of output and is therefore less informative for the tradability–current account nexus.

Table 6 / Panel fixed effects regressions, different tradability measures

Dependent variable:	**Current Account Position in % of GDP**					
	TI - value added exports		*TI - gross exports*		*manufacturing share*	
	(1)	(2)	(1')	(2')	(1'')	(2'')
TIvax	3.0824***	2.4064***				
	(0.5708)	(0.4337)				
TIx			1.4995***	1.0259***		
			(0.4129)	(0.3845)		
share mf					0.5425**	0.0842
					(0.2586)	(0.3304)
gdp growth		0.0063		0.1158		0.2628
		(0.1660)		(0.1912)		(0.2184)
rel gdpcap		0.1286*		0.2045**		0.3089**
		(0.0752)		(0.0946)		(0.1272)
rel gdpcap sq		-0.0353		-0.0557*		-0.0839*
		(0.0268)		(0.0335)		(0.0432)
gov bal		-0.0770		-0.1292		-0.0346
		(0.1470)		(0.1672)		(0.1708)
cap_int		-0.5453***		-0.6586***		-0.8216***
		(0.1266)		(0.1510)		(0.1814)
ΔREER_ulc		0.0399		0.0437		0.0124
		(0.0330)		(0.0371)		(0.0389)
Observations	227	226	227	226	227	226
R-squared	0.8229	0.8638	0.7814	0.8405	0.7177	0.8170
R-squared adj.	0.773	0.819	0.719	0.788	0.637	0.756
F test	11.56	8.933	7.683	4.966	3.295	4.521

Note: TIvax = tradability index based on value added exports. Tx= tradability index based on gross exports. shmanuf = value added share of manufacturing. Robust standard errors in parentheses. ***, **, and * indicate statistical significant at the 1%, 5% and 10% level respectively. All regressions include a constant, country and time fixed effects.

The same comparison of tradability measures is made in the panel regression framework (Table 6)[27]. In this case, both tradability indices (based on value added exports and gross exports respectively) yield similar qualitative results. The value added share of manufacturing, however, is not statistically significant in specification 2''. The reason for why the tradability index turns out to be highly statistically significant while the manufacturing share does not, in our view, is that countries may specialise in highly tradable sectors other than manufacturing which also affects the current account balance positively. By definition this is not covered by the manufacturing share but is fully captured by the TI. This confirms our initial claim that the tradability index is a more comprehensive and therefore also more appropriate indicator for the specialisation in tradable output.

[27] The results in Table 6 are those for the fixed effects model but they are not sensitive to the choice of the panel estimator.

7. Conclusions

This paper suggests a new tradability index which is a comprehensive measure summarising the extent to which an economy is specialised in the production of output that is tradable. This index allows for a proper test of the tradability hypothesis according to which countries specialising in the production of relatively more tradable output tend to run current account surpluses. Since all our empirical current account models, which include a sample of 46 European countries observed over the period 1995-2014 confirm the tradability hypothesis, we believe to have established a new and important determinant of the current account position. The result holds irrespective of whether a cross-section (based on averages) or a panel is estimated and across various subsets of countries such as developed economies, the EU or emerging Europe. The results are not sensitive to the construction of the tradability which can be calculated based on either value added exports or gross exports. Importantly, the tradability index is not constructed using country-level exports and hence less prone to endogeneity problems. Rather, it is based on *global* value added exports. Formally, it is defined as the ratio of value added exports to value added weighted by the respective country's sectoral structure.

The tradability–current account nexus we have established in this paper has important policy implications. It is directly related to the debate about external imbalances and the phenomenon of de-industrialisation in Europe. The fact that the tradability of output is a key determinant of the current account on the one hand and that many European countries are experiencing a structural shift towards services (and hence relatively less tradable output) on the other hand increases the risk of external imbalances. At least this is true for countries whose main tradable sector is manufacturing and which do not have strong (endowments-based) comparative advantages in other highly tradable sectors such as mining. Though rather intuitive, this structural problem of increasingly service-oriented economies is all too often neglected by emphasising the gains from trade as they arise in static models. These models, however, are based on the assumption of balanced trade which is not what we observe empirically.

For the EU our results imply that the increasing structural divergence, which is partly driven by the emergence of global value chains (Stöllinger, 2016), must be expected to foster external imbalances among Member States. This calls for a solution which in the long term can only consist in a comprehensive reform of the current fiscal framework, either by significantly strengthening the cohesion efforts or by introducing an internal transfer mechanism of some sort[28].

Our results also indicate that the current account is a complex matter co-determined by a plethora of factors which are often tightly intertwined. For example, Rodrik (2012) suggests that the manufacturing sector unconditionally serves as an accelerator for economic development. Economic development implies higher growth. According to the (unconditional) manufacturing convergence hypothesis we should observe that countries which shift towards manufacturing grow faster. At the same time, faster growth tends to create current account deficits. In contrast, our tradability hypothesis suggests that a

[28] A third alternative is of course to rebalance the current account by curtailing imports and hence consumption. For many EU Member States reducing consumption was the main driver behind the adjustment process after the crisis of 2008/2009.

move towards tradable activities such as manufacturing should improve the current account position. This is why in the empirical application we made a great effort to control for a wide range of factors that are equally relevant for the current account position and found our result to be robust.

A natural extension of this paper is to take the test of the tradability hypothesis to the global level. While there will be serious data constraints, for OECD countries, several South and South East Asian countries as well as South American countries the required data would be available. Another interesting route forward is to focus on selected countries for which longer time series are available and analyse the tradability–current account nexus in a co-integration framework. This would make it possible to explore the dynamics of the relationship between the current account and the tradability index.

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Appendix 1: List of countries

Abbreviation	Country	Country category
AL	Albania	Emerging
AM	Armenia	Emerging
AT	Austria	Developed
AZ	Azerbaijan	Emerging
BY	Belarus	Emerging
BE	Belgium	Developed
BA	Bosnia and Herzegovina	Emerging
BG	Bulgaria	Emerging
HR	Croatia	Emerging
CY	Cyprus	Emerging
CZ	Czech Republic	Developed
DK	Denmark	Developed
EE	Estonia	Developed
FI	Finland	Developed
FR	France	Developed
GE	Georgia	Emerging
DE	Germany	Developed
EL	Greece	Developed
HU	Hungary	Developed
IS	Iceland	Developed
IE	Ireland	Developed
IT	Italy	Developed
KZ	Kazakhstan	Emerging
LV	Latvia	Developed
LT	Lithuania	Emerging
LU	Luxembourg	Developed
MK	Macedonia	Emerging
MT	Malta	Emerging
MD	Moldova	Emerging
ME	Montenegro	Emerging
NL	Netherlands	Developed
NO	Norway	Developed
PL	Poland	Emerging
PT	Portugal	Developed
RO	Romania	Emerging
RU	Russia	Emerging
RS	Serbia	Emerging
SK	Slovakia	Developed
SI	Slovenia	Developed
ES	Spain	Developed
SE	Sweden	Developed
CH	Switzerland	Developed
TR	Turkey	Emerging
UA	Ukraine	Emerging
UK	United Kingdom	Developed
XK	Kosovo	Emerging

Note: The distinction between ‘Developed’ and ‘Emerging’ mirrors the categorisation of European countries as ‘Advanced’ and ‘Emerging and Developing’ by the IMF as of April 2014.

Appendix 2: List of sectors for the calculation of the tradability index

Number	Sector	NACE Rev. 1	NACE Rev. 2
1	Agriculture, hunting and forestry + Fishing	A+B	A
2	Mining and quarrying	C	B
3	Manufacturing	D	C
4	Electricity, gas and water supply	E	D+E
5	Construction	F	F
6	Wholesale, retail trade, repair of motor vehicles etc.	G	G
7	Hotels and restaurants	H	I
8	Transport, storage + Communication	I	H + J
9	Financial intermediation	J	K
10	Real estate, renting and business activities	K	L+M+N
11	Public administration, defence, compuls.soc.security	L	O
12	Education	M	P
13	Health and social work	N	Q
14	Other community, social and personal services + Private households with employed persons	O+P	R+S+T

Appendix 3: Methodology for calculating value added exports

Deriving the tradability score requires the calculation of the value added exports (VAX) at the industry-country level. This appendix illustrates the basic input-output methodology to calculate the VAX, including a 3-country, 2-sector example.

Following the trade in value added concept in Johnson and Noguera (2012) and the expositions in Stehrer (2012) we require three components in order to calculate the value added exports. For any country *r*, these components are the value added requirements per unit of gross output, v_i^r; the Leontief inverse of the global input-output matrix, $\boldsymbol{L}$; and the final consumption vector, c_i^r. Both vectors as well as the Leontief inverse have an industry dimension i. The industry index is omitted in order to facilitate the exposition.

Country *r*'s value added coefficients are defined as $v_i^r = \frac{value\ added_r}{gross\ output_r}$. The value added coefficients are arranged in a diagonal matrix of dimension 1435 x 1 (40 countries x 35 industries). This matrix contains the value added coefficients of country *r* for all industries along the diagonals. The remaining entries of the matrix are zero because the interest here is with the value added created in country *r*.

The second element is the Leontief inverse of the global input-output matrix, $\boldsymbol{L} = (\boldsymbol{I} - \boldsymbol{A})^{-\mathbf{1}}$ where $\boldsymbol{A}$ denotes the coefficient matrix. In the WIOD the coefficient matrix (and hence the Leontief matrix) is of dimension 1435 × 1435 which contains the technological input coefficients of country *r* in the diagonal elements and the technological input coefficients of country *r's* imports (from a column perspective) and exports (from a row perspective) in the off-diagonal elements.

The final building block is the global final consumption vector. This vector is also industry specific and if of dimension 1435 × 1. Most importantly, for our purposes, final consumption must be split into separate blocks indication the origin of the consumed goods though within the elements in the column vector. As usual, each row is associated with one source of the final demand. The full consumption vector, c_i^J, in the 3-country one sector case has the form

$$c_i^J = \begin{pmatrix} c^{r,r} + c^{r,2} + c^{r,3} \\ c^{2,r} + c^{2,2} + c^{2,3} \\ c^{3,r} + c^{3,2} + c^{3,3} \end{pmatrix}$$

where the subscript *J* indicates that the vector comprises the consumption of all countries $j \in J$. The typical element of this vector contains the final consumption from all possible sources. For example, the element $c^{r,3}$ captures the value of final goods that country 3 demands from country *r*. Since the idea of value added exports is that it comprises only value added that is created in one country but absorbed in another, the final demand from country *r* itself needs to be eliminated for the calculation of country *r*'s VAX. Therefore we will work with an adjusted final demand vector, $c_i^{j \neq r}$ in which country *r*'s final demand (i.e. the first column in the above matrix) is set to zero. Country *r*'s value added exports can then be calculated as

(1) $$VAX_i^{r,*} = \boldsymbol{v}_{\boldsymbol{i}}^{\boldsymbol{r}} \cdot \boldsymbol{L} \cdot c_i^{j \neq r}$$

where $VAX^{r,*}$ are the sector specific value added exports of country *r* to all partner countries.

To illustrate this, we illustrate the matrices in the three countries–two sector case, where country *r* acts as the model country and we label the industries with *m* (for manufacturing) and *s* (for services). Equation (1) then has the following form:

$$\begin{pmatrix} VAX_{m,*}^{r,*} \\ VAX_{s,*}^{r,*} \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} v_m^r & 0 & 0 & 0 & 0 & 0 \\ 0 & v_s^r & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix} \cdot \begin{pmatrix} l_{m,m}^{r,r} & l_{m,s}^{r,r} & l_{m,m}^{r,2} & l_{m,s}^{r,2} & l_{m,m}^{r,3} & l_{m,s}^{r,3} \\ l_{s,m}^{r,r} & l_{s,s}^{r,r} & l_{s,m}^{r,2} & l_{s,s}^{r,2} & l_{s,m}^{r,3} & l_{s,s}^{r,3} \\ l_{m,m}^{2,r} & l_{m,s}^{2,r} & l_{m,m}^{2,2} & l_{m,s}^{2,2} & l_{m,m}^{2,3} & l_{m,s}^{2,3} \\ l_{s,m}^{2,r} & l_{s,s}^{2,r} & l_{s,m}^{2,2} & l_{s,s}^{2,2} & l_{s,m}^{2,3} & l_{s,s}^{2,3} \\ l_{m,m}^{3,r} & l_{m,s}^{3,r} & l_{m,m}^{3,2} & l_{m,s}^{3,2} & l_{m,m}^{3,3} & l_{m,s}^{3,3} \\ l_{s,m}^{3,r} & l_{s,s}^{3,r} & l_{s,m}^{3,2} & l_{s,s}^{3,2} & l_{s,m}^{3,3} & s_{s,s}^{r,3} \end{pmatrix} \cdot \begin{pmatrix} 0 + 0 + c_{m,m}^{r,2} + c_{m,s}^{r,2} + c_{m,m}^{r,3} + c_{m,s}^{r,3} \\ 0 + 0 + c_{s,m}^{r,2} + c_{s,s}^{r,2} + c_{s,m}^{r,3} + c_{s,s}^{r,3} \\ 0 + 0 + c_{m,m}^{2,2} + c_{m,s}^{2,2} + c_{m,m}^{2,3} + c_{m,s}^{2,3} \\ 0 + 0 + c_{s,m}^{2,2} + c_{s,s}^{2,2} + c_{s,m}^{2,3} + c_{s,s}^{2,3} \\ 0 + 0 + c_{m,m}^{3,2} + c_{m,s}^{3,2} + c_{m,m}^{3,3} + c_{m,s}^{3,3} \\ 0 + 0 + c_{s,m}^{3,2} + c_{s,s}^{3,2} + c_{s,m}^{3,3} + c_{s,s}^{3,3} \end{pmatrix}$$

The coefficients in the Leontief matrix represent the total direct and indirect input requirements of any country in order to produce one dollar worth of output for final demand. For example, the coefficient $l_{m,s}^{r,r}$ indicates the input requirement of country *r*'s services sector from country *r*'s manufacturing sector for producing one unit of output. Likewise the coefficient $l_{m,m}^{r,3}$ indicates country *r*'s input requirement in the manufacturing sector supplied by country 3's manufacturing sector.

The resulting elements in this example, $VAX_{m,*}^{r,*}$ and $VAX_{s,*}^{r,*}$ are the total value added exports of country *r*'s manufacturing respectively services sector to all other sectors of all partner countries.

The VAX are not only calculated for country *r* but for all 40 countries plus the rest of the world. Hence, the final step needed to arrive at the global industry-level VAX is to sum up the VAX of all countries for each individual sector *i*. Dividing the global industry-specific VA by the corresponding industry-specific value added yields the tradability score by sector.

Appendix 4: The tradables and non-tradables model of the current account

This appendix provides a sketch of the inter-temporal model of the current account by Obstfeld and Rogoff (1996) featuring a tradable and a non-tradable sector which was used in the main text to derive the tradability hypothesis.

APPENDIX 4.1 CONSUMPTION

There are only two periods. The representative consumer derives her utility from consumption in periods *t=1* and *t=2.* Preferences are characterised by a constant inter-temporal elasticity of substitution, $\frac{1}{\sigma}$, resulting in a utility function with constant relative risk aversion of the form[29]

(E1) $$U = \frac{C_1^{1-\sigma}-1}{1-\sigma} + \beta \cdot \frac{C_2^{1-\sigma}-1}{1-\sigma}$$

where C_t is the instantaneous consumption in period t and β is the discount factor indicating the consumer's patience with regard to postponing consumption. In each period the consumer splits consumption between the consumption of the tradable good (C_t^T) and the consumption of the non-tradable good (C_t^N) assigning a constant fraction to each of the two goods. This gives rise to Cobb-Douglas style preferences

(E2) $$C_t = (C_t^T)^{\gamma} \cdot (C_t^N)^{1-\gamma}$$

where γ is the consumption share of the tradable good[30].

Cost minimisation yields the demand functions for the two types of goods

(E3) $$C_t^T = \gamma \cdot \left(\frac{1}{P_t^T}\right) \cdot P_t \cdot C_t$$

(E4) $$C_t^N = (1-\gamma) \cdot \left(\frac{1}{P_t^N}\right) \cdot P_t \cdot C_t.$$

Given that P_t is the numeraire, the price of the non-tradable good, P_t^N, is determined by the relative consumption of the two goods.

Since the expenditure share of the two goods are fixed, the price index takes the simple form

29 The exposition follows Harms (2008).

30 The choice of Cobb-Douglas preferences further simplifies the model as the intra-temporal elasticity of substitution between the tradable and the non-tradable good is set to 1, implying that in each period the expenditure on the tradable and the non-tradable good are constant and equal to γ and $1-\gamma$ respectively. This switches of any intra-temporal substitution effects.

(E5) $$P_t = \left(\frac{1}{\gamma}\right)^{\gamma} \cdot \left(\frac{1}{1-\gamma}\right)^{1-\gamma} \cdot (P_t^N)^{1-\gamma}$$

Once the intra-temporal choices are made, the consumer chooses the optimal consumption path over time. For the postponement of consumption until period 2 of any of her income, the consumer is compensated with the interest rate r which is assumed to be determined on international capital markets and therefore exogenous. The consumer maximises lifetime utility in (E1) under the intertemporal budget constraint

(E6) $$C_1 \cdot P_1 + \frac{C_2 \cdot P_2}{1+r} = Y_1^T + P_1^N \cdot Y_1^N + \frac{Y_2^T + P_2^N \cdot Y_2^N}{1+r}$$

which simply states that the sum of consumption in periods 1 and 2 must equal the sum of the (exogenous) output in the two periods. This maximisation problem leads to the usual Euler equation

(E7) $$C_1^{-\sigma} = \beta \cdot (1+r) \cdot \left(\frac{P_1}{P_2}\right) \cdot C_2^{-\sigma}$$

with $\sigma > 0$. The more patient the consumer is, i.e. the higher β, the more is she prepared to postpone consumption until period 2. Likewise, the higher the interest rate, the greater is the resulting income effect and the more consumption is shifted to period 2. Finally, a lower relative inter-temporal price level, $\frac{P_1}{P_2}$, (i.e. a decline in the price index over time) will induce the consumer to shift consumption towards period 2.

APPENDIX 4.2 THE CURRENT ACCOUNT

The current account in period 1 is simply the difference between the consumer's endowments with tradable goods and the consumption of tradable goods:

(E8) $$CA_1 = Y_1^T - C_1^T$$

Taking into account that in each period the consumption of the non-tradable good equals the endowment, the intertemporal budget constraint in (E6) simplifies to

(E9) $$C_1^T + \frac{C_2^T}{1+r} = Y_1^T + \frac{Y_2^T}{1+r}$$

Combining the equation for the current account with the demand function for the tradable good (E3), the Euler equation (E7) and the simplified version of the intertemporal budget constraint (E9) yields the following expression for the current account equation in period 1:

(E10) $$CA_1 = Y_1^T - \frac{Y_1^T + \frac{Y_2^T}{1+r}}{1+\beta^{\frac{1}{\sigma}} \cdot (1+r)^{\frac{1-\sigma}{\sigma}} \cdot \left(\frac{P_2}{P_1}\right)^{\frac{\sigma-1}{\sigma}}}.$$

The demand function for the non-tradable good (E4), together with the price index (E5) and the Euler equation (E7) yields an expression for the relative demand for the non-tradable good in the two periods which depends on the relative inter-temporal prices and the intertemporal elasticity of substitution *(IES)*. Since in the case of the non-tradable good consumption equals endowment in each period one obtains:

(E11) $\frac{Y_2^N}{Y_1^N} = \left(\frac{P_1}{P_2}\right)^{\frac{1-\sigma}{\sigma}+\frac{1}{1-\gamma}}$ or equivalently $\frac{P_1}{P_2} = \left(\frac{Y_2^N}{Y_1^N}\right)^{\frac{(1-\gamma)\cdot\sigma}{1-\gamma+\gamma\sigma}}$

This equation describes the development of the price index in relation to the development of the supply of the non-tradable good over time. Since $0<\gamma<1$ and $\sigma>0$, an increase in the supply of the non-tradable good over time, i.e. an increase in Y_2^N, leads to a decrease in the price index in period 2 (P_2) and consequently an increase in the relative price index $\frac{P_1}{P_2}$.

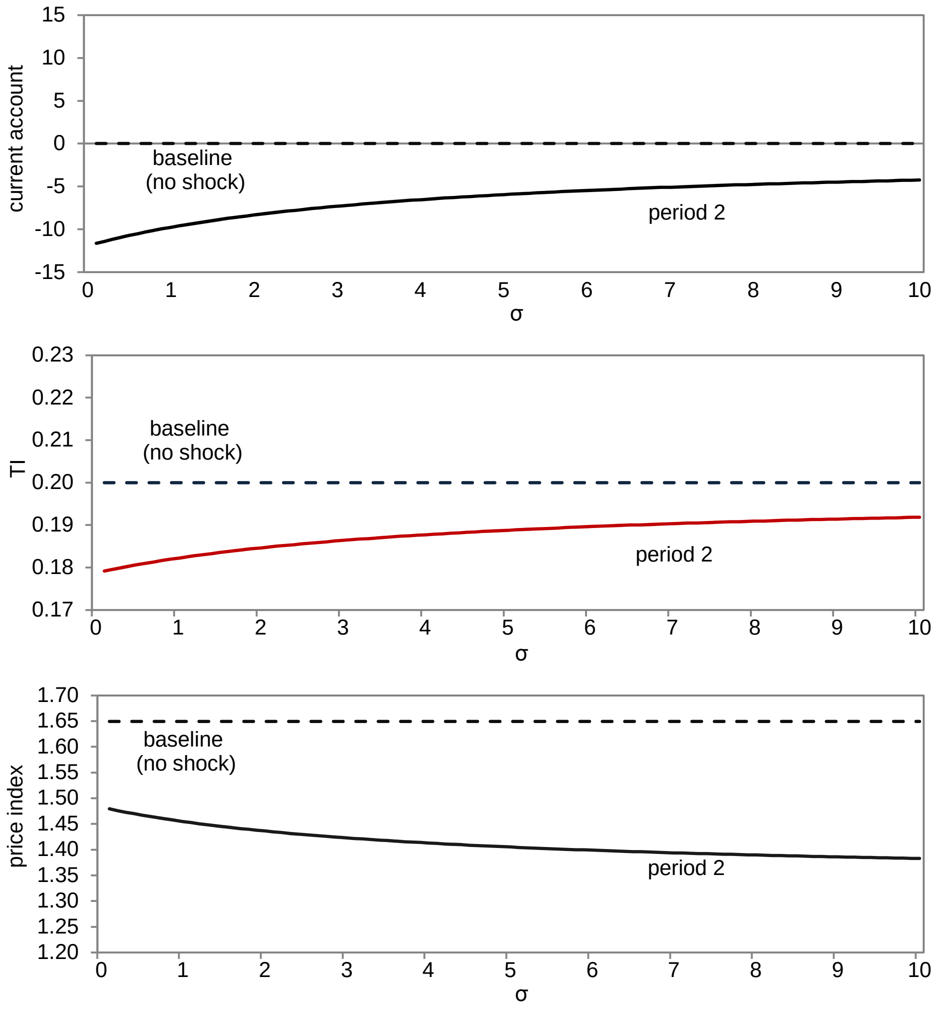
Inserting (E11) into (E10) yields the formulation of the current account equation as stated in the main text:

(E12) $CA_1 = Y_1^T - \frac{Y_1^T + \frac{Y_2^T}{1+r}}{1+\beta^{\frac{1}{\sigma}} \cdot (1+r)^{\frac{1-\sigma}{\sigma}} \cdot \left(\frac{Y_2^N}{Y_1^N}\right)^{\frac{(1-\gamma)\cdot(1-\sigma)}{1-\gamma+\gamma\sigma}}}.$

Appendix 5: Structural shocks towards non-tradables and the current account

In the main text the tradability hypothesis was derived from the logic of a two-period model of the current account. The explanation for why a decrease in the TI should be observed together with a deterioration of the current account was that consumer postpone consumption into period 2 because *(i)* they want to consume the tradable and the non-tradable good in fixed proportions which is governed by the expenditure share of the tradable good, *γ (*structural consumption adjustment effect); and *(ii)* because the declining price index over time, the consumption-based interest rate increases (income effect).

Figure A5.1 / Current account, TI and relative prices after the structural shock (Y_1^T=100; Y_1^N=400)

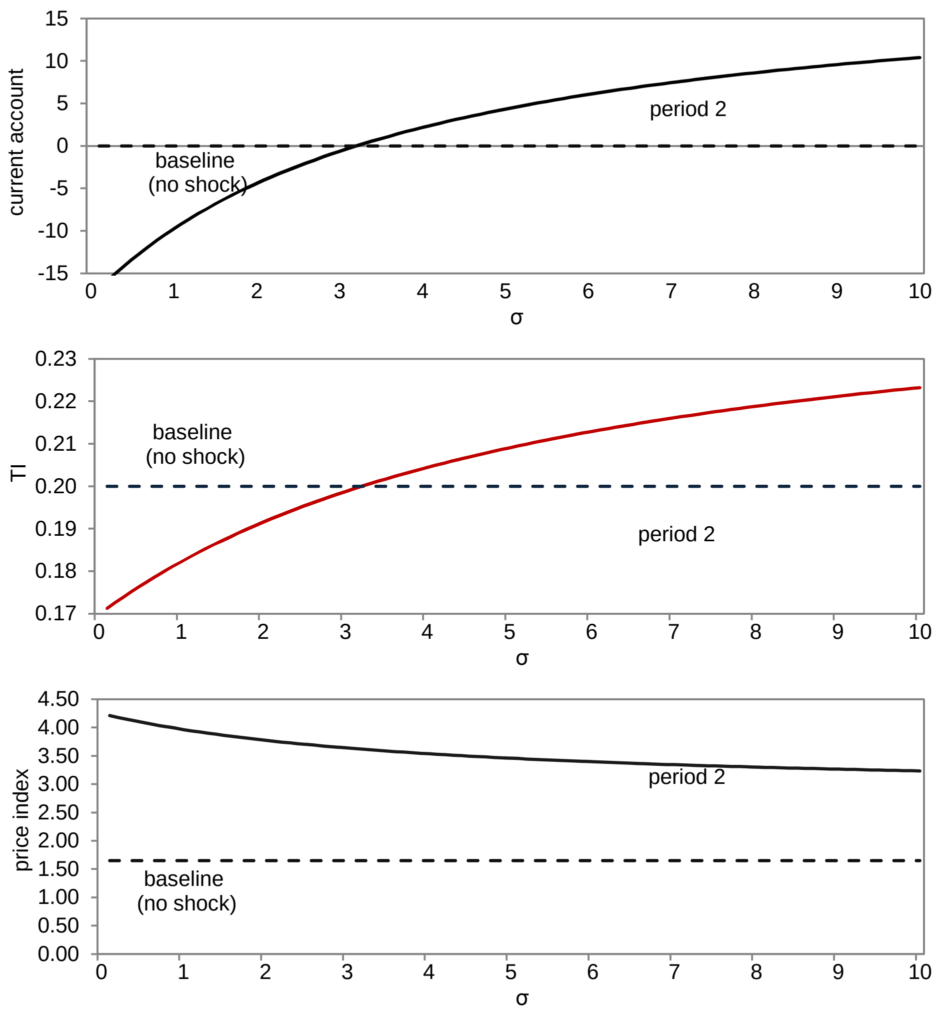


Note: Parameters: γ=0.2, $Y_1^T = 100$; $Y_1^N = 400$; structural shock in t_2: $\Delta Y_1^T = -20$; $\Delta Y_1^N = +20$.

Figure A5.1 shows again the development of the current account balance, the tradability index and the price index for various values of the inter-temporal elasticity of substitution (IES) for the scenario of a shock towards non-tradables with the same parameterisation as in the main text.

As can be seen, the current account deficit in period 2, i.e. when the structural shock has been realised, is larger the smaller is the IES (i.e. the larger *σ*). This is because with a small IES the consumer has a strong desire to smooth consumption over time and therefore less consumption is shifted into period 2 due to both the decline in the price index in period 2 (income effect) and the adjust of the intra-temporal consumption ratio between tradable and non-tradable good (structural consumption adjustment effect). Note that with the parameterisation of the main text, the current account position is always negative after the non-tradables shock (i.e. in period 2) in line with the tradability hypothesis.

Figure A5.2 / Current account, TI and relative prices after the structural shock ($\boldsymbol{Y_1^T = 100; Y_1^N = 100}$)



Note: Parameters: γ=0.2, $Y_1^T = 100$; $\boldsymbol{Y_1^N} = \mathbf{100}$; structural shock in t_2: $\Delta Y_1^T = -20$; $\Delta Y_1^N = +20$.

In the main text it was also mentioned that the impact of this structural shock is ambiguous with regards to the effect on the current account. Figure A5.2. shows that with extreme initial conditions regarding the endowments and a relatively small elasticity of substitution (large σ) the non-tradables shock need not result in a current account deficit.

Extreme initial conditions in this case mean that the endowment of the economy with the non-tradable good is very low (it is reduced to 100 units) compared to the expenditure share γ which remains unchanged at 0.2.

With this change in initial endowments, the non-tradable good is very scarce. In this constellation, the structural consumption adjustment effect works in the other direction. This is because of the scarcity of the non-tradable good, the increase in endowment has such a high welfare increasing effect that the consumer is induced to shift forward to period 1 parts of this welfare gain – at least if the inter-temporal elasticity of substitution is very high. The income effect continues to work in the other direction (the price index still declines from period 1 to period 2). Therefore, the effect of the non-tradables shock is theoretically ambiguous. With the parameter setting in as in Figure A5.2, the structural consumption adjustment effect dominates when σ is larger than 3.20. This implies the rather unintuitive result that the structural shift in endowments towards non-tradables will cause the TI (which is measured in nominal terms) to increase. The explanation for this result is that the decline in the price of the non-tradable good is so large that the nominal value of the tradable good in total nominal output in period 2 goes up.

Appendix 6: Additional regression results

APPENDIX 6.1 RESULTS BY COUNTRY GROUPS

Estimating the cross-section model in equation (1) for individual country groups entails the problem that the number of observations is getting very small. Nevertheless we perform this analysis as one of several robustness checks.

The model is re-estimated separately for developed and emerging European countries as well as the EU Member States, euro area members and the Central, Eastern and South Eastern European (CESEE) region. We further report results for the entire sample excluding Azerbaijan and Montenegro which are outliers regarding the current account balance as well as the entire sample excluding Ireland, Lithuania and Malta for which the fit between the country-level tradability scores and the global scores is somewhat weaker[31].

As shown in Table A6.1 the results – and in particular the result regarding the tradability index – hold throughout all sub-samples. As expected the tradability of output matters more for the external balance in the case of emerging countries than for developed countries, though this results is also influenced by the oil exporters within this group. Potential explanations for this finding are that the components of the current account which are not (or only indirectly) linked to the tradability of output, such as payments of factor incomes, play a larger role in developed countries and that industrial countries only require a smaller industrial base which is increasingly interlinked with services and performs an important carrier function (see Stöllinger et al., 2013) by absorbing a large amount of services which are exported only indirectly via manufactures. An interesting result is also that the government balance turns out to be positive and highly significant for the industrialised European countries and the EU Member States but not the emerging markets. Hence, for the former, the twin deficit hypothesis seems to have some relevance. Some of the other control variables which are found to be statistically significant in the specification using the full sample are also very robust across the various sub-samples such as the net foreign asset position and the relative GDP per capita. For others no statistically significant effects can be established though it is hard to tell whether this is due to the small number of observations or the particularities of the respective country group.

Finally specification (7) and specification (8) show that the cross-section results are not driven by outliers.

Table A6.2 provides the same robustness check for the panel regression model. Also in this case the tradability index is reported to have a positive and statistically significant coefficient for each country group. The relative size of the coefficients of the TI across country groups indicates that the tradability of output a country produces matters more for emerging Europe than for the developed European economies, thereby confirming the outcome of the cross-section regressions.

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[31] See Bykova and Stöllinger (2016) for details.

Table A6.1 / Cross-section regression, various subsamples

Dependent variable:	**Current Account Position in % of GDP**							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	(full sample)	(developed)	(emerging)	(EU)	(EA)	(CESEE)	(ex AZ & ME)	(ex IE & LT & MT)
TIvax	0.7558***	0.5430**	0.7428**	0.7198***	0.6970***	0.7488***	0.8091***	0.8046***
	(0.1534)	(0.2051)	(0.2443)	(0.2220)	(0.1846)	(0.1754)	(0.1959)	(0.1705)
gdp growth	-0.6014***	-0.5471	-0.6053	-0.4932**	-1.0197*	-0.6400**	-0.5548**	-0.5429**
	(0.2181)	(0.3299)	(0.4843)	(0.2148)	(0.4972)	(0.2932)	(0.2390)	(0.2391)
rel gdpcap	0.0455***	0.0422***	0.0575*	0.0450***	0.0420***	0.0501*	0.0466***	0.0442***
	(0.0071)	(0.0068)	(0.0306)	(0.0068)	(0.0052)	(0.0257)	(0.0069)	(0.0075)
gov bal	0.2456*	0.4571***	-0.0013	0.6375***	0.3248*	0.1057	0.2948**	0.2050
	(0.1281)	(0.1289)	(0.5005)	(0.1823)	(0.1746)	(0.4036)	(0.1332)	(0.1365)
nfa	0.0532***	0.0417***	0.0631***	0.0282*	0.0631**	0.0640***	0.0442***	0.0538***
	(0.0075)	(0.0044)	(0.0092)	(0.0139)	(0.0212)	(0.0086)	(0.0060)	(0.0074)
dep ratio	-0.0151***	-0.0158***	-0.0322	-0.0102	-0.0746	-0.0121***	-0.0133***	-0.0136***
	(0.0044)	(0.0033)	(0.0234)	(0.0294)	(0.0533)	(0.0036)	(0.0036)	(0.0042)
capital intensity	-0.1763	0.0231	-0.2904	-0.1485	-0.1928	-0.2971*	-0.1322	-0.1950
	(0.1402)	(0.1247)	(0.2696)	(0.1151)	(0.1783)	(0.1639)	(0.1489)	(0.1556)
dom cred	-0.0065	-0.0072	-0.0122	-0.0096	-0.0031	-0.0164	-0.0044	-0.0004
	(0.0077)	(0.0114)	(0.0168)	(0.0063)	(0.0091)	(0.0605)	(0.0078)	(0.0086)
ΔREER_ulc	-0.0173	-0.0441**	-0.0034	-0.0429**	0.0128	-0.0002	-0.0180	-0.0153
	(0.0140)	(0.0162)	(0.0265)	(0.0165)	(0.0379)	(0.0166)	(0.0139)	(0.0151)
Observations	46	27	19	28	19	27	44	43
R-squared	0.9201	0.9419	0.9191	0.9090	0.9522	0.9066	0.8990	0.9242
R-squared adj.	0.900	0.911	0.838	0.864	0.904	0.857	0.872	0.903
F-test	52.86	91.92	31.15	34.66	63.15	50.41	56.21	57.07

Note: TIvax = tradability index based on value added exports. Robust standard errors in parentheses. ***, **, and * indicate statistical significant at the 1%, 5% and 10% level respectively. All regressions are based on actual sample averages used in the regression. All regressions include a constant. CESEE includes AL, AM, AZ, BA, BG, BY, CZ, EE, EL, GE, HR, HU, KZ, LT, LV, MD, ME, MK, PL, RO, RS, RU, SI, SK, TR, UA, XK.

Table A6.2 / Panel regression, various subsamples

Dependent variable:	ΔCurrent Account Position in % of GDP									
	full sample		developed economies		emerging Europe		EU member states		CEESE countries	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	(FE)	(XTA)								
TIvax	2.4064***	1.8081***	1.4542***	1.3306***	2.0904***	1.8410***	1.6794**	1.2986*	2.1847***	1.8013***
	(0.4337)	(0.3422)	(0.4273)	(0.4714)	(0.6836)	(0.5848)	(0.7537)	(0.6793)	(0.5998)	(0.4935)
gdp growth	0.0063	0.0279	-0.1869	-0.1954	-0.0010	0.1978	-0.2389	-0.1529	0.0164	0.1456
	(0.1660)	(0.1178)	(0.2109)	(0.1239)	(0.2356)	(0.2274)	(0.1562)	(0.1326)	(0.2052)	(0.1802)
rel gdpcap	0.1286*	0.1116	0.0956	0.0526	0.7391*	0.3854	0.1538	0.0814	0.3879	0.2002
	(0.0752)	(0.0805)	(0.0847)	(0.0861)	(0.3959)	(0.3526)	(0.0995)	(0.0847)	(0.2855)	(0.2458)
rel gdpcap sq	-0.0353	-0.0131	-0.0234	-0.0100	-0.4726	-0.2710	-0.0462	-0.0132	-0.1933	-0.1295
	(0.0268)	(0.0323)	(0.0279)	(0.0284)	(0.2969)	(0.2431)	(0.0391)	(0.0299)	(0.1918)	(0.1640)
gov bal	-0.0770	-0.2196	0.3286**	0.4331**	-0.5872**	-0.5457*	0.2961**	0.3811**	-0.2909	-0.3999
	(0.1470)	(0.1675)	(0.1271)	(0.1710)	(0.2361)	(0.3247)	(0.1249)	(0.1889)	(0.2263)	(0.2637)
cap_int	-0.5453***	-0.7758***	-0.6271***	-0.8852***	-0.5303***	-0.7098***	-0.6191***	-0.8386***	-0.5499***	-0.7437***
	(0.1266)	(0.0868)	(0.1330)	(0.1258)	(0.1608)	(0.1380)	(0.1553)	(0.1269)	(0.1335)	(0.1146)
ΔREER_ulc	0.0399	0.0065	-0.0017	0.0171	0.0427	0.0266	0.0074	0.0076	0.0308	0.0498
	(0.0330)	(0.0302)	(0.0370)	(0.0324)	(0.0490)	(0.0647)	(0.0332)	(0.0330)	(0.0408)	(0.0473)
Δca (t-1)		0.2925**		-0.1838		0.3056**		-0.3969		0.3971***
		(0.1256)		(0.1996)		(0.1197)		(0.3007)		(0.1066)
Observations	226	178	133	106	93	72	140	112	131	102
R-squared	0.8638		0.9246		0.8251		0.8944		0.7872	
R-squared adj.	0.819	.	0.895	.	0.745	.	0.855	.	0.703	.
F test	8.933	.	8.170	.	9.691	.	8.015	.	8.174	.

Note: FE=fixed effects regression; XTA=Arellano-Bond fixed effects estimator. TI = tradability index based on value added exports. Robust standard errors in parentheses. ***, **, and * indicate statistical significant at the 1%, 5% and 10% level respectively. All regressions include a constant as well as country and time fixed effects.

There are also a few differences across the country groups with regards to some of the control variables, notable the government balance where for the developed countries the twin deficit hypothesis is confirmed whereas for the emerging European countries the coefficient of the government balance has a negative sign.

APPENDIX 6.2 THE ROLE OF THE REAL EXCHANGE RATE

Some of the specifications in the main text included the real effective exchange rate based on unit labour costs *(REER_ulc)*._Here the complex issue of the real exchange rate is discussed in some more detail and additional regression results using alternative measures of the exchange rate are reported.

Relative prices (respectively changes thereof), that is the bilateral real exchange rate (respectively changes thereof) influence the current account positions via exports and imports. As long as the Marshall-Learner condition is fulfilled, an increase in the relative price level worsens the current account balance by hampering exports and facilitating imports.

In our context, the issue is complicated by the fact that apart from this direct channel, relative prices may affect the current account also indirectly via its impact on countries' specialisation patterns. Let's assume a decline in the domestic price level (real exchange rate) caused, for example, by some change in the underlying labour market institutions such as an agreement between employers' associations and the trade unions on wage moderation. The wage moderation policy tends to depress the overall price level relative to the trading partners (real depreciation). This is because wage moderation implies that wages are progressing at a slower pace than productivity resulting in a fall of production costs (i.e. the wage mark-up over marginal labour productivity declines). A first consequence will be that the price of non-tradables declines. The price of tradables remains constant due to the law of one price[32]. This will cause a shift of domestic resources from the non-tradable sector to the tradable sector because of increased profit opportunities in the latter until the relative price between non-tradables and tradables has adjusted accordingly. Resources will be drawn into the tradable sector and the domestic price level P (defined as P^N/P^T) will adjust to equalise the marginal revenue product in the two sectors. So the key results will be an expansion of the tradable sector and a depreciation of the real exchange change. Since wage moderation will either reduce income or keep it unchanged, there will be no growth effect as in the case of a (positive) productivity shock that will cause households to shift consumption forward. For this reason, wage moderation should also lead to an improvement of the current account position (see e.g. Berthou and Gaulier, 2013).

Wage moderation is one scenario in which changes in the real exchange rate will affect the composition of output (and hence our tradability index). However, the causality may go in both directions. Given that, depending on the ultimate (exogenous) shock, changes in the production structure drive the development of domestic prices and the real exchange rate or vice versa, the simplest way to integrate exchange rate developments into the empirical analysis is to include it as an additional explanatory variable into the regression model. The expectation is that a higher relative price level, respectively an appreciation of the real exchange rate, worsens the current account. The main interest, however, is not

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32 If the law of one price does not hold, the price of domestic tradables may also decline making them relatively cheaper compared to foreign tradables. The effect, however, will be similar: resources will be drawn into the tradables sector, in this case because of improved 'price competitiveness' and resulting export opportunities.

with the sign of the real exchange rate (or changes thereof) but how its inclusion affects the coefficient of the tradability index. More precisely, if the specialisation patterns and resulting production structures were predominantly the result of relative prices, the real exchange rate should pick up this effect rendering the TI variable superfluous. In other words the inclusion of a measure for the real exchange rate acts as a robustness check ruling out the possibility that the tradability index only captures changes in relative prices.

The above reasoning presumed that the price of one law holds. If the law of one price were to hold for tradable goods, changes in the real exchange rate would be entirely due to the evolution of the price of non-tradables. While a convenient assumption, the law of one price is not supported by empirical research. By decomposing real exchange rate movements, Engel (1999) and Betts and Kehoe (2006) show for the US that these movements are predominantly explained by deviations of relative prices of tradable goods and not change in the relative price of non-tradables. Drozd and Nosal (2009) confirm this finding for a sample of 21 countries assigning on average only a third of real exchange rate movements to the non-tradable sector. The results in Burstein et al. (2006) suggest a somewhat greater role for the price of non-tradables in a sample of OECD countries, giving both sectors approximately equal importance for determining real exchange rate movements. Drozd and Nosal (2009) also find a greater role for price developments in the non-tradable sector in European countries than in other countries which they assign to the fact that nominal exchange rates are fixed in the euro area. A similar argument for this phenomenon is found in Ruscher and Wolff (2009). Irrespective of the exact contribution of international price differences in tradables on the one hand and the non-tradable sector on the other hand, for the empirical analysis it is useful to keep in mind that fluctuations in the exchange rate may be caused by both.

To include an overall measure for the real exchange rate we use the price level of consumption from the Penn World Tables (version 8.1) as well as the real effective exchange rate based on unit labour costs which is used in the main text. The latter indicator is also a common measure for countries' international competitiveness. If prices were equal to labour productivity, the unit labour cost based real effective exchange rate would equal the nominal exchange rate. A third indicator used is the measure of undervaluation or overvaluation of the exchange rate (*over_eval*) suggested by Dollar (1992). The measure is based on the price level of consumption and exploits the empirical regularity that the price level is generally higher in countries with higher per capita income. We follow the approach by Rodrik (2008) in estimating the expected real effective exchange rate (or relative price level) by regressing the log of the price level of consumption on the log of GDP per capita controlling for time fixed effects. The difference between the actual price level and the predicted price level is the degree to which the real exchange rate is overvalued (*over_eval*). A value greater than 0 indicates that a country's real exchange rate is overvalued, values smaller than 0 indicate an undervalued real exchange rate.

Given the link between a higher real effective exchange rate and the current account described above, a negative sign for the coefficient of the exchange rate measure is to be expected.

We test for the impact of these three exchange rate measures (see Table A6.3).

The major insight from these specifications using alternative real exchange rate measures is that the magnitude of the coefficient of the tradability index remains largely unaffected by the inclusion of the real exchange rate measures. Among the exchange rate measures, only the changes in the unit labour cost based REER (see specification 4) turn out to be statistically significant, though only marginally[33]. As expected the sign is negative implying that a real appreciation makes it more difficult to not run a current account deficit. Our conclusion from this is it is very unlikely that the positive relationship between the TI and the current account is due to a spurious correlation driven by changes in relative prices.

Table A6.3 / The role of the real exchange rate (cross-section regression)

Dependent variable:	(1)	(2)	(3)	(4)	(5)
TIvax	0.6050***	0.6050***	0.6077***	0.5443***	0.6014***
	(0.2046)	(0.2126)	(0.2070)	(0.1898)	(0.2154)
gdp growth	-0.7807***	-0.7515***	-0.7595***	-0.6554***	-0.7787***
	(0.2203)	(0.2336)	(0.2389)	(0.2357)	(0.2202)
rel gdpcap	0.0455***	0.0389***	0.0464***	0.0460***	0.0454***
	(0.0074)	(0.0075)	(0.0077)	(0.0070)	(0.0081)
gov bal	0.1583	0.1311	0.1576	0.1633	0.1614
	(0.1516)	(0.1504)	(0.1518)	(0.1491)	(0.1462)
nfa	0.0531***	0.0533***	0.0529***	0.0538***	0.0531***
	(0.0085)	(0.0084)	(0.0087)	(0.0080)	(0.0086)
dep ratio	-0.0132***	-0.0132***	-0.0135***	-0.0155***	-0.0132***
	(0.0041)	(0.0040)	(0.0044)	(0.0043)	(0.0041)
capital intensity	-0.1607	-0.1625	-0.1523	-0.1214	-0.1616
	(0.1206)	(0.1191)	(0.1236)	(0.1184)	(0.1241)
dom cred	-0.0061	-0.0093	-0.0065	-0.0102	-0.0059
	(0.0085)	(0.0092)	(0.0088)	(0.0085)	(0.0089)
oil	0.0222	0.0234	0.0226	0.0287	0.0222
	(0.0203)	(0.0207)	(0.0205)	(0.0205)	(0.0204)
pl_con		0.0175			
		(0.0180)			
Δpl_con			-0.0086		
			(0.0288)		
ΔREER_ulc				-0.0237*	
				(0.0123)	
over_eval					-0.0012
					(0.0151)
Observations	46	46	46	46	46
R-squared	0.9210	0.9222	0.9212	0.9256	0.9210
R-squared adj.	0.901	0.900	0.899	0.904	0.898
F-test	44.60	40.82	41.70	42.22	39.23

Note: TIvax = tradability index based on value added exports. EA MS = euro area members. Robust standard errors in parentheses. ***, **, and * indicate statistical significant at the 1%, 5% and 10% level respectively. All regressions include a constant. Regressions use each reporter's sample averages.

APPENDIX 6.3 TRADABILITY OF OUTPUT AND THE TRADE BALANCE

As another robustness check we re-run the regression model in equation (1), replacing the current account balance with the trade balance as the dependent variable. The expectation is that the relationship between the TI and the trade balance is even stronger than between the TI. This is because the tradability of output should affects the current account and the trade account in the same manner,

33 In fact also the *REER ulc* measure is statistically significant only if the dummy for oil exporting countries is included.

only that the former also contains other elements (notably net income and transfers) which may dilute the relationship. The results in Table A6.4 fully confirm this expectation.

Table A6.4 / Tradability of output and the trade balance (cross-section regression)

Dependent variable:	**Trade Balance in % of GDP**					
	(1)	(2)	(3)	(4)	(5)	(6)
TIvax	1.2923**	2.6120***	3.3588***	3.0272***	2.5040***	2.5413***
	(0.5924)	(0.6474)	(0.6664)	(0.4752)	(0.5600)	(0.5508)
gdp growth		0.1524	-0.4447	0.3453	0.1847	0.1165
		(0.9186)	(0.6824)	(0.6087)	(0.6746)	(0.7281)
rel gdpcap		0.2490***	0.2040***	0.1661***	0.1592***	0.1583***
		(0.0620)	(0.0226)	(0.0282)	(0.0312)	(0.0321)
rel gdpcap sq.		-0.0240				
		(0.0209)				
gov bal			-1.3190***	-1.0701***	-1.1913**	-1.1866**
			(0.4002)	(0.3791)	(0.4759)	(0.4852)
nfa			0.0064	0.0202**	0.0210**	0.0206**
			(0.0132)	(0.0083)	(0.0080)	(0.0082)
dep ratio				-0.0456***	-0.0462***	-0.0449***
				(0.0091)	(0.0095)	(0.0099)
capital intensity				-0.6590*	-0.5756*	-0.6015*
				(0.3374)	(0.2878)	(0.3075)
dom cred				0.0234	0.0161	0.0185
				(0.0242)	(0.0247)	(0.0251)
oil					0.0708	0.0667
					(0.0544)	(0.0553)
EA MS					0.0226	0.0242
					(0.0267)	(0.0272)
ΔREER_ulc						0.0140
						(0.0374)
Observations	46	46	46	46	46	46
R-squared	0.0597	0.7852	0.8220	0.8787	0.8894	0.8898
R-squared adj.	0.0383	0.764	0.800	0.852	0.858	0.854
F-test	4.758	20.11	45.65	37.93	38.08	37.34

Note: TIvax = tradability index based on value added exports. EA MS = euro area members. Robust standard errors in parentheses. ***, **, and * indicate statistical significant at the 1%, 5% and 10% level respectively. All regressions include a constant. Regressions use each reporter’s sample averages.

These results are informative as they indicate that the income balance and the transfer balance are highly relevant elements for the position of the current account. At the same, the tradability of output which affect the current account via the trade balance still seems to be a key determinant for the position of the current account and not only to the trade balance. In other words, net income received and net transfers, on average, are still insufficient to compensate for an increasing specialisation in the production of non-tradable output.

As shown in Table A6.5, the tradability hypothesis is equally confirmed when applied to the trade in the panel regression model.

Table A6.5 / Tradability of output and the trade balance (panel regression)

Dependent variable:	**Trade balance in % of GDP**			
	(1)	(2)	(3)	(4)
	(POOLED)	(RE)	(FE)	(XTA)
TIvax	3.0703***	2.8107***	2.7150***	2.2905***
	(0.2060)	(0.3722)	(0.4300)	(0.3564)
gdp growth	-0.0100	-0.3478**	-0.3908**	-0.2142*
	(0.1955)	(0.1381)	(0.1560)	(0.1141)
rel gdpcap	0.2412***	0.2433***	0.3662***	0.3053***
	(0.0255)	(0.0489)	(0.0752)	(0.0794)
rel gdpcap sq	-0.0214**	-0.0349*	-0.1288***	-0.0887***
	(0.0093)	(0.0202)	(0.0265)	(0.0317)
gov bal	-0.6851***	-0.1218	0.1692	0.0565
	(0.1679)	(0.1531)	(0.1258)	(0.1641)
cap_int	-0.5555***	-0.6444***	-0.6340***	-0.6097***
	(0.1349)	(0.1525)	(0.1182)	(0.0850)
ΔREER_ulc	0.0430	-0.0325	-0.0364	-0.0262
	(0.0530)	(0.0345)	(0.0336)	(0.0301)
Δtb (t-1)				-0.0691
				(0.1196)
country fixed effects	no	no	yes	yes
time fixed effects	no	yes	yes	yes
Observations	226	226	226	177
R-squared	0.7694		0.9580	
R-squared adj.	0.762	.	0.944	.
F test	78.14	.	17.35	.

Note: POOLED = pooled panel regression; RE = random effects regression; FE = fixed effects regression; XTA = Arellano-Bond fixed effects estimator; TI = tradability index based on value added exports. Robust standard errors in parentheses. ***, **, and * indicate statistical significant at the 1%, 5% and 10% level respectively. All regressions include a constant.

Appendix 7: Unit root tests

This appendix provides additional information on the unit root tests.

While the time series dimension of our panel data covers only 20 years, we check all the variables for the presence of a unit root. This is advisable since in case of a unit root present in any (or several) of the time series, the regression results may be spurious (see Granger and Newbold, 1974). Therefore we perform standard panel unit root tests opting for the methods suggested by Im-Pesaran-Shin (2003) and the Fisher-type tests (see Maddala and Wu, 1999). Both the Im-Pesaran-Shin (IPS) test and the Fisher-type tests have as the null-hypothesis that all panels contain a unit root against the alternative that some panels are stationary. For the IPS test we let the lag structure be determined by the Akaike information criterion (AIC), for the Fisher-type tests we include a one-period lags, except for the government balance in the test with time trend where two lags are included (given that the number of lags suggested by the AIC in the IPS test is closer to two).

We rely mainly on the IPS tests and use the Fisher tests as a robustness check only. According to the IPS tests for the main series, i.e. the current account series and the TI series, the null-hypothesis can be rejected, although for the TI in the test without a time trend only at the 10% level (see Tables A7.1a and A7.1b). Since the Fisher-type tests in this case clearly reject the null-hypothesis and the TI series for most countries do seem to have a time trend we consider the unit root tests as satisfied.

With regards to the control variables the tests signal the presence of a unit root in the case of the net foreign assets, the dependency ratio and the domestic credit. For this reason we let these variables enter the panel regression model in first differences. The differenced variables clearly pass the unit root tests (see Tables A7.2)

Given that the unit root tests signal only that at least one of the panels is stationary, we also estimated the panel model in first differences of all variables as a further robustness check. The results of the regression in first differences are presented in Appendix 8.

Table A7.1a / Panel unit root tests, excluding time trend

	ca	TI	gdp growth	rel gdpcap	gov bal	nfa	dep ratio	cap int	dom cred	ΔREER
Im-Pesaran-Shin test (IPS)										
$W_{t\text{-}bar}$ statistic	-3.37 ***	-1.63 *	-10.52 ***	3.82	-6.61 ***	0.39	-0.79	-1.92 **	3.08	-15.15 ***
p-value	*0.0004*	*0.0512*	*0.0000*	*0.9999*	*0.0000*	*0.6532*	*0.2137*	*0.0275*	*0.999*	*0.0000*
avge lags‡	1.02	0.65	0.28	0.96	0.87	1.13	0.48	1.17	0.54	0.80
Fisher-type test (chi-square)										
Inverse chi-sq.	109.80 *	192.32 ***	315.49 ***	57.07	275.94 ***	81.63	153.09 ***	136.33 ***	56.71	386.22 ***
p-value	*0.0995*	*0.0000*	*0.0000*	*0.9984*	*0.0000*	*0.7721*	*0.0001*	*0.0019*	*0.9986*	*0.0000*
Inverse normal	-1.60 *	-3.42 ***	-9.92 ***	4.65	-7.82 ***	1.33	0.30	-3.29 ***	3.23	-13.08 ***
p-value	*0.0544*	*0.0003*	*0.0000*	*1.0000*	*0.0000*	*0.9085*	*0.6171*	*0.0005*	*0.9994*	*0.0000*
Inverse logit	-1.59 *	-4.82 ***	-12.08 ***	4.60	-9.92 ***	1.30	-1.25	-3.38 ***	3.39	-15.39 ***
p-value	*0.0561*	*0.0000*	*0.0000*	*1.0000*	*0.0000*	*0.903*	*0.1058*	*0.0004*	*0.9996*	*0.0000*
lags	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Note: Both tests have the following null-hypothesis (H0): each time series contains a unit root and H1: some panels are stationary. ‡ The number of lags in the IPS test is determined by AIC with up to 4 lags included in performing the unit root tests. Exceptions are the dependency ratio variable and the domestic credit variable for which a maximum of only 2 lags was allowed due to insufficient observations. ***,** and * indicate statistical significance at the 1%, 5% and 10% level respectively.

Table A7.1b / Panel unit root tests, including time trend

	ca	TI	gdp growth	rel gdpcap	gov bal	nfa	dep ratio	cap int	dom cred	ΔREER
Im-Pesaran-Shin test (IPS)										
$W_{t\text{-}bar}$ statistic	-2.07 **	-2.06 **	-9.44 ***	-2.70 ***	-6.41 ***	-1.65 **	-0.23	-2.84 ***	-1.87 **	-9.07 ***
p-value	*0.0191*	*0.0196*	*0.0000*	*0.0035*	*0.0000*	*0.0492*	*0.4101*	*0.0022*	*0.0311*	*0.0000*
avge lags‡	1.22	1.09	1.33	1.41	1.80	0.65	0.48	1.39	0.63	1.33
Fisher-type test (chi-square)										
Inverse chi-sq.	112.44 *	184.32 ***	319.15 ***	115.51 *	189.20 ***	169.69 ***	139.08 ***	140.35 ***	169.96 ***	264.79 ***
p-value	*0.0727*	*0.0000*	*0.0000*	*0.0492*	*0.0000*	*0.0000*	*0.0011*	*0.0009*	*0.0000*	*0.0000*
Inverse normal	-0.48	-3.28 ***	-9.30 ***	-0.22	-3.84 ***	-1.59 *	1.48	-2.01 **	0.37	-8.78 ***
p-value	*0.3170*	*0.0005*	*0.0000*	*0.4121*	*0.0001*	*0.0561*	*0.9303*	*0.0224*	*0.6440*	*0.0000*
Inverse logit	-0.59	-4.04 ***	-11.89 ***	-0.37	-5.32 ***	-2.52 ***	0.02	-2.27 **	-1.60 *	-9.89 ***
p-value	*0.2779*	*0.0000*	*0.0000*	*0.3568*	*0.0000*	*0.0063*	*0.5083*	*0.0119*	*0.0551*	*0.0000*
lags	1.00	1.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00

Note: Both tests have the following null-hypothesis (H0): each time series contains a unit root and H1: some panels are stationary. ‡ The number of lags in the IPS test is determined by AIC with up to 4 lags included in performing the unit root tests. Exceptions are the dependency ratio variable and the domestic credit variable for which a maximum of only 2 lags was allowed due to insufficient observations.* **,** and * indicate statistical significance at the 1%, 5% and 10% level respectively.

Table A7.2 / Panel unit root tests for first differenced variables

	Δnfa	Δdep ratio	Δdom cred	Δnfa	Δdep ratio	Δdom cred
time trend	no	no	no	yes	yes	yes
Im-Pesaran-Shin test (IPS)						
$W_{t\text{-bar}}$ statistic	-14.25 ***	-16.64 ***	-14.46 ***	-14.05 ***	-14.50 ***	-11.71 ***
p-value	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*
avge lags‡	0.63	0.28	0.39	0.67	0.22	0.52
Fisher-type test (chi-square)						
Inverse chi-sq.	527.66 ***	364.72 ***	330.25	457.34 ***	247.86	229.14 ***
p-value	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*
Inverse normal	-15.43 ***	-11.70 ***	-8.75	-13.43 ***	-8.62	-4.61 ***
p-value	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*
Inverse logit	-21.07 ***	-14.22 ***	-11.80	-17.97 ***	-9.32	-6.05 ***
p-value	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*
lags	1.00	1.00	1.00	1.00	1.00	1.00

Note: Both tests have the following null-hypothesis (H0): each time series contains a unit root and H1: some panels are stationary. ‡ The number of lags in the IPS test is determined by AIC with up to 4 lags included in performing the unit root tests. Exceptions are the dependency ratio variable and the domestic credit variable for which a maximum of only 2 lags was allowed due to insufficient observations. ***,** and * indicate statistical significance at the 1%, 5% and 10% level respectively.

Appendix 8: Panel regression results in first differences

In Table A.8.1 the results from the regression model in equation (2) using first differences of all variables are presented. This should avoid the possibility that results may be invalid due to the data (or parts thereof) being integrated of order one. Certainly, the differenced version of the panel model should only be given a short term interpretation. We use this specification mainly to show that the confirmation of the tradability hypothesis in the data is not spurious.

Table A8.1 / Panel regression results in first differences

Dependent variable:	**ΔCurrent account position in % of GDP**					
	(1)	(2)	(3)	(4)	(5)	(6)
	(POOLED)	(POOLED+)	(RE+)	(FE+)	(XTA)	(XTA+)
ΔTIvax	2.8548***	1.7760***	1.7760***	1.7333***	3.0567***	1.8510***
	(0.4532)	(0.3658)	(0.5521)	(0.5266)	(0.2548)	(0.2708)
Δrel gdpcap		0.0421	0.0421	-0.0161		0.0149
		(0.0772)	(0.0709)	(0.0923)		(0.1002)
Δrel gdpcap sq		-0.0066	-0.0066	0.0070		-0.0037
		(0.0208)	(0.0196)	(0.0219)		(0.0273)
Δgov bal		0.0477	0.0477	0.0565		0.0139
		(0.0916)	(0.0975)	(0.0970)		(0.0584)
Δnfa (t-1)		-0.0098**	-0.0098***	-0.0094***		-0.0107*
		(0.0048)	(0.0026)	(0.0026)		(0.0061)
Δdep ratio		0.0161	0.0161	0.0176		0.0205
		(0.0222)	(0.0273)	(0.0388)		(0.0358)
Δdom cred		-0.0105	-0.0105	-0.0103		-0.0083
		(0.0066)	(0.0068)	(0.0070)		(0.0072)
ΔREER_ulc		0.0263	0.0263	0.0204		0.0220
		(0.0288)	(0.0309)	(0.0318)		(0.0238)
Δcap_int		-0.7511***	-0.7511***	-0.7574***		-0.8787***
		(0.0798)	(0.0813)	(0.0841)		(0.0606)
Δca (t-1)					-0.0482	-0.1372***
					(0.0335)	(0.0321)
country fixed effects	no	no	no	yes	yes	yes
time fixed effects	yes	yes	yes	yes	yes	yes
Observations	841	711	711	711	753	653
R-squared	0.248	0.453		0.468		
R-squared adj.	0.231	0.432		0.408		
F test	6.238	12.08		67.00		
Number of id			46	46	46	46

Note: Annual frequency data. POOLED = pooled panel regression; RE = random effects regression; FE = fixed effects regression; XTA = Arellano-Bond fixed effects estimator; TIvax = tradability index based on value added exports. Robust standard errors in parentheses. ***, **, and * indicate statistical significant at the 1%, 5% and 10% level respectively. All regressions include a constant and time fixed effects.

Regarding the choice of the appropriate estimator, a Hausman test rejects the appropriateness of the random effects model. The subsequent F-test suggests that the inclusion of the country fixed effects is not necessary. Hence, in contrast to the panel model in levels, when estimating the model in first differences, the pooled model in specification 1 (which in this case includes time fixed effects) can be considered as the appropriate model. However, also here the result is not sensitive to the choice of the panel estimator.

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