

The trade balance and the real exchange rate¹

Globalisation has affected the relationship between the trade balance and the real exchange rate in two ways. On the one hand, the growth of trade taking place within industries makes the trade balance more sensitive to real exchange rate movements. On the other hand, a higher degree of vertical specialisation and more global supply chains act to reduce this sensitivity. The relative importance of these two effects varies across countries. According to the estimates presented in this article, changes in the real exchange rate could play a larger role in curbing the US trade deficit than in reducing the Chinese trade surplus. This confirms that real exchange rate adjustment is only part of the solution for global rebalancing, and needs to be accompanied by other policy actions.

JEL classification: F32, F42.

Movements in real exchange rates could facilitate current account adjustment ...

Current account imbalances remain substantial across the globe, creating the risks of protectionism and financial vulnerabilities should the capital flows financing these imbalances suddenly dry up (BIS (2011)). Putting the world economy on a more balanced growth path implies that large trade surpluses, notably in emerging economies, and large trade deficits, especially in developed economies, would have to be reduced. Yet global rebalancing is a slow, long-drawn-out process. Boosting domestic demand and moving away from export-led growth in surplus countries, and reducing the reliance on consumption-led growth in deficit countries, cannot be carried out over a short period of time. Moreover, coordinating these shifts to avoid abrupt fluctuations in world aggregate demand is by no means an easy task. Exchange rates have therefore taken centre stage in the policy debate on how to achieve global rebalancing. Exchange rates can move quickly and by significant amounts. And by virtue of being an international relative price they can help reduce possible coordination issues.

The view that movements in exchange rates will facilitate global rebalancing is based on two assumptions. The first is that real exchange rates differ significantly from the fundamental value that is consistent with modest

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internal and external imbalances.² This seems particularly likely in many emerging markets, where regulations such as capital controls or government-controlled prices result in significant deviations of the real exchange from its long-run fundamental value.³

The second assumption is that a country's trade balance is actually sensitive to movements in the real exchange rate. If trade balances and real exchange rates do not exhibit a close relationship, then changing the value of the currency will be of little help in closing trade gaps. Understanding what determines the sensitivity of the trade balance to real exchange rates is therefore fundamental to assess whether movements in real exchange rates can affect trade flows significantly and thereby effectively contribute to global rebalancing. This will be the article's focus.

Based on the experience of OECD countries over the last 20 years, globalisation can be seen to have affected the relationship between real exchange rates and trade balances in two ways. On the one hand, the development of international trade within – as opposed to between – industries has led countries to trade similar types of goods. This has raised the substitutability between the types of goods imported and exported and thereby *increased* the sensitivity of the trade balance to the real exchange rate. On the other hand, the development of global supply chains and vertical specialisation across countries has raised the complementarity between the types of goods imported and exported, thereby *reducing* the sensitivity of the trade balance to the real exchange rate. The relative importance of these two effects varies across countries. For example, trade balances in countries such as the United Kingdom and France, which have a high level of intra-industry trade, are much more sensitive to movements in exchange rates than those of, for example, Ireland and Greece, where exports and imports affect different industries. Turning to China and the United States, the relatively low intra-industry trade index in China compared to the United States implies that the latter can expect a larger reduction in its trade deficit from an exchange rate depreciation than the drop in the trade surplus that China would experience from an exchange rate appreciation. This confirms that achieving global rebalancing will need more than real exchange rate adjustment.

... if intra-industry trade is high and vertical specialisation low

The remainder of this article is organised as follows. The first section lays down the framework of the analysis and provides a brief description of the data. The following section presents the empirical approach and estimation results, and the closing section discusses some of the policy implications of the findings and draws conclusions.

² In this case, real exchange rate adjustment can have an equilibrating effect. Another issue, however, is that different methods to assess “equilibrium” real exchange rates can actually yield very different results.

³ For example, according to Rogoff (1996) the half-life of real exchange rates is estimated in the range of three to five years. In other words, it takes three to five years for a real exchange rate to close half of the gap to the equilibrium value after a given shock. See also Edwards (1989) for a discussion of the role of economic policies in real exchange rate misalignments. Finally, see Cheung et al (2009) for a description of methods to compute real exchange rate misalignments with an application to the Chinese renminbi.

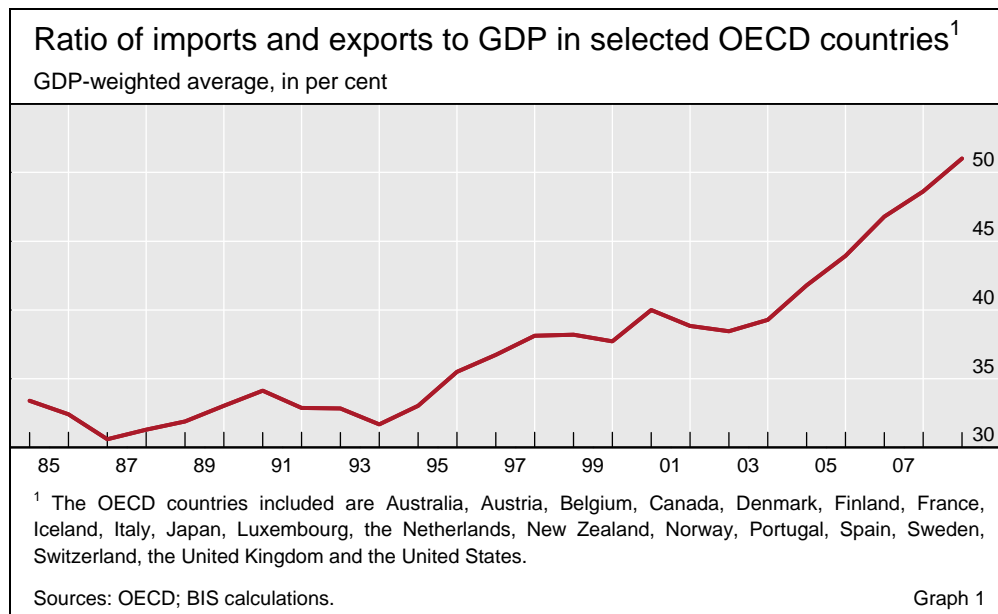
Globalisation patterns

An increase in trade shares of GDP ...

The world economy has become increasingly globalised over the past 30 years. The growth in the ratio of international trade to GDP for a group of OECD countries illustrates this trend (Graph 1). The sum of imports and exports increased from about one third of GDP in the mid-1980s to just over one half by the late 2000s. Imports and exports therefore outgrew GDP on average by around 1 percentage point per year over the period. But globalisation has deeper implications than a simple increase in the volume of international transactions.

... reflects more trade within industries ...

Globalisation has affected the substitutability between the types of goods imported and exported. To illustrate how this substitutability can be measured empirically, it is useful to compare a country that imports and exports different types of goods with a country that imports and exports similar types of goods. The first country should typically run a trade deficit for some goods and a trade surplus for other goods. Individual industries should thus deviate significantly from balanced trade. By contrast, trade should be relatively more balanced industry by industry in the second country. At the aggregate level, the sum of industry deviations from balanced trade – normalised by total trade – can therefore measure the extent to which an economy trades either similar or different types of goods. The larger the normalised sum of deviations from balanced trade, the more likely it is that an economy trades different types of goods. Building on this intuition, we can construct a measure of intra-industry trade (IIT)⁴ that is equal to zero when a country's international trade takes place exclusively between industries, ie when there is no overlap between the types of goods imported and exported, and equal to one if a country's



⁴ Following Grubel and Lloyd (1975), the index for intra-industry trade is $IIT_i = 1 - \frac{\sum |X_i - M_i|}{\sum |X_i + M_i|}$, where X_i and M_i denote respectively exports and imports of goods of sector i .

international trade is transacted exclusively within industries, ie when there is a perfect overlap between the types of goods imported and exported.⁵

Based on this intuition, the sensitivity of the trade balance to movements in real exchange rates should be much lower in a country with a low level of intra-industry trade (low IIT) than in a country with high IIT. Its imports are unlikely to fall significantly following a real exchange rate depreciation because no domestic industry can easily replace the imports that have become more expensive. Low IIT countries are typically those where raw materials or natural resources like oil account for a major share of imports. They could also be countries that have specialised in particular industries in order to benefit from a comparative advantage in some sectors. By contrast, imports fall much more in a high IIT country that depreciates its real exchange rate, as the country can more easily provide domestic substitutes for imports that have become more expensive. The sensitivity of the trade balance to the real exchange rate should therefore depend positively on IIT.

The IIT index has changed significantly both across countries and over time.⁶ European countries typically have a high IIT index, whereas larger economies such as Japan or the United States have lower IIT (Graph 2). A special case is Norway, a commodity exporter with lower IIT than its European peers. Some economies, shown in the upper panels of Graph 2, have experienced a steady increase in IIT. In others, shown in the lower panels, IIT has not shown any significant upward or downward trend. In the case of the United States and United Kingdom, IIT moved in parallel with the aggregate trade balance over the last 10 years.⁷

Globalisation has also affected the complementarity between the types of goods that are imported and exported. The different stages involved in the production of a given good can either be carried out in a single country or split across several countries. The degree of complementarity between imports and exports is typically higher if there are more goods whose production process is split across several countries. These different countries trade intermediate goods and are said vertically specialised. International vertical specialisation, which is behind the buzzword of “global supply chains”, has been an important aspect of the recent globalisation process, especially since developing economies have emerged as competitive production centres for low- and medium-skilled tasks.⁸

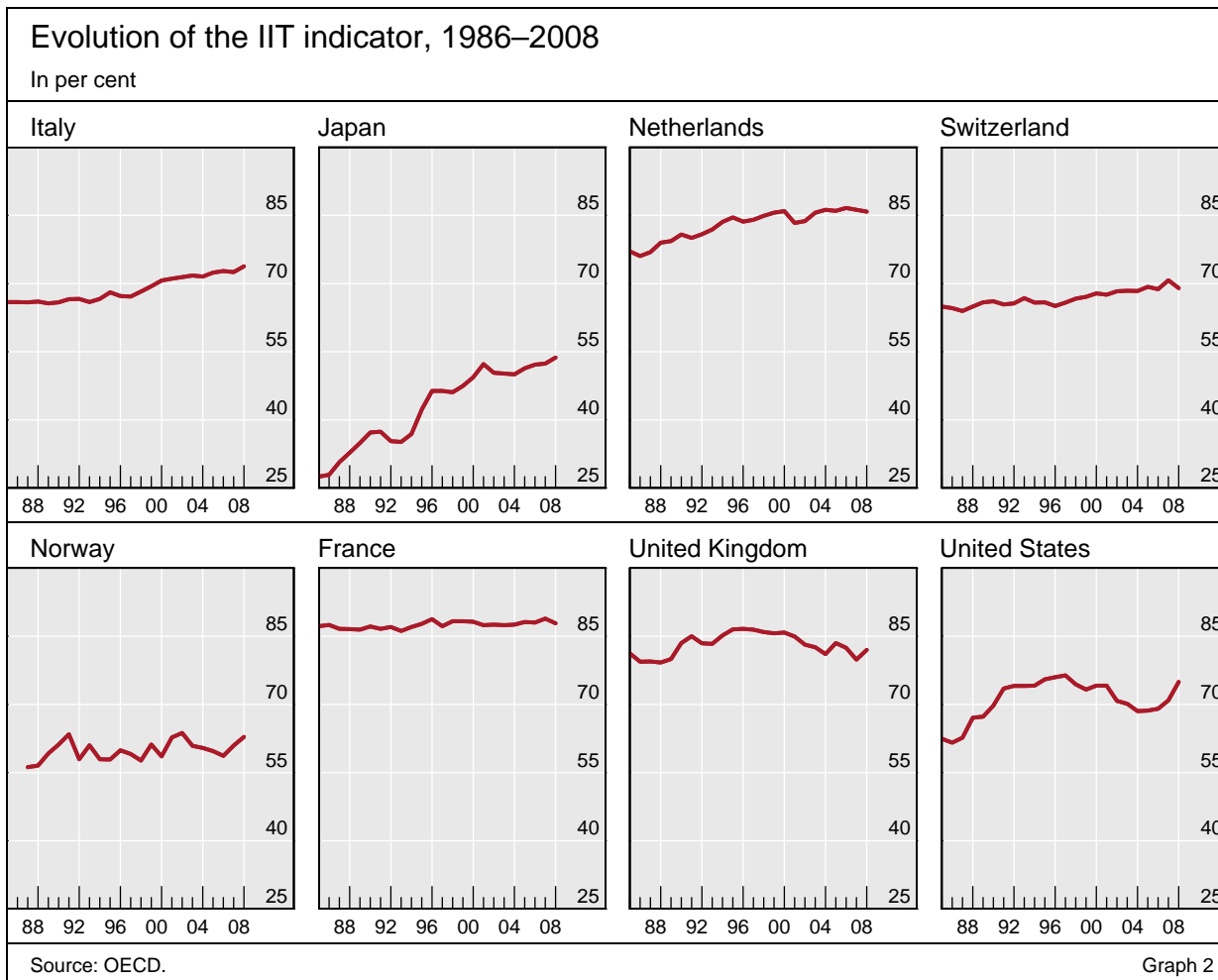
... and more
globalised
production chains

⁵ Economies of scale and trade in varieties of products are the main theoretical reasons why countries may trade similar types of goods. See Krugman (1979), Lancaster (1980) and Helpman and Krugman (1987).

⁶ Brühlhart (2009) provides an extensive empirical study of intra-industry trade patterns around the globe for the period 1962–2006.

⁷ IIT typically decreases when a country's trade deficit increases across all sectors.

⁸ To be precise, vertical specialisation applies to firms which choose to specialise in some stages of production and outsource the others, regardless of where outsourcing takes place. “Global supply chains” refers to the carrying-out of those processes in different countries.



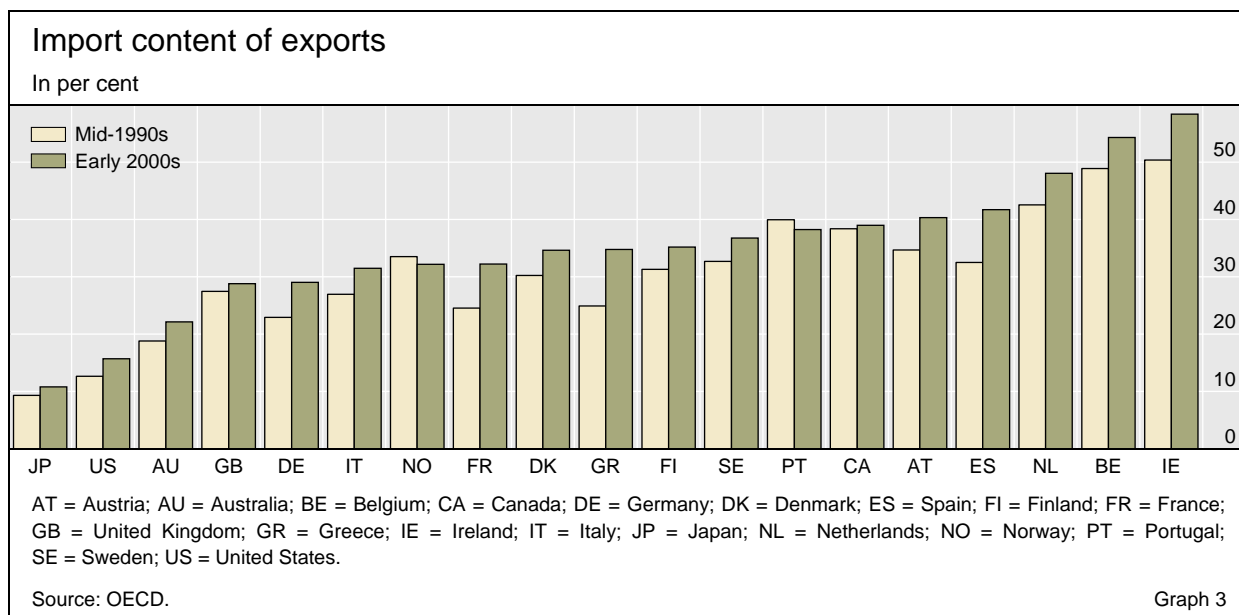
Input-output tables that measure the flow of goods between different sectors allow us to measure the development of global supply chains. The resulting measure of the import content of exports (ICE) represents the extent to which a country's international trade is vertically integrated, as it measures the contribution of imports in the production of exported goods and services.^{9, 10}

When a country is vertically specialised, the volume of its exports depends on the volume of its imports since some exports are manufactured using imports as inputs. The trade balance should hence be less sensitive to changes in the real exchange rate in countries which are more vertically specialised. A tighter co-movement between exports and imports should reduce the trade balance response to a change in the real exchange rate.¹¹

⁹ The import content of exports is computed as $ICE = U \cdot A_m \cdot (I - A_d)^{-1} \cdot X$, where A_m and A_d are the input-output coefficient matrices for imported and domestic transactions, respectively, I is the diagonal matrix, U denotes a $1 \times n$ vector each of whose components is 1 for corresponding import types, and X is the export vector.

¹⁰ See Meng et al (2010) for a more detailed discussion of vertical specialisation indicators based on input-output tables.

¹¹ The data do indeed show that countries which display a higher ICE index also exhibit a higher correlation between imports and exports to GDP.



The extent to which exports actually embed imports differs significantly across countries (Graph 3). For example, ICE is lowest in Japan and the United States and highest in Ireland and Belgium. Moreover, it has generally increased over time. In particular, European countries such as Spain, Germany and France have experienced significant increases in the ICE index ranging between 25 and 33%.

Model estimation

This section provides estimates on how the two channels described above affect the sensitivity of a country's trade balance to its real exchange rate. It builds on Goldstein and Khan's (1985) reduced form model of the trade balance. In their approach, the trade balance depends negatively on domestic income, positively on foreign income, and negatively on the real exchange rate (an increase in the real exchange rate being equivalent to an appreciation). The model is adapted as follows: the dependent variable is the ratio of each country's total trade balance to its GDP (TB). The independent variables are: (i) the growth rate of domestic absorption,¹² to control for the demand for imports (DAG);¹³ (ii) the real effective exchange rate, to control for external competitiveness (REER);¹⁴ and (iii) interaction terms between the real effective exchange rate on the one hand, and IIT and ICE on the other hand (REER×IIT

An econometric model of the trade balance ...

¹² Domestic absorption is the sum of private consumption, general government consumption and gross domestic investment. The volume measure is computed using the GDP deflator.

¹³ Including the weighted average of trading partners' growth as a control for the demand for exports resulted in statistically insignificant coefficients that moreover often had the wrong sign. This variable was therefore excluded, which had virtually no impact on the results documented below.

¹⁴ There are two possible measures for the real effective exchange rate. The first is computed using relative consumer prices, the second using unit labour costs. The regressions presented below use the real effective exchange rate based on relative consumer prices. Using the alternative measure yields similar results.

and REER×ICE), which allow us to test how the types of goods traded and/or the dependence of exports on imports affect the impact of a change in the real effective exchange rate on the trade balance. The interaction term between the real effective exchange rate and IIT is expected to have a negative sign, since a high IIT raises the sensitivity of the trade balance to the real exchange rate. By contrast, the interaction of the real effective exchange rate and ICE is expected to have a positive sign, since a higher ICE should reduce the sensitivity of the trade balance to the real exchange rate. Finally, IIT and ICE are introduced as independent variables on their own so as to separate their possible direct effect on the trade balance from their effect on the sensitivity of the trade balance to the real exchange rate.

The model is estimated for a panel of 20 OECD countries over the period 1985–2008.¹⁵ Real effective exchange rates are from the IMF’s *International Financial Statistics* and macroeconomic variables from the OECD’s *Economic Outlook*. IIT and ICE are computed from the OECD-STAN. To control for unobserved cross-country heterogeneity, country fixed effects are included. There is an important data limitation. ICE is observed for only three subperiods (mid-1990s, late 1990s and mid-2000s), so it was “extended” to a longer sample (1993–2005) using for each country a quadratic interpolation.¹⁶ Denoting i the country index, t the time index and the estimated parameters and the residual with Greek letters, the empirical specification is

$$TB_{i,t} = \alpha + \beta.DAG_{i,t} + \gamma.REER_{i,t} + \delta.IIT_{i,t} + \eta.REER_{i,t} \times IIT_{i,t} + \theta.ICE_{i,t} + \lambda.REER_{i,t} \times ICE_{i,t} + \varepsilon_{i,t}$$

... confirms the existence of the two channels

The estimation results, collected in Table 1, confirm the existence of the two channels. A first set of regressions (columns (i)–(iii)) focuses on the effect of IIT on the sensitivity of the trade balance to the real exchange rate, while a second set of regressions (columns (iv)–(v)) shows the effect of IIT and ICE on the sensitivity of the trade balance to the real exchange rate. Across all estimations, domestic absorption growth does have a significant and negative effect on the trade balance when country fixed effects are introduced, but not otherwise. This confirms that a country that grows faster experiences, all else equal, a fall in its trade surplus (or an increase in its trade deficit).

Turning first to the real effective exchange rate, columns (i)–(iii) show that it is insignificant once country fixed effects are introduced. This is probably

¹⁵ The countries included in the sample are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom and the United States. Due to data availability, it was not possible to include emerging market economies in the sample. This is the main reason why the study focuses on OECD countries.

¹⁶ The quadratic interpolation is built up assuming that the first point (mid-1990s) is reached in 1995, the second (late 1990s) in 2000 and the last (mid-2000s) in 2005. To reduce the possible errors that would stem from this interpolation procedure, instead of including the index directly, a dummy variable is constructed that is equal to one when the ICE index is above the median of the ICE distribution and zero otherwise. The estimation hence tests whether the sensitivity of the trade balance to the real exchange rate is significantly lower for a country whose ICE index is above the median compared to a country whose ICE index is below, controlling for other factors that may influence this sensitivity, such as the extent to which trade happens within industries.

Estimation results					
	(i)	(ii)	(iii)	(iv)	(v)
Domestic absorption growth	-0.075 (0.123)	-0.153** (0.072)	-0.209** (0.087)	-0.275* (0.136)	-0.382*** (0.121)
Real effective exchange rate	0.209*** (0.060)	0.024 (0.040)	-0.020 (0.040)	0.153*** (0.034)	0.142*** (0.033)
Interaction (real effective exchange rate and IIT)	-0.279*** (0.093)	-0.202*** (0.062)	-0.153** (0.062)	-0.330*** (0.054)	-0.331*** (0.051)
Intra-industry trade	0.318*** (0.074)	0.245*** (0.050)	0.036 (0.049)	0.378*** (0.071)	0.310*** (0.072)
Interaction (real effective exchange rate and above median ICE dummy)				0.071*** (0.031)	0.069** (0.032)
Above median ICE dummy				-0.069 (0.030)	-0.071*** (0.031)
Country dummies	No	Yes	Yes	Yes	Yes
Time dummies	No	No	Yes	No	Yes
Time span	1985–2008	1985–2008	1985–2008	1993–2005	1993–2005
Observations	491	491	491	247	247
<p>The dependent variable is the trade balance as a share of GDP. Domestic absorption growth is the growth rate of the sum of private consumption, gross domestic investment and government consumption. The real effective exchange rate is computed using relative consumer prices. IIT is the index for intra-industry trade. The above median ICE dummy is a variable which is equal to one if the country's ICE is above the median and zero otherwise. Interaction variables are the product of the variables in parentheses. Estimation coefficients are in bold. Robust standard errors are in parentheses below the estimation coefficients. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.</p>					

Table 1

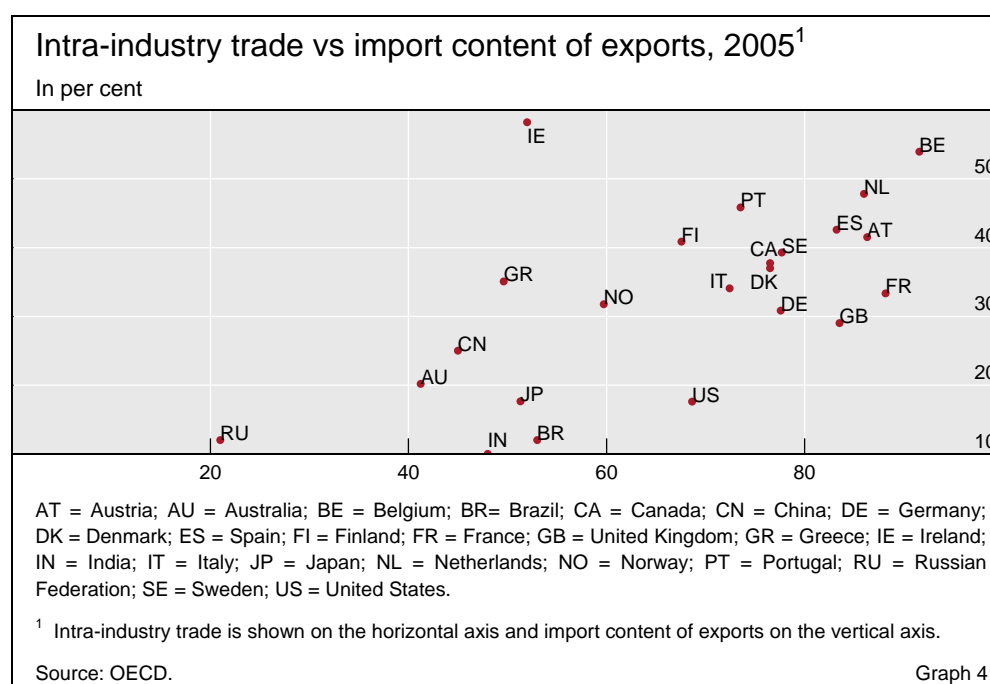
because real exchange rate variations over time are relatively small compared to cross-country variations. Yet this does not imply that real effective exchange rates have no significant impact on the trade balance. On the contrary, the estimated coefficient for the interaction term between the real effective exchange rate and IIT is always negative and significant. Hence an appreciation (depreciation) in the real effective exchange rate always reduces (increases) the trade balance, the more so when IIT is higher, ie when trade takes place more within and less between industries. Based on the estimated coefficients (column (ii)), a one standard deviation depreciation in the real effective exchange rate improves the trade balance by 0.9 percentage points of GDP for a country at the lower quartile of the IIT distribution. The same figure rises to 1.25 percentage points of GDP for a country at the upper quartile of the IIT distribution, around 40% larger than in the previous case.

Next, we turn to estimations (iv)–(v), which evaluate the impact of IIT and ICE on the sensitivity of the trade balance to the real effective exchange rate. First, they also support the hypothesis that the trade balance is more sensitive to changes in the real effective exchange rate in countries where trade takes place more within industries. It is interesting to note that the coefficient is actually larger (in absolute value) than in the case where ICE is not controlled for. This probably reflects the fact that both indicators have increased in

parallel in many countries. If ICE has an opposite effect to IIT on the sensitivity of the trade balance to the real effective exchange rate, such collinearity should push up the estimated coefficient on IIT when ICE is controlled for. Second, the interaction term between the real effective exchange rate and the dummy for above median ICE is positive and significant. Given that the trade balance sensitivity to the real exchange rate is negative, this positive coefficient implies that the estimated sensitivity of the trade balance to the real exchange rate is significantly smaller for a country whose ICE index is above the sample median. Put differently, a country whose ICE index moved above the median would experience a drop in the sensitivity of the trade balance to the real effective exchange rate. To fix ideas, consider a country whose IIT index is below the sample median. Based on the estimation results in columns (iv) and (v), the sensitivity of the trade balance to the real exchange rate is around 9% when the ICE index is below median. This means that a 1 percentage point depreciation in the real exchange rate translates into a 9 percentage point increase in the trade balance. Conversely, the sensitivity of the trade balance to the real exchange rate is not significantly different from zero when the ICE index is above median. In this case, a depreciation in the real exchange rate would not have any significant effect on the trade balance.

Policy implications and conclusions

The estimations presented in this special feature indicate that countries that can expect an improvement in their trade balance through a depreciation in the real effective exchange rate are those which feature both a high IIT index and a low ICE index. Conversely, countries with low IIT but high ICE should not expect depreciating their real effective exchange rate to bring a significant increase in their trade balance. To draw some policy implications, consider the 2005 figures for the ICE and IIT index in a group of countries (Graph 4).



Countries located in the bottom right-hand corner can expect a larger gain in their trade balance from depreciating their real effective exchange rate. By contrast, countries located in the top left-hand corner can expect the lowest gain in their trade balance from depreciating their real effective exchange rate. This simple comparison shows that there is a large variety in what countries can expect from using the exchange rate as a policy tool to boost their trade balance and hence their growth. For instance, the United States is likely to benefit more from a real exchange rate depreciation than Japan since it features a relatively similar ICE index but a relatively higher IIT index. Applying the results of this study to a country like China, the relatively low IIT index in this country suggests that a real exchange rate appreciation is unlikely to reduce the Chinese trade surplus significantly. This confirms the view that global rebalancing is likely to require more efforts than simply adjusting exchange rates.

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