North–South competition in quality

SUMMARY

Analyzing a new database that makes it possible to disaggregate trade flows across many countries according to unit values, we show that international specialization in terms of quality within industries and product categories plays an important role in the dynamics of North–South competition. The different specialization of countries at different levels of development within products and across varieties is mirrored in the recent shifts in world market shares, which are very different across quality segments: the South is not gaining market share in high-value portions of trade pattern. In this respect Europe's specialization pattern appears to be different from that of the US and Japan, and may allow it to better resist the competitive pressure of the South.

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Specialization across varieties and North–South competition

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1. INTRODUCTION

Empirical work on trade data (see especially Schott, 2004, and references therein) has documented considerable variation in prices of traded products at the most detailed level of product classification. More precisely, such observation pertains to unit values, since prices are not directly observable in trade statistics. Unit values are defined as values of shipments (Free On Board), divided by quantities shipped. On average, Japanese unit values are 1.43 times higher than for Brazil, 1.80 times higher than for India, and 2.89 times higher than for China, for the *same* products, shipped to the *same* markets, within the *same* year (2004). Similarly, US export unit values are on average 1.55 times higher than for India and 2.44 times higher than for China.

To illustrate this phenomenon, and this paper's research strategy, let us split international trade prices into three market segments (low, medium, high), using the world distribution of unit values (see Appendix A2). In Figure 1 we plot the share of down and up-market varieties, in US imports from each exporter, by development level

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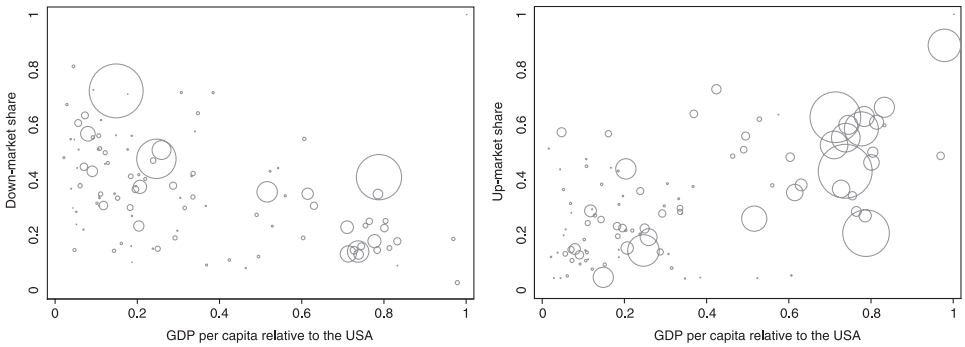

Figure 1. Share of down- and up-market varieties, in US imports from each exporter, by development level of the exporter

Note: Horizontal axis: GDP per capita of the exporter, relative to the US. Vertical axis: share of market segment in US imports. The size of the bubble is proportional to the value of US imports by country of origin. Import data below USD 1bn are not plotted.

Source: BACI-CEPII, and authors' calculations.

(GDP per capita relative to the US) of the latter. The size of the bubble is proportional to the value of US imports from each country. In the case of down-market varieties, there is a negative relationship between the development level of the exporter to the US market and its specialization. In the case of up-market ones, the relationship is positive.

Accordingly, in a given market, countries at different development levels do sell differentiated varieties of the same products, at very different prices; these countries do not compete directly since they are not positioned in the same market segment. The policy implications of such a simple stylized fact are considerable and such a shift in our understanding of international specialization should prevent us from drawing hasty conclusions on the competitive pressures faced by high income countries coping with competition from emerging economies.

On the one hand, the North is now in competition with the South on a wide range of products. Nearly the whole spectrum of the headings of the international product classification are covered by Chinese exports. Out of 5041 products traded at the international level in 2004, 4898 were exported by China, compared with 4932 for Germany. Moreover, when one takes as a benchmark the number of pairs of destination markets and exported products, China was exporting on 335 720 such 'elementary markets' in 2004 (but only 163 250 in 1995), compared with 352 855 in 2004 for Germany. All in all, China is exhibiting specialization patterns at the most detailed level corresponding to countries three times as rich (Rodrik, 2007). Accordingly, workers in the North could fear that direct competition from the South on the whole range of products will induce downward pressure on their wages.

However, although China may well export as many products as Germany, varieties exported by Germany and China seem too different to be in direct competition. This implies that workers in the two countries do not compete in production of the same

varieties, and if the different varieties are not very substitutable, there will be only a weak link between trade and factor prices.

Of course, it might be the case that such broad brush evidence as that reported above hides large differences among sectors or countries. And it is also important to consider dynamic aspects, because such large differences in unit values could well be only transitory. To shed further light on these phenomena, we adopt a fact-oriented approach and systematically scan world trade data, in order to establish the precise patterns of specialization across varieties of countries of the North and the South, and to detect their determinants. We aim at assessing policy challenges posed by the emergence of competitors in the South covering the whole range of traded products, and we focus particularly on similarities and differences across the US, Japan, and the EU as regards the character of competition from the South.

To measure the within products specialization of countries and their market positioning, we use a newly developed database of world trade flows: BACI.[1] It covers the largest available set of countries over a decade and reconciles the declarations of trading partners, extracting trade costs from unit values of imports, and correcting for the quality of the declarations. Relying on this exhaustive set of more than 200 countries and 5000 products in the database, we address differences in unit values for the same *manufactured* products. These unit values are used to calculate the relative prices of the varieties exported, as well as to allocate the shipped varieties in the three different market segments we referred to above. Importantly, we do find that Europe differs from other developed regions of the world. The EU appears to be less specialized than the United States or Japan in hi-tech industries, and has a very resilient market share in the upper segment of the unit value distribution.

2. POLICY QUESTIONS

Policy makers are concerned by the increasing range of sectors facing the competition of emerging countries. Considering differentiated varieties of products rather than sectors sheds new light on the perceived similarity in specialization between North and South, and contrasts with the classical view of the trade theory (see Box 1).

2.1. Trade impacts revisited

Since the pioneering work of Finger (1975), a series of contributions have confirmed that specialization is taking place within products across varieties as well as across products or across industries. Torstensson (1991) provided early evidence of Sweden's specialization on quality vis-à-vis countries at different levels of per capita income. But the major breakthrough was Schott's (2004) finding that US imports are exhibiting a large variance in unit values within product categories; it has launched a new series

[1] BACI is the French acronym for 'Base pour l'Analyse du Commerce International', the new CEPII Database for International Trade Analysis. See Appendix A1 and http://www.cepii.fr/anglaisgraph/bdd/baci.htm.

Box 1. Predictions of trade theory contradict empirical evidence

According to the standard theory of international trade, and using a multi-products setting, countries will not specialize in products exhibiting relative factor contents at odds with their relative endowments. Hence different countries should have different bundles of exported products.

In contrast, the 'new' trade theory basically relies on trade in varieties having the same production function. In the latter framework using a single factor, countries advantaged in terms of productivity should ship low price varieties. This is the very framework synthesized by Helpman and Krugman (1985), where different countries specialize in different industries, while similar countries specialize in different varieties shipped at the same price.

Both predictions are conflicting with the repeated empirical evidence of trade in varieties at dissimilar prices among countries at different levels of development. Countries advantaged in terms of productivity do not export low price but rather high price varieties. Exporters to a given market do not specialize in a limited subset of products exhibiting production functions in coherence with their factor endowments, but on the contrary manage to specialize in a wide range of products. Lastly, countries actually import only a subset of all available varieties, while all varieties should enter symmetrically in preferences.

Hence, one is not facing an endowment-driven specialization across products, but on the contrary an endowment-driven specialization across varieties within products. This finding led Schott to suggest that 'our thinking about international specialization must shift away from industries (. . .) and toward varieties within industries (. . .)' (Schott, 2004, p. 649).

Such specialization may be the result of a double selection process: in a theoretical framework allowing for heterogeneous multi-product firms, not only does trade select among firms: there is also a self-selection within firms among products, as trade costs induce firms to ship mostly the best products of their portfolio (Bernard, Redding and Schott, 2006).

of works on the actual patterns of trade specialization. For instance, the International Monetary Fund's explanation of increasing world market shares of eight Central and Eastern European Countries, in spite of an appreciation of their real exchange rate, invokes an upgrading of the quality of exported varieties (IMF, 2006). Similarly, using 1995 import data for 59 countries from 110 exporters at the 6-digit level of the harmonized classification of traded goods (HS6 hereafter), as well as 10-digit data on US imports, Hummels and Klenow (2005), find that large countries do export higher quality goods (the 'quality margin' that may be interpreted as one component of the intensive margin), and not only more varieties (the extensive margin).

In total, we face a situation where countries are completely specialized within products, on varieties with different market positioning. In terms of the traditional factor price equalization mechanism, the North and the South are not directly competing and this should smooth the perception of the impacts of globalization.

We provide in the following convincing evidence that this new approach of international specialization helps to better understand the dynamics of North–South competition and its implications for advanced countries.

Firstly, we show that this dissimilarity in the specialization of countries at different levels of development within products and across varieties is mirrored in the recent shifts in world market shares. These shifts may profoundly differ among market segments, and different countries may be differently affected; hence, the popular view that the South is gaining market shares inexorably must be better qualified if one aims at drawing sound policy conclusions on the consequences of emergence for advanced economies.

Secondly, specific policy concerns arise with the hi-tech sector. Presumably, this is the very last refuge of industries of advanced economies, or at least the very place where rents are extracted. Hence, it is worth considering recent shifts in market shares and the presence of emerging economies as competitors. Here again, we observe that the diagnosis must take into account the differentiation of the varieties traded.

Thirdly, we identify a specific pattern of Europe's specialization that may allow it to better resist the competitive pressure of the South.

Our evidence calls for further analysis of the distributive impacts of such specialization across varieties: the need to climb the ladder of vertical differentiation of products may well profoundly impact on advanced economies. A first and obvious channel is that the production function of goods is accordingly changing. Instead of producing a consumption good with inputs of blue collar workers, capital and raw materials, what is needed is a combination of highly skilled designers, market analysts, engineers, etc. Accordingly, such a shift in production technologies may well have a similar impact to biased technical progress, detrimental to low-skilled, less adaptable workers. These arguments shed new light on the roles of technical progress and international competition in the relative worsening of the position of unskilled labor in the North, which may result not from product market competition directly but from the labor market implications of up-market positioning strategies by firms in the North. Similarity between North and South is limited at the variety level.

There is necessarily arbitrariness in the definition of what a product, versus a variety of a product, is. We rely here on the distinction proposed by Schott (2004). Two different headings of the most detailed level of the international trade classification represent two different products (HS6). Two different market segments represents two different varieties of a product having different unit values (see Box 2).[2]

[2] This departs from the vocabulary of the literature on intra-industry trade, which would use 'varieties' to refer to products shipped under the same heading but having similar unit values (horizontal differentiation), as opposed to 'qualities' having different unit values (vertical differentiation).

Box 2. Unit values and quality of the traded varieties

Using detailed trade data, Hummels and Klenow (2005) point to differences in quality to explain such differences in unit values. But interpreting differences in unit values of varieties of the same product is rather challenging, and a narrow view based on quality only is not necessarily warranted.

Firstly, consider the case that rich countries export high price varieties. Using cross-sectional bilateral data for 60 countries in 1995, Hallak (2006a) asks whether the correlation of export prices with per capita income, and thus with other factors than quality *per se*, leads to spurious conclusions. Is it quality or other factors tightly linked to income, such as production costs, that determine export prices?

Secondly, Hallak and Schott (2005) challenge the strong association of prices to quality, stressing that differences in unit values may reflect, not only the quality of the product, but also exchange rate misalignments or differences in production costs. Instead of assuming a one-to-one relationship between unit value and quality, they extract the 'comparative advantage' component of the difference in unit values by taking into consideration sectoral global balances of the exporting country. A country running a trade surplus and selling at a low unit value is considered as having a comparative advantage, rather than selling low quality products.

Thirdly, the composition of exports may vary with distance if transport costs have a fixed component, i.e. are not simply proportional to prices. In this case, distance should be less relevant for higher-quality products, according to the Alchian-Allen conjecture that 'the better apples are exported' (Hummels and Skiba, 2004).

Our bottom line is that quality and other characteristics differentiating varieties exported lead to the observed differences in relative unit values for the same product exported by two different countries on the same destination market. And inversely, that different export prices for a given product and in a given market, are reflecting differences in the quality perceived by local consumers.

To illustrate how exactly the international division of labor is taking place among countries at different levels of development, let us consider indicators of export similarity between countries, computed alternatively at the level of 26 'sectors', i.e. International Standard Industrial Classification (ISIC) codes; or 'products,' i.e. 4528 headings of manufacturing HS6 codes; or 'varieties,' i.e. the 4528 times 3 categories of export grouped in three price groups within each HS6 classification code. The similarity of export sectoral structures is one minus half the sum of the absolute value

of the differences between the sectoral (or product or variety) shares in manufacturing exports of each country (1 is perfect similarity).

Given the heterogeneity of the EU-25, we *include* intra-EU exports in our calculation, and we consider separately the largest member states, France, Germany, Italy and the United Kingdom.

By considering similarity indexes computed at the sectoral level (Table 1, first panel), one might conclude that there is intensive competition between the North and the South. Similarity is however especially high for pairs of countries in the North, like for example an index of 0.77 for the United States and Japan. More interestingly, values near or above 0.50 are obtained for North–South comparisons: the similarity between China and the United States or Japan is comparable to the similarity between China and India. Italy is more similar to China (0.60) than to Japan (0.58).

Using a more aggregated classification of products, the Broad Economic Categories of the United Nations by transformation level, leads, not surprisingly, to an even greater level of similarity (see Appendix A5). Similarity peaks to 0.95 for the pair USA–Japan in 1995, and has very much increased between 1995 and 2004 for Chinese exports and Japanese or US exports. The share of intermediate, consumption or investment products in total exports is accordingly converging, which explains the increasing concerns of advanced economies' exporters, confronted with Chinese exporters in markets where they were not present a decade ago.

A similar calculation can be made at the most detailed level of the classification of the *products* (the 6-digit level of the Harmonized System), instead of using ISIC industries (second panel of Table 1). Certain bilateral relationships exhibit very similar patterns among industrialized countries, even at such a detailed level, as for instance between Germany and France (0.55). However, the similarity indexes are much lower between North and South exporters, indicating that countries at different levels of development are specialized on different products. Still sizeable similarity can be found between China and Japan (0.34) or China and the United States (0.34). With the exception of Italy, export structures of the European member states considered here are less similar with respect to the Chinese ones than the US or Japanese export structures.

Lastly, if we consider *varieties* of products, the similarities decrease again, especially for North–South pairs (third panel of Table 1). Industrialized countries are not competing with emerging countries (or with each other to a lesser extent) on the same varieties, thanks to a clear specialization across varieties within product categories. As Section 4 shows, when China and Northern countries export the same products, Chinese varieties are usually down-market, while Northern varieties are up-market. The similarity index between China and the US falls to 0.24, and to 0.18 vis-à-vis Japan. Here again the United Kingdom, Germany and France exhibit much less similarity with China than the US export structure does.

As a useful summary of common patterns in these data, consider the case of Germany and China. When *industries* are considered, the similarity between Chinese

Table 1. Similarity of export structures at various levels of detail of the classification (2004)

		Brazil	China	France	Germ.	Italy	Japan	Russia	India	UK	USA	Other emerging
Sector level	China	0.39	.									
(ISIC headings)	France	0.61	0.50	.								
	Germany	0.55	0.47	0.76	.							
	Italy	0.55	0.60	0.66	0.70	.						
	Japan	0.52	0.56	0.64	0.82	0.58	.					
	Russia	0.54	0.30	0.47	0.45	0.44	0.37	.				
	India	0.51	0.56	0.54	0.47	0.63	0.38	0.49	.			
	UK	0.62	0.49	0.86	0.82	0.66	0.73	0.51	0.53	.		
	USA	0.59	0.55	0.84	0.81	0.64	0.77	0.48	0.48	0.88	.	
	Oth. Em.	0.46	0.44	0.40	0.34	0.42	0.35	0.38	0.45	0.39	0.38	0.40
Product level	China	0.21	.									
(HS 6 headings)	France	0.32	0.30	.								
	Germany	0.34	0.30	0.55	.							
	Italy	0.29	0.35	0.48	0.51	.						
	Japan	0.29	0.34	0.41	0.56	0.36	.					
	Russia	0.31	0.16	0.24	0.24	0.21	0.20	.				
	India	0.26	0.30	0.29	0.27	0.35	0.23	0.21	.			
	UK	0.29	0.30	0.55	0.57	0.43	0.44	0.25	0.27	.		
	USA	0.33	0.34	0.56	0.59	0.45	0.53	0.26	0.27	0.59	.	
	Oth. Em.	0.18	0.23	0.18	0.17	0.19	0.17	0.14	0.20	0.18	0.19	0.18
Variety level	China	0.17	.									
(market segment)	France	0.24	0.17	.								
	Germany	0.24	0.17	0.50	.							
	Italy	0.22	0.19	0.42	0.43	.						
	Japan	0.22	0.18	0.36	0.43	0.29	.					
	Russia	0.26	0.12	0.18	0.17	0.16	0.15	.				
	India	0.23	0.23	0.24	0.20	0.24	0.16	0.23	.			
	UK	0.20	0.16	0.47	0.51	0.36	0.36	0.18	0.20	.		
	USA	0.25	0.24	0.45	0.46	0.35	0.40	0.21	0.21	0.46	.	
	Other emerging	0.15	0.16	0.13	0.12	0.14	0.13	0.12	0.19	0.13	0.15	0.14

Note: Similarity between country A (column) and B (row) is one minus half the sum of the absolute value of differences between the (e.g.) sectoral shares in manufacturing exports of country A and those of country B. It ranges between 0 (perfect dissimilarity) and 1 (perfect similarity). The 'other emerging' group are defined as the emerging economies less Russia, India, China and Brazil. Any classification of countries is arbitrary. We stick here to CEPII's definition of emerging economies, based on the statistical criterion reproduced in Appendix A4. Note that new member states of the EU-25 are not considered as emerging economies.

Source: BACI-CEPII, and authors' calculations.

and German exports is high (similarity 0.47). When *products* within industries are considered, this similarity is much lower (similarity 0.30). When *varieties* of these products exported at different unit values are considered, the similarity is once again reduced (similarity 0.17).

Beyond this snapshot, one should ask how this similarity has been changing at the most detailed level over the last decade. Do we observe an increasing similarity in exports?

2.2. Similarity between North and South is hardly increasing at the detailed level

The answer to the previous question depends of the aggregation level. At the broad product categories level, the similarity is increasing between North and South. Table 2 shows how the similarity between export structures of selected developed and emerging economies has been changing recently. The largest increase in absolute terms over 1995–2004 in the similarity of exported products is between China and Japan. The similarity between China and the European member states considered here increased greatly too, and Germany, France or the UK have been the most affected. This evolution is slightly smoother in the US case. A similar evolution is observed between Italy or Japan and Brazil. Switching to the similarity of varieties exported, the evolution is more limited, except for India. The similarity between China and

Table 2. Absolute change in similarity of export structures at the broad product categories and variety level (1995 to 2004)

		Brazil	China	France	Germ.	Italy	Japan	Russia	India	UK	USA	Oth. Em.
Broad product categories	China	15	.									
	France	8	21	.								
	Germany	7	20	–1	.							
	Italy	12	12	1	3	.						
	Japan	10	22	1	2	5	.					
	Russia	–6	9	2	3	7	4	.				
	India	7	1	2	0	2	5	4	.			
	UK	10	20	–1	–6	7	–4	4	8	.		
	USA	7	17	–4	–4	1	–1	6	4	–7	.	
	Oth. Em.	5	–5	4	4	3	7	6	–3	8	5	–2
Variety level (market segment)	China	2	.									
	France	3	4	.								
	Germany	4	5	4	.							
	Italy	–1	4	2	4	.						
	Japan	3	7	3	3	2	.					
	Russia	6	1	9	8	8	8	.				
	India	5	–2	9	6	5	3	12	.			
	UK	1	3	5	6	1	5	7	5	.		
	USA	1	5	4	7	2	1	8	5	1	.	
	Oth. Em.	2	–1	2	3	2	3	4	3	3	2	1

Source: BACI-CEPII, and authors' calculations.

Japan has increased three times less than for broad products categories, for instance. Accordingly, the observed evolutions confirm that recent competitive pressures have been much more limited at the variety level.

We now need to go beyond such simple observations and consider in detail how the competitive pressures at stake have led to a redistribution of market share. The next section points to resilience of EU market shares in the upper segment of the world market.

3. EU TRADE EXHIBITS RESILIENCE IN THE UPPER SEGMENT

All developed countries have not been affected similarly by the emergence of new competitors. Despite their specialization in different varieties, the US economy as well as the Japanese one have been losing ground in all segments of the world market. For Japan, the market share loss is even larger in the upper segment of the market than in the lower one. In contrast, the market share of the EU-25 is resilient in the upper segment of the market, where high-priced varieties of consumer goods even slightly improved their positions on the world market.

This general European pattern is the result of an internal specialization of the EU in the production of up-market varieties, detrimental to France and Germany, and beneficial to new member states as well as the UK, Ireland and Italy. The latter result does not imply that Germany has been losing ground in up-market products, but that its gains in market shares have been less important in this segment of the market than in the middle or lower ones.

3.1. Recent shifts in market shares are concentrated in the low segment of the market

The market positioning of exporters and the recent shift in world market shares confirm the diagnosis of tough competition in the lower segment of the market. Let us once again split the world distribution of unit values of trade flows of a given product into three equal market segments (low, medium, high).

World market shares by transformation level and market segment are reported in Table 3. In the lower segment of the world market, the share of EU exporters was limited to 15.3% in 2004. This is to be compared with a 30.6% world market share in the upper segment. A similar pattern is observed for Japan: 14.6% in the upper segment and 7.5% in the lower segment. Such positioning was much less striking for the US economy: 14.4% in the upper segment and 11.9% in the lower market segment. In contrast, China had an impressive market share in the lower segment (20.1% of the world market), but five times less than that in the upper segment. Such differences in market positioning are more apparent for consumer goods, which have the potential to be highly differentiated, where the EU market share in the upper segment peaks to 38.8%, against 5.8% for China.

Table 3. World market shares by transformation level and market segment (intra-EU exports *excluded*, 2004, %)

Market segment	Exporter	Intermediate goods	Consumer goods	Investment goods	All
Lower	EU-25	14.7	13.6	18.4	15.3
	USA	14.4	7.4	11.5	11.9
	Japan	8.1	4.6	9.4	7.5
	Other developed	19.0	19.7	17.8	18.9
	China	14.9	25.0	25.7	20.1
	Brazil	2.1	1.9	1.4	1.9
	Russia	2.1	0.7	0.8	1.4
	India	2.7	3.0	0.3	2.2
	Other emerging	15.0	16.8	11.3	14.6
	Rest of the world	7.1	7.3	3.5	6.2
	All	100	100	100	100
Upper	EU-25	28.7	38.8	26.1	30.6
	USA	14.6	9.9	18.5	14.4
	Japan	15.8	9.9	16.8	14.6
	Other developed	22.3	13.3	20.3	19.5
	China	2.6	5.8	5.6	4.1
	Brazil	0.7	1.0	0.6	0.7
	Russia	1.1	0.3	0.3	0.7
	India	0.8	1.1	0.6	0.8
	Other emerging	9.9	14.3	9.4	10.9
	Rest of the world	3.7	5.7	2.0	3.8
	All	100	100	100	100

Source: BACI, and authors' calculations.

The redistribution of market shares by market segment and transformation level observed over the last decade confirms that European producers have better resisted new competitive pressures in the upper segment, essentially thanks to consumer goods. The EU has lost 2.75 percentage points of world market share in the lower segment, but has *gained* 0.24 percentage points in the upper segment. Japan and the US have lost ground on both market segments, while Chinese gains have been more concentrated in the lower segment (10.98 percentage points, Table 4).

3.2. Competition in high tech sectors

The technological sector, once seen as a safe haven for developed countries, seems to be increasingly contested by emerging countries. Using the by now standard view of international trade, whereby countries compete in terms of technological leadership and extract rents, it is worth isolating hi-tech products in our data. This can be done at the product (rather than sector) level using the OECD-Eurostat classification. According to this classification, a product is either 'hi-tech' or 'standard' and all varieties of a 'hi-tech product', whatever the market segment they belong to, are 'hi-tech'. We focus on the 261 HS6 headings belonging to this list and ask what is the

Table 4. Changes in world market shares by transformation level and market segment (intra-EU exports *excluded*, 1995 to 2004, percentage points)

Market segment	Exporter	Intermediate goods	Consumer goods	Investment goods	All
Lower	EU-25	–3.55	–0.20	–4.34	–2.75
	USA	–3.99	–4.39	–4.35	–4.19
	Japan	–3.94	0.85	–4.62	–2.78
	Other developed	–4.20	–3.77	–6.77	–4.68
	China	9.94	5.83	18.83	10.98
	Brazil	0.18	0.81	0.26	0.34
	Russia	0.60	0.21	0.56	0.46
	India	1.48	0.60	–0.03	0.86
	Other emerging	1.54	–1.32	–1.38	0.05
	Rest of the world	1.96	1.38	1.86	1.70
	All	0	0	0	0

	Upper	Intermediate goods	Consumer goods	Investment goods	All
Upper	EU-25	–0.06	3.00	–1.65	0.24
	USA	–3.02	–0.90	–6.00	–3.19
	Japan	–4.53	–4.22	–5.92	–4.73
	Other developed	0.90	–4.41	0.78	–0.40
	China	1.71	1.99	4.89	2.52
	Brazil	–0.26	0.14	0.21	–0.04
	Russia	0.73	0.00	0.28	0.44
	India	0.29	0.40	0.43	0.35
	Other emerging	3.12	2.41	6.15	3.64
	Rest of the world	1.13	1.57	0.82	1.16
	All	0	0	0	0

Source: BACI, and authors' calculations.

market positioning of technological products exported by the North and the South and how market shares have changed over the last decade.

Table 5 sheds light on how market shares have changed for the upper and lower market segments, for standard versus high-tech products. China has dramatically increased its market share for hi-tech products in the last decade, but Chinese gains are concentrated in the lower segment of the market.

The better resilience of Europe to competition from emerging economies is no longer confirmed as we focus on hi-tech products: while Europe's market share has been improving for standard goods in the upper segment of the market (by 1.1 percentage points), it has shrunk in the same segment of the market for hi-tech products (by 3.1 percentage points).

It is important to investigate reasons why reactions to the emergence of new competition are so different across countries that are basically similar in terms of factor endowments, technological level and factor costs, such as the EU, the US and Japan.

Table 5. World market shares (intra-EU *excluded*) for standard and hi-tech manufactured goods, by market segment (1995 and 2004, %)

	Standard goods		HT goods	
	down-mkt	up-mkt	down-mkt	up-mkt
Exporter		1995		
EU-25	17.9	30.9	19.2	26.7
USA	15.5	15.7	20.4	28.9
Japan	9.5	19.8	15.8	16.2
Other developed	23.8	19.9	21.5	20.3
China	9.5	1.8	6.4	0.4
Brazil	1.7	0.9	0.6	0.2
Russia	1.0	0.3	0.3	0.0
India	1.4	0.5	0.5	0.2
Other emerging	14.7	7.4	13.5	5.9
Rest of the world	5.0	2.8	1.8	1.2
All	100	100	100	100
Exporter		2004		
EU-25	15.0	32.0	16.8	23.6
USA	11.2	13.4	15.7	19.4
Japan	7.2	14.4	8.9	15.3
Other developed	19.0	18.5	18.1	24.7
China	19.3	4.1	24.3	4.1
Brazil	2.2	0.8	0.5	0.5
Russia	1.6	0.7	0.7	0.5
India	2.4	0.9	0.8	0.2
Other emerging	15.0	11.0	12.3	10.2
Rest of the world	7.1	4.2	1.9	1.6
All	100	100	100	100

Note: See Table 1. High-tech goods are identified at the most detailed level by the Eurostat-OECD list.
Source: BACI-CEPII, and authors' calculations.

Let us briefly consider the usual suspects. The observation that countries running a large macroeconomic deficit (USA), or a large surplus (Japan), have similarly been losing ground in both segments of the market (down and up-market), suggests that widening trade imbalances may not be the explanation.

Regarding exchange rates, a period of appreciation of the dollar against the euro (up to 2001) has been followed by the opposite evolution, and the difference in bilateral exchange rates between 1995 and 2004 remains limited. In total, if we exclude intra-EU flows and thus get rid of the associated valuation effect, any observed impact of the exchange rate over the considered period should have led at most to a slightly better relative performance of the EU.[3] In any case the magnitude of such

[3] A 3% variation in the bilateral real exchange rate in favour of Europe's competitiveness has been observed over the period (euro Real Effective Exchange Rate, CPI deflated, vis-à-vis 44 groups of currencies, fixed definition of the euro area (euro-13), as published by the ECB). Guessing a price elasticity equal to 2, the gain in exported volumes should be 6% with a perfect pass through. Converted to US dollars, since the euro (actually compared with the ecu) has depreciated in nominal terms, this leads to 2% additional EU exports in value. Using an elasticity equal to 1, the evolution in value terms is reversed, with a 1% decrease.

effect is too limited to explain the divergence in relative performances of the two regions.

To better shed light on the observed resilience of the EU, we are now interested in checking how individual member states contribute to this European pattern, and if differences among member states have evolved over the last decade.

3.3. Member states contribute differently to the market positioning of the EU-25

The EU-25 is a very heterogeneous area with regards to the market positioning of member states. The common perception is that large and advanced member states, in particular Germany, are exporting mostly up-market products and thus contributing a large part to the observed market positioning of the EU. Such a statement must however be carefully checked, especially when it comes to the recent dynamics of specialization.

In Table 6 we consider the contribution of each member state to the EU-25 exports in 2004, by market segment and in total. The German contribution is the

Table 6. Contribution of individual EU-25 member states to EU exports (intra-EU excluded), by market segment (2004)

	Down	Middle	Up	Total
Austria	2.7	2.6	3.0	2.8
Belgium and Luxembourg	4.6	4.9	4.3	4.5
Cyprus	0.1	0.1	0.1	0.1
Czech Republic	1.3	1.0	0.7	0.9
Denmark	2.6	2.3	2.3	2.3
Estonia	0.2	0.1	0.1	0.1
Finland	2.4	2.8	2.1	2.4
France	12.6	13.3	11.6	12.3
Germany	24.9	29.7	31.2	29.2
Greece	0.7	0.5	0.3	0.5
Hungary	1.3	1.1	0.9	1.1
Ireland	2.4	1.8	6.3	4.1
Italy	14.3	11.9	10.9	12.0
Latvia	0.2	0.1	0.1	0.1
Lithuania	0.4	0.2	0.1	0.2
Malta	0.3	0.3	0.2	0.2
Netherlands	5.8	5.1	4.5	5.0
Poland	2.6	1.6	0.6	1.4
Portugal	0.7	0.7	0.7	0.7
Slovakia	0.5	0.5	0.4	0.5
Slovenia	0.8	0.5	0.3	0.5
Spain	5.3	4.6	3.0	4.0
Sweden	3.7	4.2	4.5	4.2
United Kingdom	9.8	10.3	12.1	11.0
All	100	100	100	100

Source: BACI-CEPII, authors' calculation.

largest overall, (29.2%), and is even larger in the upper segment of the market (31.2%). At the extreme opposite, Latvia is contributing only marginally (0.1%) and mostly for down-market varieties (0.2%). All in all, when we talk about EU exports of high-range varieties, we focus on Germany, France, the UK and Italy, which account for two thirds of the corresponding EU exports.

We must however get rid of the absolute size and the overall trade balance of each exporter, in order to better understand the evolutions at stake: the contribution of Italy is even larger for varieties located at the bottom of the market, and the German gains might be concentrated or not in the upper segment. To shed light on this, a specialization index will help.

3.4. Specialization of EU member states in the three market segments

We now calculate a simple specialization index by normalizing each market segment share by the average contribution of the country to EU exports (total contribution column in Table 6). Accordingly, the index of specialization for Germany in the up-market varieties will be 1.07 (31.2/29.2) in 2004. These specialization indexes are reported in Table 7 for 1995 and 2004 for each member state. The picture is more nuanced, however, since the most specialized European countries in the up-market segment are Ireland (1.54), the UK (1.10), Sweden (1.08) and Austria (1.07). The second interesting observation is the rapid reduction in the heterogeneity of specialization of the different member states with regards to their market positioning. The standard error reported in the last row of the table illustrates this point, as well as the upgrading of new member states varieties.

The Czech Republic, Poland, Hungary or Slovakia are all moving up the ladder. In contrast, and this is the last important information delivered, France and Germany have reduced their specialization in the upper segment over the last decade, while Italy and the UK were specializing in the opposite direction. All in all, while the European specialization in the upper segment of the market has a permanent pattern, we are facing an internal redistribution of up-market specialization where France and Germany on the one hand, new member states and Italy, Ireland and the UK on the other, move in opposite directions.

3.5. A closer look at US comparative advantages

Macroeconomic imbalances strongly impact US trade and might also affect US trade patterns at the detailed level considered here. In order to properly assess the comparative advantages of a country, the calculation of specialization indexes relates sectoral exports to total exports. We accordingly proceed here to the calculation of revealed comparative advantages (a Balassa index calculated by market segment on ISIC sectoral exports), at the market segment level. A glance at Germany and the United States illustrates the differences in the market positioning of the two countries. In

Table 7. Specialization index of individual EU-25 countries, by market segment (1995 and 2004, intra-EU trade excluded)

	1995			2004		
	Down	Middle	Up	Down	Middle	Up
Austria	0.84	0.96	1.13	0.97	0.91	1.07
Belgium and Luxembourg	0.97	1.09	0.96	1.01	1.09	0.94
Cyprus	1.75	1.00	0.50	1.67	0.83	0.83
Czech Republic	1.96	0.82	0.54	1.39	1.08	0.74
Denmark	1.01	0.92	1.06	1.10	0.97	0.97
Estonia	2.38	0.88	0.38	1.58	1.00	0.58
Finland	1.05	1.13	0.87	1.02	1.18	0.89
France	0.90	1.00	1.06	1.02	1.08	0.94
Germany	0.75	0.99	1.17	0.85	1.02	1.07
Greece	1.60	1.00	0.60	1.44	1.13	0.69
Hungary	2.00	0.80	0.53	1.24	1.04	0.84
Ireland	1.11	0.65	1.18	0.60	0.44	1.54
Italy	1.35	0.92	0.83	1.19	0.99	0.90
Latvia	2.30	0.90	0.30	1.70	1.00	0.70
Lithuania	2.18	0.82	0.35	2.00	1.05	0.47
Malta	0.78	0.44	1.56	1.29	1.08	0.83
Netherlands	0.97	1.13	0.92	1.16	1.02	0.90
Poland	2.15	0.93	0.32	1.88	1.15	0.44
Portugal	1.03	1.03	0.97	1.03	1.06	0.96
Slovakia	2.13	0.96	0.26	1.02	1.18	0.89
Slovenia	1.60	1.09	0.57	1.63	1.06	0.61
Spain	1.32	1.09	0.73	1.33	1.15	0.74
Sweden	0.75	1.03	1.13	0.87	0.99	1.08
United Kingdom	1.07	1.04	0.93	0.89	0.94	1.10
Standard Error	0.56	0.16	0.35	0.35	0.15	0.23

Note: Ratio of contribution by market segment and in total (Balassa index taking EU-25 as a reference). Includes intra-EU exports. Market segments are defined with the exclusion of internal EU prices.

Source: BACI-CEPII, and authors' calculations.

Table 8, seven of the ten main German revealed comparative advantages are in the up-market segments and three in the middle one. Germany's specialization in the upper segment is particularly apparent for transport equipment. In contrast, out of the 10 main revealed comparative advantages of the United States, three are in the up-market segments, three in the middle market segment, and four in the lower one.

In order to systematize these observations and better understand the specialization of countries across varieties within products and their determinants, a careful examination of the dynamics of relative prices of exported varieties is done in the next section.

4. PERMANENT DIFFERENCES IN PRICES AND THE NORTH–SOUTH SPECIALIZATION ACROSS *VARIETIES*

We start by calculating ratios of unit values by pair of countries, destination market and product, in order to assess to what extent varieties of products jointly exported

Table 8. Main specialization sectors by market segment, 2004, United States and Germany (intra-EU trade *excluded*)

United States	Market segment	RCA	Germany	Market segment	RCA
Printing and publishing	2	2.34	Transport equipment	3	3.47
Plastic products	2	2.20	Printing and publishing	2	2.02
Tobacco	2	2.02	Rubber products	3	1.93
Printing and publishing	3	1.80	Fabricated metal products	3	1.89
Tobacco	1	1.61	Other chemicals	2	1.83
Paper and products	1	1.55	Pottery china earthenware	3	1.80
Professional and scientific equipment	1	1.53	Machinery except electrical	3	1.80
Tobacco	3	1.52	Professional and scientific equipment	3	1.79
Professional and scientific equipment	3	1.49	Plastic products	3	1.73
Printing and publishing	1	1.45	Professional and scientific equipment	2	1.64

Note: The Revealed Comparative Advantage (RCA) is calculated annually (t), on ISIC sectoral (k) exports of country i, by market segment g: low (1), middle (2) or upper (3).
The index is computed as

$$RCA^{t}_{i,k,g} = \frac{X^{t}_{i,k,g}}{\sum_{k,g} X^{t}_{i,k,g}} \cdot \frac{\sum\sum_{i\ k,g} X^{t}_{i,k,g}}{\sum_{i} X^{t}_{i,k,g}} \quad (1)$$

Source: BACI-CEPII, and authors' calculations.

by the two countries in the pair are dissimilar. We take advantage of the time coverage of our sample to compare the results for 1995 and 2004, and thus to check whether a convergence of relative unit values between North and South is taking place.

In a second stage, we examine the relationship between market positioning, as defined by the unit value of exported varieties of each product, and the level of development of trading countries.

4.1. Relative prices between North and South are stable

The North and the South may indeed export the same bundle of products, in contrast to the standard view of international trade, but they will specialize in different varieties shipped at different unit values. A key issue is whether such differences in unit values of varieties exported by the North and the South are only transitory, reflecting delays in market adjustments, or sustainable patterns in the international division of labor.

In order to do this, we rely on our exhaustive set of exporters and importers and ask what the overall evidence is at the world level. We accordingly calculate bilateral *unit-value ratios* for varieties exported by the North and the South on each destination market at the HS6 level of the nomenclature of traded products.

Table 9. Relative unit values at the product level, 1995

	EU-25	Germany	France	UK	Italy	USA	Japan	China	Brazil	Russia	India
EU-25	.	.	.	.	.	0.90	1.04	0.39	0.76	0.81	0.51
Germany	.	.	0.98	0.84	0.72	0.79	0.87	0.27	0.62	0.75	0.38
France	.	1.02	.	0.88	0.73	0.86	0.95	0.25	0.68	0.57	0.36
UK	.	1.19	1.14	.	0.85	0.87	0.98	0.30	0.70	0.91	0.44
Italy	.	1.39	1.38	1.17	.	1.00	1.43	0.29	0.73	0.64	0.47
USA	1.12	1.27	1.16	1.15	1.00	.	1.11	0.43	0.93	0.85	0.65
Japan	0.96	1.15	1.05	1.02	0.70	0.90	.	0.31	0.76	0.62	0.44
China	2.59	3.74	4.06	3.39	3.46	2.34	3.25	.	1.38	1.00	1.14
Brazil	1.31	1.62	1.48	1.42	1.36	1.07	1.32	0.73	.	0.97	0.89
Russia	1.23	1.34	1.75	1.09	1.57	1.17	1.62	1.00	1.03	.	1.05
India	1.95	2.66	2.75	2.27	2.14	1.54	2.25	0.88	1.13	0.95	.

Note: A weighted geometric median of relative unit values of country A (in column) and B (in row) across common HS6 positions and geographical destinations of exports (weights are the simple averages of the shares of the export flow in the total exports of A and B) is calculated here. The ratio of export unit-value for a country pair (A,B) is the weighted median of $UV^k_{A,j} \big/ UV^k_{B,j}$ where j is the direction of export. The weighting variable is $w = 0.5\left(V^{hs6}_{A,j} \big/ V_A + V^{hs6}_{B,j} \big/ V_B\right)$ where V_A and V_B are the total exports of A and B. These ratios are computed for each year. Intra-EU trade flows are excluded.

Source: BACI, and authors' calculations.

Following our research approach, we *exclude* intra-EU trade flows from the calculation of relative unit values. (Results including intra-EU trade flows are provided in Appendix A5, available on the journal's website.) These computations can shed light on the phenomena of interest by answering such questions as 'how did the relative unit value of liquid dielectric transformers in a certain category of power handling capacity, shipped to the same destination market by the US and by China, vary over the last decade?' Lastly, we aggregate such information, for each pair of countries, in order to examine the evolution of the price gap between pairs of developed and emerging countries.

The results are given in Table 9 for 1995. The median of the distribution of Brazilian prices relative to Chinese prices is 1.38, meaning that Brazilian prices were 38% higher than Chinese ones in 1995. Reciprocally, the median of the distribution of Chinese prices relative to Brazilian prices is 0.73 (=1/1.38), meaning that Chinese prices were three quarters of Brazilian prices in 1995. Generally speaking, in 1995 Brazil did not exhibit prices so different from those of advanced economies (93% of US prices, 76% of Japanese prices, 62% of German prices). Accordingly, Brazil might well be specialized in certain products, in a traditional way, rather than in varieties within products.

The opposite is true for China. With prices in 1995 representing 27% of German prices, 31% of Japanese prices, 43% of US prices, or even 88% of Indian prices, for the same products, China was clearly specialized on the lower segment of the market for the bulk of its exported varieties. India was exhibiting the same type of specialization, however it was less pronounced: 38% of German prices, 44% of Japanese prices, or 65% of US prices.

Table 10. Relative unit values at the product level, 2004

	EU-25	Germany	France	UK	Italy	USA	Japan	China	Brazil	Russia	India
EU-25	.	.	.	.	.	0.98	1.00	0.40	0.75	0.77	0.61
Germany	.	.	1.01	0.98	0.89	0.94	0.87	0.33	0.62	0.72	0.60
France	.	0.99	.	1.00	0.84	0.95	0.96	0.27	0.69	0.69	0.41
UK	.	1.02	1.00	.	0.84	0.86	0.86	0.28	0.61	0.74	0.32
Italy	.	1.13	1.19	1.20	.	1.00	1.14	0.35	0.70	0.72	0.57
USA	1.02	1.06	1.05	1.16	1.00	.	1.00	0.41	0.87	0.81	0.64
Japan	1.00	1.15	1.04	1.16	0.88	1.00	.	0.35	0.70	0.76	0.55
China	2.51	3.06	3.67	3.53	2.83	2.44	2.89	.	1.20	1.17	1.27
Brazil	1.34	1.62	1.45	1.65	1.42	1.15	1.43	0.84	.	0.99	1.00
Russia	1.30	1.39	1.45	1.35	1.39	1.23	1.32	0.85	1.01	.	1.16
India	1.65	1.67	2.44	3.13	1.77	1.55	1.80	0.79	1.00	0.86	.

Note: See Table 9 for definitions.

Source: BACI, and authors' calculations.

More interestingly, the Chinese market positioning has not changed dramatically within a decade, even if we record a slight increase in its relative prices (Table 10). Over the period considered, Chinese relative prices have gained 4 percentage points vis-à-vis Japan and 6 percentage points vis-à-vis Germany. In contrast, Chinese relative prices have lost 2 percentage points vis-à-vis the US, and are up 9 percentage points vis-à-vis India and 15 vis-à-vis Russia. Accordingly, the outcome of a specialization on varieties within products is a rather stable pattern.

Export prices of varieties of individual products have hardly converged over the last decade, for instance between China and the EU: observed relative unit values have only slightly decreased from 2.59 to 2.51 over a decade, meaning that on average EU exported varieties are steadily 2.5 times more expensive than Chinese varieties *of the same products*.

Were the products homogenous, such difference in prices should have led within a decade to a profound redistribution of market shares, which has not been observed. European exporters are still in the market, despite their high prices, meaning that varieties are considerably (vertically) differentiated.

At first sight, these findings point to a strong rejection of the Law of One Price (LOP). Notice that, in contrast to the literature on departures from the LOP that focuses on prices of narrowly defined goods sold in different locations (e.g. cities in the Economist Intelligence Unit's Worldwide Cost of Living Survey, as in Crucini and Shintani, 2006), our relative unit values bilateral indexes do proxy prices for the same six-digit headings shipped to the *same* locations. Accordingly the LOP is more likely to show up in our case. However, as in other studies of this kind of evidence, the observed price gaps are arguably too large and too persistent to be explained by price differences across very similar goods. They are more likely evidence of the existence of several varieties of the same good, which may be poorly substitutable to each other. Controlling properly for the elements associated to differentiation (brand, design,

associated services, etc.) could provide us with evidence of some form of the LOP. Prices cleaned from vertical differentiation would be needed to better assess convergence properties; but the hedonic price methods necessary for this require microeconomic data that are not available, except for very specific sectors (e.g. passenger cars).

4.2. Determinants of the market positioning of varieties

How have such differences in relative prices of varieties among exporters been sustainable during a decade without profound swings in market shares among exporters?

The impact of the level of development of the exporter (here, proxied by its Purchasing Power Parity GDP per capita) on the price of the varieties exported very much depends of the product considered. Whether the product is differentiated or not and the extent to which vertical differentiation is possible, will certainly impact on this relationship. Where varieties are highly differentiated, the upper market segment will correspond to production functions intensive in R&D, skills and organization, and this is where advanced economies will be advantaged. Lastly, when one considers a large market such as the EU, imports of different varieties of each individual group of products (HS6 heading) may reflect matching of foreign countries' individual endowments and production function prerequisites. This is why we must rely on estimates made at the product level, rather than within large industries.

In order to tentatively answer this question, we extend the empirical analysis on US imports by Schott (2004), by using a world sample (see Table 11). Schott regresses unit-values of American imports on proxies of exporter's level of development or factor intensities. We replicate the exercise for the US imports and two other comparable

Table 11. Impact of the level of development on the unit value of products imported by different groups of countries (pooled data)

	World	USA	EU-25	Japan
Intercept	0.004	–0.001	0.002	0.000
	(0.000)	(0.002)	(0.000)	(0.002)
Log GDP per capita exporter	0.356	0.389	0.353	0.340
	(0.000)	(0.002)	(0.001)	(0.002)
Log GDP per capita importer	0.156	–	–	–
	(0.000)	–	–	–
Log dist	0.097	0.182	0.140	0.349
	(0.000)	(0.004)	(0.000)	(0.003)
N	25 158 156	652 964	8 355 338	422 384
R^2	0.0611	0.0524	0.047	0.1046
F	545 952	18 062.5	206 252	24 665.8

Note: The following equation is estimated for a sample in which products are sourced simultaneously and significantly in the North and the South and taking into account product * year fixed effects. In the last three columns, the estimated equation is $\ln UV_{i,hs6,t} = C_{hs6,t} + \beta \ln GDPPC_{i,t}$, with i the exporter, HS6 the product and t the year.

Source: BACI, and authors' calculations.

importers, the EU and the Japan. Distance is added in the equation in order to account for the Alchian-Allen conjecture. Lastly, we perform the same calculation using a world sample, which introduces importers' income level. Estimations are done at the product level, over 10 years, and we examine the distribution of the estimated elasticity across products, by market. GDP data are taken from the World Bank's WDI database for 2006. Distances are provided by CEPII.

In order to better shed light on the actual patterns of North–South competition, we select the products that are sourced simultaneously and significantly in the North and the South. In order to do so, we take the first quartile of the distribution of market shares of OECD and emerging exporters (referred to as North and South respectively) in each developed market (across all products) as thresholds. We will retain only the 6-digit products for which the market share of the South and the North is larger than the respective thresholds. We exclude intra-EU exports, but the trade flows are considered for member states on an individual basis, since there is no obviously neutral way of aggregating their unit values.

As shown in Table 11, the price of the imported varieties is positively related to the development level of the exporter.[4] This is true for the three large importing markets and we do not notice any specificity of Europe here. However, a potential heterogeneity among member states is to be considered. We accordingly performed the estimation on a (EU) country-by-country basis and found that EU member states are quite heterogeneous as concerns unit-value elasticity to GDP per capita. The median of estimated coefficients ranges from 0.34 (Ireland) to 0.48 (Portugal).

Distance is proved to a have a positive impact on the unit value of the varieties shipped: this confirms the conjecture of the good apples shipped. This result is particularly pronounced for Japan. This might be the result of its peculiar geographical position: Japan trades with poorer Asian neighbours as well as exporting high unit-value varieties to the US or Europe.

Another approach authorized by our exhaustive sampling is to estimate the relationship considered in Table 11 for the whole set of exporters' unit values. We obtain a comparable parameter estimate on the GDP per capita of the exporter (0.35), a positive estimate on the GDP per capita of the importer, and a positive impact of the distance on the unit value of traded products.

In order to confirm this first set of results obtained by pooling data across products for each importer, we estimate one equation by product for each importer and consider the distribution of the estimated elasticity (see Appendix A6). We have more than 5000 products in total within the HS6 classification, but fewer when the sample is restricted to manufacturing (4528) and even fewer when it is restricted to products exported by both the North and the South (3252). We have a window of ten years leading to (e.g. for EU member states considered individually) 420 369 equations

[4] We also included in another specification (not reported) a non-linear term on the GDP per capita of the exporter, which proved to be significant and positive but left other results unaffected.

giving the same number of estimated elasticity. For the EU, the median elasticity is 0.36, meaning that a 10% increase in the GDP per capita of the exporter to the EU will translate into a 4% increase in the price of its exported products, for a given product. This distribution validates our explanation despite the inter-product categories and inter-member state countries variance of the estimated coefficient.

These results confirm the remarkable robustness of the underlying relationship: with economic development, as skills, capital intensity, R&D capacity and organizational capacities increase, countries climb the ladder of vertical differentiation between varieties of exported products.

5. SUPPLY AND DEMAND DETERMINANTS OF TRADE IN VARIETIES

Regularities observed in terms of market positioning of traded products are not determined only by the characteristics of the exporting country. Demand-side explanations of such empirical evidence must also be considered: rich countries spend a larger share of their income on top quality products and import products of higher quality (see Box 3). The facts are consistent with this. Table 12 presents the results of a bilateral calculation, indicating how much each exporter is selling in the upper tier segment on each destination market.

On the demand side, we observe a clear difference in the market positioning of the various exporters on their different destination markets, stressing that importers at different levels of development do consume a different bundle of varieties. In 2004, 72.9% of European exports to Japan were up-market varieties, compared with only 46.5% to China.

Table 12. Share of up-market products in manufactured exports, by destination market (2004, %)

Importer	EU-25	USA	Japan	Oth. dev	China	Brazil	Russia	India	Oth. Em.	RoW	Total
Exporter											
EU-25	41.1	60.3	72.9	50.6	46.5	34.0	21.8	49.1	36.0	37.6	43.2
USA	54.5	.	64.4	32.3	40.0	26.0	23.9	50.3	15.4	30.3	36.9
Japan	54.5	43.2	.	46.4	42.1	33.4	5.8	48.6	32.7	18.8	43.0
Oth. dev	46.5	24.4	41.2	34.0	27.1	28.4	16.1	32.2	22.4	27.7	32.1
China	16.6	4.9	20.7	7.2	.	24.4	2.8	20.9	11.6	8.1	11.6
Brazil	22.8	15.5	37.8	16.4	9.1	.	2.2	14.2	10.5	13.7	15.9
Russia	15.6	22.2	23.2	13.0	13.3	31.5	.	42.8	8.9	14.4	16.0
India	22.0	15.1	19.3	16.9	15.6	17.6	9.3	.	17.0	16.7	17.8
Oth. Em.	36.4	19.3	36.9	26.5	25.1	30.1	9.9	25.8	20.4	18.4	25.8
RoW	32.0	19.0	34.7	18.6	6.6	32.4	9.0	28.1	16.5	19.1	22.9
Total	40.5	31.4	43.9	34.0	34.4	30.0	16.7	36.2	23.3	27.9	35.1

Note: The sample covers manufacturing HS6 goods including the food industry.

Source: BACI-CEPII, and authors' calculations.

Box 3. Supply and demand of quality and the specialization across varieties within products

On the supply side, possible explanations of the positive relationship between unit values of exports and exporters' income per capita identified by Schott (2004) in the US case, would be the exploitation of the productivity advantage to specialize in top-range varieties (Melitz, 2000); or, more generally, an old-fashion theoretical framework, where advantage is based on a combination of factor endowments and technological advance (e.g. Falvey and Kierzkowski, 1987).

On the demand side, rich countries trade more with each other, after controlling for inter-sectoral determinants of trade (Hallak, 2006a and 2006b), in line with the Linder hypothesis (Linder, 1961). Flam and Helpman (1987) proposed a framework in which varieties of different qualities were produced at a cost reflected in higher prices for higher qualities. Marginal income is spent by the consumers on quality rather than on quantity. This model, extended by Choi *et al.* (2006) to a multi-product, multi-country framework, allows for high-income countries buying high unit value varieties. However, even when countries have access to the same technology, the quality positioning of their specialization will be determined by domestic conditions: the larger or the more sophisticated the domestic market, the higher the quality of products supplied to the local consumer (Motta *et al.*, 1997).

These facts call for systematic analysis of supply and demand determinants of the market positioning of trade varieties, considering the direction of trade flows. On the supply side, rich countries should be advantaged in exporting up-market products. On the demand side, rich countries should purchase and import more up-market products, and the opposite should be observed for developing economies.

5.1. A gravity equation accounting for the market positioning of varieties

The basic framework of analysis in this section is the workhorse of the empirical analysis in international trade, namely an augmented gravity equation.

The dependent variable is the value of bilateral exports from country i to country j at year t into market segment g. The market segment in which an industry exports is observed at the HS6 level, according to the methodology referred to above. We estimate this relationship both for total exports, by summing over all manufacturing products but keeping the market segment dimension, and at the sector level. Among the three market segments, only two are considered in samples used in regressions: up-market and down-market.

Regarding explanatory variables, the GDPs of exporter and importer are introduced in the equation explaining the total bilateral value of exports in each of the two market

segments. When estimating the equation at the sector level, we use available information on sectoral output of the exporter and sectoral demand of the importer, from the new version of the 'Trade and Production' database compiled by the World Bank and completed by the CEPII.[5] Other unobservable patterns of manufacturing industries, that are common to all exporters and importers, are controlled for by using sector fixed effects.

Regarding distance, we use a harmonic average, taking into account internal distances (see Box 4). Distances are measured using city-level data to assess the geographic distribution of population (in 2004) inside each nation.[6] Bilateral distance may have two different effects. Firstly, as a proxy for transport costs, distance increases the relative price of the lower-market segment for the consumer. This should increase the share of the upper-market segment in imports. Secondly, distance is a proxy for the lack of information on products and may reduce the consumption of expensive varieties. Which of the two is the dominant effect is a matter for empirical analysis. Since cultural proximity may play an important role in the demand for up-market products differentiated by brands or other intangible attributes, we introduce a dummy for common language. We also tentatively introduce past colonial links but the results are not reproduced here. The latter are very similar and we preferred a more parsimonious specification: the only affected parameters with the introduction of colonial links are those obtained to common language. Bilateral distances and common language are from the CEPII geographical database.[7]

Besides these standard gravity variables, the GDP per capita of the exporter (supply side determinant) as well as for the importer (respectively demand side) previously used are introduced in order to account for the determinants of specialization.

Interaction variables are finally introduced. We consider the market segment each elementary bilateral trade flow (an HS product exported by country i to market j at year t) belongs to, either the lower or the upper market segment. The corresponding dummy variables are interacted with distance (does one ship the good apples?), with common language (is the upper segment of the market more sensitive to cultural proximity?) and with GDP per capita (what is the role of supply and demand related determinants?).

Results are summarized in Table 13. The first two columns are dedicated to the equation estimated on total bilateral trade flows by market segment. The remaining columns give the results of the estimations done with the panel of sectors. In all regressions, we introduce time fixed effects in order to control for annual changes in the value of world trade (the period is 1995–2004). For estimations at the sectoral level we use the ISIC classification, in which there are 25 manufacturing sectors, which are introduced as fixed effects.[8]

[5] Data available at http://www.cepii.fr/anglaisgraph/bdd/tradeprod.htm.

[6] The distance variable taking into account internal distances makes it unnecessary to introduce a control for contiguity.

[7] Data available at http://www.cepii.fr/anglaisgraph/bdd/distances.htm.

[8] In each manufacturing sector the classification of exports in each market segment is made at the product level before summing the values attributed to each segment in each sector.

Box 4. Computation of distances

The idea is to calculate the distance between two countries based on bilateral distances between the biggest cities of those two countries, those inter-city distances being weighted by the share of the city in the overall country's population. This procedure can be used in a totally consistent way for both domestic and international distances. The distance is based on data from the *World Gazetteer* website, which provides current population figures and geographic coordinates for cities, towns and places of all countries. The calculation is based on the general formula developed by Head and Mayer (2002),

$$d_{ij} = \left(\sum_{k \in i} (pop_k / pop_i) \sum_{\ell \in j} (pop_\ell / pop_j) d_{k\ell}^{\sigma} \right)^{1/\sigma} \quad (2)$$

where pop_k (pop_l) denotes the population of agglomeration k (agglomeration l) belonging to country i (country j). σ measures the sensitivity of trade flows to bilateral distance d_{kl} and is set to -1, which corresponds to the usual coefficient estimated from gravity models of bilateral trade flows.

We firstly run OLS regressions of bilateral trade flows, weighted by the log of their value. Working with a very large and heterogeneous dataset, we avoid giving the same importance to tiny trade flows, more likely to be measured erroneously, and very large trade flows between major countries. All variables are in logarithm. The standard gravity equation however includes prices or country fixed effects aimed at controlling for prices. We accordingly include country fixed effects (for exporters and importers) in the second column of Table 13.

A last concern is with zero flows, which cannot simply be ignored since they carry information. If zeros are due to censoring, the estimators are biased, and this is an important concern at the sector level, where zero values are more frequent. A Poisson Maximum Likelihood method can be suitable under such circumstances (see Santos Silva and Tenreyro, 2006). Note that the explained variable is then the value and not the log value of bilateral exports. The Vuong test discriminates between standard Poisson Pseudo-Maximum Likelihood estimates and Zero Inflated Poisson Estimates (large negative values of the test statistic favour the Poisson, while large positive values favour the ZIP). Based on this test we perform estimations of the latter kind at the sectoral level, in order to check the robustness of our results. In a first step, a probit explains the presence of zero values, while in a second step, the parameters of interest are estimated accordingly.

Table 13. Explaining bilateral exports in a panel of 163 countries and 10 years

Model:	Bilateral trade		Sectoral trade		
	OLS, log (1)	OLS, log (2)	OLS, log (3)	OLS, log (4)	ZIP, level (5)
Intercept	–31.08[a]	–14.39[a]	–13.91[a]	–9.37[a]	4.07[a]
	(0.31)	(1.64)	(0.37)	(0.83)	(0.05)
Low prices	6.34[a]	6.45[a]	10.60[a]	3.70[a]	13.80[a]
	(0.17)	(0.17)	(0.24)	(0.12)	(0.00)
Distance * low	–1.08[a]	–1.37[a]	–0.89[a]	–1.22[a]	–0.93[a]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.00)
Distance * high	–1.03[a]	–1.31[a]	–0.77[a]	–1.19[a]	–0.72[a]
	(0.01)	(0.02)	(0.02)	(0.02)	(0.04)
Language * low	0.79[a]	0.71[a]	0.87[a]	0.61[a]	0.33[a]
	(0.04)	(0.04)	(0.06)	(0.05)	(0.00)
Language * high	0.97[a]	0.87[a]	0.96[a]	0.69[a]	0.07[a]
	(0.04)	(0.04)	(0.05)	(0.05)	(0.00)
Exporter GDP	0.95[a]	0.01			
	(0.01)	(0.02)			
Importer GDP	0.74[a]	0.59[a]			
	(0.01)	(0.02)			
Exp. sectoral production			0.73[a]	0.75[a]	0.89[a]
			(0.01)	(0.01)	(0.00)
Imp. sectoral demand			0.60[a]	0.27[a]	0.34[a]
			(0.01)	(0.01)	(0.00)
Exp. GDP PC * low	0.09[a]	0.65[a]	–0.20	–0.36[a]	–0.41[a]
	(0.02)	(0.06)	(0.02)	(0.08)	(0.00)
Exp. GDP PC * high	0.43[a]	0.99[a]	0.49[a]	–0.12	0.42[a]
	(0.02)	(0.06)	(0.02)	(0.08)	(0.12)
Imp. GDP PC * low	–0.03[b]	0.40[a]	–0.05[b]	0.58[a]	0.83[a]
	(0.01)	(0.06)	(0.02)	(0.08)	(0.00)
Imp. GDP PC * high	0.24[a]	0.68[a]	0.26[a]	0.69[a]	1.25[a]
	(0.01)	(0.06)	(0.02)	(0.08)	(0.00)
N	218 981	218 981	890 174	890 174	1 730 322
R^2	0.702	0.793	0.595	0.706	–
RMSE	1.575	1.313	1.707	1.454	–
Country fixed effects	–	yes	–	yes	yes
Sector fixed effects	–	–	yes	yes	yes
Time effects	yes	yes	yes	yes	yes
Vuong test	–	–	–	–	478.30

Note: The estimated equation at the sectoral (ISIC) level is (for column 2):

$$\ln X^t_{ij,k,g} = \alpha + \beta_1 \ln GDP^t_j + \beta_2 \ln GDP^t_j + \beta_3 g_1 \ln GDPPC^t_i + \beta_4 g_3 \ln GDPPC^t_i + \beta_5 g_1 \ln GDPPC^t_j + \beta_6 g_3 \ln GDPPC^t_j + \delta g_1 z_{ij} + x g_3 z_{ij} + u_k + u_i + u_j + u_g + u^t + \varepsilon^t_{ij,k} \quad (3)$$

where g indicates the market segment (g_1: low; g_3: high) in which exports of HS6 products take place in ISIC industry k ($k = 1, \ldots, 25$), z is a vector of bilateral resistance terms (distance and language) between exporter i and importer j. For the Zero Inflated Poisson regression in column (5) we use the value of exports instead of the log value as dependent variable.

Standard errors in parentheses take into account the correlation of the error terms for a given dyad of countries. Superscripts a, b and c denote statistical significance at the 1%, 5% and 10% levels, respectively.

Source: BACI, and authors' calculations.

We report in column (1) results for the whole sample without sectoral dimension (218 981 observations) and excluding country fixed effects. In column (2) country fixed effects are introduced: the meaning of the GDP variables accordingly change, since only the time dimension of the latter variables is then taken into account.

Columns (3) and (4) report the results for the estimations at the sectoral level (ISIC sectors), with sector fixed effects, and differ according to whether country fixed effects are included or not. There are 890 174 observations, which is much fewer than 25 × 218 981 because, firstly, not all countries do trade in every industry, and, secondly, information is not available on trade and production in the same classification for every country.

Column (5) relies on the ZIP estimator. Limiting the sample in column (5) to the bilateral relationships for which trade is recorded at the sectoral level for at least one market segment (either low, middle or upper), we would get 134 199 zero bilateral sectoral flows and 925 385 non-zero values adding up to 1 059 584 observations. But using the full set of censored values, including the ones pertaining to bilateral flows without any trade, we add 804 937 zero values adding up to 1 730 322 observations. We estimate the probability of trading or not in the upper and lower market segments using this second and larger dataset, before explaining bilateral export values of the two types of variety.

5.2. Supply and demand determinants of trade in varieties

Let us firstly consider the estimations performed on total bilateral trade, in columns (1) and (2). The standard gravity variables have the expected sign and order of magnitude, with the exception of the GDP of the exporter when country fixed effects are introduced.

More interestingly, we can now assess the theoretical predictions referred to above. The parameters on distance interacted with the market segment of the exported varieties (low versus high) illustrate the Alchian-Allen conjecture. Low price varieties are slightly more sensitive to transaction costs than high price ones. This result holds in all the specifications here.

Consider next the theoretical predictions concerning the supply and demand effects of the level of development on the unit value of shipped varieties. Do we observe a within product specialization in line with standard trade theory? We do, since the elasticity associated with the interacted variable on the per capita GDP of the exporter is larger for up-market varieties than for low-market ones. Turning to the demand side effects, we ask whether countries import more of those varieties shipped at a higher unit value, when their income increases. We observe a large difference in the parameter estimated on the importer GDP per capita variable, when it is interacted with low and high prices dummies, indicating that marginal income may be spent on quality rather than on quantity.

Turning to estimations at the sectoral level in columns (3) and (4), the previous conclusions hold. The sectoral determinants in terms of supply and demand have the

correct sign. Considering our main variables of interest, namely the interacted variables between per capita income and the market segment in which varieties are traded, results are even clearer. In column (3), when the development level of the exporter increases, exports of varieties in the lower segment of the market decrease, and the opposite holds for the upper segment. We observe the same pattern on the importer side. Accordingly, we can conclude that countries having a higher development level are specialized in varieties having a higher unit value, in the different sectors of their specialization. There is a specialization within sectors, across varieties, in line with the central argument of this paper.

We are less confident in the estimations reported in column (4): the introduction of country fixed effects aiming at controlling for unobserved prices has an undesired consequence; the level of economic development of countries is also captured by these effects, and our interacted variable on the GDP per capita accounts only for the change in this variable. Accordingly, while an increase in the income level of the exporter translates into diminishing exports of down-market varieties, the expected increase in exports of high-market varieties is not observed (the parameter is no longer significant).

As mentioned, however, all these estimates may be biased by the presence of zero values in the sample. In order to assess the robustness of our conclusion, we must proceed in two steps, by using a ZIP estimator. In column (5) we report results obtained by using the ZIP estimator and, accordingly, by taking into account the probability of not exporting in a given market segment of a given sector on a given market in a given year. The results are broadly robust to this change. When an exporting country is moving up the ladder of development, it increases its exports of high-price varieties and reduces its shipments of low-price varieties in the same industrial sector. On the import size, when an importing country gets richer, it imports more of all varieties, but this increase is more pronounced for high-price than for low-price ones.

6. CONCLUSION

Analyzing a database of bilateral trade, we have systematized in this paper the repeated finding of the trade literature that there is considerable variation in unit values of traded products at the most detailed level of products classification. Accordingly, international specialization is taking place within products across varieties, rather than across products or industries, especially for trade between advanced and emerging economies. Our results point to four stylized facts.

Firstly, the similarity of exports between North and South is much more limited when we consider differentiated varieties. At the industry level, the similarity between Chinese and EU exports is large. When we consider products this similarity is more limited. When we consider the market positioning of *varieties*, this similarity is further reduced.

Secondly, and this generalizes Schott's findings, the unit value of exported products to a certain market varies with the level of development of the exporter. Moreover, unit value of traded products is also affected by the distance, and this sheds light on plausible determinants on the supply side.

Thirdly, and according to the role played by traditional determinants of specialization now operating across varieties, the observed redistribution of market shares at the world level has been especially detrimental to advanced economies for low price varieties, while the EU has better resisted competition in high price varieties, in particular in consumer goods.

Fourthly, bilateral trade in varieties can be explained by a gravity equation controlling for the supply side and the demand side determinants considered in the literature, as well as for the determinants of their specialization within products across varieties and demand for quality.

On the basis of such detailed and systematic empirical evidence regarding the specialization of countries *within* – rather than *between* – products, the fears raised by North–South competition may be exaggerated. China may be exporting under quite as many product headings as Germany, but, at the most detailed level of the international classification of products, varieties exported, for instance, by Germany and China are not in direct competition. And if workers in the North and the South hardly compete on the same varieties, the link between trade and factor prices is somehow weakened (subject to the degree of substitution between high and low quality goods).

Our analysis confirms that advanced economies are keeping an advantage, or are at least suffering a lesser disadvantage, in the upper market segment. It also indicates that the North and the South are not competing head on within industries. Still, this need not prevent domestic labor market effects, and further research should explore the impact of systematic repositioning on up-market varieties by advanced economies' firms.

Discussion

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This paper makes a number of important contributions to the growing literature that has emerged following Schott (2004), which establishes that specialization occurs at finer levels of commodity disaggregation than traditionally thought. The paper's findings are closely linked to policy debates about the extent to which workers in advanced industrialized countries compete with those in developing countries such as China. In traditional theories of international trade, such as the Heckscher–Ohlin model, international trade can have very different effects on the real income of factors of production depending upon patterns of specialization. If countries produce the same products, reductions in prices due to the integration of developing countries

into the world economy imply, via zero-profit conditions, changes in nominal factor prices in advanced countries. In contrast, if countries produce different products, reductions in prices due to international integration constitute a pure terms of trade gain for workers in advanced countries.

One of the key findings of this paper, and of the wider literature on within-product specialization, is that there are large differences in unit values (the ratio of values to quantities shipped) across countries even within narrowly defined products shipped to the same market within the same year. A key challenge for international economics is establishing the reasons for this variation in unit values. A natural explanation, which is considered in this paper, is that the products observed in the data are too aggregated. On this line of thinking, countries are really specializing in different goods, which only appear to be the same product, because of the use of too coarse a commodity classification in international trade statistics.

To delve deeper and identify the nature of the differences in goods across countries within products raises a number of issues. As discussed by the authors, one explanation for the variation in unit values across countries within products is variation in product quality. But distinguishing vertical differentiation in the form of quality differences from horizontal differentiation that sustains differences in quality-adjusted prices is extremely challenging. Recent work has sought to make progress in distinguishing variation in quality from variation in quality-adjusted prices through the structural estimation of demand systems (see e.g. Hallak and Schott, 2005).

This paper finds that bilateral distance has a positive and highly statistically significant effect on unit values, which connects with recent debates about product quality and the Alchian-Allen hypothesis (see, in particular, Hummels and Skiba, 2004). The goods produced by countries within products may vary not only in terms of their demand-side characteristics, such as quality, but also in terms of their supply-side characteristics, such as factor intensity. Schott (2004) presents evidence that within-product variation in unit values is systematically related to countries' capital and skill abundance, and this paper finds that within-product variation in unit values is systematically related to countries' GDP per capita, which is itself likely to be correlated with capital and skill abundance.

The question arises as to how to interpret the rich array of empirical results reported by the authors in terms of international trade theory. Here two very different stances can be taken.

On the one hand, the results appear entirely consistent with traditional trade theory. On this interpretation, comparative advantage operates at the level of individual varieties or qualities within products, perhaps modelled as in Eaton and Kortum (2002). Specialization within products therefore naturally arises. Products are simply aggregations across heterogeneous varieties or qualities chosen by statistical agencies and industries are further aggregations of products. On this view, traditional trade theory was right after all, but existing empirical work may have considerably underestimated the amount of specialization by focusing on variation across products and industries.

On the other hand, recognizing that comparative advantage operates at a finer level of disaggregation than conventionally thought can profoundly change the conclusions of what otherwise appear to be relatively standard trade models. Thus Feenstra and Hanson (1996) show that the outsourcing of activities that are labor-intensive in the North but skill-intensive in the South can lead to a rise in the relative skilled wage in both the North and South. This result stands in marked contrast to the Stolper-Samuelson Theorem of traditional trade theory, in which the relative skilled wage rises in the skill-abundant North and falls in the skill-scarce South. In an influential paper Grossman and Rossi-Hansberg (2006) develop a general equilibrium model of trade in which the outsourcing of tasks within industries can potentially raise the relative wage of unskilled workers in skill-abundant countries. The intuition is that outsourcing acts to raise productivity within industries, which has general equilibrium consequences for relative factor prices. Again this finding stands in marked contrast to conventional wisdom, in which international integration is expected to lead to a fall in the relative wage of unskilled workers in skill-abundant countries. On this interpretation of the evidence, the recognition that specialization occurs at the level of finely-detailed products or production tasks leads to entirely new theoretical results and can overturn standard intuitions.

Therefore the paper's empirical findings are not only of interest in themselves but also provocative and stimulating for international trade theory. This ongoing dialogue between empirical evidence and theoretical modelling promises to considerably enhance our understanding of the causes and consequences of international trade.

Panel discussion

Several panel members were concerned with possible confusion in the data between quality differences, and price differences for given quality. Ray Rees thought that the long-lasting differentials measured and analyzed in the paper should indeed reflect vertical differentiation in terms of quality, because competition should eliminate price differences for goods of the same quality. Christian Schultz however wondered whether price differences and dynamics could be attributable to market power. In particular, a different and changing competitive environment in Europe and the US could explain some of the paper's findings. Hylke Vandenbussche thought that some of the price differences could reflect quality perceptions influenced by advertising or reputation, rather than intrinsic characteristics of the goods traded.

The panel was also intrigued by the difference between European and American trade trends. Josef Zweimueller thought that the aggregate European data might be importantly influenced by catch-up dynamics on the part of new Member States of the EU. Richard Portes was puzzled by the apparent lack of any influence in the paper's data of the large swings in the exchange rate between the euro on the one

hand, and the US dollar and the renmimbi on the other hand. Peter Schott suggested that the paper's evidence is consistent with outsourcing to less developed countries of low quality production, while Europe concentrates on production of high quality goods, and that Japanese outsourcing to China of increasingly sophisticated production could also play a role. Allan Drazen was interested in the paper's evidence that competition between old and new industrial countries might not be as sharp as to trigger tough protectionist policies, but thought that expectations of trade pattern dynamics may well induce established producers to pre-empt incipient competition with trade barriers.

APPENDIX A

A1. Data description

The BACI database draws on United Nations' COMTRADE data and covers trade for more than 200 countries and 5000 products, between 1995 and 2004. Only 4528 manufactured products are considered here. Imports and exports flows are reported annually by 140 countries to United Nations in values and quantities at the HS6 level. The HS6 distinguishes more than 5000 different products, out of which 4200 are manufactured products. There are 16 380 products in 2001 in the 10-digit classification used by Schott (2004) for US data. This loss of detail is the price to be paid when one aims at using data covering all the importing countries in the world.

New procedures have been developed in the BACI database in order to provide a disaggregated and rigorous trade dataset for the largest possible number of countries and years, with special care given to the treatment of unit values.

When only one country reports the observed flow, there is no way of assessing the quality of this specific record. When both the exporting and the importing country report, we have two figures for the same flow, which have to be reconciled given the, often huge, discrepancies between them. An evaluation of the reliability of country declarations is then used as a weighting for the average of mirror values, unit-values and quantities.

In order to evaluate the reliability of countries reporting (as exporters or importers) we decompose the absolute value of the ratios of mirror flows using a (weighted) variance analysis. The error variable (absolute value of the natural log of the ratio of mirror flows) is regressed on four sets of fixed effects concerning exporters, importers, products and years. The OLS estimator is used, each trade flow being weighted with the natural log of the sum of the two reports.

$$\left| \ln\left(\frac{VM_{(FOB)}}{VX_{(FOB)}} \right)_{i,j}^{hs6,t} \right| = \sum_i \alpha_i \cdot I_i + \sum_j \beta_j \cdot I_j + \sum_t \gamma_t \cdot I_t + \sum_{hs6} \lambda_{hs6} \cdot I_{hs6} + error \qquad (4)$$

VM and *VX* are respectively the report by the importer (adjusted to account for transport costs: see below) and by the exporter. *I* denotes dummy variables for exporters (index *i*), importers (index *j*), years (index *t*) or products (index *hs*6). Estimated country fixed effects give the marginal impact on discrepancies between reported flows that

Table A1. Treatment of intra-EU trade in the text of the article

Issue	Unit values	Trade
Market positioning	Intra-EU trade excluded	Intra-EU trade included
Market shares		
Relative unit values	Intra-EU trade excluded	

can be attributed to country characteristics cleaned from sectoral, temporal and geographical (exporter or importer) effects. We assume they represent the (relative) reliability of a country data report, that will be used, after transformation, as weights in the reconciliation of bilateral flows.[9]

Besides reconciling the data, the aim was to have a matrix of world trade free of freight costs. Import values are reported CIF (cost, insurance and freight) and the exports are reported FOB (free on board). We use a gravity-type equation to get the FOB-FOB data. To allow the comparison between mirror declarations, CIF costs have to be estimated and removed from import values to compute FOB import values. This procedure is not applied when it widens the gap between mirror flows. We use a gravity-type equation to estimate them.

A gravity-type equation, estimated by OLS on pooled data is used to estimate freight costs:

$$\ln(UVM_{ij}^{kt}/(UVX_{ij}^{kt}) = \alpha + \beta \ln dist_{ij} + \chi \ln(dist_{ij})^2 + \delta \ln UV^k + \gamma\ contiguity_{ij} + \phi\ landlocked_i + \eta\ landlocked_j + \sum_{l=1989}^{2004} \varphi_l t_l + \varepsilon_{ij}^{kt} \quad (5)$$

The right-hand-side variables are bilateral distance ($dist_{ij}$), dummies for adjacent and for landlocked countries (respectively, $contiguity_{ij}$, $landlocked_i$ *and* $landlocked_j$), dummies for years (t_l), and the world median unitvalues for each product ($UV^{k,t}$). We consider a non-linear relationship between CIF-FOB ratios and distance by introducing also the square distance. *UVM* and *UVX* are respectively the unit value reported by the importer (valued CIF) and by the exporter (valued FOB). The dependent variable is the unit-value ratios reported for a given elementary flow, rather than the ratios of mirror values, because we observe a strong positive relationship between values and quantities (errors, or non-documented differences in ways of reporting are likely to affect values and quantities in the same way). For the same reason, we also weight observations by the inverse of the gap between reported mirror quantities, noted *QX* and *QM*: $\text{Min}(QX_{ij},QM_{ji})/\text{Max}(QX_{ij},QM_{ji})$, where *i* is the exporter and *j* is the importer.[10]

[9] For instance, what matters is the share of poor/good reporters in its trade partners and the share of products with frequent report errors, for instance because of lack of homogeneity in the 6-digit position.

[10] As expected, we find that CIF costs increase with distance and decrease with unit value. Notice that, apart from reporting errors, the left-hand-side variables should be only CIF since the net of freight trade value (which depends on distance) is present both in the numerator and the denominator of the ratio of mirror reports variable. Therefore, the effects of distance and other gravity variables on freight and on trade values are identified separately.

Since this gives the higher weight to trade flows equally reported by partners, differences between reported import and export values are then more likely to be freight costs.

A2. Classification of varieties into three market segments

The classification of unit values of exported varieties in three ranges (low, medium, high) which we adopt is suitable when one thinks of a continuum of vertically differentiated products. Indeed, we use data at the 6-digit level, involving different traded goods aggregated under the same HS6 heading, reported by several firms of a given country on several dates by year. We decided not to classify each trade flow in unique single vertical specialization positioning. Instead, we propose a smoother procedure that divides each elementary trade flow into two ranges, either low range and medium range, or medium range and high range.

We proceed as follows. We define the relative unit value ratio for any trade flow s: $r = (UV_s/UV_{world})$, where the reference group is the trade weighted (geometric) average of UV over all flows in the world.

If $r < 1$ then the value of flow s is divided into low and medium ranges as follows: the share of low range is $(1 - r^{\alpha})$ and the share in medium range is the complement (r^{α});

If $r > 1$ then the value of flow s is divided into high and medium ranges as follows: share in top range is $(1 - 1/r^{\alpha})$ and share in medium range is $(1/r^{\alpha})$;

Table A2. Manufacturing exports of emerging countries

Country	Share in emerging countries manufacturing exports, 2004, %
China	49.4
Malaysia	9.0
Thailand	6.8
Brazil	5.6
India	5.3
Russia	4.9
Indonesia	4.2
Philippines	3.5
South Africa	2.7
Argentina	1.6
Chile	1.5
Vietnam	1.3
Pakistan	1.0
Bangladesh	0.7
Tunisia	0.7
Costa Rica	0.6
Egypt	0.4
Sri Lanka	0.4
Ecuador	0.2
Mauritius	0.1
Mozambique	0.1
Uganda	0.0
Sudan	0.0

If $r = 1$ the whole flow is ascribed to medium range.

This procedure prevents the threshold effects that would be present if each trade flow were assigned to a single positioning: a small change in α implies a small change in quality classification. The lower α, the higher the share of trade in the medium range. In the calculations here, the parameter α that regulates the smoothness of the market segment allocation function is set at 4 to have around the same value in average in each range for total trade in all products.

However, one shortcoming of this method is that it does not ensure stability of the shares of the three segments for the world total. As a robustness check, we applied a more simple method: market segments were simply defined by percentiles in each year (down-market under the 33th percentile of unit-values, up-market above the 67th percentile, middle-market in the middle of the distribution). Our conclusions are robust to such a change.

An additional problem is that the matrix of world trade is not completely filled, even when mirror reports are taken into account. In particular, quantities are not systematically reported for certain reporters. For instance, if India does not report the quantity shipped of a given product to a given market and if the importer is not reporting its trade at all, then the quantity will not be available. When the quantity is missing, we calculate bilateral market shares for up-market varieties, assuming that non-allocated flows are distributed by market segment in the same way as allocated flows. As concerns world market shares by market segment, dropping non-allocated flows would minimise the world market share of countries having more missing quantities. Therefore, we attribute missing flows to market segments in proportion of the allocated flows, for each pair of countries before computing market shares.

A3. How intra-EU trade and associated prices are taken into account

A specific issue arises with prices (unit values) observed within the Single European Market. As a result of the fragmentation of this market, one might observe a specificity of the varieties shipped within Europe. We may include or exclude trade among member countries. However, excluding trade flows that represent the lions share of member states' trade might bias our judgement with regards to their market positioning. At the same time, using world unit values, comprising intra-EU trade flows, to determine market segments in which Member states are specialized, would not be satisfactory either.

In order to bypass this difficulty, world unit values are computed by *excluding* intra-EU flows throughout this article. Intra-EU trade flows are taken into account for the determination of market positioning but excluded when it comes to market shares in order to avoid artificially boosting the European market share in the upper segment of the market as a result of higher European prices. Lastly, relative unit values are computed by excluding intra-EU trade flows. These methodological choices are summarized in Table A1. Alternative choices are provided for the sake of comparison in an appendix available on the journal website.

A4. The CEPII list of emerging countries

Countries in the CEPII's list of emerging countries have been selected according to two criteria: GDP per capita of less than half the average of industrialized countries; rate of export growth at least 10% higher than the average for industrialized countries. These criteria must be fulfilled either during two of the three sub-periods (1985–90, 1990–95, 1995–2002) or in the latest only (1995–2002).

We obtain a list that includes three members of the EU and Korea. Those four countries are dropped, Korea being considered as an industrialized country. This list could have been updated by taking into account more recent data. However we preferred to keep the original list unchanged, in order to favour comparability with previous work (Fontagné *et al.*, 2004). Furthermore, actualizing the list would have very little consequence for small countries.

Table A2 reports the share of each emerging country in the total of manufacturing export in 2004. China represents about half the total exports by emerging countries, while countries as Mozambique, Uganda and Sudan are marginal exporters.

A5. Additional detail tables

Available at http://www.economic-policy.org.

Table A5. Similarity of export structures at the *transformation* level (within BEC categories, 1995 and 2004)

1995	Brazil	China	Japan	Russia	India	USA	EU-25	Oth. Em.
Brazil	.							
China	0.65	.						
Japan	0.80	0.62	.					
Russia	0.80	0.45	0.65	.				
India	0.81	0.77	0.74	0.68	.			
USA	0.85	0.62	0.95	0.70	0.76	.		
EU-25	0.81	0.74	0.83	0.62	0.80	0.84	0.85	
Oth.Em.	0.72	0.76	0.63	0.59	0.81	0.64	0.73	0.71

Source: BACI-CEPII. Authors' calculations.

2004	Brazil	China	Japan	Russia	India	USA	EU-25	Oth. Em.
Brazil	.							
China	0.8	.						
Japan	0.91	0.84	.					
Russia	0.74	0.54	0.69	.				
India	0.88	0.79	0.79	0.71	.			
USA	0.92	0.78	0.94	0.76	0.81	.		
EU-25	0.89	0.84	0.88	0.67	0.82	0.85	0.88	
Oth. Em.	0.77	0.71	0.71	0.65	0.78	0.7	0.76	0.7

Source: BACI-CEPII. Authors' calculations.

A6. Distribution of the median elasticity of export prices to GDP per capita of the exporting country

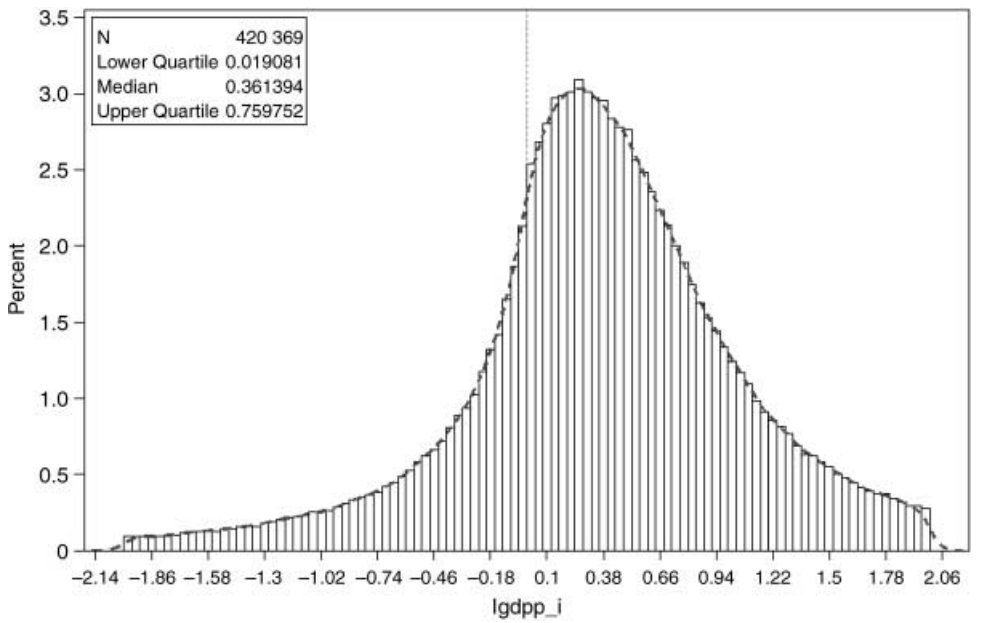

Figure A6.1. EU imports, 1995 to 2004, Member states considered individually

Source: BACI, and authors' estimation using a log linear specification.

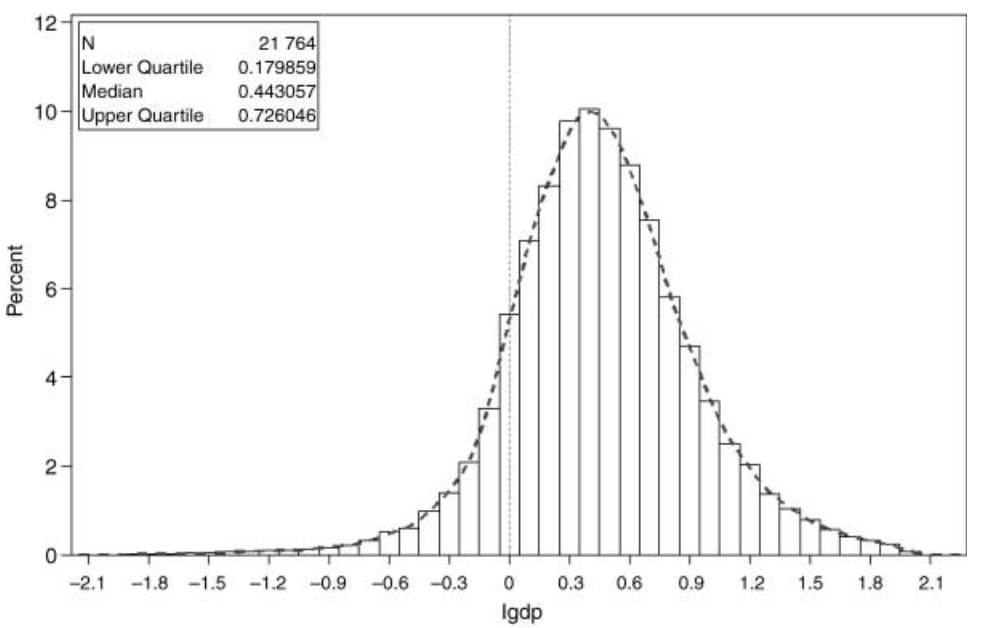

Figure A6.2. Japanese imports

Source: BACI, and authors' estimation using a log linear specification.

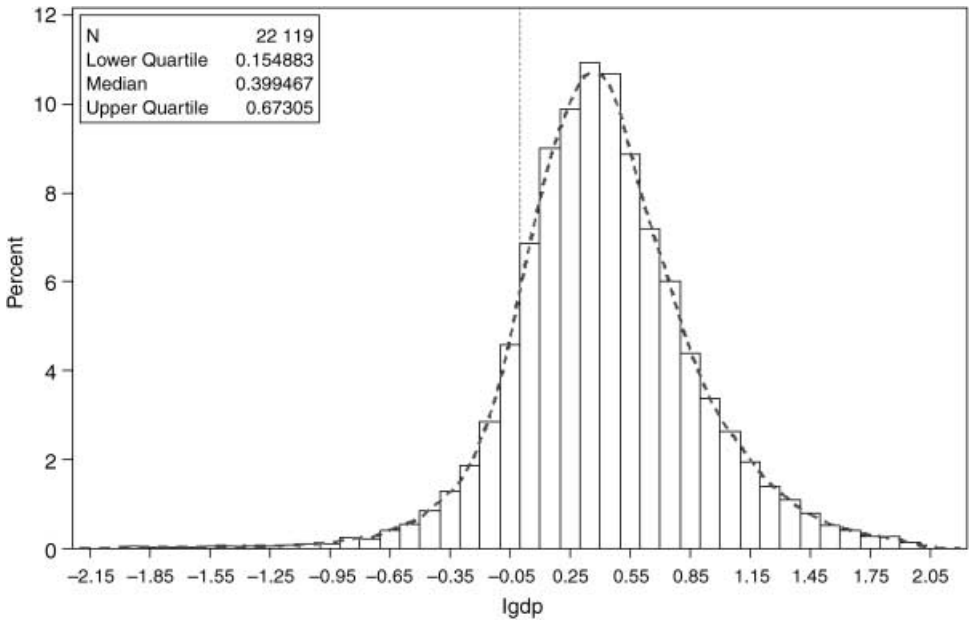

Figure A6.3. US imports, 1995 to 2004

Source: BACI, and authors' estimation using a log linear specification.

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