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The international commodity trade

Stylized facts

Vincenzo De Lipsis, Paolo Agnolucci and Raimund Bleischwitz

1 Introduction

The fundamental question about what conditions ensure sustainable water security must be understood having in mind the crucial nexus between water, energy and food production. Future water security will depend on the behaviour of several economic actors that interact mainly within the mechanism of international commodity markets. One of the common complaints about markets as allocation mechanism is their inability to correctly assess the sustainability of certain economic activities. The value of the water resources consumed to produce important staples, for instance, is not reflected in market prices, with the consequence of ignoring the risks related with an excessive use of water resources (Allan, 2011). Despite most of the virtual water included in food commodities remains within the national borders of the producers, an increasing portion is now being internationally traded, which has helped provide water security in regions in need but has not guaranteed its sustainability. On the other hand, a crucial role is played by consumer preferences with respect to water consumption, which is a function of demographic trends, food behaviour and diets. For all these reasons it becomes fundamental to understand how the very place of interactions among all these players actually work, and how its features have

changed over time. Therefore, to fully understand the implications that the nexus has for current important global issues we cannot transcend from analysing the characteristics of international commodity markets.

The recent dynamics in the price of primary commodities has attracted considerable interest in these markets. After a long period of high price levels, we have witnessed a substantial decline in commodity prices, since 2011 in the case of metals and agricultural products, and since 2014 in the case of crude oil. These changes are related to modifications in the numerous factors that lie behind supply and demand in the market, with some of these aspects being temporary shocks, while others reflecting more permanent transformations of the market structure. In this chapter we shed some light on this latter group of phenomena by looking at important stylized facts of the structure and the evolution of some specific commodity markets. We put the recent events in a broader historical perspective by focusing on the international dimension of the modern commodity industry, and in particular on the recent trade pattern that has emerged among different countries and world regions.

The new role played by Asian emerging economies, and in particular by China, has had a strong impact on the configuration of the trade flows in both manufactures and primary commodities. By considering the price of important commodities some commentators have referred to this as an example of super cycle, drawing a comparison with previous episodes of industrialization involving major countries.[1] We analyse recent data on both the monetary and physical dimensions of the international trade in major commodities to uncover the trade inter-dependence between different countries in the world, and highlight some important peculiarities in the ongoing development of commodity markets. Our attention is focused on three main dimensions that characterize the commodity sector. First, we use publicly available datasets to

understand to which extent are individual markets globally integrated, looking at volumes of exports and production. Second, we examine the direction of commodity trade flows between different geographical regions, in order to identify which countries can be described as world suppliers or consumers with respect to important commodity products. Third, we measure the supply concentration of commodity markets, which represents an important feature of market structure.

We start in Section 2 by providing a brief taxonomy to illustrate the distinctive features of specific groups of commodities, and assessing their importance in the economic development of a country. In Section 3 we offer a brief description of the most important historical events that have transformed the structure of commodity markets. In particular, we will describe how technological progress has dramatically reduced transportation costs and facilitated the emergence of global commodity markets. A description of the geography of production and consumption of different commodities is the topic of Section 4. In that section we examine how the importance of different countries in the international trade has evolved over time, and analyse recent data on real imports of commodities to assess the magnitude of the influence of China in the international trade patterns. In Section 5 we examine how market concentration for some essential commodities has changed in the last few decades, and identify which countries have played the role of dominant supplier of important primary goods, while the growing importance of international trade in water is the subject of Section 6. Final remarks and a summary of the main findings can be found in Section 7.

2 Taxonomy

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A well-known feature of economic development is the declining importance of the primary sector in the national output. Interestingly, most of the reduction in the relative size of the primary sector is due to agriculture. Only a slightly decreasing trend is generally observed for the mining industry, while the energy sector has been responsible for a fairly constant, sometimes increasing, share of the national output. As shown in Table 20.1, a fall in the size of the primary sector as a proportion of GDP can be observed in most countries between 1970 and 2014. A slower decrease, or sometimes an increase, in the importance of the primary sector in the wealth generation process can be explained as the result of large investments in the energy production, e.g. in Norway and Russia, or mining capacity, as for instance in Australia and Argentina.

While defining commodities as the output from the primary sector is useful when analysing economic growth, it is not appropriate when studying commodity trade between countries. A commonly accepted definition of commodities in the international trade literature is the one incorporated in the Standard International Trade Classification (SITC), adopted by the UN.

Table 20.1 Output from the primary sector, and the mining and energy sector, as a share of GDP

		1970	1978	1987	1996	2005	2014	
Argentina	Primary	0.4	.5	0.8	.4	6.0	6.5	
	Mining and energy	.2	.1	.9	.4	.6	.3	
Australia	Primary	3.6	6.2	4.1	1.2	2.8	4.4	

	Mining and energy	.1	.2	.5	.6	.8	2.0	
Brazil	Primary	4.6	3.1	4.3	.7	2.0	2.0	□
	Mining and energy	.0	.8	.9	.5	.5	.4	
Canada	Primary	1.5	3.5	1.4	1.0	3.3	1.8	
	Mining and energy	.1	.3	.3	.0	1.5	0.1	
Chile	Primary	9.0	6.6	0.5	5.3	2.8	8.2	□
	Mining and energy	3.7	1.0	3.9	0.1	8.7	4.8	□
China	Primary	1.6	2.1	4.5	0.6	1.2	7.0	□
	Mining and energy	6.4	3.9	7.8	1.0	.1	.6	□
France	Primary	.8	.1	.6	.7	.6	.2	
	Mining and energy	.3	.5	.1	.0	.7	.6	

Germany	Primary	.2	.0	.8	.4	.9	.8	
	Mining and energy	.1	.5	.3	.3	.1	.1	
India	Primary	6.5	1.2	7.0	4.6	5.6	1.8	□
	Mining and energy	.8	.0	.2	.3	.3	.8	□
Indonesia	Primary	7.7	3.1	1.8	1.8	4.2	5.0	□
	Mining and energy	.0	7.1	2.1	.0	2.0	1.3	□
Israel	Primary	.4	.5	.7	.9	.8	.8	
	Mining and energy	.6	.3	.0	.1	.1	.5	□
Italy	Primary	1.5	.0	.1	.3	.0	.3	
	Mining and energy	.8	.4	.9	.0	.7	.1	□
Japan	Primary	.8	.3	.0	.5	.6	.1	

	Mining and energy	.9	.9	.3	.8	.4	.9	
Mexico	Primary	9.7	9.5	9.2	6.8	6.6	5.8	□
	Mining and energy	.2	0.4	1.8	1.3	3.4	2.5	□
Nigeria	Primary	9.4	6.7	5.8	7.4	0.5	1.8	□
	Mining and energy	.3	.1	0.8	0.1	4.9	1.6	
Norway	Primary	.8	4.8	7.4	2.6	0.3	6.5	□
	Mining and energy	.0	0.1	3.7	0.1	8.7	4.8	□
South Korea	Primary	6.6	8.2	6.0	.2	.0	.3	□
	Mining and energy	.8	.7	.0	.7	.8	.0	□
Russia	Primary				8.1	9.4	8.4	
	Mining and energy				0.9	4.4	4.2	

South Africa	Primary	8.1	3.8	1.0	4.0	1.9	4.6	□
	Mining and energy	0.9	7.0	5.4	.8	.2	2.1	□
United Kingdom	Primary	.4	.9	.3	.9	.1	.8	
	Mining and energy	.0	.0	.8	.5	.5	.1	□
United States	Primary	.0	.9	.7	.9	.5	.7	□
	Mining and energy	.7	.6	.2	.5	.5	.5	□

Key: upward trend (□); strong upward trend (□□), fluctuating (□□), stable (−), downward trend (□), strong downward trend (□□)

Source: United Nations Statistics Division

Within the approach incorporated in the SITC, we will use the taxonomy of commodities in four major classes proposed by Radetzki (2008):

1 unprocessed and processed food

a. Food and live animals (SITC 0)

b. Beverages and tobacco (SITC 1)

c. Oil seeds, oil nuts and oil kernels (SITC 22)

d. Animal and vegetable oils and fats (SITC 4)

2 agricultural raw materials

a. Hides, skins and fur skins, undressed (SITC 21)

b. Crude rubber including synthetic and reclaimed (SITC 23)

c. Wood, lumber and cork (SITC 24)

d. Pulp and paper (SITC 25)

e. Textile fibres, not manufactured, and waste (SITC 26)

f. Crude animal and vegetable materials, n.e.s. (SITC 29)

3 minerals and metals

a. Crude fertilizers and crude minerals, n.e.s. (SITC 27)

b. Metalliferous ores and metal scrap (SITC 28)

c. Iron and steel (SITC 67)

d. Non ferrous metals (SITC 68)

4 mineral fuels

a. Mineral fuels, lubricants and related materials (SITC 3).[2]

3 Globalization of commodity markets

Technological progress and trade policy in the 19th and 20th centuries have been the main drivers of the considerable integration of commodity markets, although this process has not occurred in a linear fashion due to historical events such as wars and recessions (Findlay and O'Rouke, 2003). Before the full completion of the Industrial Revolution, huge transportation costs prevented long-distance shipping of goods other than valuable commodities like coffee, spices and certain metals. Radetzki (2008) identifies two fundamental moments in history when innovation transformed the transportation technology, especially for bulk materials. The first occurred in the second half of the 19th century and consisted in the application of the steam engine to transport and in the introduction of refrigerated ships.[3] The second historical episode is the block of the Suez Canal in the 1950s, which created the incentives for the shipping industry to develop large carriers suitable for long-distance transportation of bulk materials such as iron ore and coal. Both occasions determined a plunge in the incidence of transportation costs on the final price level, and a substantial rise in the long-distance maritime trade.

The most important consequence of these changes was a greater price convergence of many commodities across the regional markets of the time, a clear signal of the emergence of global markets for food, minerals and oil. The globalization of the market for gas came only in the mid-1990s, when innovation in the transportation process and reductions in the costs of liquefaction of natural gas facilitated the connection of a multitude of supply sources, in this way replacing the previous geographical segmentation of three isolated regional markets. The most evident results of these technological innovations is the fact that almost every commodity is currently traded in global markets.

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The levels of economic growth and the increasing market globalization in the last 50 years explain the impressive increase in world exports from 107 billion US dollars in 1962 to 17,651 in 2014 (Comtrade database, 2016). What happened to commodities in the meantime? The upper panel of Figure 20.1 displays the time series of total world exports, expressed in current US dollars, for the four categories of commodities introduced in Section 2. Although all series are upward trending, the rate of increase is relatively low and stable for agricultural raw materials, which changes from 8.8 to 247 billions. Food and minerals exhibit very similar pattern, with a rise from 20 to 1,445 and from 12 to 1,140 billions, respectively. What clearly emerges from the plot is the considerable increase in the value of fuel exports, from 8 to 2,363 billions, accompanied also by a markedly higher variance compared to the other commodities, partly due to the large changes in the price of oil, especially in the last 10 years of the sample.[4]

Figure 20.1 shows that monetary values of exports for all commodity groups except agricultural raw materials appear to undergo an acceleration at the beginning of the 21st century, strengthened by the commodity price boom started in 2003. In addition, all exports experienced a sudden drop in correspondence with the 2008 financial crisis, but this is especially marked for the fuels and, to a lower degree, for minerals. This is not surprising given their strong sensitivity to the business cycle and the dominance of demand shocks in the price determination process. In the last 50 years, virtually all primary commodities have seen a rise in the traded physical quantity, in addition to the increase in the monetary value discussed above. The share of the value of commodity exports out of all traded goods, however, has decreased considerably from 47% in 1962 to 29% in 2014, reflecting the growing importance of manufactures in international trade. As shown in the lower panel of Figure 20.1, the share of food exports has dropped from 18% to 9%, whereas agricultural raw materials and minerals show a more gradual fall, and fuels

exhibit no general trend over the five decades period, but a clear plateau in the 1970s and early 1980s as a result of the oil price shocks occurred in this period, and a more recent steady increase starting at the end of the 1990s.

A better perspective into how commodity trade has grown in the last few decades can be obtained by assessing the proportion of world production that has been subject to international trade. In Figure 20.2 we plot the share of the exports out of production for six commodities that are representative of three of the groups discussed in Section 2, namely wheat and maize for unprocessed and processed food (group 1), aluminium and iron ore for minerals and metals (group 3) and oil and coal for mineral fuels (group 4).[5] As shown in the figure the share of the exports either increased or remained stable. A similar pattern can be observed for other commodities belonging to the four groups discussed in Section 2. Fuels have increased by only a small amount, with coal steadily rising from 7% in 1980 to 12% in 2008 and crude oil reaching 54% in 2008 (slightly higher than the level observed in 1980) after decreasing to 38% in 1985. Among metals, export of aluminium as a share of total production have more than doubled, from 25% in 1980 to 52% in 2008, whereas the level of iron ore exports in 2008 were not markedly different from those in 1980, as a consequence of a fall in the last part of the sample. On the contrary, the share of maize and wheat has remained fairly stable, like other food commodities.

Figure 20.1 ABOUT HERE

Figure 20.1 World commodity exports. Values are expressed in US dollars at market exchange rate.

Source: authors' calculations on Comtrade data

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A significant contribution to the development of globalized markets for commodities has come from the emergence of commodity exchanges, and the fact that the list of traded commodities has been steadily increasing over time, especially as a result of improved storage and conservation technology. Although commodity exchanges are dominated by purely financial transactions that are not accompanied by a physical exchange, this type of market delivers greater transparency with regard to price and grade of the commodity, and ensures also higher liquidity, which have facilitated the expansion of the international physical trade in commodities.[6]

<Figure 20.2. ABOUT HERE>

Figure 20.2 World export as share of production. Ratios are obtained from real quantities in tonnes

Source: Comtrade, FAOSTAT, BP, and IEA

4 Geography of trade

Given the increased international integration of commodity markets, it is important to analyse how the geographic pattern of the corresponding flow of resources has evolved over time. Monetary figures on imports and exports are influenced by a set of factors that transcend the real volume of trade, as the price of commodities can change, exchange rates are subject to their own dynamics and final prices can be affected by tariffs or transfer pricing. For these reasons, if we want to uncover the actual pattern in the real volume of trade and identify the producers and the consumers of world primary resources, we need to look at the physical quantities imported and exported by each country. Dittrich et al. (2010) provide a recent comprehensive analysis of real

trade flows within different regions of the world for broad classes of commodities.[7] As available databases show considerable gaps in relation to physical trade flows, these authors propose a simple method to overcome this problem whenever monetary values are available. We follow Dittrich et al. (2010) to calculate physical quantities of imported and exported commodities across countries, but we decide to look only at 11 individual commodities, as this ensures a greater degree of homogeneity when calculating the corresponding weight measures, while covering the most important commodities in the manufacturing process.[8]

In Tables 20.3 and 20.4 we display the physical trade balance, defined as imports minus exports in thousands of tonnes, in 1991 and 2011, for a set of 20 countries, which are chosen for their importance in world trade and their being representative of different geographical regions of the world. We also show in parenthesis the countries' share in world exports so as to highlight the extent of each country's contribution to the world supply.[9] We now analyse one group of countries at a time, underlining any changes in the material trade profile that occurred during those 20 years.

South America emerges as an important exporter of commodities in 1991 with the exception of energy commodities. In 1991 the main countries in Latin America are dependent on foreign supply of energy, i.e. oil, gas and coal, with the exception of Mexico, which is self-sufficient in terms of coal and is a net exporter of natural gas (2% of world total). From the tables one can see that South America is an important source of metals for the rest of the world. In 1991 Brazil generated 34% of the world exports of iron ore while Chile contributed to 27% of world copper exports. The contribution of South America to world trade of agricultural commodities was also significant, with Argentina exporting 4%, 5% and 9% of the world volume of cotton, wheat and maize respectively, while Brazil represented an important supplier of sugar, with 9%

of world exports. In 2011, development of oil fields turned Mexico and Brazil into important oil exporters – the net exports of the whole region being about a quarter of net exports from Saudi Arabia in the same year. It is however worth mentioning that South America is still a net importer of coal and gas, as shown by the positive trade balance in the table. On the other hand, net exports of metals have increased considerably, especially for iron ore and copper, which for Brazil has tripled and doubled between 1991 and 2011 to attain a volume of 330 and 5 million tonnes, respectively. South America as a whole exported in 2011 about a third of the world's exports of iron an copper, although its contribution to the aluminium market was considerably smaller, with Brazil accounting for about 10% of global exports. The fact that the increased South American commodity exports is mainly driven by Brazil emerges also in the agricultural sector. This country's share in world exports indeed is approximately 10% for maize and 50% for sugar. In the case of maize, the combined exports originating from Argentina and Brazil is about a quarter of the world's exports.

Changes between 1991 and 2011 have been staggering with regard to the trade balance of energy and metal commodities in China and India. The former was a moderate net exporter of oil, coal and maize in 1991 which more than compensated its being net importer of iron and wheat. Similarly, India accounted in 1991 for about 10% and 4% of global exports of iron and cotton, respectively. In 2011 China and India were two of the biggest consumers of commodities, especially of energy and metals. As an example, China's and India's net importing position was equal to Saudi Arabia's net-exporting position in the case of oil and almost as big as Australia's net-exporting position in the case of coal. China's net imports of iron ore in 2011 was close to the staggering level of 700 million tonnes, about 200 million higher than Australia's net exports.

India, instead, was a net exporter of iron ore, although its exports account only for 4% of world's total, and an important cotton exporter, as it accounted for a quarter of global exports.

Among Southeast Asian countries, Indonesia plays an important role in the trade of energy commodities. In 1991 it accounted for 14% of the world exports of natural gas, although this share has recently decreased. In 2011 it had the highest net-exporting position in the coal market, about 320 million tonnes, even higher than Australia's net exports. Remarkably, Indonesia contributed in 2011 to almost half of the world aluminium exports and about a third of natural rubber. This commodity is characterized by a very high concentration with Indonesia, Malaysia and Thailand holding about 75% of global exports in 1991 and 2011. Thailand was also a strong exporter of sugar, both in 1991 and 2011, with about 15% of global share. On the other hand, Indonesia, Malaysia and Thailand depend on outside sources for food commodities such as wheat and maize.

Between 1991 and 2011 Saudi Arabia retained its dominant share of world oil exports, i.e. 22% in 2011, while Russia confirmed its position of leading world supplier of energy commodities, with shares in global exports equal to 14% for oil, 25% for natural gas and 10% for hard coal. Contribution of South Africa to commodity trade is moderate with the exception of coal and iron ore. In these two markets South Africa hold a 6% and 5% share of 2011 world exports, respectively.

In the last group we include a set of OECD countries that are either significant consumers due to the size of their economy or important exporters due to the abundance of natural resources. Among the latter, Australia arises as a world leading supplier of a wide set of commodities, such as coal (25% of world exports in 2011), iron ore (41%), aluminium (15%), copper (9%), wheat (13%) and cotton (11%). Among the OECD countries in Tables 20.3 and

20.4 that are significant commodity consumers, Japan has a prominent role in the fuel and metal markets, although there has been no substantial increase in volume between 1991 and 2011 in the case of metals. The US emerges as the greatest consumer of imported oil, with more than 450 million tonnes of net imports in 2011, more than the net exports of Saudi Arabia (359 million tonnes). The US is also an important supplier of coal, with 30% of the global exports in 1991 and 10% in 2011, and a dominant supplier of wheat, maize and cotton, with respectively 22%, 42% and 35% of world exports in 2011. The volume of US exports of maize and cotton has almost doubled between 1991 and 2011, whereas those of wheat have remained constant. Canada is a net exporter of energy commodities, with a considerable increase in the net physical trade of oil and gas between 1991 and 2011. Also noticeable are Canadian net exports of wheat, although Canada's share of exports in 2011, 11%, is only half of the share in 1991. Between 1991 and 2011, Norway's importance as an oil-exporting country has decreased both in terms of net physical trade and share of global exports. It however remains an important world supplier of natural gas, with 11% of global exports in 2011 and a considerable increase in net exported volume compared to the levels observed in 1991. Between 1991 and 2011 Germany and France reduced their dependence on imported oil, but have increased gas net imports. The UK changed from becoming a relevant supplier of oil in 1991, with 6% of world exports, to a net consumer in 2011, while increasing its dependence on world supply of gas and coal. The role of France in the world supply of wheat, with 14% share in world exports in 2011, is also noticeable.

Table 20.2 Physical trade balance in 1991. Physical trade balance is defined as volume of imports minus exports, expressed in thousands of tonnes

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	Crude oil	Natural gas	Hard coal	Iron ore	Copper	Aluminium	Wheat	Maize	Sugar	Cotton	Rubber
Argentina	668 (0%)	,453 (0%)	45 (0%)		7 (0%)	62 (1%)	5,498 (5%)	3,896 (9%)	53 (1%)	161 (4%)	2 (0%)
Brazil		,306 (0%)	1,553 (0%)	113,115 (34%)	05 (1%)	6,093 (3%)		15 (0%)	67 7 (9%)	18 (3%)	8 (0%)
Chile		17 (0%)	,518 (0%)	6,262 (2%)	2,472 (27%)	(0%)	62 (0%)	79 (0%)	02 (0%)		1 (0%)
Mexico		2,376 (2%)	5 (0%)	31 (0%)	246 (3%)	3 (0%)	52 (0%)	,369 (0%)	84 (0%)	13 (1%)	1 (0%)

hina	16,265 (2%)	57 (0%)	18,656 (6%)	8,549 (0%)	05 (0%)	25 (3%)	2,366 (0%)	7,781 (17%)	70 (2%)	70 (5%)	18 (0%)
ndia		68 (0%)	,141 (0%)	29,440 (9%)	0 (0%)	175 (1%)			92 (1%)	157 (4%)	2 (0%)
ndon esia	32,125 (4%)	25,597 (14%)	7,367 (2%)	(0%)	551 (7%)	1,143 (7%)	,221 (0%)	90 (0%)	09 (0%)	50 (0%)	1,223 (26%)
alays ia	21,569 (2%)	7,547 (4%)	,074 (0%)	,156 (0%)	30 (1%)	232 (2%)	,306 (0%)	,292 (0%)	57 (1%)	0 (0%)	1,042 (24%)
haila nd		813 (1%)	42 (0%)	(0%)	9 (0%)	46 (0%)	53 (0%)	1,227 (3%)	988 (15%)	45 (0%)	1,259 (27%)

audi Arabia	309,830 (30%)	14,342 (8%)	2 (0%)	(0%)	0 (0%)	41 (0%)	829 (1%)	9 (0%)	3 (0%)	(0%)	(0%)
ussia											
outh Africa											
ustralia	,328 (1%)	3,492 (2%)	120,936 (37%)	112,481 (34%)	405 (5%)	956 (5%)	11,571 (11%)	18 (0%)	2,370 (13%)	396 (11%)	5 (0%)
apan		2,158 (0%)	11,953 (0%)	27,186 (0%)	82 (1%)	,874 (0%)		6,646 (0%)	,838 (0%)	37 (0%)	03 (0%)
S	89,32	,960 (2%)	97,58	,556 (1%)	385 (9%)	3,58	30,359	24,196	,332	1,528	59 (1%)

	4 (0%)		8 (30%)			8 (5%)	(30%)	(55%)	(3%)	(41%)	
anada	10,536 (4%)	14,172 (8%)	20,717 (10%)	25,031 (9%)	639 (8%)	,374 (8%)	23,241 (22%)	492 (2%)	11 (0%)		4 (0%)
orway	93,658 (9%)	25,443 (15%)	(0%)	2,128 (1%)	126 (1%)	710 (4%)		(0%)	62 (0%)		(0%)
ermany	04,669 (0%)	1,684 (1%)	1,565 (1%)	3,332 (0%)	,145 (1%)	,067 (3%)	1,319 (2%)	66 (1%)	1,421 (9%)	89 (1%)	28 (0%)
rance	3,362 (0%)	5,875 (1%)	0,921 (0%)	5,053 (1%)	32 (0%)	,646 (1%)	17,125 (16%)	4,444 (11%)	2,106 (13%)	06 (0%)	74 (0%)

									,104		
K	6,371 (6%)	,959 (1%)	7,717 (1%)	3,675 (0%)	39 (0%)	54 (1%)	3,281 (4%)	,503 (0%)	(1%)	2 (0%)	24 (1%)

Source: authors' calculations from Comtrade data

Table 20.3 Physical trade balance in 2011. Physical trade balance is defined as volume of imports minus exports, expressed in thousands of tonnes

	Crude oil	**Natural gas**	**Hard coal**	**Iron ore**	**Copper**	**Aluminium**	**Wheat**	**Maize**	**Sugar**	**Cotton**	**Rubber**
rgentina	3,024 (0%)	,771 (0%)	,047 (0%)	,623 (0%)	437 (2%)	180 (0%)	8,411 (6%)	15,802 (14%)	76 (0%)	84 (1%)	7 (0%)
razil	14,837 (2%)	,908 (0%)	9,935 (0%)	330,830 (29%)	8 (3%)	7,108 (8%)	,390 (2%)	8,831 (9%)	25,359	614 (10%)	27 (0%)

									(48 %)		
hile		,647 (0%)	,154 (0%)	10,287 (1%)	5,034 (22%)	3 (0%)	55 (0%)	20 (0%)	76 (0 %)	(0%)	0 (0%)
exico	66,768 (4%)	,035 (0%)	,336 (0%)	3,446 (0%)	439 (3%)	95 (0%)	,212 (1%)	,434 (0%)	1,074 (3 %)	14 (1%)	4 (0%)
hina	51,255 (0%)	2,568 (0%)	67,396 (1%)	85,127 (0%)	,641 (1%)	433 (1%)	,209 (0%)	,617 (0%)	,860 (0 %)	,337 (0%)	,115 (0%)
ndia	57,820 (0%)	8,139 (0%)	8,888 (0%)	38,228 (4%)	,712 (1%)	366 (1%)	500 (0%)	3,940 (4%)	2,644 (5 %)	1,830 (24%)	19 (1%)

ndonesia	4,566 (1%)	32,669 (5%)	323,547 (9%)	12,209 (1%)	1,494 (7%)	40,404 (46%)	,605 (0%)	,195 (0%)	,502 (0%)	46 (0%)	2,536 (30%)
alaysia	3,148 (1%)	25,111 (4%)	1,480 (0%)	2,845 (1%)	15 (0%)	7 (0%)	,135 (0%)	,859 (0%)	259 (1%)	6 (1%)	280 (11%)
hailand	7,940 (0%)	1,124 (0%)	6,203 (0%)	405 (0%)	34 (0%)	37 (0%)	,426 (0%)	186 (0%)	6,508 (12%)	19 (0%)	2,993 (35%)
audi Arabia	359,242 (22%)	1%)	9 (0%)		45 (0%)	9 (0%)	,997 (0%)	,649 (0%)	90 (1%)		3 (0%)
ussia	219,100 (14%)	190,567 (25%)	108,801 (10%)	26,928 (2%)	197 (1%)	3,319 (4%)	15,184	607 (1%)	,310	6 (0%)	8 (0%)

							(10%)		(0%)		
outh Africa	7,829 (0%)	,346 (0%)	71,195 (6%)	55,736 (5%)	222 (1%)	514 (1%)	,583 (0%)	2,866 (3%)	109 (1%)	2 (0%)	1 (0%)
ustralia	0,664 (1%)	24,667 (4%)	281,306 (25%)	460,234 (41%)	2,137 (9%)	13,424 (15%)	19,742 (13%)	43 (0%)	68 (0%)	852 (11%)	(0%)
apan		0,783 (0%)	75,286 (0%)	28,399 (0%)	,053 (2%)	,671 (0%)			,534 (0%)	1 (0%)	95 (0%)
S	58,132 (0%)	4,997 (3%)	105,488 (10%)	5,805 (1%)	18 (2%)	1,611 (1%)	30,822 (22%)	45,150 (42%)	,204 (0%)	2,757 (35%)	,002 (1%)

anada	74,238 (8%)	30,165 (6%)	24,254 (3%)	26,807 (3%)	498 (2%)	43 (3%)	16,271 (11%)	(1%)	,105 (0%)	(0%)	44 (0%)
orway	69,337 (4%)	80,416 (11%)		2,308 (0%)	36 (0%)	939 (2%)	0909 (0%)	3 (0%)	31 (0%)	(0%)	(0%)
ermany	7,054 (0%)	0,200 (3%)	2,676 (0%)	1,612 (0%)	,661 (1%)	,517 (1%)	1,802 (4%)	,136 (1%)	416 (2%)	7 (0%)	87 (2%)
rance	2,757 (0%)	4,376 (1%)	5,422 (0%)	3,402 (0%)	79 (0%)	,911 (0%)	19,849 (14%)	5,740 (6%)	1,880 (4%)	7 (0%)	67 (0%)
K	9,160 (2%)	3,266 (2%)	1,292 (0%)	,933 (0%)	1 (0%)	2 (0%)	1,456 (2%)	44 (0%)	,168 (0%)		0 (0%)

	(1 %)
Source: authors' calculations from Comtrade data	

Even though Tables 20.2 and 20.3 provide us with an indication about the direction of the trade flows in commodities across different world regions, it remains important to analyse how the trade balance has evolved year by year for broad classes of commodities. In Figure 20.3 we plot the monetary trade balance, defined as the value of imports minus value of exports, of the four groups of commodities defined in Section 2, as well as of manufactures, for five regions we have selected on the basis of their contribution to international trade. We focus on three industrialized regions, i.e. Europe (the 27 EU countries plus Norway), North America (US and Canada) and OECD Asia Pacific (Australia, New Zealand, Japan, South Korea), and two developing regions, i.e. China and India, and South America (Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Falkland Islands, French Guiana, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela).[10]

Starting with food, both Europe and OECD Asia Pacific are predominantly net importers throughout the whole period, increasingly so for the Asian countries, while Europe very recently became a net exporter. Wheat and maize from US and Canada are the main causes of this region being a net exporter. South America has undoubtedly become the leading world supplier, reflecting the large share of world exports in wheat, maize and sugar from Brazil, and wheat from Argentina, which was apparent in Tables 20.3 and 20.4. One can notice a considerable acceleration in the size of South America trade balance starting in 2003. Lastly, China and India

became net importers in 2008, having been net exporters since 1960. One can notice the speed at which the size of their net import is increasing between 2006 and 2014.

China and India have also become heavily dependent on imported agricultural raw materials, with surging needs from the end of the 1990s, mainly satisfied by North and South America (recall for instance the exports of cotton from these two regions which can be seen in Tables 20.3 and 20.4). Europe and OECD Asia Pacific are also net importers, although their net imports have fallen considerably in recent years.

In the case of minerals, all regions with the exception of South America had fairly balanced trade positions until the end of the 1990s but have since then witnessed an impressive surge. Net imports of China and India have increased dramatically, especially since 2007, to reach a peak of 200 billion dollars in 2011 (recall that only China imported a net of 685 billion tonnes of iron ore as shown in Table 20.4), although it moderately decreased in the following years. European demand for foreign supply of minerals is modest but has increased in the last decade. North America has traditionally been a net importer, although its trade account has recently been more balanced. The graph reveals South America as the main source of minerals, a consequence of strong net exports from Brazil for iron ore and Chile for copper, as shown in Tables 20.3 and 20.4. A considerable acceleration in the size of the region's net exports started in 2004. Increasing net exports from Australia caused a change in the sign of the monetary trade balance in the OECD Asia Pacific group in 2009, with the whole region being net exporters since then.

As some of the most important gas and oil-exporting countries, e.g. Saudi Arabia and Russia, are not included in Figure 20.3, the plot for fuel commodities highlights the net monetary deficit of all four regions in the graph, with the exception of South America. All three

industrialized regions have witnessed a considerable rise in the value of fuel net imports since the beginning of the 2000s, which is mainly caused by oil for North America, and a mixture of gas and oil for Europe, although this partially reflects the rise of oil price in this period. The demand from China and India has increased exponentially since the end of the 1990s generating a trade deficit that surpassed that of Europe in 2014, with almost 400 billion dollars of net imports. One can also notice how the recent 2009 financial crisis caused the sudden drop in all series with positive values, a change caused by a pronounced fall in both price and quantity traded. Finally, oil exports of Venezuela, Mexico and Brazil explain the net-exporting position of South America, although it was close to zero in 2014.

Figure 20.3a-e ABOUT HERE AND BELOW HEADINGS.

Figure 20.3 Net monetary trade balance for classes of commodities. Net monetary trade balance is defined as value of imports minus value of exports, measured in current US dollars.

Source: authors' calculations using Comtrade data

Food **<Fig 20.3a here>**	**Agricultural raw materials** **<Fig 20.3b here>**
Minerals **<Fig 20.3c here>**	**Fuels** **<Fig 20.3d here>**
Manufacturers **<Fig 20.3e here>**	

In terms of manufactures, North America has increased its net imports since 1982, reaching a value of 800 billion dollars in 2014. South America is also a net importer with increasing values of its deficit since 2003. On the contrary, OECD Asia Pacific countries have always been important world suppliers, with a positive linear time trend, while Europe has generated positive and rising monetary trade balances since the beginning of the 1990s. The main feature of the graph is however the staggering growth in the size of China and India monetary trade balance. Although the two countries have been net exporters since 1992, the size of the balance has experienced an impressive acceleration since 2004 rising from 126 in 2004 to 979 billion US dollars in 2014.

Figure 20.3, jointly with Tables 20.2 and 20.3, allow us to derive a few important observations about structure and evolution of international commodity trade. Industrialized countries, with the exception of Australia, Canada and Norway, depend heavily on commodities imported from developing countries, something which is confirmed also when looking at real traded quantities (Dittrich et al., 2010). This phenomenon can be explained with the significant fall in bulk transportation costs, the industrialization process that Western countries experienced in the 20th century and the more competitive prices of emerging markets (Radetzki, 2008). At the country level, US, Europe and Japan have considerably increased their dependence on foreign supply of commodities in recent years, whereas South America has expanded substantially its exports in all four classes of commodities discussed in Section 2.

It is worthwhile to highlight that the trade profile of different countries reflect their economic and production structure. While imports of food are strictly related to population density and protective policy measures, minerals demand reveals the stage of economic development that a country is experiencing. This is particularly relevant for India and China that

have been important resource consumers only since the mid-1990s, although their contribution to consumption of commodities has shown an exceptional increase in the last decade. Imports of minerals in countries like the US, Japan, and those of the EU have been relatively low and stable since the 1990s as the result of the mature stage of economies, where production inputs are mainly allocated to the tertiary sector. On the contrary, China has witnessed over the same period an accelerated industrialization process that required the establishment of important parts of the physical infrastructure, e.g. transport network, spurring the development of the construction sector and industries characterized by high capital and resource intensity.[11] The country has undergone a similar development process to that experienced decades earlier by the OECD economies, but at a much faster pace. The exponential rise in the dependence on world supply of all four classes of commodities is perfectly matched by an impressive expansion of China's net exports of manufactured goods, especially in the last decade. We also notice a recent reduction in the net imports of minerals and agricultural raw materials, which might signal the inception of a different phase in the Chinese development process.

It is interesting to frame the size and the changes in China's consumption of primary commodities within international consumption and trade. In order to do so, Figure 20.4 compares imported quantities of iron ore, copper, aluminium and oil for China, the US and the eight European countries with the highest levels of GDP (Germany, UK, France, Italy, Spain, Netherlands, Sweden and Denmark). The speed of China's structural transformation is apparent from the sudden changes in the quantity of imported iron ore, aluminium and copper. From 2000 imports of iron ore have increased exponentially, with an average annual growth rate of 12%, whereas they have stayed virtually constant in Europe, and have slightly decreased in the US. In terms of size, China imported 932 billion tonnes of iron ore in 2014, compared to 98 billion of

Europe and 5 billion of the US. A similarly increasing trend can be seen in the Chinese imports of copper and aluminium, even if the magnitude of the difference with the US and the European countries is lower. Imports of crude oil have been approximately stable for the European countries, whereas they have decreased in US since 2004, almost reverting the increases that occurred between 1991 and 2004, presumably as a consequence of the boom in shale oil production stimulated by the advances in extraction technology and high energy prices. Physical imports of oil in China, on the other hand, present a positive trend throughout the sample, with an average annual growth of 15%, which resulted in the amount of oil imports from abroad being 52 times bigger in 2014 than in 1990, i.e. an increase from 6 to 308 billion tonnes, reaching the same level as the US in 2014.

Figure 20.4 a – d ABOUT HERE AND BELOW HEADINGS.

Figure 20.4 Physical imports of industrial commodities. Quantities are expressed in tonnes.

Source: authors' calculations using Comtrade data

Apex-Bold>Iron ore **<Fig 20.4a>**	**Copper** **<Fig 20.4b here>**
Aluminium **<Fig 20.4c here>**	**Oil** **<Fig 20.4d here>**

The Sankey diagram in Figure 20.5 helps to get an even more vivid picture of both the size and the origin of Chinese imports in 2014. All these figures confirm an impressively rapid

shift of the world production centre of commodity-intensive manufactured goods towards China, which has occurred in the last two decades.[12]

Figure 20.5 ABOUT HERE

Figure 20.5 Resource flow to China

5 Market concentration

Both economic theory and empirical analysis suggest that market concentration is a key factor in determining the degree to which a market is competitive. Factors influencing the concentration of supply in commodity markets include geographical distribution of natural resources, and the role played by governments in resource extraction. While in theory the increased international integration of a market is likely to be accompanied by increasing competition, it remains interesting to verify whether this is what actually occurred in the last few decades, and in particular how much of world supply is currently distributed among different producing countries. In order to do so we use the Herfindahl index, which is widely used in the trade literature.[13] Figure 20.6 displays the time series of the Herfindahl index for three individual commodities in each of the four broad classes discussed in Section 2, over the period 1974–2014, while Table 20.5 reports the share of the four largest exporters in 1974 and 2014.

In the case of fuel commodities, the Herfindahl index has decreased for oil, gas and coal since 1975, indicating an overall reduction in the degree of market concentration, but at varying speed in different periods and across fuels.[14] This is confirmed by the fact that the sum of shares of the four largest exporters is smaller in 2014 (51%) than in 1974 (76%). Consequently, the Herfindahl index for the fuel market as a whole (i.e. comprising oil, gas and coal) has halved

from the levels observed in 1974. It is important to notice however that a considerable degree of concentration remains present in all three fuel markets, but in particular in the case of hard coal, where the sum of the share of the four largest exporters was a very substantial 77% in 2014, although down almost 20 percentage points from 95% in 1974.

Metal commodities, with the exception of aluminium, display a less competitive structure over time. The rise in market concentration is evident from 2008 onwards in the case of the iron ore, for which the Herfindahl index has almost tripled between 1974 and 2014, with the four largest suppliers accounting for 86% of global exports in 2014, and Australia remaining the top contributor with a striking share of 53%. Aluminium, on the other hand, appears to have an increasingly competitive structure, with the four largest suppliers having almost equal shares.

The market for food commodities seems to have become considerably less concentrated over time, at least as far as wheat, maize and soybean are concerned, with the Herfindahl showing a negative trend throughout the last 40 years despite temporary oscillations. US remains the leading supplier of all three staples, but its share has dropped dramatically by half in the case of maize and soybean, and by two-thirds in the case of wheat. Concentration in wheat, as measured by the Herfindahl index, was in 2014 about one-third of the level observed in 1974. Market concentration is considerably higher in the case of soybean, where US and Brazil alone made up 80% of world exports in 2014, down from 99% in 1974.

Figure 20.6 a – d ABOUT HERE AND BELOW HEADINGS.

Figure 20.6 Market concentration measured by the Herfindahl index

Source: authors' calculations using Comtrade data

Fuels	**Metals**

<Fig 20.6a here>	<fig 20.6b here>
Food <Fig 20.6c here>	**Agricultural raw materials** <Fig 20.6d here>

In the case of agricultural raw materials, a fairly flat pattern of the Herfindahl index can be seen for cotton and rubber. Concentration in the former, however, is subject to wide fluctuations within the sample, probably due to the fact that new major suppliers have emerged over time (i.e. India, Australia and Brazil). Market dominance of the US is still significant, with its share of exports being unaltered between 1974 and 2014. The market for natural rubber remains fairly concentrated, with the four largest suppliers accounting for 85% of world exports, whereas the market for wood, on the other hand, has taken a more competitive structure over time, with the concentration index reaching 0.06 in 2014.

Table 20.4 Countries' shares in world exports. H indicates Herfindahl; UAE and SACU stand for United Arab Emirates and Southern African Customs Union, respectively

Crude oil				Natural gas				Hard coal			
1974		2014		1974		2014		1974		2014	
Exporter	Share	Exporter	Share	Exporter	Share	Exporter	Share	Exporter	Share	Exporter	Share

	S		S									
audi Arabia	.36	audi Arabia	.22	etherl.	.32	atar	.21	S	.55	ustral ia	.36	
	I		F					erma		ndone		
ran	.21	ussia	.14	anada	.24	ussia	.15	ny	.19	sia	.20	
	K		C					ustral				
uwait	.10	anada	.08	enezu ela	.09	orwa y	.09	ia	.15	ussia	.12	
	I		N									
ibya	.09	igeria	.07	uwait	.06	lgeria	.06	anada	.06	S	.09	
	I											
index	.20		.10	index	.18		.09	index	.37		.20	

	Iron ore			Copper			Aluminium		
	1974		2014	1974		2014	1974		2014
Exporter	Share	Exporter	Share	Exporter	Share	Exporter	Share	Exporter	Share
Australia	.23	Australia	.53	Chile	.20	Chile	.32	Canada	.18	Canada	.12

Brazil	.15	Brazil	.23	Gambia	.14	Peru	.08	Norway	.15	Russia	.11
Canada	.15	South Africa	.06	Canada	.12	Australia	.07	Netherl.	.08	Australia	.08
Sweden	.12	Canada	.04	Congo	.10	Gambia	.06	Suriname	.06	AE	.08
Index	.13		.34	Index	.10		.13	Index	.08		.05
	Wheat				Maize				Soybean		
	1974		2014		1974		2014		1974		2014
Exporter	Share	Exporter	Share	Exporter	Share	Exporter	Share	Exporter	Share	Exporter	Share
US	.46	US	.16	US	.62	US	.34	US	.85	US	.41
Canada	.22	Canada	.15	Argentina	.11	Brazil	.12	Brazil	.14	Brazil	.39

Australia	.13	France	.11	France	.09	Argentina	.11	Paraguay	.00	Argentina	.06
France	.11	Russia	.11	ACU	.05	Ukraine	.10	Canada	.00	Paraguay	.04
Index	.29		.10	Index	.41		.16	Index	.75		.33
	Cotton				Natural rubber				Wood			
	1974		2014		1974		2014		1974		2014	
Exporter	Share	Exporter	Share		Exporter	Share	Exporter	Share	Exporter	Share	Exporter	Share
US	.34	US	.32		Malaysia	.39	Thailand	.37	Canada	.16	Canada	.15
Egypt	.18	India	.21		Singapore	.27	Indonesia	.29	US	.14	US	.12
Turkey	.06	Australia	.13		Indonesia	.15	Vietnam	.10	Sweden	.11	Russia	.09

	S		F									
yria	.05	razil	.10	hailand	.08	alaysia	.09	ndonesia	.08	wedeн	.06	
	F											
index	.16		.18	index	.25		.24	index	.08		.06	

Source: authors' calculations using Comtrade data

6 Trade in water

Most of the water readily available for human consumption is devoted to agriculture, which is accountable for 70% of all global freshwater extraction (reaching 90% in the least developed countries), whereas water withdrawals for energy production are 15% of the total (UN, 2015). A long list of factors – i.e. population growth, industrialization, urbanization and migration – is responsible for generating a surging demand for freshwater in the last 60 years and increasing pressure on existent resources. Bearing in mind environmental degradation, climate change, and increased agricultural production, there is a serious risk of compromising the planet's capacity to provide enough water for the growing population especially when increasing access to standard water sources (UN, 2012).

Water is a commodity that, compared to other primary commodities, has not been subject to significant international trade, despite being distributed unevenly across the globe and being severely scarce in some countries rather than others. One reason for the lack of water trade is related to the fact that water is not cheap to transport given its bulky nature, and at the same time countries that are poor in water are geographically close to each other, so transportation needs to

occur over long distances (WTO, 2010). On the other hand, international trade in water-intensive, mainly agricultural, commodities is an important way in which water is indirectly traded among countries. In fact, the volume of this traded water has doubled from 1986 to 2007, and has contributed to important savings in world resources (Dalin et al., 2012).[15]

Focusing on the actual, rather than indirect, trade of water, Figure 20.7 shows the time series from 1962 to 2014 of the monetary value of world exports. Any actual rise in the trade volume might be exaggerated due to the Comtrade database being largely incomplete in the early part of the sample, and to the fact that the number of countries reporting their data to UN Comtrade increase over time. Nevertheless, we observe a considerable rise in world exports of water, namely from 1.5 to 3.6 billion dollars between 2000 and 2014, when the same number of countries reported their data to Comtrade.[16] Physical exports have more than doubled, from 8.38 million tonnes in 1992 to 18.41 in 2014.[17] In terms of trade flows across different regions of the world, Europe and China are net exporters of water, whereas North America and the OECD countries of the Pacific are net importers. In all cases this pattern has increased as time went by, as shown in Figure 20.8.[18] It is also worth mentioning that "virtual water" is discussed in Part II of this handbook.

Figure 20.7 ABOUT HERE

Figure 20.7 World exports of water. Values are expressed in US dollars at market exchange rate.

Source: Comtrade

Figure 20.8 ABOUT HERE

Figure 20.8 Net monetary trade balance for water. Net monetary trade balance is defined as value of imports minus value of exports, measured in current US dollars

Source: authors' calculations on Comtrade data

7 Final remarks

The trade dimension is a crucial part to comprehend the actual way in which the nexus operates in the real world. Because most commodities, including energy and water, are now subject to international trade, it is important to know the core features of the international commodity markets of today. If the recent attention given to primary commodities has been driven mainly by the dynamics of their prices, we should not forget that the observed price level is the result of the interactions among a multitude of factors underlying the market structure. Especially if we are interested in uncovering the long-run trend in future price developments, features like degree of market globalization, geographical structure of supply and demand flows, and degree of market concentration play a crucial role.

We have used data on international trade to highlight how these three dimensions in particular have evolved over time for individual and broad classes of commodities. Our mainly descriptive analysis sheds light on some important stylized facts about relevant characteristics of the commodity markets, which would be interesting to further investigate in dedicated empirical works.

We found that in the last few decades international scope has increased faster for some commodities than others, that the direction of trade has changed as a likely response to different stages of economic development across countries, and that the trend in production concentration differs substantially across commodities. In particular, we observed that international trade has increased more intensively for fuels and minerals than agricultural products. Moreover, while

most industrialized countries have remained dependent on foreign supply of important natural resources, we have shown how the extraordinary growth of China has translated into a modification of the international trade balance in both industrial commodities and manufactured goods. As for the degree of market concentration, we found that this has been decreasing for food commodities, which may help explain the observed long-run gradual fall in their prices. On the contrary, we could not detect any clear pattern in market concentration in agricultural raw materials, while mineral fuel supply is less concentrated than 40 years ago, and some widely used metals, like iron ore and copper, have been characterized by rising degree of concentration. Finally, we discovered that, despite being far less traded than other commodities, water is becoming increasingly subject to international exchange, with China and Europe representing important net exporters.

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1 See, for instance, Heap (2005), Radetzki (2006), Tilton (2006), Radetzki et al. (2008), Humphreys (2010) and Clayton (2015).

2 This includes energy fuels such as fossil fuels, both conventional and unconventional.

3 Harley (1988), for instance, finds that the adoption of metal ships and steam propulsion from 1850 was the main reason for the dramatic decline in the freight rates in the years thereafter. See, also Radetzki (2010).

4 A note a caution is in order here since any increase in exports might be exaggerated by the fact that in the Comtrade database not all countries report trade data for each year, and for China, for instance, data are available only from 1984.

5 We limit the graph to the period 1980–2008 because of lack of data for earlier years, and the presence of significant outliers in more recent figures.

6 Some authors have also emphasized how the increasing world market integration has reduced commodity price volatility, facilitating the growth process of poor countries (see Jacks et al., 2011). On the other hand, there are negative consequences from decreasing prices of food commodities for farmers in developing countries (see, for instance, Gilbert and Varangis, 2003).

[7] See also the analysis in UNEP (2015).

[8] Given the lower reliability of real quantity data, we decide to apply their approach also to recalculate the real quantity whenever the recorded figure implies a price that is an extreme outlier relative to the distribution of values for all countries in a given year. See Dittrich et al. (2010) for more details.

[9] Bear in mind that since re-exports are included, a country's share in world trade can be overstated.

[10] We skip the Middle East, Russia and North Africa since they are relevant only with respect to fuels trade.

[11] The implications for resource-rich Asian economies of the commodity price boom triggered by the rapid growth of China and India is analysed by Coxhead and Jayasuriya (2010), looking in particular at the growth and environmental impacts wherever there is lack of solid institutions and governance.

[12] Montalbano and Nenci (2012) examine the recent trade specialization of major developing countries, and find that China appears to emerge as a competitor for the main industrialized economies, while India, Brazil, and South Africa represent dominant players in markets supplied by other developing countries. Qureshi and Wan (2008) assess in detail the competitiveness and complementarities of China and India in their trade with the rest of the world, and they highlight how the export structure of China has been changing over time with an increasing share of high-technology goods and less labour-intensive products.

[13] See, for instance, Van Long and Soubeyran (1997), and Oladi and Gilbert (2012). Notice that while 1 is the upper bound of the index, indicating perfect monopoly, the lower bound is determined by the reciprocal of the total number of suppliers in the market.

[14] The usual note of caution is necessary here since the number of reporting countries have increased over the years, but, at the same time, it is very likely that each country has reported its exports as far as they reached a non-negligible figure. Thus, we still believe that the index is capable of capturing the overall degree of market concentration.

[15] See also Chapagain and Hoekstra (2008).

[16] Also, the difference in terms of set of countries is negligible when looking at their share in world exports.

[17] These two years allow a balanced comparison since the difference in the set of countries reporting their figure is not significant when we consider their share in world exports.

[18] Notice that data for China are available from 1987, and we exclude India since it is a net importer of negligible size.