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Trends in world agricultural and food trade

Hector Maletta
maletta_he@up.edu.pe

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ABSTRACT

International commerce in agricultural and food products is an important component of food security and, for many developing countries, an essential part of their economic development. Agricultural products (which may be food or non-food) are imported or exported by most countries. Certain views equate food security with self-sufficiency, and thus regard importation of food as a mark of food insecurity at the national level, but the internationally accepted definition of food security does not share those views. Food security is nowadays defined as a situation in which all people at all times have access to adequate food; the food that is to be accessed may be produced domestically or imported. Thus exporting and importing food (and other agricultural products) is nowadays considered as a key element in achieving food security. This paper reviews tendencies in the amount and content of agricultural and food trade since the early 1960s, at the world scale and for major world regions, using a metric of world-average unit values based on 2004-2006. It finds that during the past half century, whilst agricultural production trebled, agricultural trade increased by a factor of eight. At region level, only the Americas (North and Latin America) are net exporters of agricultural and food products, whereas the other major regions (Europe, Asia and Africa) are net importers. It also finds that recent surges in agricultural and food commodity prices (2007-08 and 2010-11) have not disrupted the physical amounts traded, as initially feared. A Methodological Appendix at the end of the paper provides detailed information on sources and methods. Supplementary Information available online includes an Excel file containing estimates of reference world-average unit values for over 350 traded items for the base period 2004-2006. Results are mainly based on the detailed country-level time series on agricultural and food trade annual flows for the period 1961-2011, contained in FAO-STAT, the FAO statistical information system on food and agriculture.

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Introduction

For most of the developing world, agricultural trade is a very important element in their economies. They export and import agricultural products, both for food and non-food purposes. A number of tropical products, for instance, are regularly exported from developing countries around the world, to both developed and developing country destinations. Staple foods, like cereals, are also traded in large amounts. For instance, about 16% of cereals in all their forms (excluding beer) and above 50% of vegetable oils were traded in 2011 (FAOSTAT, <http://faostat.fao.org>, Food Balance / Commodity balances).

One frequent aspect in the discussion of food trade is that in many analyses of food security it is regretted that some developing countries are dependent on food imports. However, this often stems from an outdated notion of food security that equates it with national self-sufficiency in the production of food. Food security as a concept was in circulation since the 1940s, but was officially defined for international use by the 1974 World Food Conference, as the availability (*at world level*) of sufficient supplies of major food items, to sustain growth in consumption and smooth fluctuations of output and prices (UN 1975). This definition subsequently evolved into the notion of achieving *national* self-sufficiency in the production of food, implying that each country is able to 'feed itself' and thus avoid the vagaries of world markets; a country's 'dependency' on imported food was regarded as a mark of food insecurity. However, the fact that many countries are able to afford food imports with revenue coming from other exports, and that the costs involved in achieving self-sufficiency 'at all costs' may hamper development and actually reduce food security, along with conceptual considerations, eventually led to the abandonment of such notion.¹

Food security is defined nowadays not in terms of food production but in terms of **access to food by individual people**. The definition adopted by the first World Food Summit (WFS 1996), just slightly updated afterwards (WFS 2009), is as follows: **Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.** *Physical* access requires that food is made available at the point of potential consumption; *economic* access means that people get a reliable entitlement to consume the food (by producing it on their own account, by receiving it as a donation, or by being able to purchase it in the market); *social* access implies the absence of social discrimination or or cultural barriers in the allocation of food to individuals independently of income (e.g. girls receiving less food than boys within the same household, or some groups being deprived of access to food by political or racial reasons).

The WFS definition is universally applied today both in academic usage and for the work of all international organizations. It does not require self-sufficiency: food security can be individually achieved by people not producing any food, and also by the people of a country that does not produce much or any of the food consumed by its population, if adequate access to food is otherwise ensured for all people at all times.

Trade is the main process bringing food from point of production to point of consumption, the main mechanism making each food item physically accessible to the vast majority of people who are not its direct producers. Even food supplied through non-market channels (e.g. food aid) is usually purchased from producers or traders before being transferred to beneficiaries. For the above definition of food security to be coherent, **food trade** should be recognised as a key element for food security. In fact the 1996 Declaration of the first World Food Summit (WFS 1996) emphatically stated as much:

We agree that trade is a key element in achieving food security. We agree to pursue food trade and overall trade policies that will encourage our producers and consumers to utilize available resources in an economically sound and sustainable manner. [...] We will strive to ensure that food, agricultural trade and overall trade policies are conducive to fostering food security for all through a fair and market-oriented world trade system.

This position has been reiterated in many other international agreements. The latest World Food Summit (WFS 2009) thus declared:

¹ For an account of historical developments in the concept of food security see Maletta 2014a.

We will pursue policies and strategies that improve the functioning of domestic, regional and international markets and ensure equitable access for all, especially smallholders and women farmers from developing countries. We support WTO-consistent, non-trade-distorting special measures aimed at creating incentives for smallholder farmers in developing countries, enabling them to increase their productivity and compete on a more equal footing on world markets. We agree to refrain from taking measures that are inconsistent with the WTO rules, with adverse impacts on global, regional and national food security.

The food consumed by a person or household might conceivably be produced by the same person or household, but it is (most usually) produced by others and obtained through the market; even small food producers, like subsistence farmers or artisanal fishermen, normally specialize in one or a few specific food products, and acquire other foodstuffs in the market (using farm or off-farm income). As is true for households, it is also true for countries, or for zones within a country: some foods are locally produced whilst other food is brought from other parts of the country or from abroad, and some local production is possibly dispatched to other parts.

Trade's role in food security includes both domestic and international commerce. Intervening actors range from large international food-trading corporations down to small retail traders (and also local farmers and fishermen bringing their produce or catch to the village marketplace). Domestic trade has greatly increased in developing countries that are rapidly urbanizing (as urban populations are unable to do much farming, requiring food to be brought from the countryside or from abroad), and this fostered an increased commercialization of agriculture; in most developing countries an expanding proportion of farm output is for sale; on-farm food consumption represents a dwindling proportion of food output and also a dwindling proportion of rural food consumption. However, in this study we refer mostly to foreign (i.e. border-crossing) trade.

In spite of its great importance for food security, food trade has been severely hampered by trade policies, specifically concerning agricultural products (primary or industrially processed). For instance, developed countries (especially the European Union, Japan, and to a more limited extent the United States) impose subsidies for domestic production as well as quotas, tariffs and other restrictive measures for the importation of agricultural products. Some agricultural exporter countries, either developed or developing, have enacted export bans, export excise taxes, import tariffs or other barriers for trade in such products (e.g. Russia and Argentina), most notably in recent years after the rise in agricultural commodity prices along the 2000s, which peaked in the price surges of 2007-08 and 2010-11, sparking fears of a food security crisis. Agricultural trade was explicitly excluded from the 1994 international agreement on free trade, at the end of the GATT's Uruguay Round which gave birth to the World Trade Organization. The Doha Round of negotiations was intended to strive for increased liberalisation of agricultural trade, but it never really took flight. In the meantime, some changes in protection policies have taken place, such as the reform of the European Common Agricultural Policy since 1992, which changed the nature of farm subsidies (not to products, but to farmers) and gradually reduced such subsidies in a still on-going process. Various bilateral or regional trade agreements have included a more liberal approach to trade in farm products, as in the case of the North American Trade Agreement (NAFTA) and other similar schemes between the US and other countries, or various accords between European and African countries. Some developing nations have thus gained access to developed-country markets for their produce, which is often composed of non-food or non-staple food products, and thus providing much needed export revenue and enhancing their food security by making their staple-food imports more affordable.

This paper will not go further into trade policy developments and discussions. It would rather focus on the composition and growth of agricultural (and food) trade during the half century since 1961, and the implications thereof for food security, making extensive use of the FAOSTAT database on agricultural trade (<http://faostat.fao.org/site/406/default.aspx>) and other complementary sources.

For international comparison and for proper interpretation of food trade in the context of food security, trade must be measured in real terms. As the various traded items have to be aggregated, its monetary expression should control for price changes over time and across countries. Unfortunately, the main source of data in this regard (the FAOSTAT database maintained by FAO) offers only physical

amounts traded, and an aggregation in *current* US dollars. FAO provides index numbers of trade value, quantity and unit values, but only for total exports and total imports, not reporting such indexes for individual products, and not reporting absolute values but only index numbers.

In this regard, an important contribution of this paper is offering a constant and uniform set of international trade prices for traded agricultural items, based on the world-average unit values prevailing in 2004-2006 for exports and imports of hundreds of agricultural products, primary or processed, estimated in this paper with data in the FAOSTAT database. The Methodological Appendix at the end of the paper, and Supplementary Information available online, provide detailed information on sources and methods. This leads to **estimates of real trade** based on constant and uniform prices that are used throughout this paper. On that basis, changes of those estimates over time, and their differences across countries, can be interpreted as quantity indexes, measuring **real** variation in quantities traded.

World agricultural trade growth

Real growth in farm-related trade since 1961 is shown at Figure 1 ('real' because it is measured at constant and uniform world-average 2004-06 prices, and is hence an index of real quantities exported). It includes primary and processed products (e.g. it includes exports of wheat grain and also exports of flour, noodles, and pastries). Real agricultural exports expanded worldwide by a factor of 7.3, at an annual rate of 4.1%. *Food* exports grew even faster, expanding by a factor of 8.5 along that half century (Figure 2), at a yearly rate of 4.3%. Non-food exports grew more slowly, at 3.56% per year. The global recession started in 2008 made only a small dent in the pace of real growth of agricultural and food trade. It is interesting to note that the small setback in 2009, under the twin pressures of recession and high prices, affected much more non-food than food products: real food exports continued their rising course almost unaltered in spite of recession and the surge of food prices.

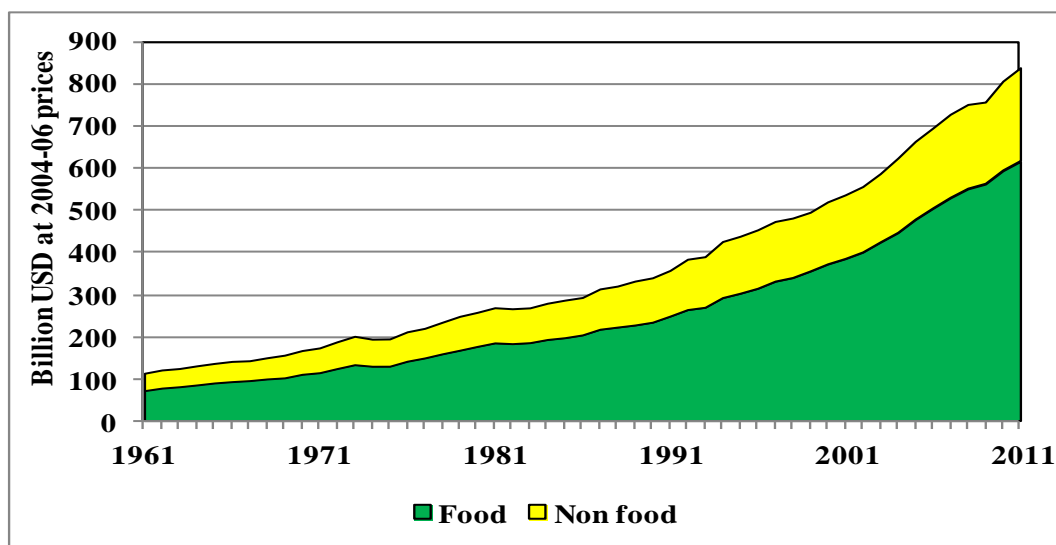


Figure 1. World exports of food and non-food agricultural products, raw or processed (excluding fish and forestry), in billion US dollars at constant world-average 2004-06 FOB export unit values, 1961-2011. Based on FAOSTAT data. See Methodological Appendix for details.

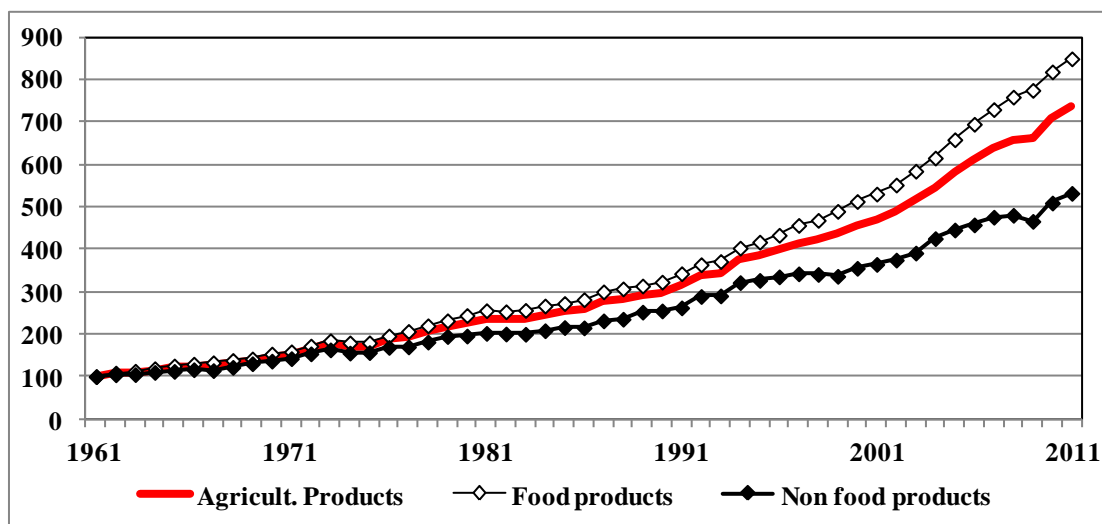


Figure 2. Index of world real agricultural exports (total, food, and non-food), at constant world-average 2004-06 FOB prices, 1961-2011 (Base 1961=100)

During this past half century food production grew faster than population, resulting in a sustained increase of world per capita supply to meet increasing demand during the period of fastest population growth in the history of mankind (see Maletta 2014b). Agricultural production more than trebled during this period, whereas population only doubled. Now we see that agricultural and food trade grew much faster than agricultural and food production (Figure 3 and Figure 4). Whilst the world's real food output trebled in the half century since 1961, real agricultural exports increased by a factor of 7.4, and *food* exports by a factor of 8.5.

World agricultural (and food) markets are thus becoming more interrelated and integrated, and an increasing amount of food and other agricultural products are internationally traded, i.e. produced in one country and consumed elsewhere. Trade is indeed becoming '*a key element in achieving food security*', as stated in the 1996 World Food Summit declaration and reaffirmed in subsequent similar meetings and elsewhere.

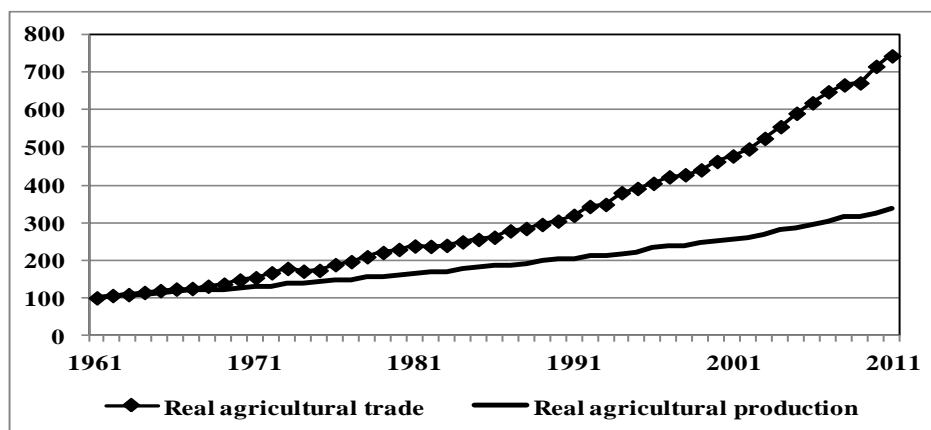


Figure 3. Index numbers of world real agricultural output and exports, 1961-2011 (Base 1961=100). Production valued at world-average 2004-06 producer prices, converted into international dollars at PPP conversion rates (FAOSTAT, net agricultural value of production). Exports in US dollars (FAOSTAT) at world-average 2004-06 export unit values. Fish and forestry products excluded. Food and non-food agricultural products are included.

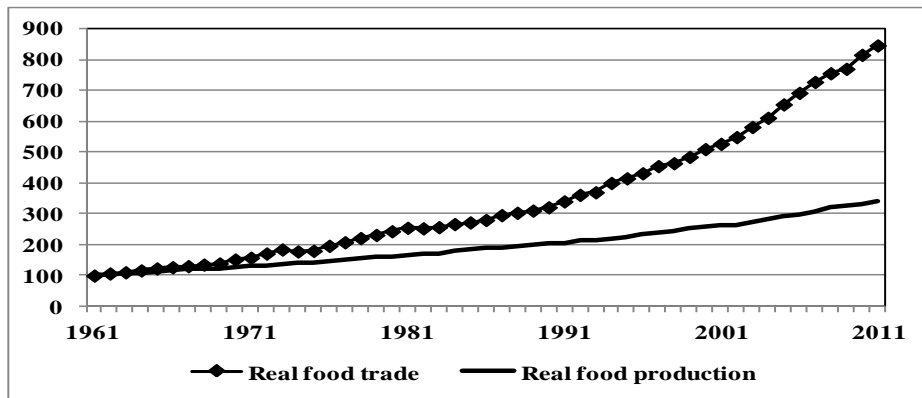


Figure 4. Index numbers of world food products real output and exports, 1961-2011, at 2004-06 prices (Base 1961=100). Source: FAOSTAT. Includes only food products from crops and livestock (excluding coffee, tea, beverages, fish and seafood). See caption at Figure 3.

The fact that trade increases so much faster than production indicates an increasing international openness of the food and agriculture sector. Agricultural products are traded in increasing proportion relative to production, at world level.

World agricultural trade composition

Agricultural trade in general expanded greatly, as seen before, not just in nominal but real terms; but some products grew much faster than others. As a result, the relative composition of trade flows changed over time.

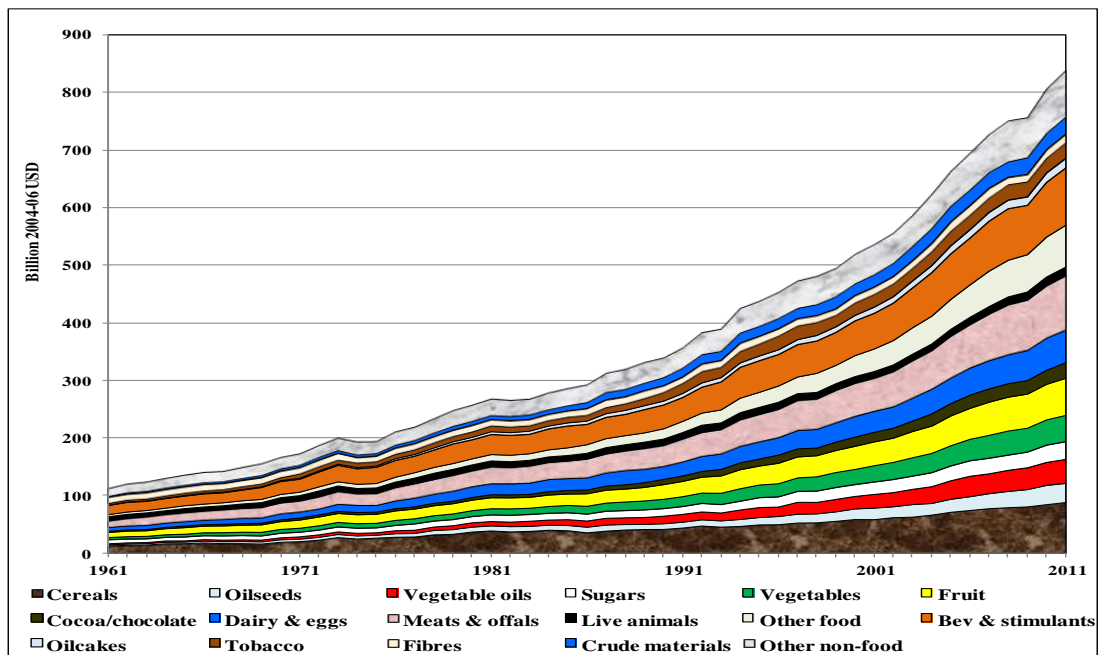


Figure 5. Real agricultural exports by product group, in billion USD at constant 2004-06 prices, 1961-2011. Source: FAOSTAT. Includes primary and processed products.

Table 1. World real agricultural exports by product category, 1961-2011

	Billion USD at constant 2004-06 FOB prices						Index (1961=100)	% of total	
	1961	1971	1981	1991	2001	2011		1961	2011
Agriculture^a	\$114.0	\$174.0	\$269.2	\$357.6	\$536.6	\$838.0	735	100.0%	100.0%
Food^b	\$67.4	\$106.4	\$171.8	\$229.6	\$355.4	\$570.5	847	59.1%	68.1%
Cereals	\$12.3	\$19.7	\$38.5	\$43.6	\$58.3	\$88.4	720	10.8%	10.5%
Oilseeds	\$2.6	\$4.9	\$9.3	\$10.6	\$20.5	\$33.5	1,285	2.3%	4.0%
Vegetable oils	\$2.3	\$4.6	\$8.0	\$14.0	\$23.9	\$41.4	1,809	2.0%	4.9%
Sugars	\$6.8	\$7.8	\$11.3	\$13.3	\$21.3	\$30.4	449	5.9%	3.6%
Vegetables	\$3.6	\$6.7	\$10.8	\$17.2	\$28.7	\$46.5	1,295	3.2%	5.6%
Fruit	\$8.8	\$14.1	\$19.1	\$26.5	\$41.4	\$64.6	736	7.7%	7.7%
Cocoa/chocolate	\$2.4	\$3.8	\$5.5	\$9.8	\$16.9	\$27.2	1,129	2.1%	3.2%
Dairy & eggs	\$6.7	\$10.6	\$19.1	\$24.1	\$36.2	\$56.1	837	5.9%	6.7%
Meats & offals	\$11.2	\$19.0	\$29.0	\$39.7	\$57.2	\$94.0	841	9.8%	11.2%
Live animals	\$6.8	\$8.8	\$10.1	\$11.1	\$11.7	\$15.7	232	5.9%	1.9%
Other food	\$4.0	\$6.4	\$11.3	\$19.7	\$39.3	\$72.8	1,811	3.5%	8.7%
Non-food^c	\$46.6	\$67.6	\$97.4	\$128.0	\$181.2	\$267.5	574	40.9%	31.9%
Bev. & stimulants	\$15.8	\$22.4	\$34.7	\$41.3	\$61.8	\$99.3	629	13.9%	11.9%
Oilcakes	\$0.8	\$2.1	\$5.0	\$7.1	\$10.4	\$16.0	1,979	0.7%	1.9%
Tobacco & cig.	\$3.7	\$7.8	\$10.9	\$18.2	\$23.0	\$27.9	757	3.2%	3.3%
Crude materials	\$2.0	\$4.8	\$7.4	\$15.7	\$21.4	\$29.4	1,488	1.7%	3.5%
Fibres	\$10.5	\$10.7	\$10.5	\$10.6	\$12.2	\$14.3	136	9.2%	1.7%
Other non-food	\$13.8	\$19.7	\$28.9	\$35.1	\$52.4	\$80.5	584	12.1%	9.6%

a. Primary and processed products from crops and livestock. Fishery products not included.

b. As per FAO classification. Sugars include also sugar crops (e.g. sugar beets), syrups, confectionery, and honey.

c. As per FAO classification. Beverages and stimulants include coffee and tea, regarded as non-food products by FAOSTAT. Fibres include wool, hair, silk, and various vegetal fibres (cotton, jute, coir, etc.). Crude materials include a variety of products from feathers to flowers, from hair for brushes to plants used in perfumes.

Exports of oilseeds and their products (oils and cakes) grew very fast. Vegetables, fruit, cocoa/chocolate, meat, dairy products and eggs have grown faster than cereals, as did "other food" products like nuts (Figure 5 and Table 1). This reflects changing consumption patterns across the world, mostly derived from economic development and rising incomes, whereby diets tend to diversify beyond staple foods towards items rich in protein, fat, and micronutrients. These dietary shifts involve better nutrition for many, but also tendencies towards excessive fat intake and thus obesity.

Non-food exports grew more slowly than food, except for the heterogeneous 'crude materials' group which includes from tortoiseshells to cut flowers, from pig bristles to seaweeds and algae, from bird feathers to bones and horns. The extraordinary growth rates of heterogeneous groups like 'other food' and 'crude materials' products reflect a greater diversification of agricultural trade and a growing demand for more expensive non-staple products. As a result of these tendencies, the shares of product groups in total trade have also changed (Figure 6). In particular the share of oil-crop products (seeds, oils, cakes) increased from 5% to nearly 12%, and also other products like vegetables or meats experienced an increase in their respective shares.

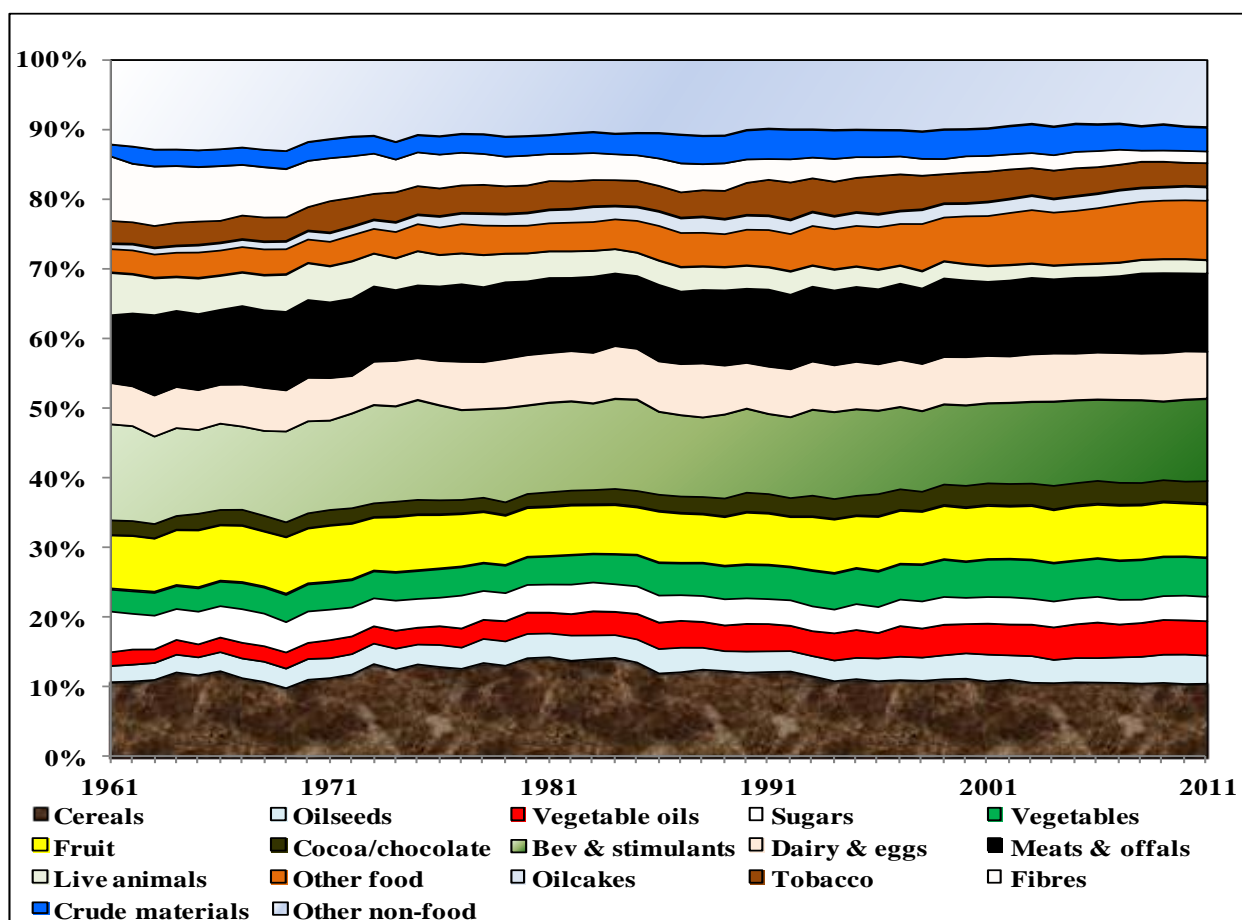


Figure 6. Shares of product groups in world agricultural exports, at constant 2004-06 FOB export prices. Source: FAOSTAT.

Regional agricultural trade

As agricultural and food trade grew strongly during recent decades, it also did so in most parts of the world. This is reflected in flows of trade (exports and imports) by region.² However, it should be borne in mind that the total exports (or imports) of a region represent the sum of the exports (or imports) of the individual countries in the region, including intra-region trade. For instance, exports from Africa (i.e. from all countries located in Africa) include exports both to other African countries and to countries in other regions.

A measure of a region's importance in world trade is its share in **total trade** (the sum of its exports and imports). By this measure, and concerning agricultural trade, European countries have the largest share, followed by Asian countries. Countries in these regions jointly account for 73% of world agricultural trade in 2011. North American and Latin American countries have shares of 11% each, and Africa 5% (Figure 7 and Table 4). Asian countries multiplied its trade by a factor of 10.4, and those in LAC by 8.95, both above the world average of 7.18. Europe, growing by a factor of 6.65, North America by 5.84, and Africa by 3.90, were below the growth rate of world agricultural trade. However, it should be borne in mind that these regional figures include intra-region trade.

² Countries have been grouped by continent, as they are grouped in FAOSTAT, with three modifications: 1. 'Asia' in this paper includes also countries in Oceania and the Pacific, like Australia, New Zealand, Philippines, and all Pacific island countries, and therefore it should be regarded as 'Asia/Pacific'. 2. The former USSR was entirely classified in Europe up to 1991 (including its Asian parts), as is today the Russian Federation; to maintain consistency throughout the whole half century, the Asian splinters of the former Soviet Union, now independent countries, have been classified here in Europe, where their territories were included before the USSR dissolution; this refers to Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. 3. Our LAC region is the sum of FAOSTAT regions 'South America', 'Caribbean', and 'Central America' (the latter including also Mexico) or equivalently, the difference between FAOSTAT's regions 'Americas' and 'Northern America'.

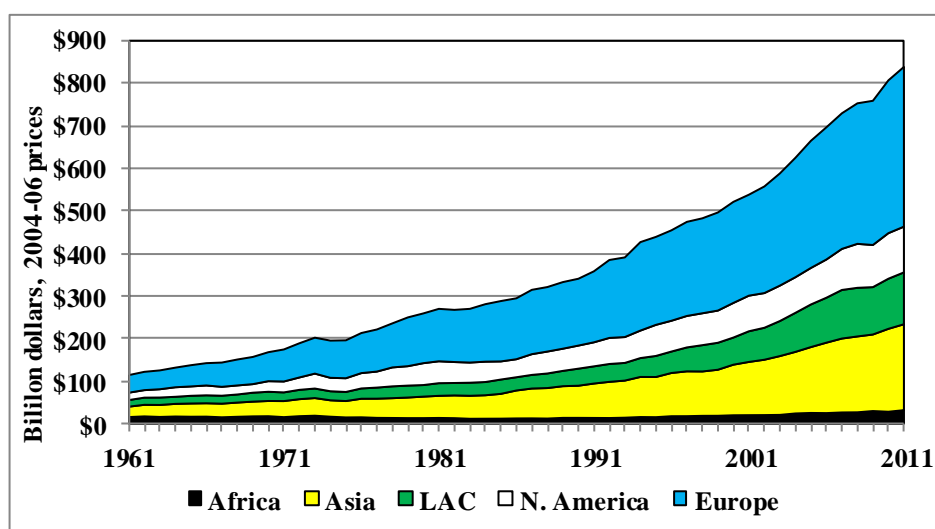


Figure 7. Total agricultural trade (exports + imports) by region, 1961-2011, in billion USD at 2004-06 prices. Based on FAOSTAT. Regional trade includes intra-regional trade.

Regions exhibit differences in the **relative** growth in agricultural exports, as shown in Table 2 in the form of annual growth rates, and in Figure 8 in the form of index numbers.

Table 2. Annual growth rates of agricultural exports by region, 1961-2011. Based in FAOSTAT.

	1961-63 to 2009-11	1961-63 to 1969-71	1969-71 to 1979-81	1979-81 to 1989-91	1989-91 to 1999-01	1999-01 to 2009-11
World	4.03%	4.12%	4.54%	2.85%	4.19%	4.45%
Africa	1.27%	0.40%	-2.30%	0.29%	3.60%	4.34%
Asia	4.21%	3.87%	3.39%	4.34%	4.31%	5.05%
LAC	4.15%	3.00%	3.02%	3.21%	5.51%	5.83%
N. America	3.71%	3.30%	7.71%	0.92%	3.99%	2.68%
Europe	4.52%	6.15%	5.52%	3.08%	3.91%	4.29%

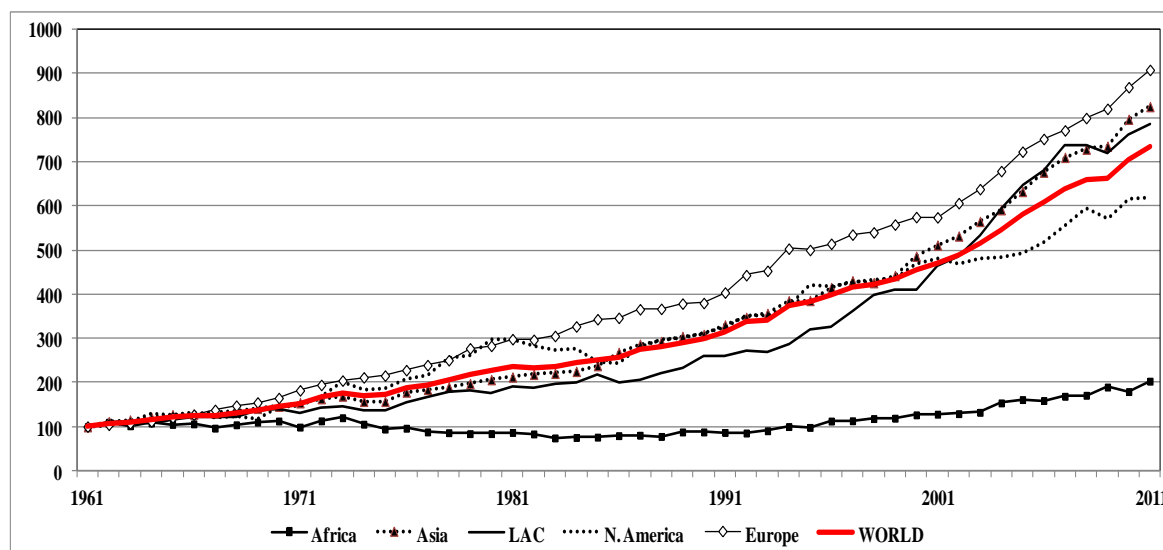


Figure 8. Index of real agricultural exports by region (valued at 2004-06 prices), 1961-2011 (1961=100). Regional figures include intra-regional exports.

The most dynamic countries are in Europe, Asia, and Latin America, where total exports (including intra-regional trade) grew well above the world average. North America grew generally close to the world average (albeit below it in the 2000s). Africa performed much more poorly than other regions up to the 1980s, but its exports have nonetheless been growing strongly lately, at 4.34% per year since the turn of the century (i.e. above the rates of Europe and North America, and close to the world average), and doubled since the mid-1990s.

As regards imports, Asia and Latin America were the two regions that expanded more rapidly; Africa was somewhat above the world average, whilst North America and Europe grew at a pace just below the world average (Figure 9). As shown in Table 3 the worst period for African farm exports (1969-71 to 1979-81) was also the period when imports grew faster (at 7.15% per year), because of fast demographic growth, relatively slow growth in production and weak exports; since the turn of the century, while African farm exports were growing quite strongly, its farm imports grew even faster, in spite of decelerating demographic growth, probably a reflection of income growth and strong non-farm exports (especially from mining) in a context of high commodity prices. As will be seen later, Africa (in spite of the strong growth of its farm imports) is devoting to them a small and decreasing fraction of its export revenues.

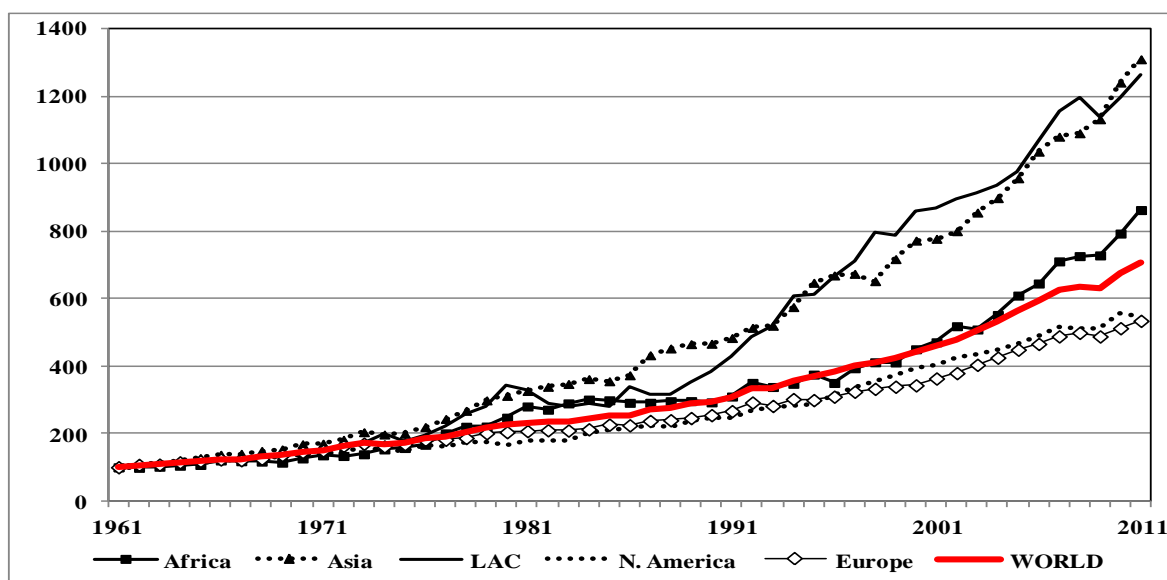


Figure 9. Index of real agricultural imports by region (valued at 2004-06 prices), 1961-2011 (1961=100). Regional figures include intra-regional imports.

Table 3. Annual growth rates of agricultural imports by region, 1961-2011. Based in FAOSTAT.

	1961-63 to 2009-11	1961-63 to 1969-71	1969-71 to 1979-81	1979-81 to 1989-91	1989-91 to 1999-01	1999-01 to 2009-11
World	3.95%	4.15%	4.47%	2.83%	4.09%	4.24%
Africa	4.40%	2.78%	7.15%	1.85%	4.01%	6.00%
Asia	5.29%	5.92%	6.66%	4.21%	4.83%	4.97%
LAC	5.21%	4.11%	8.19%	2.00%	8.04%	3.63%
N. America	3.44%	3.04%	2.57%	3.44%	4.78%	3.28%
Europe	3.36%	3.99%	3.59%	2.28%	3.14%	3.92%

Regional shares in global agricultural trade changed accordingly (Table 4. Regional shares and cumulative real growth in total agricultural trade (exports + imports), 1961-2011, at 2004-06 prices (Based on FAOSTAT). Includes intra-regional trade.

	1961	1971	1981	1991	2001	2011	2011 index (1961=100)
World	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	718.7
Africa	9.3%	6.7%	5.6%	4.5%	4.5%	5.0%	390.9
Asia	18.6%	19.8%	21.0%	24.0%	25.3%	27.1%	1042.8
LAC	8.4%	7.6%	8.1%	8.1%	10.1%	10.5%	895.0
N. America	13.9%	13.1%	14.4%	12.9%	13.3%	11.3%	584.5
Europe	49.8%	52.8%	51.0%	50.5%	46.8%	46.1%	665.1

Table 5 and Table 6).³ North America and Europe provide the bulk of agricultural exports (from 51% in 1961 to 57% in 2011). The share of Africa has decreased from nearly 14% in 1961 to just 3.8% in

³ These regional shares refer to total imports or exports of nations within a region, and may include intra-regional trade with other countries in the same region. Thus, they do not represent the trade openness of a *region* as regards its trade with the rest of the world, but the degree of trade openness of the *countries* within each region.

2011, whilst Asia remained this past half century between 21% and 24% of total agricultural exports. As regards imports, also Europe and North America receive a dominant portion of the total, albeit decreasing their joint share from 75% in 1961 to 57% in 2011. The reduction in the share of Europe and North America was gained by Asia and Latin America, which almost doubled their shares. The share of Africa was relatively stable, receiving 5-6% of total agricultural imports along the past half century.

Table 4. Regional shares and cumulative real growth in total agricultural trade (exports + imports), 1961-2011, at 2004-06 prices (Based on FAOSTAT). Includes intra-regional trade.

	1961	1971	1981	1991	2001	2011	2011 index (1961=100)
World	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	718.7
Africa	9.3%	6.7%	5.6%	4.5%	4.5%	5.0%	390.9
Asia	18.6%	19.8%	21.0%	24.0%	25.3%	27.1%	1042.8
LAC	8.4%	7.6%	8.1%	8.1%	10.1%	10.5%	895.0
N. America	13.9%	13.1%	14.4%	12.9%	13.3%	11.3%	584.5
Europe	49.8%	52.8%	51.0%	50.5%	46.8%	46.1%	665.1

Table 5. Regional shares and cumulative real growth in agricultural exports, 1961-2011, at 2004-06 prices. (Based on FAOSTAT). Includes intra-regional trade.

	1961	1971	1981	1991	2001	2011	2011 index (1961=100)
Africa	13.8%	8.9%	5.1%	3.8%	3.7%	3.8%	203.1
Asia	21.4%	21.6%	19.3%	22.6%	23.2%	24.1%	825.6
LAC	13.5%	11.7%	11.0%	11.3%	13.4%	14.5%	787.2
N. America	15.2%	14.7%	19.1%	15.8%	15.5%	12.8%	619.7
Europe	36.1%	43.1%	45.6%	46.6%	44.1%	44.8%	908.6
World	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	733.5

Table 6. Regional shares and cumulative real growth in agricultural imports, 1961-2011, at 2004-06 prices (Based on FAOSTAT). Includes intra-regional trade.

	1961	1971	1981	1991	2001	2011	2011 index 1961=100
Africa	5.1%	4.6%	6.2%	5.1%	5.2%	6.2%	863.3
Asia	16.1%	18.2%	22.7%	25.3%	27.2%	29.9%	1310.7
LAC	3.7%	3.7%	5.3%	5.1%	7.0%	6.6%	1262.7
N. America	12.7%	11.7%	9.9%	10.3%	11.1%	9.9%	545.6
Europe	62.5%	61.9%	56.0%	54.1%	49.4%	47.4%	534.4
World	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	704.9

Agricultural trade balance

When food security was equated with self-sufficiency at country level, a most significant indicator was the food trade balance. A country with a food trade deficit was deemed 'not able to feed itself'. Those days are long gone: trade is now seen as 'a key element for achieving food security'. On the other hand, even under an old-fashioned principle of *agricultural* self-sufficiency, it is not absolutely required that a country should be self-sufficient in *food* production, when the corresponding resources (especially farmland) may be devoted to either food or non-food production. The agricultural sector itself may generate exports of non-food products and thus providing funds for food imports. Thus a country may export cotton fibre or coffee (both non-food by FAO classification) and import maize or rice, reckoning that revenue from non-food agricultural exports affords importation of more food than the country could otherwise produce. Most countries in practice export some agricultural products and import others. They may also pay for agricultural imports with exports from other sectors (e.g. mining, tourism or manufacturing) or the converse. All these situations are compatible with any prevalence of food security or insecurity among their people: having a positive or negative balance in agricultural trade is not, per se, a significant clue as regards food security.

Two methodological remarks are in order here. First, it is obvious that at the world scale, global exports should equal global imports, except for statistical discrepancies. As discussed in the Methodological Appendix, the net balance of statistical discrepancies creates a small apparent deficit at the world scale (amounting in 2011 to 2.8% of total exports). Second, regional exports (or imports) include intra-regional trade, but these intra-regional flows offset each other (except for statistical discrepancy) in a region's trade *balance*, which thus mostly represents net exports from the region to the rest of the world.

Regional agricultural trade balances vary. We have seen that developed regions (Europe and North America) account for a majority of both agricultural exports and agricultural imports. Their balance is, however, different from each other. North America shows a longstanding agricultural trade surplus whereas Europe has a persistent deficit. North America surplus rose from about zero in the early 1960s to about \$20 billion in 1978-80, and has been oscillating around that amount ever since (all at 2004-06 prices). Europe, instead, has been always in deficit during the past half century, oscillating about -\$40 billion with an occasional improvement to -\$23 billion in the 1990s and a temporary drop to nearly -\$60 billion in 2007.

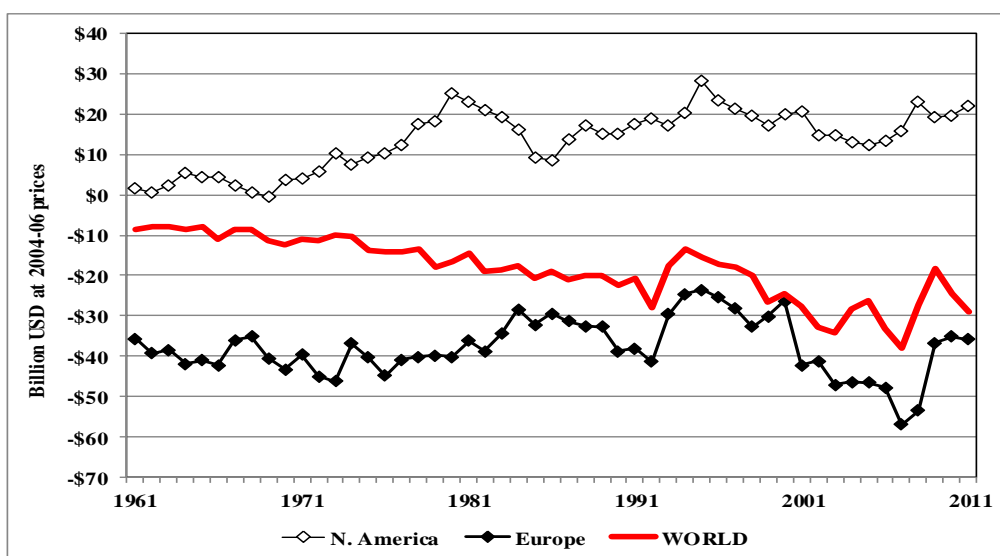


Figure 10. Agricultural trade balance of North America and Europe, in billion USD at 2004-06 prices, 1961-2011. Based on FAOSTAT.

Absolute trade balances in these two regions have been within a more or less stable range in recent decades, but the *relative* significance of those balances (as compared to total agricultural trade) has been generally *decreasing*: their agricultural trade deficit or surplus represents a decreasing share of their total agricultural trade (Figure 11); it has been so in Europe since the early 1960s, and in North America since the late 1970s.

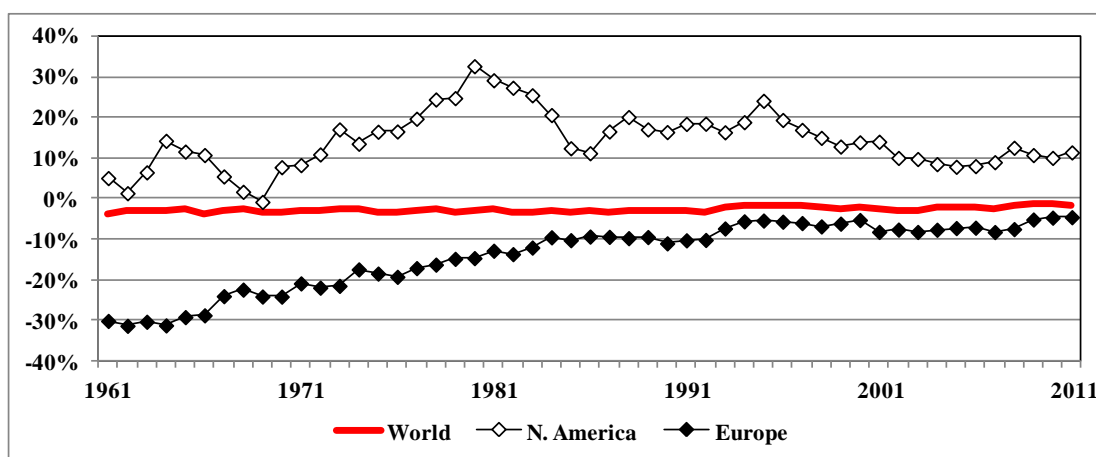


Figure 11. Relative agricultural trade balance in Europe and North America (trade balance as a percentage of regional agricultural trade, at 2004-06 prices), 1961-2011. Based on FAOSTAT.

North America's surplus as a percentage of trade did increase in 1961-80, to about 30% of total agricultural trade, but declined afterwards to settle in the 2000s about 10%. In Europe the deficit shrunk in relative terms from about 30% of total trade in the 1960s to about 5% in the two more recent decades. Notice that at this scale the world balance (caused mainly by the CIF-FOB gap) is seen as small and stable. In summary, Europe continues to have an agricultural trade deficit, albeit a diminishing one that tends towards equilibrium, while North America is a net exporter.

In the developing world (approximated here by Africa, Asia, and Latin America), the only region with a persistent and expanding agricultural trade surplus is Latin America: its relatively small surplus of the early sixties gradually increased, especially since the late 1990s. By 1961 both Asia and Africa had a small surplus in agricultural trade, but it turned into a deficit by the mid-1970s, a deficit growing larger ever after. The ensemble of the three regions, however, shows a net deficit of about \$15 billion in 2011, dominated by the Asian deficit of about \$60 billion.

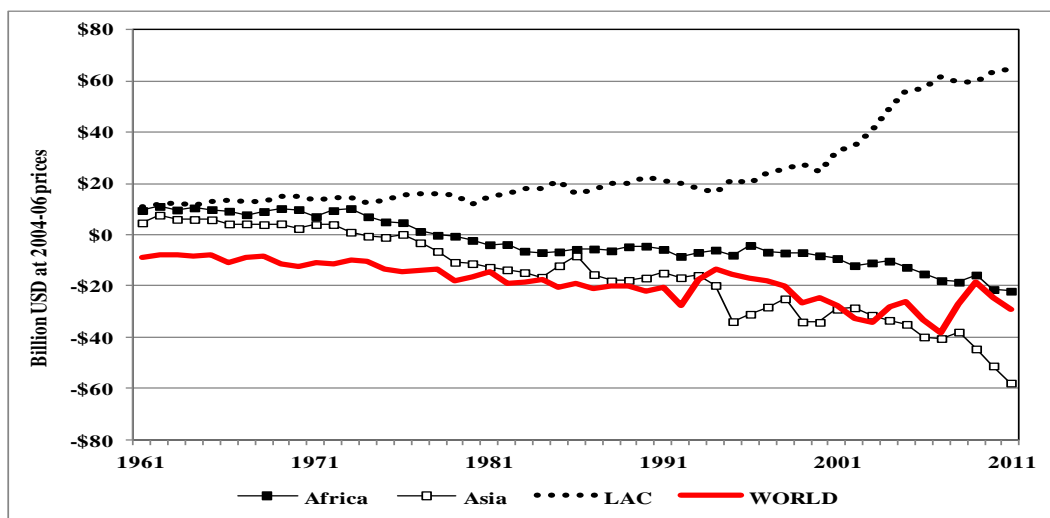


Figure 12. Agricultural trade balance of Africa, Asia, and Latin America and the Caribbean, in billion USD at 2004-06 prices, 1961-2011. Based on FAOSTAT.

At the world scale, as discussed in the Methodological Appendix, there is a small statistical discrepancy between global exports and imports. However, Figure 13 and Figure 13 show that the world's apparent deficit with itself is quite small. At regional level, whilst the absolute magnitude of the Latin American trade surplus was rising, its relative significance (as a percentage of its total agricultural trade) decreased slightly from about 55% in the 1960s to around 30-40% in more recent periods. LAC is however the only developing region with positive net exports over the entire half-century analysed here. Africa started with a surplus representing 40% of its agricultural trade, to plunge during the 1970s into a deficit that has hovered about 20% of total agricultural trade since 1981. Asia had in the 1960s a modest surplus of about 15% that gradually turned since the late 1970s into a deficit of similar proportions (relative to total agricultural trade).

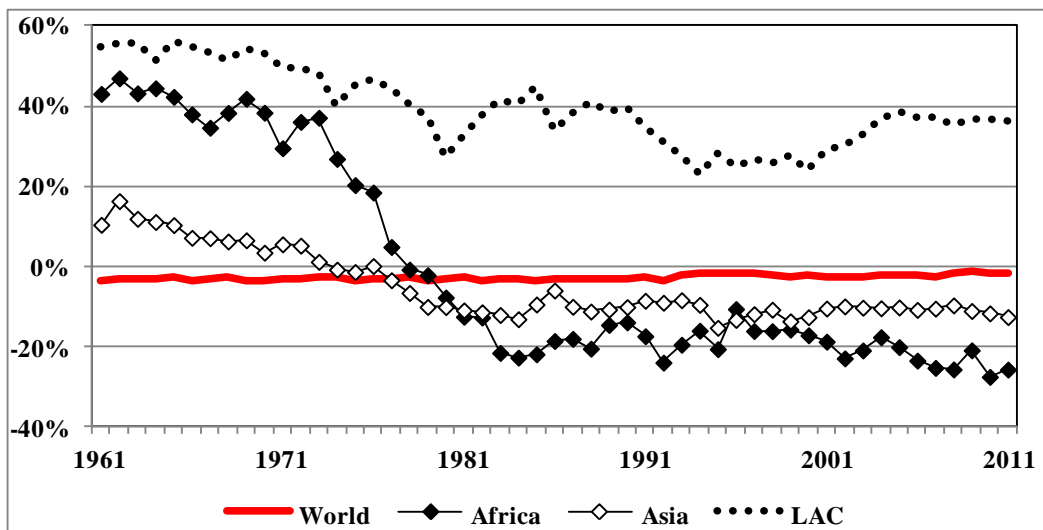


Figure 13. Relative agricultural trade balance in Africa, Asia, and LAC (trade balance as a percentage of regional agricultural trade, at 2004-06 prices), 1961-2011. Based on FAOSTAT.

As a whole, both developed and developing regions have tended to equilibrium in their agricultural trade. Their movements in this regard mirror each other: by 1961, Europe and North America were net importers, with a joint agricultural trade balance equivalent to 15% of the world's total agricultural trade volume (world exports + world imports), whilst Africa, Asia and LAC were net exporters with a balance worth 10% of total agricultural trade.⁴ The two opposite figures converged gradually during the 1960s and 1970s, and have been hovering about the equilibrium level (approximately 0%) since 1980 (Figure 14). It should be recalled that at world level there is an apparent, albeit small, trade deficit, due to an import-export pricing gap discussed in the Methodological Appendix. For all intents and purposes, the two broad groups of regions have been at trade equilibrium ever since 1980.

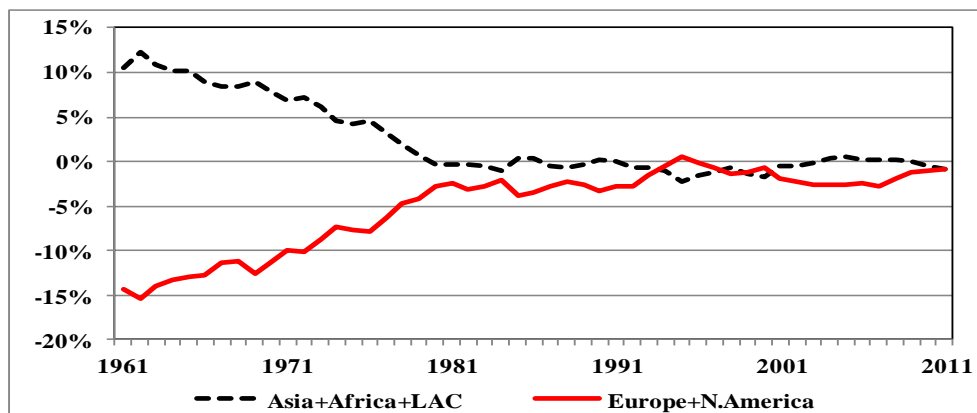


Figure 14. Agricultural trade balance in two broad groups of regions, as a percentage of world total agricultural trade, at 2004-06 prices, 1961-2011

By 1960, therefore, the developing world was a net supplier of food and other farm products to the richer parts of the world; this agreed with a traditional representation of disparities in economic development, whereby the 'centre' was industrial and the 'periphery' was agricultural. This has changed, at least regarding agricultural trade. On the whole, both broad classes of countries are near equilibrium in their farm-related trade, and have been so for many years. *Within* each group of regions, North America in one of them and Latin America in the other are the only ones with a significant surplus in agricultural trade; Asia and Africa are net importers, and Europe is close to a balanced trade. The Americas therefore are, in a manner of speaking, 'feeding the world'.

⁴ These two broad regions might be taken as an approximation to developed and developing countries, although some developed countries (like Japan and Australia) are included in our 'Asia' region, and some countries in our 'Europe' region (viz. some Asian splinters of the former USSR) are classified as developing.

A traditional view of development included the notion that developing countries export agricultural products towards the developed parts of the world. But this simplified picture is no longer valid. It was approximately valid up to the 1960s, indeed; these data imply that developing countries in the 1960s were net exporters of agricultural products to the developed part of the world, but this has ceased to be true, at least for developing countries as a whole. Among developing regions, LAC is still a net exporter, whilst Asia and Africa have changed from net exporters into net importers. This process responds to several factors. One is faster growth of food demand in developing economies, especially in Asia and Africa, where both population and incomes grow faster than in the developed world. Another is the growth of other foreign revenues in developing economies, such as foreign investment, remittances, increasing exports of non-renewable resources such as oil and minerals, and probably also a gradual 'relocation' of manufacturing to emerging countries, whilst developed countries evolve a 'knowledge economy' more concentrated on services and information (some developing countries are also able to export increasing amounts of *services* to the developed world, including for instance software development and call centres, not to speak of tourism); this process generates increasing non-agricultural exports in the periphery of the world system, as well as other flows of revenue (foreign investment and transfers), allowing developing countries to afford increasing agricultural imports.

Financial capacity to import food

The main source of foreign currency to import food (and other goods) is export revenue. Exports have increased and diversified, even in the areas that require significant amounts of food imports like Africa. Exports comprise merchandise and service flows; tourism, for instance, is an expanding area of service exportation that is growing in all regions of the world. However, the present analysis is only about *merchandise* exports. The question we ask is what percentage of merchandise exports is required to pay for food imports. Answer: a small proportion that is itself diminishing over time.

The two developing regions with a negative trade balance are Asia and Africa. In both, food imports represented about 15-20% of merchandise exports back in the early 1960s. That percentage has been generally falling, though much more in Asia than Africa due to the faster growth of Asian exports. For this particular analysis, we use exports and imports at *current* prices, since those are the significant values that have to be afforded in order to pay for imports. Besides, in the case of Asia we also show data for Asia *excluding its developed countries* (OECD members: Japan, Australia, New Zealand, and South Korea), to have a narrower indicator concerning the developing nations in Asia. It turns out that developing Asia showed a stronger trade surplus than all Asia in the 1960s, but has lately been at the same level than the whole continent, especially since 1990, making the distinction irrelevant for the more recent decades.

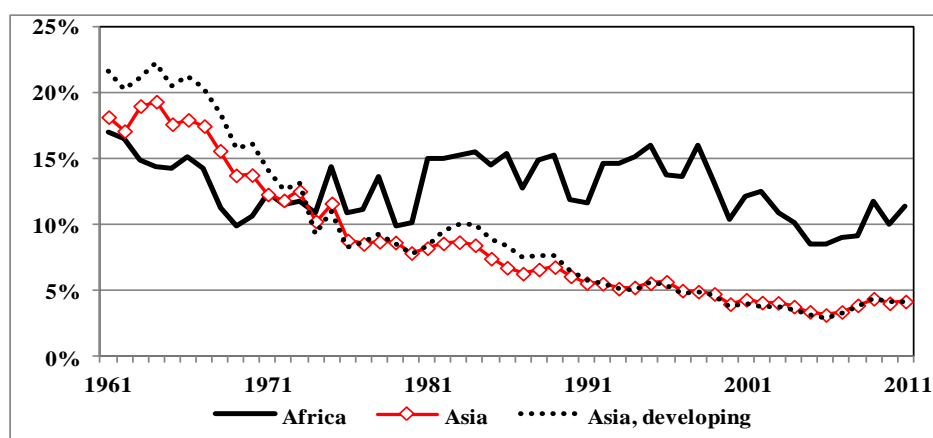


Figure 15. Africa and Asia: Food imports (excluding fish) as a percentage of total exports, at current prices, 1961-2011

As shown in Figure 15, food imports in the early 1960s represented 17-18% of total export revenue in both Africa and Asia (and 22% in the **developing** parts of Asia). Those percentages fell in both

regions over half a century, albeit more steeply in Asia, to 4% in Asia and 10% in Africa. In the case of Africa, a strong reduction in this indicator occurred after the turn of the century, when it fell from around 15% of total exports to around 10%; Africa devoted a higher share of its exports to the importation of food in the 1980s and 1990s, when food prices were generally lower, than in the 2000s, when food prices increased significantly. This leads to our next section.

Agricultural prices and trade

After a period of relatively low international prices for agricultural (and other) commodities, which covered the years around the turn of the century, agricultural commodity prices rose significantly in the 2000s, peaking first in the first half of 2008, then subsiding and subsequently rising again in 2010 until early 2011. They have been generally diminishing in 2011-2014. The price surges sparked fears of a 'food crisis' which may develop into famines, food riots and a worldwide surge in poverty and malnutrition.⁵ As a matter of fact, the repercussions were less harmful than was feared at the time; the number of undernourished people and the percentage prevalence of undernourishment (FAO-SOFI 2012, 2013) kept diminishing during the high-price years, per capita food demand kept increasing, and production kept growing to unprecedented levels, fuelled by rising demand and higher prices.

The surge in agricultural prices in the 2000s implied for importing regions (Asia and Africa) a rise in the burden of food imports relative to total exports revenue, but the increase was slight, not reaching the levels that were usual in past decades. In particular, Africa devoted to food imports about 15% of its export revenue in the 1980s and 1990s, whereas after the prices surges in 2007-11 the percentage barely rose from 8% in 2006 to a high of 12% in 2009, and 11% in 2011. The surge did imply an increased cost of importing food, as is noticeable in the figures for food imports at current prices in Africa and Asia (Figure 16). It is important to note, however, that the **real** amounts of food imported in Asia and Africa, i.e. food imports at constant 2004-06 prices, did not diminish with the surge in food prices, did not increase either as prices fell in 2009, nor were they depressed when prices surged again in 2010 (Figure 17). Real food imports behaved quite inelastically along these periods of high price volatility, thus not affecting food supplies in importing countries.

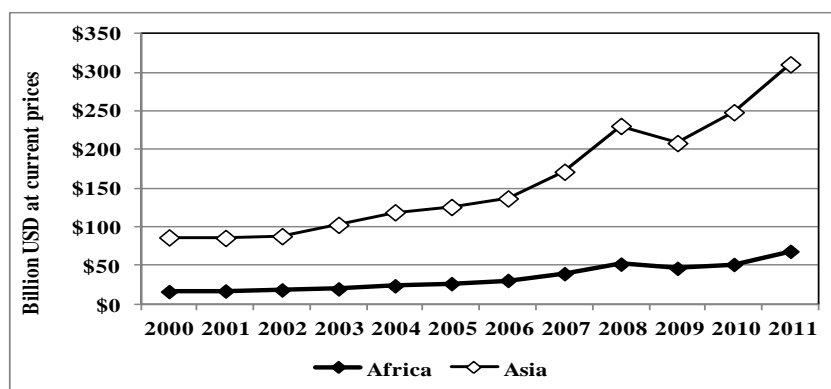


Figure 16. Nominal food imports in billion USD at current prices, in Asia and Africa, 2000-2011

⁵ See for instance UN 2011, Headey & Fan 2010, Bobenrieth & Wright 2009, NYT 2008, Mittal 2009; and many others. FAO estimated at the time that the number of the undernourished would surpass one billion (FAO-SOFI, 2008 and 2009 issues), a claim eventually withdrawn (FAO-SOFI, 2012 issue).

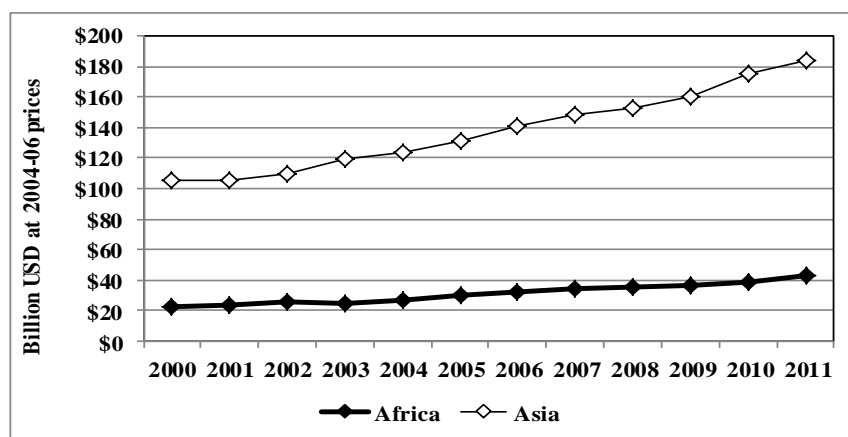


Figure 17. Real food imports, in billion USD at constant 2004-06 prices, in Asia and Africa, 2000-2011

In fact, the food price rise of 2007-08 did not cause a significant movement in the percentage of export revenue devoted to food imports (as has been seen in Figure 15); and the rise of that percentage in 2009, for both food importing regions, was chiefly due to a fall in total export revenue (which decreased more steeply than the cost of food imports); in the case of Asia, the cost of food imports fell by 7% in 2009 (relative to 2008), but total export revenue fell by 19%; in the case of Africa, the cost of food imports fell by 10% whilst total exports fell by as much as 30%. The 2009 temporary rise in the share of exports devoted to food imports was hence more an effect of the international recession than a result of higher food prices. As a matter of fact, the rise and subsequent fall in food prices was contemporary with similar movements in other primary products (including non-food crops) exported from Asia and Africa; the price volatility of traded commodities affected both their exports and their imports, with a net effect that was smaller than initially expected.

Beyond these transient movements, the overall picture suggests that food-importing regions devote a decreasing share of their exports to the importation of food, and have also experiencing a sustained growth in incomes that may help afford more expensive food. This started earlier in Asia, which entered an export-driven rapid development path during the past half century; in Africa the fall in relative food-import burden occurred mostly since the mid-1990s, as the region as a whole started growing faster. It is most remarkable that Africa as a whole devotes to food imports a mere 10% of its total export revenue (fluctuating recently between 8% and 12%). Of course, this region-wide view does not show the profound differences between individual countries of both regions, where dynamic export economies coexist with stagnant and more closed ones, including some collapsing under State failure or violent conflict. Reasons of space preclude at this point any further discussion of country-level situations.

Summing up

Food trade grows much faster than food output, implying that exported (and imported) food represents an increasing share of the world's food supply. Food exports grow also faster than non-food agricultural exports. Most of the increase in food exports comes from trade in **non-staple** products which grow much faster than average (oilseeds, vegetable oil, vegetables, chocolate, dairy products and other food, plus oilcakes –which are themselves non-food but are used for feeding livestock to produce non-staple foods of animal origin). Demand for these products is more elastic in relation to income. Trends in food trade thus amplify the growing trend in food production, reflecting a world with increasing levels of income, and increasingly inter-related.

Recent fluctuations in international food commodity prices have not caused a corresponding movement in the real flows of food imports coming into food importing regions (Asia and Africa). The rising trend in real food imports continued unabated, and the percentage of food imports relative to total exports responded more to the effects of the international recession on total exports than to the effect of changes in imported food prices. In fact, for many developing countries international agricultural commodity price fluctuations affected both food imports and total export revenues (where agri-

cultural and other primary products represent a high proportion of total exports). The financial burden of importing food thus represents a dwindling proportion of export revenue, most especially in Asia but also in Africa.

Does trade represent 'a key element in achieving food security', as described by World Food Summits (WFS 1996, 2009)? It apparently does, and its role in food security tends to grow over time. The fact that food trade grows much faster than food production, and represents a decreasing fraction of export revenue, especially in net food-importing regions like Asia and Africa, does suggest as much. However, this paper is limited to trends in agricultural and food trade, not covering food consumption or access to food, or inequalities thereof across households and individuals, which are the essential elements defining food security, and really merit a separate discussion.

Methodological Appendix

Agricultural and food trade statistics

Trade as a general economic process includes both domestic and international trade. However in the present context the source data are at the scale of nations, and thus trade data refer to **international** trade. From the point of view of food security (interpreted in terms of food access by individuals) domestic trade is equally important, but in the present context we mostly discuss foreign trade.

FAOSTAT, the FAO Statistical database on food and agriculture, is the main source of detailed international data on agricultural trade with yearly data on quantities and values at country level and for major regions, for nearly 200 countries and over 400 agricultural commodities (primary and processed products, food or non-food), covering the period from 1961 to 2011 (latest year available at the time of writing). FAOSTAT trade data come from *national* statistics, though FAO performs certain adjustments to harmonise reporting standards and other aspects of national data in order to produce comparable figures worldwide.

Regions

FAO provides trade statistics for individual countries and also for major continental regions and other country groupings (although no totals are offered for developed and developing countries). For the purpose of this study, FAO regions have been slightly modified. First, we have corrected the inter-temporal inconsistency arising from the dissolution of the USSR: the entire Soviet Union, including its Asian parts, was counted in 'Europe' until the time of its dissolution; the independent nations formed after the USSR was dissolved were classified since 1992 in the continent to which they belong. Thus the entire Russian Federation is still classified in Europe, as are Ukraine and Belarus, but the Asian parts of the former USSR that are now independent nations were counted in Europe until 1991 and in Asia since 1992. In the present study, to restore consistency, the Asian USSR splinters are included in 'Europe', so that our 'Europe' and 'Asia' regions (unlike the respective FAOSTAT regions) cover the same territory from 1961 to 2011. Other than that, FAOSTAT region Oceania has been merged here with Asia, which thus must be understood as 'Asia/Pacific', and the FAOSTAT Americas region has been split into North America (US and Canada), and LAC (Latin America and the Caribbean). Thus the regional classification in this study is as follows:

REGION	COVERAGE
Africa	The FAOSTAT Africa region.
Asia	Asia/Pacific, including FAOSTAT region Asia plus FAOSTAT region Oceania (i.e. Australia, New Zealand, and other Pacific island countries), and excluding Asian nations that are splinters of the former USSR (Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan).
LAC	Latin America and the Caribbean, i.e. the sum of FAOSTAT sub-regions Central America, Caribbean, and South America.
North America	The FAOSTAT sub-region Northern America, including the US and Canada.
Europe	The FAOSTAT Europe region, plus the Asian splinters of the former USSR.

Valuation. FAOSTAT figures on the value of exports and imports are in **current** US dollars. FAOSTAT offers also trade *index numbers* for total exports and imports, based on constant 2004-06 prices, but no *absolute figures* in constant dollars are available. Figures at constant prices are required to measure real trade growth; in this study, hence, we have estimated trade flows at world-average 2004-06 export and import unit values, at the level of individual products. These world-average unit values are then used to estimate changes in real trade flows from 1961 to 2011. Technical details are given below, and the resulting unit values are in the Supplementary Information available online.

Intra-region and extra-region trade. FAOSTAT basic data on exports and imports refer to merchandises leaving or entering individual countries. For a given continent or region, regional aggregate exports or imports in FAOSTAT are the sum of the exports *of the respective countries*, including flows within the same region; thus total agricultural exports for a region (e.g. Africa) *include also intra-region trade*, and should *not* be construed as the amount of exports 'leaving the region'. Likewise, total imports into a region's countries should not be seen as imports 'entering the region' but 'entering the countries'. Regional imports or exports are just the value of products entering or leaving *the countries* of that region.

However, intra-regional exports approximately offset intra-regional imports (except for statistical discrepancies); therefore the regional *trade balance* represents, within statistical discrepancy, the net exports *of the region*. FAOSTAT offers a matrix of imports and exports by origin and destination, but only for certain products and for a limited number of years, which renders it unusable for the purposes of this paper.

Fish trade. One important aspect of FAOSTAT's trade (as well as production) statistics is the treatment of fisheries. Fishing statistics are on a separate domain, processed with a different software which produces different tabular results, and their trade figures in dollars do not start in 1961 (as do those concerning traded products from crops and livestock) but in 1976. Detailed quantities and values are available for recent years, but data for previous times are at a higher level of aggregation. Most of the analysis of production and trade in the present study is therefore limited to crops and livestock, excluding fish. For fishery statistics including trade, see FAO 2012.

Import/Export statistical discrepancy

Total world exports should equal total world imports, but it is not exactly so: world imports tend to be slightly larger than world exports. This is so for both agricultural products and also for all merchandise trade, both at current and constant prices. At current prices, for instance, world agricultural exports in 2011 amounted to \$1313.84 million, whereas world agricultural imports were \$1359.73 million, a 2.8% discrepancy. In the case of total merchandise trade, exports were \$18302.36 million whereas imports amounted to \$18396.25 million, a 0.5% discrepancy (much narrower than observed in agricultural trade).

This statistical discrepancy comes from several sources. One of them is how and when both flows are valued. Trade is ordinarily valued by national statistical systems at *border prices*: exports are thus valued by countries at the time and port of embarkation, in FOB (free-on-board) terms, and imports at the time and point of entry, in CIF (cost, insurance and freight) terms. Correct comparison of real agricultural exports and imports would require using the same valuation principle for both; for instance, using FOB prices for both flows. According to the World Trade Organization norms about trade statistics, both exports and imports should be reported in FOB (free on board) terms.⁶ FAO vows to comply with the WTO norms but, however, their methodological metadata state that this is not usually possible:

Most countries report export values as Free-On-Board (FOB, i.e. insurance/transport costs are not included), while import values are mostly reported as Cost-Insurance-Freight (CIF, i.e. insurance/transport costs are included). Therefore, for a given agricultural commodity, assuming that the declared export and import quantities match, the reported export value should be lower than the corresponding reported import value (<http://faostat.fao.org/site/362/DesktopDefault.aspx?PageID=362>, under Agricultural Trade).

⁶ http://stat.wto.org/StatisticalProgram/WSDStatProgramTechNotes.aspx?Language=E#Data_Notes.

For its Trade Indices, and attempting to comply with WTO norms, FAOSTAT deducts a standard percentage (12%) on account of insurance and freight whenever the original import data are in CIF terms and the respective FOB figure is not available. However, details on this selective deduction are not explicitly available for the series of absolute figures by country and product.

But the CIF-FOB gap should generate a wider chasm than observed (12% as per FAO's estimate, in countries reporting imports at CIF values, but smaller on average because other countries report both flows in FOB terms as per WTO rules). The actual gap is much narrower, indicating that other factors (including the fact that imports are often reported in FOB terms) tend to offset the CIF-FOB difference. The other factors of statistical discrepancy include smuggling, different registration rules for imports into (or exports from) free zones, re-exportation, on-board industrial processing occurring in factory ships at sea, and other factors, as described in FAOSTAT metadata under Agricultural Trade (<http://faostat.fao.org/site/362/DesktopDefault.aspx?PageID=362>). These factors include **time lag** (goods exported in December may reach destination in January, causing those shipments to be classified in different years for exports and imports); **reporting period** (most countries report by calendar year, January to December, but a few use other periods); **free zones** (in some countries, goods are regarded as imported or exported when they enter or exit a free zone, even if coming from or destined to the national territory); **misclassification** (a commodity may be classified differently at origin and destination countries); **in route losses** (some shipments are lost or destroyed before reaching destination); **reporting errors** (some reports may contain involuntary typos or errors); **confidentiality** (transactions not reported, due to various reasons); **smuggling and informal trade** (shipments not cleared through customs and thus unregistered); and **misinvoicing** (deliberate over-pricing or under-pricing of shipments to avoid taxes or currency controls, or other similar reasons).

The net effect of these various factors may potentially amplify or reduce the FOB/CIF gap between exports and imports. As a matter of fact, the net effect is that the reported value of world imports is just slightly higher than the reported value of world exports, and as a result the world unaccountably appears to have a small trade deficit with itself. Figure 18 shows the two world flows at constant prices; with current prices the image is practically the same.

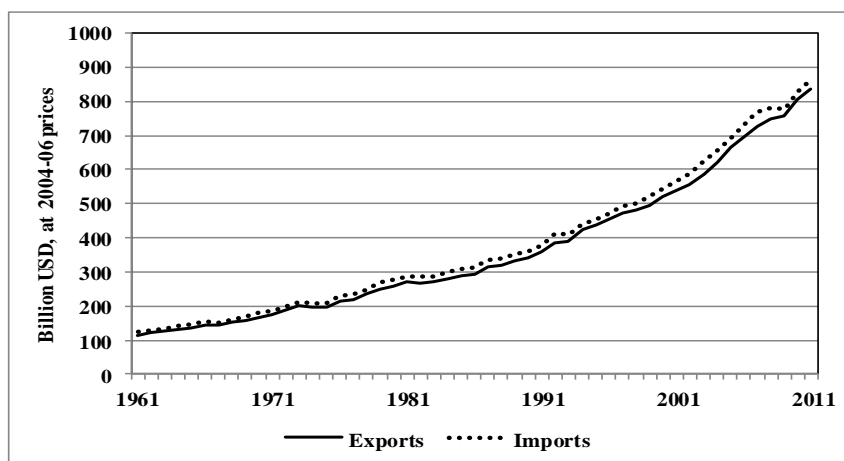


Figure 18. World agricultural exports and imports, in billion USD at constant 2004-06 prices. Based on FAOSTAT.

Due to these discrepancies, even the world as a whole appears unaccountably to have a trade deficit with itself, chiefly on account of the CIF-FOB gap, plus/minus some statistical discrepancy (Figure 19). The apparent deficit in world agricultural trade has been growing larger in absolute terms, from about -\$10 billion in the 1960s to around -\$30 billion in the 2000s, but in relative terms (Figure 20) it is of lesser and diminishing importance, shrinking from about -3% of total trade between the 1960s and the 1980s, to about -2% in more recent years.

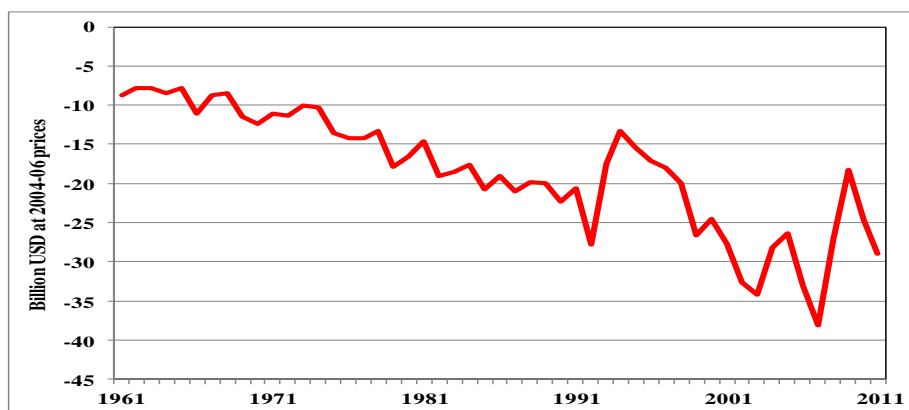


Figure 19. Apparent world balance of real agricultural trade (exports minus imports), 1961-2011, in billion USD at world-average 2004-06 prices. Based on FAOSTAT.

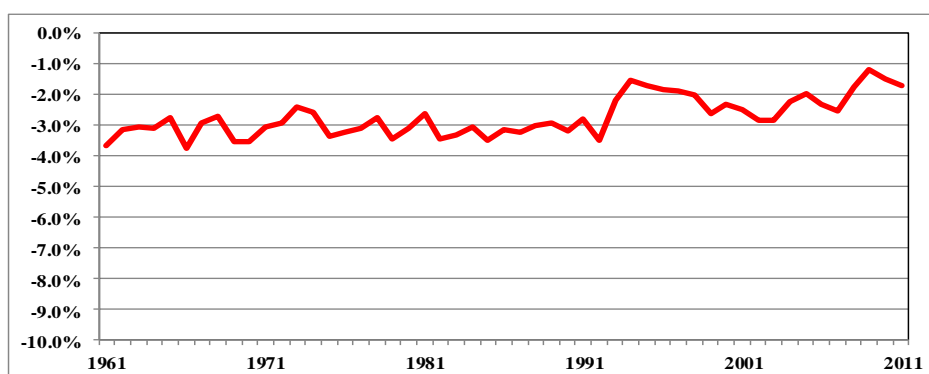


Figure 20. Apparent relative world balance of real agricultural trade (exports minus imports), as a percentage of total trade (imports+exports), both in USD at world-average 2004-06 prices, 1961-2011. Based on FAOSTAT.

The asymmetric charge of freight and insurance costs (on imports but not on exports), and other discrepancies, with a small net effect on world trade, is also surely a component of the trade balance of every country or region, though it is difficult to quantify in any particular case. However, it should be borne in mind that a regional agricultural trade deficit of below 2-3% of total trade might be just a statistical discrepancy, not reflecting any real difference between quantities exported or imported.

Estimating real agricultural trade

For most commodities, FAOSTAT statistics provide the *physical quantities* traded and the corresponding *value*. Users may derive unit values as the ratio of value to quantity. Physical flows are expressed generally in terms of weight (in metric tonnes), though a few products are expressed in physical units (e.g. head count of live animals traded). The monetary value of *agricultural trade flows* is given by FAO in *current* US dollars. FAOSTAT does *not* provide an account of trade flows at constant and uniform prices, as it does with production. It provides only *index numbers* of value, quantity and unit value, for both exports and imports, at country level and also for major regions and the world, but not the absolute figures underlying those index numbers.

As we have seen in the case of output, a measure of aggregate real quantities would imply adjusting for price changes over time and price differences across countries. Since export and import prices are ordinarily denominated in US dollars for most traded commodities, and goods have the same value for the exporter and the importer country, misalignments in the purchasing power of currencies at market or official exchange rates are of limited importance. Thus, for evaluating real trade flows, data in current US dollars should only be corrected for price changes over time. For this purpose we have computed **mean unit values of the period 2004-2006**, the same period on which real output series are based in FAOSTAT, and applied those unit values to physical export flows available since 1961, to get a series of real exports for agricultural or food products, at constant 2004-06 prices.

This approach requires some adjustments for products lacking information about quantities (or values) in 2004-06. Products without quantity or value data include at least the following categories:

- Products not traded in 2004-06 (but traded at other periods since 1961).
- Products traded in one or two of the reference years (2004-06) but not in all three.
- Products traded in 2004-06 but in small quantities, rounded to zero in the FAOSTAT database. Quantity data are in tonnes, or head of livestock, or thousand head in the case of chicken and other small animals, all given in integer amounts; quantities below 0.5 tonne or below 500 units are rounded to zero. Value, in turn, is given in thousand dollars, again in integer format. Some small flows may be rounded to zero in both quantity and value; in other cases only one component is rounded to zero, and thus those products show a positive *value* and a (reported) zero *quantity*, or the converse.
- Some **heterogeneous product categories** given only in value but not in quantity. This includes, for instance, 'Crude materials' (FAOSTAT item code 1293), for which only a total monetary amount is reported without any disaggregation into individual commodities or reference to their quantity. The 'Crude materials' item includes: **Of vegetable origin:** bulbs, tubers, tuberous roots, corms, crowns and rhizomes; live plants, cuttings and slips; mushroom spawn; cut flowers and flower buds; foliage, branches and grasses, mosses and lichens; plants and parts used primarily in perfumes, pharmaceuticals, insecticides, fungicides, or for similar purposes; seaweeds and other algae; vegetable saps and extracts; materials used for plaiting, stuffing or padding; materials used primarily in brooms or brushes; and materials used primarily in dyeing and tanning. **Of animal origin:** human hair, unworked and waste; pigs bristles and hair; badger hair and other brush- making hair and waste; guts, bladders and stomachs of animals (other than fish); skins and other parts of birds with their feathers or down; bones and horn-cores, unworked, defatted, simply prepared; powder and waste; ivory, tortoiseshell, whalebone, claws and beaks; coral and shells of molluscs and crustaceans; sponges of animal origin, ambergris, castoreum, civet and musk; cantharides, bile glands and other animal products used in pharmaceuticals.
- Another example of a traded product without reported quantity is 'Live animals, unspecified' (FAOSTAT item code 1171) which may include small and large animals and is thus not specified in terms of quantity.

Considering the above issues, the general procedure for estimating real value of both exports and imports was as follows:

- Tables for exports and imports by product and year (1961-2011) were obtained from FAOSTAT, at world level, with value in current USD and the respective quantities, for each product and year. This covered over four hundred distinct items.
- Average reference prices (unit values) for 2004-2006 were computed for 355 export items and 359 import items for which both quantity and value were available in the three years 2004, 2005 and 2006. This generated a set of unit values for exports and another set for imports. Both sets included a very similar but not exactly the same list of goods. Goods with 2004-06 unit values (i.e. with available quantity and price data for the three years of that period) covered typically 95% of each trade flow; the remainder corresponds to goods lacking quantity or value data for the three years 2004, 2005 and 2006, including also those few categories for which no quantity at all is reported for *any* year, but only the value.
- Trade flows at constant 2004-06 prices from 1961 to 2011 were computed *for each region of the world*, for goods for which 2004-06 unit values were available (covering about 95% of all agricultural trade). This implied downloading all the 51-year series of quantities for all the products traded at each FAOSTAT region, plus data for each of the Asian countries that were formerly part of the USSR and had to be transferred from Asia to Europe. Once the quantities for the regions used in this study were thus obtained, they had to be multiplied by the respective 2004-06 world-average unit value.
- To add an estimate of trade in the remaining commodities (the 5% of agricultural trade for which no unit values were available), at world and region levels, the value of trade flows (imports and exports) *at current prices* in US dollars was also computed at each region, for all agricultural product trade and also for those agricultural products with available 2004-06 unit values. The ratio of these two flows in current dollars was then used as an adjustment factor, to pass from the estimate of trade at 2004-06 prices, computed only for items with a 2004-06 unit value, to an estimate for all agricultural trade including also other items lacking a reference unit value. This adjustment factor was computed separately for imports and exports, for each region, and for each year from 1961 to 2011.

Online supplementary information

Online Supplementary Information for this paper contains an Excel file with the list of all import and export items in the FAOSTAT database (i.e. all items reportedly traded in at least one country for at least one year between 1961 and 2011). The table reports the computed reference unit values (average unit value for 2004-2006); these reference unit values are reported only for commodities having

both quantity and value information in the three reference years (2004 to 2006). Items without a unit value include: items traded in one or two of the reference years, but not in all three; items not traded in 2004-06 but traded in other years; and items traded in the reference years for which value data are reported but no quantity data is available. When valued at current dollar prices, these items typically represent less than five per cent of total exports or total imports.

Items are not exactly the same for imports and exports. FAOSTAT reports 410 export items, and 450 import items at least for one of the years from 1961 to 2011; out of that total, 355 export items and 359 import items have the required information (quantity and value in the three reference years 2004 to 2006) to estimate unit values. Some export items do not appear in the import items list, and vice versa. This discrepancy is mainly caused by the fact that exports are classified by the exporting country, and imports by the importing one; the respective authorities may place a given item in different categories. Another possible reason is that a flow of trade went unregistered in the origin but was registered at destination, or the converse.

As an example of differences in product classification, consider for instance the various items related to rice; *exports* include: Rice, milled/husked; Bran of rice; oil of rice bran; cake of rice bran; and Beverages made of fermented rice. Countries with rice-based *imports* at some year from 1961 to 2011 have reported the following items: Rice, paddy; Rice, husked; Rice, milled; Rice, milled/husked; Rice, broken; Bran of rice; Oil of rice bran; Cake of rice bran; and Beverages made of fermented rice. All these items report quantities and prices, for both exports and imports, with the sole exception of the cake of rice bran. In this case, some items appear as exports and as imports, but some appear in the import list but not in the export list. Other similar situations exist for other products.

The Excel tables provided online as Supplementary Information show all the items that appeared as imports or exports at some point during the half century 1961-2011; for most of them there are data on both quantity and value during the three reference years, and have consequently an estimated reference unit value for that base period; a few were not traded during any of those three years, or only the value is known but not the quantity.

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