## BOX 2.1   China's integration in global supply chains: Review and implications[1]

Since 2001, China has rapidly integrated into global supply chains. Rising foreign content has been associated with robust growth in the domestic content of exports, especially in knowledge-intensive sectors. This has shifted China's comparative advantage towards these sectors.

FIGURE B2.1.1   Growth of foreign and domestic value added of exports and total exports

Strong growth in foreign and domestic value added of exports followed China's WTO accession.
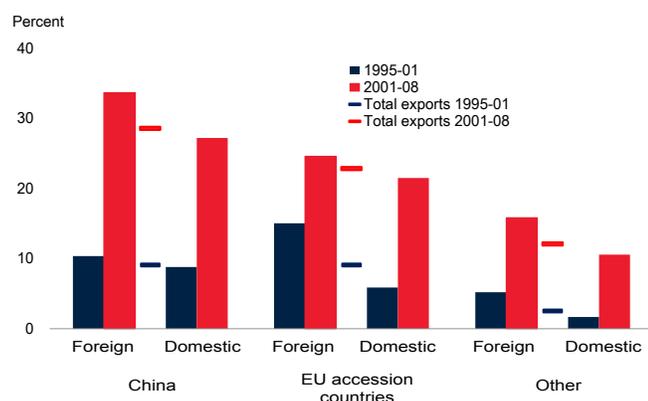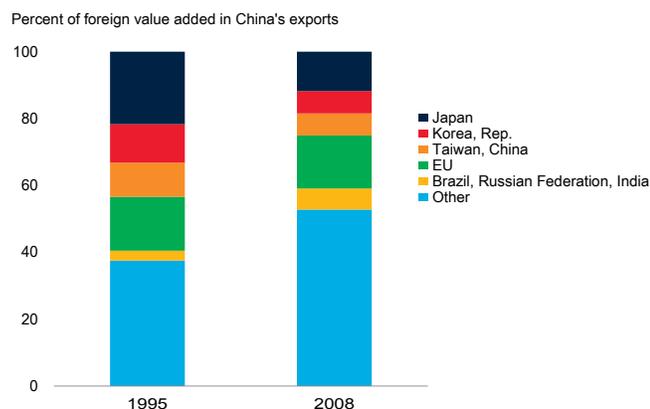

Sources: WIOD and World Bank.
Note: Average annual growth for manufacturing goods exports. EU accession countries are Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovenia, and Slovak Republic.

FIGURE B2.1.2   Source of foreign content of China's exports

The share of foreign content of China's exports from outside East Asia has grown significantly.

Sources: WIOD and World Bank.
Note: In both bars, EU includes the 15 member countries of the European Union before 2004, excluding the accession countries from 2004 onwards.

Between 2001 and 2008, manufacturing exports from China surged by 29 percent per year, on average. This rate was significantly faster than that of other Asian countries and other regions, including Eastern Europe, which over the same period rapidly integrated into Western European production processes. The brisk growth of China's manufacturing exports reflected a surge in both foreign content (i.e., the intermediate inputs and raw materials that are shipped from abroad and processed in China into exports) and domestic content (i.e., the domestic factor inputs that complement foreign intermediate inputs and raw materials to produce China's exports), which grew on average by 34 and 27 percent per year, respectively (Figure B2.1.1). The increase in foreign content is partly attributable to China's World Trade Organization (WTO) accession in 2001.

This box examines the episode during which China integrated into global supply chains with a focus on two questions:

- How has China's participation in global supply chains evolved?
- What are the implications of China's vertical integration on trade balances and comparative advantage?

The analysis employs sector-by-sector and country-by-country input-output and import-export matrices from the World Input-Output Database (WIOD) to calculate the shares of foreign content and domestic content in exports for each of 35 sectors in 41 countries from 1995, the first year for which WIOD data is available, until the start of the global financial crisis in 2008.[2] This time period was chosen because it represents a unique episode in China's process of integration into global supply chains.

Evolution of China's integration in global supply chains

China initially participated mainly in the East Asian supply chain. In 1995, nearly half of the foreign content in China's exports was sourced from three economies: Japan; the Republic of Korea; and Taiwan, China. After its WTO accession, China
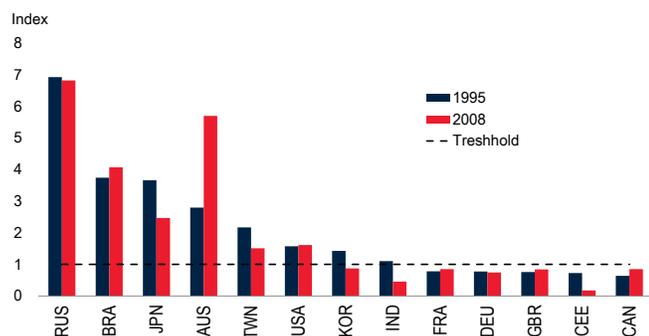

BOX 2.1 *(continued)*

FIGURE B2.1.3 Foreign content in exports

*China's position relative to other countries in the global value added chain has shifted.*

Sources: WIOD and World Bank.
Note: The index is constructed as a ratio of each country's value added in China's exports to China's value added in the other country's exports. An index value greater than 1 indicates China is downstream relative to the country, while an index value less than 1 indicates China is upstream relative to the country.

FIGURE B2.1.4 Decomposition of foreign content in China's iPhone exports, 2009

Only 4 percent of the value added of China's iPhone exports was domestic as of 2009.
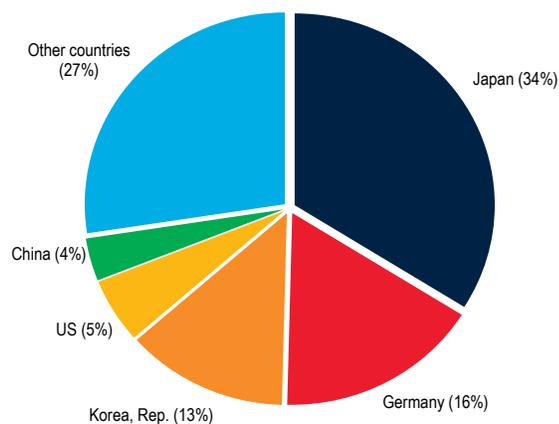
Source: Xing and Detert, 2010.

began to expand beyond the regional supply chain into the global network and, as a result, the share of foreign content from Japan; Korea; and Taiwan, China in China's exports declined to less than a quarter in 2008 (Figure B2.1.2).

As it became vertically integrated with a more diverse set of countries, China moved "downstream" to several resource exporters (such as Australia and the Russian Federation) and high-tech intermediate component exporters (such as the United States)—that is, these economies' content in China's exports increased more than Chinese content in their exports (Koopman, and others, 2010). Meanwhile, China gradually moved "upstream" to Central and Eastern European countries that, over the same period, rapidly integrated into Western European production processes (Figure B2.1.3).

Implications for trade balances and comparative advantage

Integration into global supply chains increased bilateral trade imbalances between China and other countries. The production chain for iPhones constitutes a good example: prior to the financial crisis, iPhones were entirely assembled in China, using inputs from nine companies in other countries, before being exported to the United States. Of the total value of China's iPhone exports, 96 percent was from Japan, Germany, South Korea, and the United States and other countries, while only 4 percent was domestic Chinese content (Figure B2.1.4). Although predominantly produced with foreign content, the full value of Chinese exports of iPhones to the United States was recorded in China's trade surplus in *gross terms* to the United States (Xing and Detert, 2010). In contrast, only 4 percent of Chinese content in iPhones would be recorded in China's trade surplus with the United States in *value-added terms*.

Because China's exports embed content from other countries in the global supply chain, its bilateral trade balances in value-added terms can differ significantly from bilateral trade balances in gross terms (Figure B2.1.5).[3] China's bilateral trade deficit with Japan, for example, is about three times larger in gross terms than in value-added terms. This reflects significant exports of intermediate goods from Japan to China, which are used not for domestic Chinese consumption, but rather in the production of China's exports to the world. China's bilateral trade surplus with the United States is about one-quarter larger in gross terms than in value-added terms because intermediate inputs produced by other countries (e.g., in

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[3]The bilateral trade balance between, China and the United States, in value-added terms is China's value added that is eventually absorbed by the United States net of the value added of the United States eventually absorbed by China—as opposed to the bilateral trade balance in gross terms, which is simply the difference between total exports and imports between China and the United States (Koopman, Wang, and Wei, 2014).

BOX 2.1 *(continued)*

the iPhone) are used extensively in Chinese goods made for export to the United States (Cheung, Chinn, and Qian, 2014).

As it integrated into global supply chains, China also rapidly expanded its domestic content of exports.[4] This was most pronounced in knowledge-intensive sectors.[5] With foreign content growth of 30 percent per year during 1995–2008, vertical integration in the knowledge-intensive manufacturing sectors was almost twice as fast as that in most other sectors. Although the share of domestic content in knowledge-intensive exports remained lower than in other sectors, rapid vertical integration in this sector was accompanied by brisk growth in domestic content, also well in excess of that in most other sectors (Figure B2.1.6).

As expected, this rapid vertical integration contributed to a gradual shift in comparative advantage (Bahar and others, 2014). China's revealed comparative advantage (RCA) captures this process, where RCA is defined as the share of an industry's exports in China's total exports compared with the share in world exports—all based on domestic content of exports.[6] In 1995, China had a comparative disadvantage in knowledge-intensive sectors. By 2008, however, following a period of rapid vertical integration in these sectors, this comparative disadvantage had turned into a comparative advantage (Figure B2.1.7). As a result, the value-added trade deficits that China ran in these sectors in 1995 had turned into, in some cases, large value-added trade surpluses in 2008 (Figure B2.1.8).

Conclusion

Since joining the WTO in 2001, China has rapidly integrated into global supply chains, especially in knowledge-intensive industries. While the analysis here is limited by data availability, it shows that the process of integration was accompanied by a rapid expansion of domestic production for exports and led to an increase in the degree of comparative advantage in knowledge-intensive industries. The results also suggest that trade balances in value added terms can provide additional information about bilateral trade positions, especially for countries that are integrated in global supply chains.

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[4] The positive correlation between the growth of foreign content in exports and growth of domestic content in exports is also found in the European supply network (Rahman and Zhao, 2013).

[5] The classification of knowledge-intensive sectors follows the Organisation for Economic Co-operation and Development (OECD) Technology Intensity Definition. Specifically, the industries belonging to "high-technology" or "medium-high-technology" in the OECD definition are classified as knowledge-intensive sectors here.

[6] Recent research shows that a RCA based on the value-added decomposition of exports eliminates double counting and is more accurate than a RCA based on gross trade (Koopman, Wang, and Wei, 2014; Rahman and Zhao, 2013).

FIGURE B2.1.5 China's bilateral trade balance in value-added and gross terms, 2008

Because of vertical integration, China's bilateral trade balance with Japan is more negative in gross terms than in value-added terms (and vice versa with the United States).
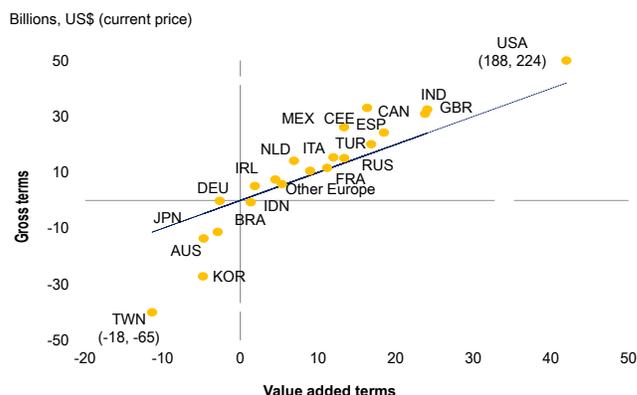
Sources: WIOD and World Bank.
Note: China's bilateral trade deficit with Taiwan, China and bilateral trade surplus with the United States is off the scale in the figure; the relevant amounts are shown in parenthesis.

FIGURE B2.1.6 Average annual growth in domestic and foreign content in Chinese merchandise exports by sector, 1995–2008

Growth in foreign value added of China's exports was accompanied by growth in domestic value added.
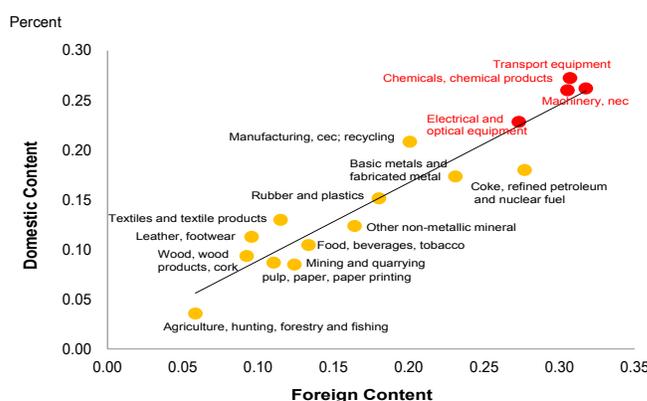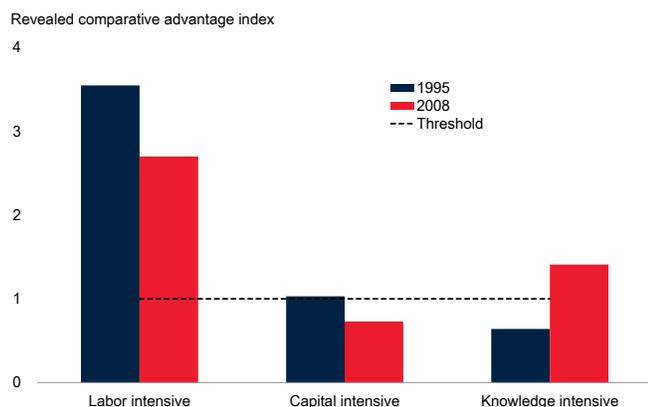

Sources: WIOD and World Bank.
Note: Knowledge-Intensive manufacturing sectors are shown in red.

BOX 2.1   *(continued)*

FIGURE B2.1.7 **China's revealed comparative advantage in three sectors**

China's comparative advantage in knowledge-intensive industries has grown as the economy became increasingly vertically integrated.
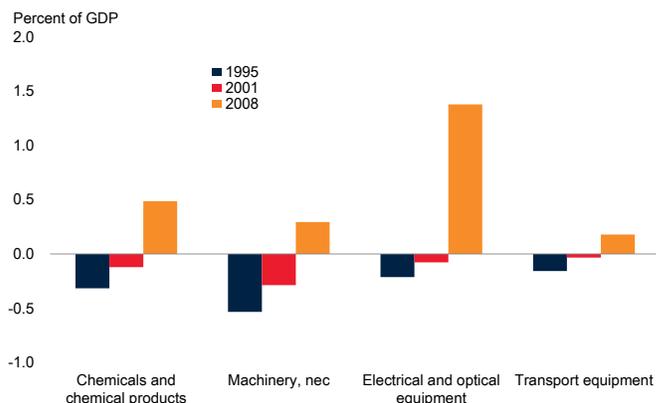
Revealed comparative advantage index

Sources: WIOD and World Bank.

Note: An RCA above the threshold of 1 indicates comparative advantage. Revealed comparative advantage is defined as an industry's share of China's exports (in terms of domestic value added of exports) relative to the same industry's share in world exports (also in terms of domestic value added of exports).

FIGURE B2.1.8 **China's value-added trade balances**

China's value-added trade balance in knowledge-intensive sectors turned from deficit to surplus between 1995 and 2008.

Percent of GDP

Sources: WIOD and World Bank.