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The Manufactures Terms of Trade and Global Value Chains

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THE MANUFACTURES TERMS OF TRADE AND GLOBAL VALUE CHAINS

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ABSTRACT

This paper analyzes the terms of trade of manufactures exported by developing countries relative to manufactures exported by developed countries. The empirical analysis shows that negative shocks to manufacture terms of trade observed in the 1980s and in the 2000s, when China was admitted to the WTO, have persisted over time. Developing countries' manufacture relative unit values now represent about 30 per cent less than in 2000 and about 50 percent less than in 1980. Concurrently, developing countries have been integrated in manufactured goods global value chains, led by large firms typically based in developed countries and relying on complex networks of suppliers around the world. There may be a "Prebisch-Singer Trap for the Twenty-First century". It would respond to the asymmetry of market structures along global value chains, as oligopoly lead firms seek to promote competition and risk-bearing among suppliers, implying a systematic downward pressure on the price offered by supplier firms. This may be valid for manufactures of low and high-skill intensity and for low and high-tech manufactures. On the contrary, there are no signs that the trap for the 21st century affects manufactures of medium skill and technology levels, for which the terms of trade do not increase or decrease. In addition to being lower on average, manufacture unit values may grow more slowly in developing countries than in developed countries. In terms of technology level, the analysis suggests that the rate of growth for developing countries is significantly lower for low-tech manufactures and for high-tech non-electronic. In a global value chains world, the demand for most manufactures exported by developing countries comes not from the final consumer but from the buyer in the upstream chain. Manufactures exported by developing countries have "commodity-like" characteristics. One of them is that producers in developing countries are price takers. Another is that the product is not distinguishable from that of competitors, yet it must abide by external quality standards.

[1] While I developed this work over the years in parallel to my role as United Nations staff member, the views and opinions expressed herein are mine and do not necessarily reflect those of the United Nations Secretariat.

1 Introduction

This paper examines the evolution of the terms of trade of developing-country manufactures. It reviews the empirical and theoretical debate surrounding the observed deterioration in the aggregated data published by the United Nations and empirically explores manufactured goods exports unit value trends by types of manufactures and countries.

We find that the negative shocks observed in manufacture terms of trade in the 1980s and 2000s have persisted over time and imply that developing countries manufacture relative unit value represent now about 30 per cent less than in 2000 and about 50 percent less than in 1980, according to United Nations official statistics. We also find that the Milberg and Winkler (2013)'s idea of a Prebisch-Singer (P-S) trap for the 21st century may be valid for manufactures of low and high-skill intensity and for low and high-tech manufactures, but not so relevant for manufactures of medium skill and technology levels, for which the terms of trade do not increase or decrease. While significant, the effect of China does not explain this entirely.

After this introduction, the second section provides a historical and theoretical discussion, illustrating the changes that the global economy has experienced since the 1950s and that affect the assumptions underlying the two variants of the P-S hypothesis (Ocampo and Parra 2010). The third section looks at the trends of manufactures unit values of developed and developing countries in light of the empirical debate on the manufactures terms of trade triggered by Sarkar and Singer (1991) and Athukorala (2000). The fourth section provides an analysis of the dynamics of the disaggregated series by regions and types of products. The last section provides brief conclusions and interpretation.

2 Historical and theoretical discussion

Up until the 1950s, the traditional division of labour between developed and developing countries was generally uncontested. Developing countries specialized in exporting primary commodities and imported manufactures from industrialized economies. Traditional international trade theory attributed such a division of labour to comparative advantage, associated with relative resource endowments: developing countries had natural resources and labour in abundance, relative to the abundance of capital in developed countries. According to Heckscher–Ohlin's model, countries export products that use their abundant and cheap factors of production and import products that use the countries' scarce factors. The theory suggested that the traditional division of labour between developed and developed countries maximized the welfare effects of all involved (Viner, 1953).

On the contrary, for Raúl Prebisch and Sir Hans Singer, pioneers in the study of terms of trade, the traditional division of labour following comparative advantages was not beneficial to developing countries in their quest for better living standards. As Singer stated:

> "The principle of specialization along the lines of static comparative advantages has never been generally accepted in the underdeveloped countries, and not even generally intellectually accepted in the industrialized countries themselves" ... … "By specializing on exports of food and raw materials and thus making the underdeveloped countries further contribute to the concentration of industry in the already industrialized countries, foreign trade, and the foreign investment which went with it, may have not spread present static benefits fairly over both." (Singer 1950, p. 476-477).

The Prebisch-Singer hypothesis about a secular deterioration of the terms of trade of primary commodities was a compelling argument against the traditional and static division of labour between developed and developing countries (Sarkar, 1986, p. 125). The common claim of a mutually beneficial international economy was confronted with evidence of asymmetric benefits.

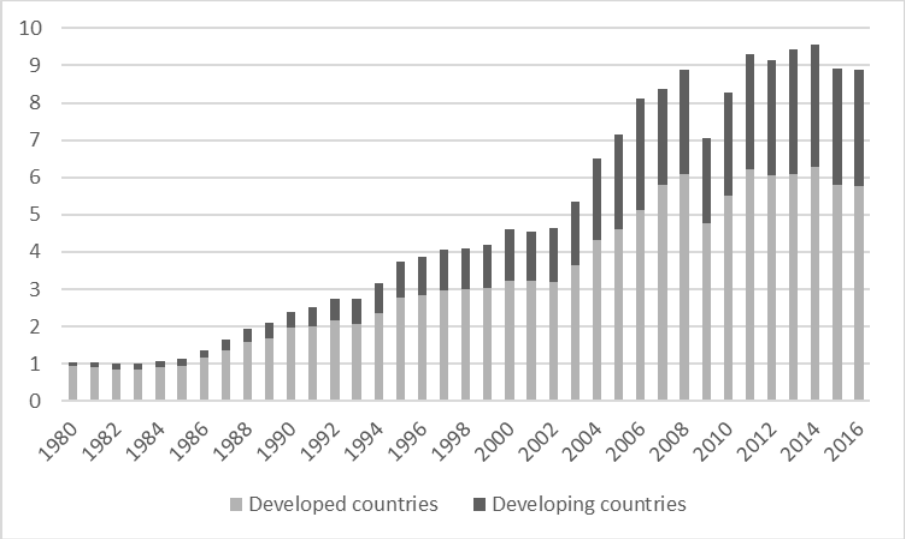
As Prebisch stated:

> "… [the reasoning on the economic advantages of the international division of labour] is based upon an assumption … [that] the benefits of technical progress tend to be distributed alike over the whole community, either by the lowering of prices or the corresponding raising of incomes. The countries producing raw materials obtain their share of these benefits through international exchange, and therefore have no need to industrialize. If they were to do so, their lesser efficiency would result in their losing the conventional advantages of such exchange.… [But] the enormous benefits that derive from increased productivity have not reached the periphery in a measure comparable to that obtained by the peoples of the great industrial countries…. Thus, there exists an obvious disequilibrium …[that] destroys the basic premise underlying the schema of the international division of labour. Hence, the fundamental significance of the industrialization of the new countries." (Prebisch 1962, p.1.[2])

[2] Prebisch 1950 original article in Spanish was reproduced by the United Nations Economic Commission for Latin America (now ECLAC) in the Economic `Bulletin for Latin America Vol. VII No. 1, Santiago, Chile, February 1962.

During the last quarter century, developing countries progressively expanded their participation in manufacture export markets. Developing countries share in total manufactured goods exports went from 12 per cent in 1980 to 35 per cent in 2016 (see Figure 1).

Figure 1: Manufactured goods exports value (US$ trillion)



Source: Author's calculations based on International Trade Statistics Yearbook editions, Special Table 40, Manufactured goods exports, available at https://unstats.un.org/unsd/trade/data/tables.asp

Note: In the United Nations historical official statistics, manufactured goods are defined sections 5 to 8 of the SITC classification.

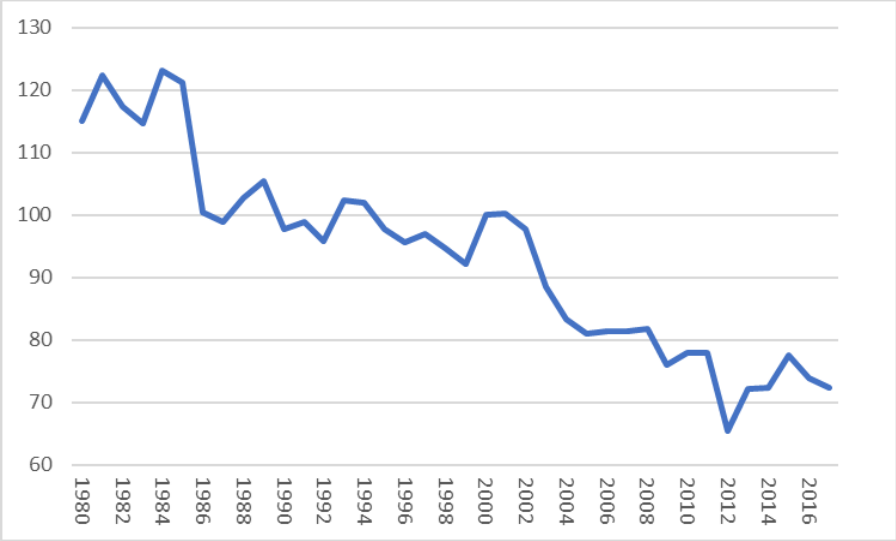
At the same time the terms of trade of manufactures (defined as the unit value of manufactured goods exported by developing countries deflated by the unit value of manufactures exported by developed countries) deteriorated significantly (see Figure 1.B). As the series are I(1)[3], the negative shocks observed in the 1980s and 2000s have persisted over time, and implies

[3] I (1) stands for integrated of order 1, meaning that the series has a unit root and thus is not stationary.

that developing countries manufacture relative unit value represent now about 30 per cent less than in 2000 and about 50 percent less than in 1980, according to United Nations official statistics.

The data from 1980 to 2000 doesn't appear to have a trend, while there appears to be negative trend since the 2000s. This would suggest that the entrance of China in the WTO may have represented a structural break in the manufacture terms of trade. This will be further explored in section 4.A.

Figure 2: Manufactures Terms of Trade Index (2000=100)



Source: International Trade Statistics Yearbook editions, Special Table 40, Manufactured Goods Exports, available at https://unstats.un.org/unsd/trade/data/tables.asp. U.N.

Note: Manufactured goods are defined to comprise sections 5 through 8 of the Standard International Trade Classification (SITC). These sections are: chemicals and related products, manufactured goods classified chiefly by material, machinery and transport equipment and miscellaneous manufactured articles.

1.2.A The "new" terms of trade pessimism

The following discussion aims at understanding the reasons behind this deterioration that, since the 1970s, gave ground to a new terms of trade pessimism (Athukorala 2000) in the sense that it could be self-defeating for developing countries to industrialize to escape the relative deterioration of commodity prices. One of the justifications for such pessimism has been empirical evidence of a fallacy of composition phenomenon. In his seminal contribution to the debate, Mayer (2002) argued that if all, in particular large, developing countries try to substantially increase exports of labour-intensive manufactures, there is a risk that they would encounter rising protective resistance from developed countries or that the terms of trade would decline to such an extent that the benefits of any increased volume of exports would be more than offset by losses due to lower export prices.

Accordingly, the expansion of manufacturing export capacity in one developing country makes sense for that country alone, but when many countries expand at the same time, the resulting system-wide excess capacity creates declining international prices of the associated goods, in a fallacy of composition. This became increasingly patent when China joined the WTO in 2001 and progressively increased its market share in manufactures' markets.

Giovannetti and Sanfilippo (2016) highlight that Chinese price and supply competition has influenced not only the export prices of low- and middle-income countries in sectors at different levels of technology, but also the prices of high-income countries in low-technology sectors. They note that firms in sectors most affected by Chinese import competition have experienced reductions in export prices, employment and profitability, consistent with the fallacy of composition argument.

In Ocampo and Parra (2007) we note that this over supply of exports could be identified not only in primary commodities and natural resource-based manufactures, most of which face low income-elasticities of demand in world markets, but also in low-tech manufactures and, more generally, manufactures for which production can be transferred easily from one country to another, responding to footloose foreign direct investment or to competition among suppliers in global value chains, the phenomenon that replaced protectionism as the strategy of developed countries when faced with increased manufacturing in developing countries. While national policies have played a key role in China's astonishing economic expansion (Rodrik 2006), it is also clear that an important share of Chinese manufacturing exports can be closely traced back to the development of global value chains (Gaulier, Lemoine and Unal-Kesenci 2007).

1.2.B Global value chains

An important development in the last quarter century has been the integration of developing countries in manufactured goods global value chains, led by large firms based typically in developed countries and relying on complex networks of suppliers around the world (Milberg and Winkler 2013).

Since the 1970s, large retail organizations identified sources of production in developing countries, supplied R&D inputs, provided product specification and enabled developing countries' producers to keep abreast of changing tastes in the market countries (Donges and Riedel, 1977). As Keesing (1983, p. 339) described it: "Most of these finished consumer goods are made by developing economy firms-enterprises started, owned, and managed by people from the developing economies … most exports of finished consumer goods are made to buyers' orders.

The buyer specifies in full detail the design of the product, the materials to be used, the numbers and sizes to be made, and such other matters as the way the product will be labelled, packed and shipped. Designs and requirements change from order to order".

Presciently anticipating the proliferation of buyer-driven global value chains in manufacturing, Donges and Riedel stated that "Given the increasing popularity of low-cost retailing in industrial countries and the evident profitability of such adventures, one would expect this activity to spread in the future" (Donges and Riedel, 1976, p. 34).

While the manufacturing multinational corporations of the 1970s were integrated horizontally, producer-driven global value chains have been developing since the 1980s. The transfer of certain production processes was initially facilitated by advances in transportation that substantially reduced costs (Hummels 2007). Progressively, international trade allowed nations to specialize in industry as distinct from other sectors, in different manufacturing branches, and increasingly even in different stages in production (Gereffi 1989, Grossman and Ross-Hansberg 2008, Baldwin and Robert-Nicoud 2014).

Through global value chains, fabrication itself has been subdivided into tasks and distributed among various countries, many times linked only by timed contractual obligations without further commitments. Without moving operations or creating subsidiaries through FDI, multinational corporations can have final goods and parts and pieces made in developing countries. Rather than substitutes, international trade and FDI became complementary elements of a global strategy to access lower-cost inputs, gain market share and supply domestic and foreign markets (Ernst and Sánchez-Ancochea, 2008).

Kaplinsky (2000) suggests that value chain analysis can provide insights to the relationship between globalization and unequalization. He argues that there is a casual relation

between the increasing inequality and the global integration of production and trade. He argues that as more and more countries developed their capacities in industrial activities, barriers to entry in production fell and the competitive pressures heightened, especially since the entrance of China in global markets in the 1980s. He argues that this underlies the falling terms of trade in manufactures of developing countries. Although he doesn't explicitly posit it, it is clear that this is not merely a matter of fallacy of composition and excess competition among producers of final goods. Developing countries manufacturers are competing among themselves, "…in a chain of production… in which the primary economic rents are to be found in areas outside of production" (Kaplinsky 2000, p. 127). This also explains why high-income countries placed so much emphasis on intellectual property rights at the time, and this continues nowadays (Baldwin 2016).

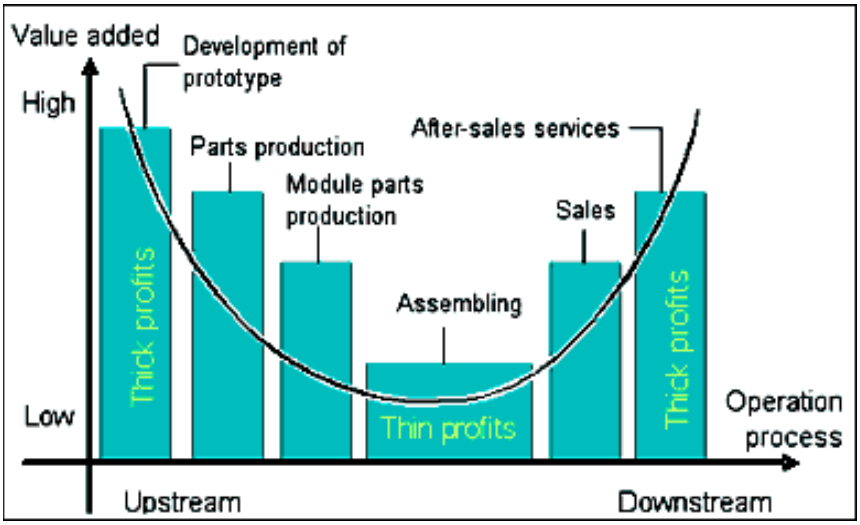
Intangible capital – in the form of intellectual property, technology, design and brand value as well as workers' skills and managerial know-how – has become critically important in dynamically competitive markets. Firms continuously invest in intangible capital to stay ahead of their rivals (WIPO 2017, p. 10).

Saadi (2012) finds a deterioration of developing countries terms of trade associated with the increase in the sophistication of their exports. He argues that several factors can explain this, including the fallacy of composition explored above, the asymmetry of market structures in global production networks, technological upgrading and low price/quality range and the product cycle. The section below will consider these further.

1.2.C Global value chains and manufacture terms of trade

A first characteristic of global value chains that may help explain the deterioration of the manufacture's terms of trade, is that fabrication stages and parts have been standardized and shifted to low-cost locations in developing countries. Baldwin argues that this has made fabrication stages and parts in most manufacturing sectors to lose value. Value added is concentrated in the two sides of the “smile curve”, a concept first proposed by Stan Shih, the founder of Acer (see Figure 3), pre- (R&D and design) and post-fabrication, usually performed in developed countries (Baldwin 2016, Low 2013).

Figure 3: Stan Shih "smiling curve"



Source: atimes.com/atimes/China/DJ04Ad01.html

Early on, Singer realized that simple manufactured products share many of the characteristics attributed to primary commodities (Singer, 1975). He was influenced by Vernon

(1979)'s argument that there is a product cycle in which new products are consumed and produced first in developed economies and later on, only after they have gone through a standardizing process and are then considered mature products, they are produced in less developed countries.

Jovanovic (2004) models the product cycle and explains how it relates to world inequality. Contrary to Vernon's (1979) idea that the product cycle arises because firms in rich places sell to the world's richest and most demanding customer, and because in rich places labour is the most expensive and capital-intensive technology is more profitable, Jovanovic argues that the product cycle arises instead because technologies are product specific. New products are more high-tech and demand more skills to make them. The people using the best technologies will then want to raise their skills relative to those of other people. Thus, the product cycle and inequality both have their origins in the complementarity between technology and skill.

Li and Liu (2017) argue that, albeit accurate, Vernon's product life cycle was not the only ongoing cycle. During the same period, many Northern products retained their Northern identities, though their production was progressively fragmented and gradually moved to the South. So, instead of developing countries gaining market share in the production and export of final products, the final products were still exported by developed countries, although fabrication had been moved to developing countries. They refer to this phenomenon as the production life cycle and argue that it unravelled the era of global manufacturing, including offshoring by the North, industrialization of the South, global output increments, income redistribution, and the formation of value chains.

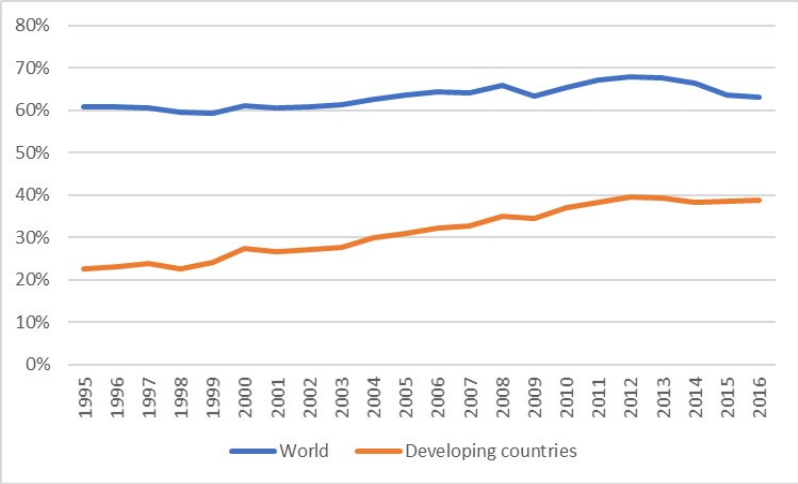
A second characteristic of global value chains is the prominence of trade in intermediates. Until the early 1990s most trade in parts was among developed countries, based on specialization, reputation and quality. At the time it was practically impossible to monitor and ensure that developing countries could follow the specifications required by developed countries' producers

(Baldwin, 2016). The internet helped to overcome this barrier, increasingly offering what nowadays is a seamless transmission of instructions and real-time monitoring. The push for trade liberalization since the 1980s and the creation of the World Trade Organization (WTO) in 1995 were also instrumental.

This process considerably expanded trade in intermediates, and especially developing countries' share in it, while diminishing the share from developed countries (Baldwin, 2016 p 153). Export prices for intermediates produced in developing countries are a fraction and practically independent of the price of the final products to which they contribute to.

An important portion of global trade today consists of intermediate and semi-finished products, as opposed to the more traditional raw materials and finished goods (See Figure 4). Developing countries have become an important part of such trade (Baldwin and Lopez-Gonzalez 2015), doubling their participation since 1995. Most developing countries export standard and usually low-quality labour-intensive manufactured intermediate goods at low export prices (Ghani and Sofyan, 2014). Most of the technology and skills are embodied in imported parts and components, and much of the value added accrues to the producers in more advanced countries where these parts and components are produced and to the multinational enterprises that organize such production networks (Baldwin 2016).

Figure 4: Share of intermediates in total manufacture exports, world and developing countries



Source: Author's calculations based on CEPII's BACI database, using the Broad Economic Categories classification (See Appendix A. C).

While the import content of manufacture exports through global value chains is high (Hummels et al. 2001, Gereffi and Fernandez-Stark 2016), Ghani and Sofyan (2014) highlight that developed countries have increased their share in world manufacturing value added, despite having a lower share in world manufacturing exports. Developing countries have achieved a rapid increase in the ratio of manufacturing exports to gross domestic product (GDP), but without a significant upward trend in the ratio of manufacturing value added to GDP.

A third characteristic of global value chains that may be behind the deterioration of the relative unit value of manufactures exported by developing countries is the asymmetry of market structures in global production networks (Saadi 2012), with oligopoly firms in lead positions (typically from developed countries) and competition among suppliers (typically from developing countries) (Milberg and von Arnim 2006). Milberg (2008) argues that the creation of monopsonistic buyer relations in global supply chains has allowed some shifting in the source of

corporate profits: from traditional oligopoly pricing power in product markets to oligopsony power in global supply chains in which lead firms have greater control over input prices and greater flexibility due to the presence of multiple suppliers.

This has meant intense pressure on suppliers in developing countries who, in seeking to maintain mark-ups, must keep wages low to avoid a shift in the supply process to another firm or country. Milberg and von Arnim (2006) argue that through competitive pressure, lead firms offload a greater share of risk onto suppliers, limit suppliers' access to some advanced technologies, and create barriers to entry that limit prospects of "moving up" the supply chain. These findings make them skeptical of the magnitude of any "dynamic" benefits of offshoring that are so cited in support of the vision of the global gains from increased market-based international integration.

The volume of the purchases of global buyers affords them a considerable amount of power over their suppliers (Sturgeon and Gereffi 2005). The same can be said for producer-chains. The GVC literature suggests that the GVC business model was set up to harness asymmetries in market power to generate and capture profit (Phillips 2017). Tung and Wan (2013) note that American lead firms seek, in outsourcing manufacturing activities, the flexibility of an open network: to scale up production after a successful pilot run, without investing in fixed equipment with the sunk cost. Thus, trial-and-error remains affordable in innovation even with shortened product lives.

Saadi (2012) highlights the role of the asymmetries of market structures in global production networks in the deterioration of developing countries terms of trade. He links the flexibility in sourcing decisions, mimicking capital mobility (Heintz 2005) with the expansion of global value chains that induce highly competitive conditions in which producers in developing countries struggle to maintain unit labour costs low (Seguino 2007).

Milberg and Winkler (2013) argue that there may be a "Prebisch-Singer Trap for the Twenty-First century". It would respond to the asymmetry of market structures along Global Value Chains (GVCs), as oligopoly lead firms seek to promote competition and risk bearing among suppliers, implying a systematic downward pressure on the price offered by supplier firms. They argue that Prebisch-Singer structural problems are today not about the nature of the product as much as they are about the governance structure within GVCs.

> "Many lead firms in GPNs maintain markups by operating in factor or input markets that are increasingly oligopsonistic. Buying practices of lead firms can lead to shaving of markups and cost cutting by suppliers that leaves them unable to innovate and resistant to improvements in wages or labour standards (Milberg and Winkler 2013, p. 280)."

If a high share of developing countries manufacturing trade takes places within global value chains, which is plausible given the size of the phenomenon (Taglioni and Winkler 2016), the three characteristics above, namely standardization and low cost, prominence of trade in intermediates, and asymmetry of market structures, compounded with the size and role of China as manufacturing powerhouse in that context, imply that manufactures exported by developing countries may be fundamentally different from those produced and exported by developed countries when Prebisch and Singer wrote their crucial contributions in the 1950s.

In a global value chains world, the demand for most manufactures exported by developing countries comes not from the final consumer but from the buyer in the upstream chain. Athukorala (2000) argues that manufactures exported by developing countries have "commodity-like" characteristics. One of them is that producers in developing countries are price takers. Another is

that the product is not distinguishable from that of competitors, yet it must abide by external quality standards.

Thus, the income elasticity of final demand for manufactures may be elastic but what is transmitted through the value chain to the producers is not elastic. It is in fact a price that may not cover costs, let alone provide resources to innovate (Milberg and Winkler 2013). In that sense, manufactures exported by developing countries would share more characteristics with abundant inputs of production such as primary commodities and un-skilled labour, than with the more final (post-fabrication) products/ services (pre-fabrication) that developed countries tend to export as manufactures.

Saadi (2012) notes that in a product cycle scenario, the income elasticity of the technologically backward countries' demand for goods produced in the developed countries is likely to be higher than that of the advanced countries' demand for goods produced in the technologically backward countries.

1.2.D Center-periphery and the Prebisch and Singer hypothesis

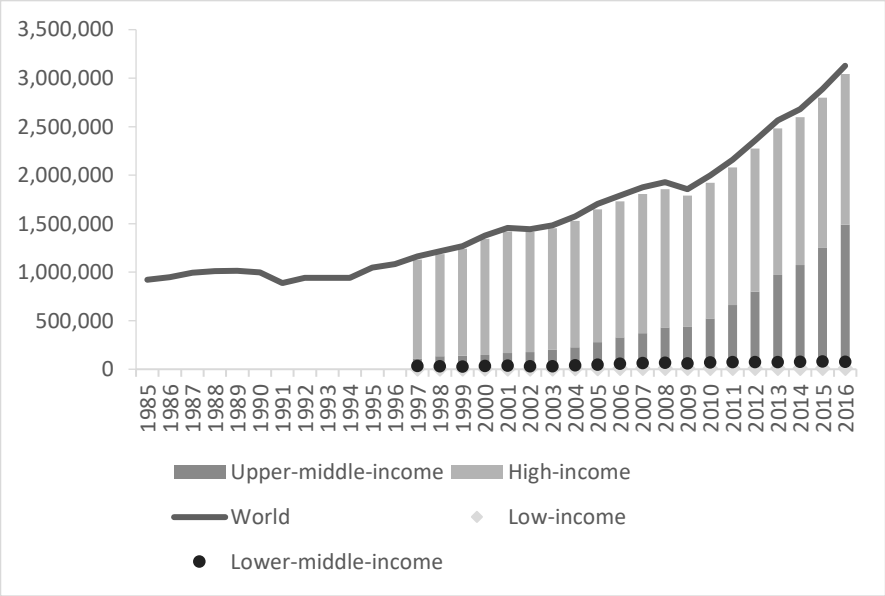
At the core of Prebisch and Singer's views was an inherently asymmetric international system, in which the center (defined as developed countries) and the periphery (defined as developing countries) interacted in binary opposition (Jameson 1986). This vision was grounded in what they identified as an asymmetric distribution of the gains from technological progress between developed and developing countries (Sánchez-Ancochea 2007).

Prebisch stated that "…while the centres kept the whole benefit of the technical development of their industries, the 'peripheral countries transferred to them a share of the fruits

of their own technical progress" (Prebisch 1962, p. 5). For Singer, "technical progress in manufacturing industries showed in a rise in incomes while technical progress in the production of food and raw materials in underdeveloped countries showed in a fall in prices" (Singer 1950, p. 478).

While much has changed in the last 70 years, and by 2010, around 25 per cent of global R&D occurred outside of the OECD economies Kaplinsky and Farooki (2017, p. 213), technological advances and, perhaps more importantly, their patents, continue to be concentrated in developed countries (see Figure 5). According to United Nations (2018), the share of triadic patent applications (patents filed at the three major patent offices) was 82 percent from Japan, USA and the EU, 5 per cent from China and 12 per cent for the rest of the world.

Figure 5: Total patent applications, by income group, 1995-2016



Source: United Nations (2018). Based on World Intellectual Property Organization (WIPO) statistics database.

The proliferation of global value chains, through which multinational enterprises subcontract fabrication in developing countries, can thus be interpreted as another manifestation of the center-periphery system. Through global value chains, developed countries subcontract the now codified fabrication of parts and tasks to developing countries, while keeping the rents deriving from intellectual property rights associated with R&D and from design and marketing (Baldwin 2016, p. 155).

1.2.E Theoretical variants in the 21st century

At this point, it is interesting to reconsider the two theoretical variants through which the Prebisch-Singer hypothesis was developed. The first variant depended on the differences between the markets for primary commodities and manufactures. The second, in turn, depended on the asymmetries between labour markets in developed and developing countries and thus applied to all goods and services produced in developing countries, regardless of the characteristics of those goods and services or of the demand for them. Accordingly, there was always a latent risk that the change in the role in the international division of labour of developing countries towards manufactures wouldn't make a difference in terms of gains from trade.

One of the corollaries of the P-S hypothesis, related to the first variant, was that developing countries should diversify towards manufactures. This is how it was interpreted by policy makers at the time. This corollary depends on the assumption that the income-elasticity of demand for manufactures is less inelastic than that for primary commodities. As discussed above, in a global value chain context, even if the income elasticity of final demand for manufactures is

elastic, what is transmitted through the value chain to the producers is not elastic but a result of asymmetrical negotiations between partners of disparate power.

A second corollary, related to the second variant, is that the asymmetric functioning of factor and good markets between developing and developed countries should be addressed; otherwise any product exported by developing countries would be subject to unfavourable terms of trade. This corollary depends on the assumption that labour markets in developed countries are isolated from the pressures faced in developing countries due to excess supply of labour in developing countries.

The second variant was further developed in the "North-South" models. In those models, in the North, real wages increase parallel with productivity, in the South they are unaffected by technical change. The corresponding effect is transmitted through production costs and is therefore unrelated to the type of good being produced or the characteristics of its demand.

While real wages in the developing countries can still be meaningfully considered independent of technological change, due to the existence of a surplus of labour in subsistence sectors, the relationship between productivity and wage increases in the center has been diluted, while rents to capital have increased (United Nations 2018, p. 53). One of the reasons behind this decoupling has been financialization and the shareholder model of distribution of profits (Milberg and Winkler, 2013).

In addition, labour bargaining power in developed countries has been substantially reduced by the entrance in global markets of the significant contingent of workers from China and other economies in transition (almost doubling labour supply worldwide), as well as by the globalization of production facilitated by the transport and communications revolutions mentioned above. The relative wages of low-skilled labour fall in both developed and developing countries

as the demand for labour becomes skewed toward higher skilled labour in the light of respective skill standard of each economy (Feenstra and Hanson 1996, Timmer et al 2014). This may weaken the validity of the second variant of the P-S hypothesis in terms of labour markets but, as discussed before, the asymmetry in terms of technological change is still predominant.

After this historical and theoretical recount, the next section briefly presents the empirical debate on manufacture terms of trade to which section 4 contributes.

3 Empirical debate

In 1991, Sarkar and Sir Hans Singer himself called attention to a deterioration observed in the manufactures terms of trade for the period 1970-1987 according to United Nations official statistics. This revived an empirical debate that had started in the 1970s (Helleiner 1981) over whether exporting manufactures has been indeed a way for developing countries to escape the deteriorating terms of trade associated with primary commodity exports. Athukorala (2000) framed it as a "new terms of trade pessimism".

Table 1 summarizes the results of a wide selection of empirical papers testing for trends in manufactures terms of trade up to 2010.

Table 1: Manufacture terms of trade selected literature

	Period	Result	Caveat/comment
Keesing 1979	1960-1976	Large drop in 1975	Attributed to inclusion of non-ferrous metals (SITC-68)
		Declining trend of labour intensive goods of developing countries	Relative to prices of other manufactured goods
Sarkar and Singer 1991	1970-1987	Relative decline of about 1% per year (cumulative 20% decline)	High growth of volume, income terms of trade increased 10% per annum in favour of developing countries
	1965-85	Very few showed a significant improvement in dealing with US Latin America: 7 out of 10 negative trends Asia: 2 out of 10 negative trends Deteriorated even further than NBTT	It was not conclusive in their dealings with the rest of the world
Athukorala 1993		Strong response to Sarkar and Singer (1991)	Criticisms: 1) end point bias; 2) limitation of MUV index and UV to calculate ToT; 3) intra-regional trade (majority in developed, only 25% in developing) bias; 4) SITC-68; 5) aggregation bias; 6) manuf productivity vs export manuf productivity
Bleaney 1993			Regarding end point bias: coincided with debt crisis and real devaluation of currencies of developing
Sarkar and Singer 1993	1970-1989	Relative decline of about 1% per year	1) Dummy for 1982: no change in results; 2) no bias; 3) argue opposite bias: monopoly power increase over time; 4) regressing with SITC68: variations in SITC68 do not explain ToT; 5) bias may go in either direction; 6) rates of growth reflected
Lucke 1993	1967-1987	Relative decline in prices of manufactured goods exported predominantly by developing countries	Attributed to expansion of supply and intensified competition
Rowthorn 1997	Post 1975		Inclusion of non-ferrous metals made very little difference
Minford, Riley and Nowell 1997	1960-1995	Large although irregular deterioration in terms of trade index of developing countries vis a vis developed. Large drop in 60s and 1985-90	Increasing supply and then China effect
	1985-1995	Developing countries had experienced a 20% decline in their TOT when compared with the manufactures (and some services) exported by high-income economies.	
Maizels, Palaskas and Crowe 1998	1979-1994	Deterioration of the terms of trade of manufactures of developing vis a vis the EU	
Athukorala 2000		Trendless when SITC68 is excluded	Calls for study considering diversification
Maizels 2000	1981-1996	NBTT of developing countries vis a vis US declined significantly in 80-85 and then trendless NBTT of developed countries vis a vis US trendless in 80-85 and then improved significantly	Significant deterioration of terms of trade of manufactures of developing countries vis a vis developed countries

Cont.

Table 1: Manufacture terms of trade selected literature (cont.)

	Period	Result	Caveat/comment
UNCTAD 2002		Signs that prices of manufactured exports of developing countries have been weakening in the last 20 years vis-à-vis those of industrial countries	Especially for the less skill-intensive manufactured exports
Mayer 2003		No conclusive evidence on developing countries as a group have moved.	Adverse effect most pronounced for developing countries whose manufactured exports are composed largely of labor intensive goods
Todaro and Smith 2003		Increase in manufactured exports has not brought gains to developing countries	
Sarkar 2005	1967-2001	Deterministic trend decline in terms of trade in South Korea	Despite increase in manufacture and electronics
Razmi and Blecker 2008		Most developing countries compete with other developing country exporters, rather than with industrialised country producers.	Fallacy of composition applies mainly to the larger group of countries exporting mostly low-technology products

Source: Chakraborti (2012), Saadi (2012) and author's literature review

In short, studies that treated the developing countries as a homogeneous group found that there is a tendency towards a weakening of manufactures terms of trade. In contrast, work focusing either on diverse groups of developing countries or on individual East Asian countries, show that this is not a general problem for all developing countries. Accordingly, it would be important to engage in or continue pursuing industrialization efforts without being derailed by a pessimism that would justify going back to exporting primary commodities only.

Using data for the period 1970-2005, Chakraborty (2012) finds evidence of a secular negative trend in the movement of the manufacture-manufacture terms of trade of the developing countries vis-à-vis the developed countries. The author associates this decline with the division of labour in manufactures between two broad categories of products: simple manufactured goods and sophisticated manufactured goods. The latter are beyond the purview of the developing countries due to lack of advanced technologies. The author claims that the manufactured goods produced by developing countries are mostly mere value additions to the primary commodities.

Edwards and Lawrence (2010) find large and systematic differences in unit values for exports of developed and developing economies, which, they argue, shows that the products made by developed and developing countries are not very close substitutes — "developed country products are far more sophisticated". They find that export unit values of developed and developing countries of primary commodity-intensive products are typically quite similar. Unit values of standardized low-tech manufactured products exported by developed and developing countries are somewhat similar. By contrast, the medium and high-tech manufactured exports of developed and developing countries differ greatly. They conclude that US and China occupy distinct parts of the export market, China competing more with high-income Asian economies than with developed countries.

Both Chakraborty (2012) and Edwards and Lawrence (2010) exclude global value chains (GVCs) from the analysis. In fact, most of the empirical literature on terms of trade ignore their implications. While it has been shown that Korea and other NIEs in East Asia were initially pursuing an independent industrialization path (Amsden 2001), China's exports expansion cannot be seen independently of the decision of developed countries business to transfer production to countries with lower input costs, maintaining control through global value chains. Athukorala and Yamashita (2006) argue that international production fragmentation in global value chains has played a pivotal role in the continuing dynamism of the East Asian economies, including China.

In contrast, Saadi (2012) includes global production networks. He finds that the increase in the export sophistication of these countries is accompanied by a downward pressure on the export prices. Many of high growth developing and emerging countries have experienced deterioration of their terms of trade despite having a diversified export structure. As most of the developing countries' middle and high technology exports are located at the bottom of the

price/quality ladder, he argues that they do not export the same as developed economies, and thus do not compete directly with them. He also notes the relatively low unit value of most developing countries' high-technology good exports. He suggests that to enter the world markets for such products, they have to rely on strong and 'fierce' price competitiveness. This would go against the results of Blecker and Razmi (2008) who argue that the fallacy of composition applies mainly to the countries exporting mostly low-technology products.

Analysing US import prices, Milberg and Winkler (2013) find that import prices declined the most in sectors susceptible to offshoring (computers, electrical and telecommunications) and those with well-developed GVCs (clothing, footwear, textiles, furniture, miscellaneous manufactures and chemicals) experienced import price declined (relative to US consumer prices) over two decades of more than 1 per cent per year on average, or 40 per cent in the period from 1984 to 2006. They show that some of the most important developing countries heavily involved in global value chains have not experienced significant improvements in their terms of trade and suggest that this is a contemporary version of the Prebisch-Singer dilemma (Milberg and Winkler 2013, p. 278).

The following section contributes to this debate by using disaggregated manufacture trade data by region, skill-level, technological intensity and broad economic categories.

4 Empirical analysis

In the context of global value chains, traditional trade data measures of values and quantities exchanged at the border can lead to misrepresentation of the content and size of trade from a particular country (Maurer and Degain, 2012). The famous study on the IPhone in China is

a good example of that (Kraemer, Linden and Dedrick 2011). Given that products cross borders at different stages of fabrication, they may be counted more than once. Second, while a product may be classified as high-tech, the contribution in terms of value added of the developing country from which it crosses the border may not be high-tech at all (assembling and processing).

While it would be ideal to use only value-added statistics (Inomata 2017) in the analysis, the issue remains one of aggregation. Value-added statistics are available at the sector level, not at the product level. More importantly, value-added data does not include weights. Without weights it is not possible to calculate unit values and thus terms of trade.

This section explores disaggregated manufactured unit value series from two sources. The first one is the Special Table 40 on manufactured good exports in the United Nations International Trade Statistics Yearbook [4]. While this table has been published since the 1950s, only in the 1980s the coverage widened to systematically include developing economies, responding to their increasing share in manufacture exports (see again Figure 1). This table was the source used by Sarkar and Singer in 1991 and the subsequent debate on the topic. The unit value indices reported by the United Nations are obtained from national sources. To calculate regional aggregates, sub-indices are aggregated to approximate an index of SITC sections 5-8, for countries that do not compile indices for manufactured goods export conforming to the above definition.

The online database includes aggregates for developing countries and developed countries (divided by region: America, Europe and other), and individual series for selected developed countries and 7 developing countries. In 2000 the exports of manufactured goods reported in the

[4] Available at https://unstats.un.org/unsd/trade/data/tables.asp

aggregated data accounted for approximately 97 per cent of world exports of manufactured goods.[5].

To ensure a wider coverage of developing countries, in section 4.B we will turn to the second source: The Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) Base pour l'Analyse du Commerce International (BACI) database, or CEPII's BACI.[6].

1.4.A United Nations Statistics on Manufactured Good Exports

As shown in Figure 2 above, developing countries' manufacture terms of trade have deteriorated significantly since the 1980s and represent now about 30 per cent less than in 2000, according to United Nations official statistics.

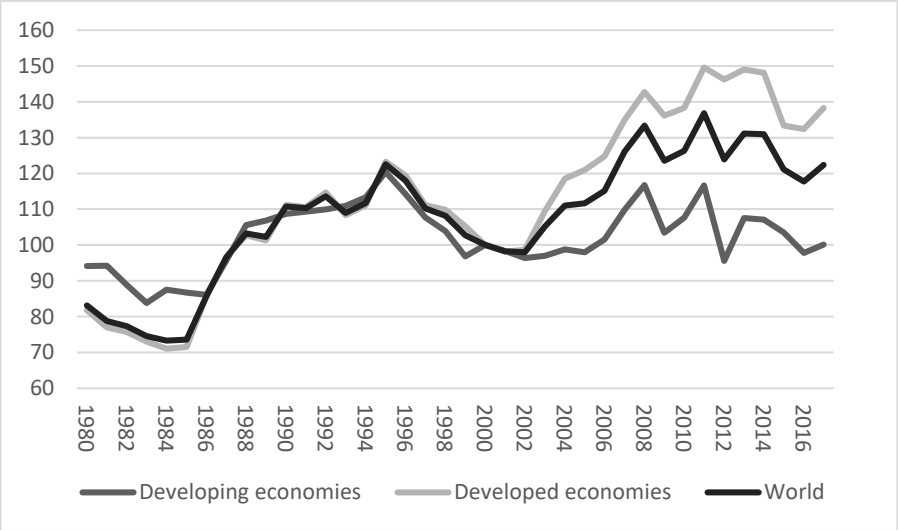
Figure 6 shows that this deterioration responds to an increasing gap between the manufactured goods exports unit values indices for developed countries and developing economies. This gap seems to have turned into a decoupling since the 2000s, as the manufacture unit value index has grown for developed countries, while the unit value index for developing countries has remained relatively stable. Figure 6.B shows that manufacture unit values were relatively stable for the United States and Canada in the 1990s and the increase in the 2000s less pronounced than that for Europe and other developed economies.

[5] Notes for Special Table 40, Manufactured goods exports International Trade Statistics Yearbook editions, available at https://unstats.un.org/unsd/trade/data/tables.asp

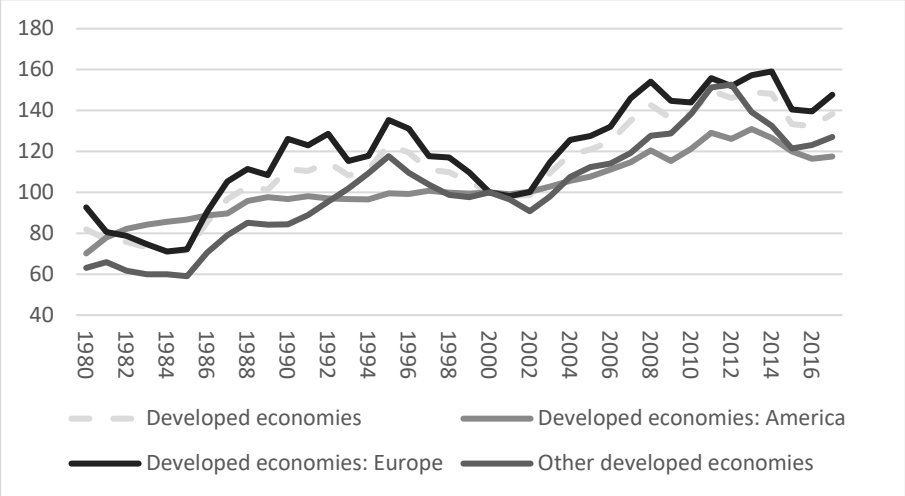
[6] Available at http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=1

Figure 6: Manufacture Unit Value Indices (2000=10), world (ex. transition economies) and regional aggregates

A. World



Developed economies



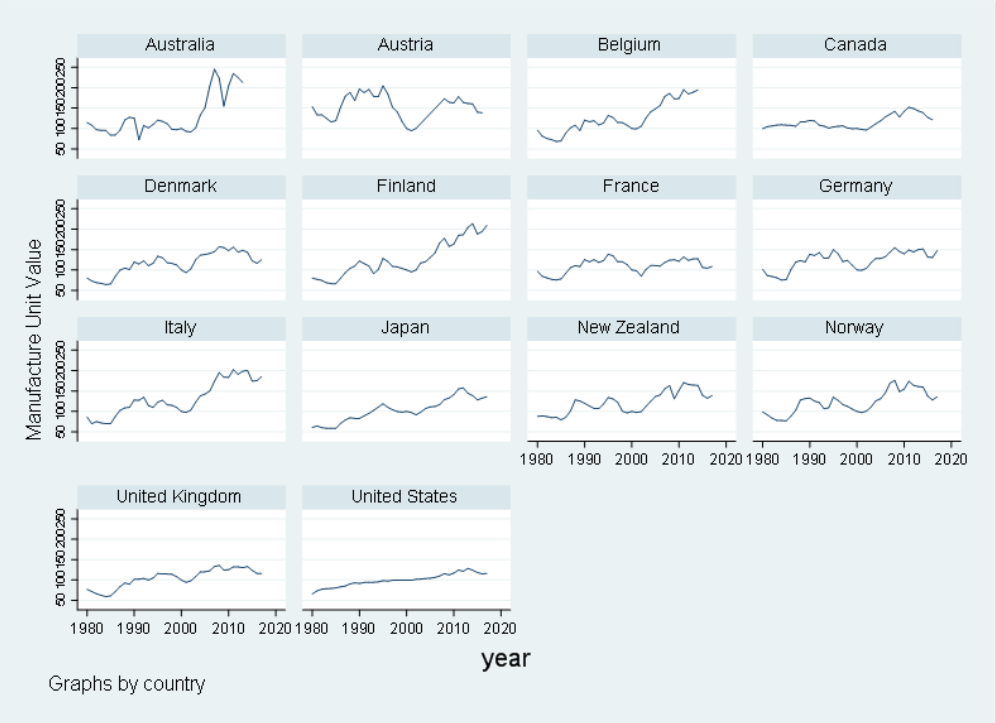
Source: International Trade Statistics Yearbook editions, Special Table 40, Manufactured goods exports, available at https://unstats.un.org/unsd/trade/data/tables.asp

Figure 7 presents the manufacture unit values for those economies that report from national sources. The data covers 14 developed countries and 7 developing countries. While the sample of

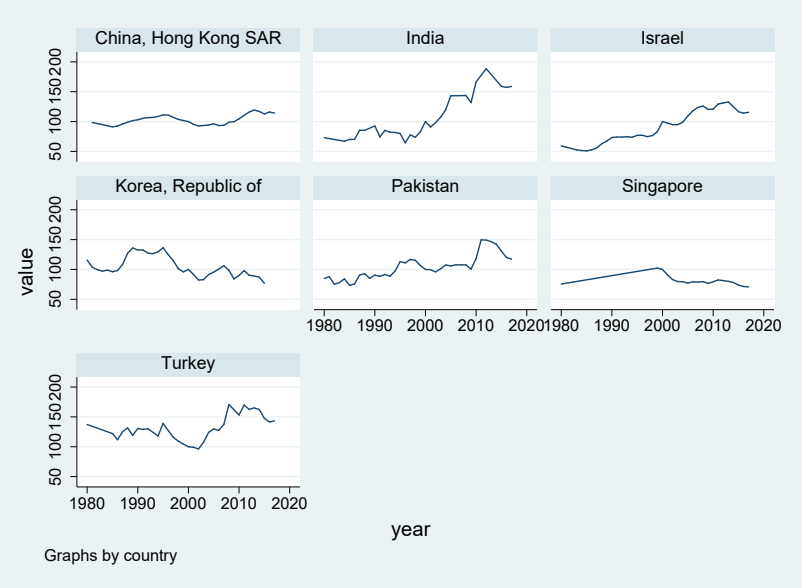
developed countries cover the main manufacture exporters in the group in 2015 (Germany, United States, Japan, France and Italy), it only covers 2 of the 5 major developing countries exporters of manufactures, Singapore and Republic of Korea (excluding China, Mexico and Malaysia) (See Table 7). This is a good time to bring up again the caveat that traditional trade data may include significant biases in a world of global value chains, as China and Mexico are big players in processing and assembling, in activities with low value-added.

Figure 7: Manufacture Unit Values by country, 2000=100

A. Developed countries



B. Developing countries



Source: International Trade Statistics Yearbook editions, Special Table 40, Manufactured goods exports, available at https://unstats.un.org/unsd/trade/data/tables.asp

Although in different magnitudes and patterns, all developed countries manufacture unit values are higher or equal around 2015 to those in the 1980s. In contrast, the Republic of Korea and Singapore are below. While Hong Kong SAR, Israel, Pakistan and Turkey's manufacture unit values have increased, they represent small shares of total manufacture exports. India has increased its share in world manufacture exports, following a strategy aimed at supplying higher quality goods or "customized" products and services (Lemoine and Unal-Kesenci 2008).

The order of integration of a time series is important in assessing patterns. A time series has stationarity if a shift in time doesn't cause a change in the shape of the distribution; unit roots are one cause for non-stationarity. If a time series has a unit root, it shows a systematic pattern that is unpredictable.

Table 2 shows that the manufactures unit value for both developing and developed countries have a unit root. This implies that, even if the trend for developed countries is positive and significant, this pattern cannot be considered predictable.

Table 2: Augmented Dickey-Fuller Test for stationarity: Aggregate manufacture unit values and manufactures terms of trade

	Obs.	Lags (AIC)	Est.	C. value (5%)		Trend	
Developing Economies	35	2	-1.64	-3.56		-0.02	
Developed Economies	36	1	-2.47	-3.56		0.46	**
America	36	1	-1.98	-3.56		0.26	
Europe	36	1	-2.49	-3.56		0.50	*
Other Developed	36	1	-3.19	-3.56		0.59	***
Manuf Terms of trade	36	1	-3.78	-3.56	**	-0.87	***

Source: Author's estimations in Stata.

Note: *, **, ***: 99%, 95% and 90% significance, respectively.

In addition, further analysis on structural breaks (Table 3) shows that the series experienced a significant structural break in 2001, which affected mostly Europe and corresponded with the introduction of the Euro. Interestingly, the great recession of 2008-09 did not seem to have an effect in manufacture unit values, affecting only America and not statistically significant.

Table 3: Clemente, Montanes and Reyes (1998) test for non-stationarity with 1 or 2 structural breaks: Aggregate manufacture unit values and Manufactures Terms of Trade

	Additive Outlier (Trend)		Innovational Outlier (Intercept)	
Developing Economies	1984	**	1985	**
	1988, 1997		1986, 1994	
Developed Economies	2009		2001	**
	1987, 2005		1984, 2001	
America	2004		2002	
	1990, 2007		1986, 2004	
Europe	2009		2001	**
	1987, 2005		1984, 2001	
Other Developed	1996		2001	
	1989, 2007		1984, 2001	
Manuf Terms of trade	2000		2001	
	1987, 2004		1984, 2001	**

Source: Author's estimations in Stata.

Note: *, **, ***: 99%, 95% and 90% significance, respectively.

Table 4 shows that the manufacture unit value series for all developed countries including in the sample are non-stationary. Although their trends are positive, and significant for some countries, this implies that no inference can be made about future trends based on previous observations.

Table 4: Augmented Dickey-Fuller Test for stationarity: Aggregate manufacture unit values and manufactures terms of trade

A. Developed economies

	Obs.	Lags (AIC)	Est.	C. value (5%)	Trend
Australia	31	2	-1.80	-3.58	1.20 **
Belgium	33	1	-2.16	-3.57	1.00 *
Canada	35	1	-1.84	-3.56	0.15
Denmark	36	1	-2.17	3.56	0.40
Finland	35	2	-1.64	-3.56	0.87 *
France	36	1	-1.96	-3.56	0.06
Germany	35	2	-2.06	-3.56	0.30
Italy	36	1	-2.12	-3.56	0.73 *
Japan	36	1	-3.02	-3.56	0.63 **
New Zealand	36	1	-3.02	-3.56	0.73 **
Norway	35	2	-2.16	-3.56	0.49
United Kingdom	36	1	-2.36	-3.56	0.38 *
United States	36	1	-2.02	-3.21	0.32

B. Developing economies

	Obs.	Lags (AIC)	Est.	C. value (5%)	Trend
Hong Kong SAR	31	1	-2.03	-3.58	0.03
India	19	1	0.47	-3.60	0.19
Israel	34	3	-1.71	-3.56	0.67
Republic of Korea	33	2	-1.88	-3.57	-0.29 *
Pakistan	36	1	-3.54	-3.56 *	0.74 **
Singapore	17	1	-4.51	-3.60 ***	-0.26 *
Turkey	31	1	-1.66	-3.58	0.23

Source: Author's estimations in Stata.

Note: *, **, ***: 99%, 95% and 90% significance, respectively.

Table 5 identifies structural breaks around 2001 for most European countries and statistically significant for Italy, Denmark and Norway. It also shows that the Great Recession affected particularly Canada, New Zealand and Norway. It also affected strongly most developing countries in the sample.

Table 5: Clemente, Montanes and Reyes (1998) test for non-stationarity with 1 or 2 structural breaks: Aggregate manufacture unit values and Manufactures Terms of Trade, selected countries

A. Developed economies

	Additive Outlier (Trend)		Innovational Outlier (Intercept)	
Australia	2004	**	2004	**
	1988, 2004	**	1986, 2004	**
Belgium	2004		2001	
	1987, 2004		1984, 2001	
Canada	2008	**	2004	
	1993, 2005		1990, 2004	
Denmark	1991		1984	
	1987, 2004		1984, 2000	*
Finland	2009		2004	
	1991, 2009		1984, 2005	
France	1988		1984	
	1988, 2000		1984, 2001	
Germany	1988		1984	
	1988, 2009		1984, 2001	
Italy	2009		2001	**
	1987, 2005		1984, 2005	
Japan	2013		2001	
	1989, 2007		1989, 2006	
New Zealand	2008	**	2001	
	1989, 2008		1985, 2004	
Norway	2008	**	2002	
	1989, 2008		1986, 2004	*
United Kingdom	1989	**	1984	
	1989, 2005		1984, 2001	
United States	2004		2005	
	1990, 2007		1986, 2005	

B. Developing economies

	Additive Outlier (Trend)		Innovational Outlier (Intercept)	
China Hong Kong SAR	2014		2005	
	2004, 2014		1999, 2008	**
Israel	2001		1997	
	2001, 2008		1997, 2003	
Republic of Korea	2000	**	1994	
	1989, 1999	*	1986, 1996	
Pakistan	2007		2008	
	1991, 2007	**	1992, 2008	**
Singapore	2004		2013	
	2002, 2014	**	2008, 2013	
Turkey	2005		2006	**
	1997, 2005		1994, 2006	**

Source: Author's estimations in Stata.

Note: *, **, ***: 99%, 95% and 90% significance, respectively.

Given the low coverage of developing countries in the United Nations database and the interest in understanding differences according to product characteristics, the next section explores a database that processed official data of exports and imports published by the United Nations, to generate consistent inflows and outflows of goods and comparable quantities.

1.4.B Calculating manufacture terms of trade indices

While the United Nations data suggests that there are differences in manufacture unit values among developed and developing countries, this section will explore if these differences apply to all or some types of manufactures and to all or some developing countries.

The Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) Base pour l'Analyse du Commerce International (BACI) database, or CEPII's BACI[7], is a database that reconciles COMTRADE's[8] declarations of the exporter and the importer, generating trade statistics (value and quantity) at a high-level of product disaggregation. Given the size of the CEPII's BACI database, which includes bilateral values and quantities of exports at the HS 6-digit product disaggregation, for more than 200 countries since 1995, it is compulsory to be selective.

CEPII's BACI is a database that reconciles COMTRADE's[9] declarations of the exporter and the importer, generating trade statistics (value and quantity) at a high-level of product disaggregation. Even though most quantities are reported in tons, there is 15% reported in other quantity units (units, meters, watt, etc). For each product concerned, CEPII estimates the rates of conversion into tons of the different units in which it is reported, using mirror flows reported in tons by a country and in another unit by the other trading partner.

Given the size of the CEPII's BACI database, which includes value (in thousands) and quantity (in tons) by exporter, importer, product category (HS) at 6 digits for more than 200 countries since 1995, it is compulsory to be selective.

Table 6 shows that the market for manufactures is quite concentrated. The fifty largest exporters represent around 97 percent of total manufacture exports (see Table 7). This concentration has not changed since 1995. As mentioned before, a notorious change is the increase in the share of China in total manufacture exports, which grew from around 5 percent in 1995 to

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[7] Available at http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=1

[8] UN COMTRADE is a repository of official international trade statistics and relevant analytical tables. United Nations Statistical Division database accessible at https://comtrade.un.org/

[9] UN COMTRADE is a repository of official international trade statistics and relevant analytical tables. United Nations Statistical Division database accessible at https://comtrade.un.org/

20.5 percent in 2015. EU 15, Japan and USA's shares in total manufactures fell 11, 6 and 4 percent respectively in the same period.

Table 6: Share of total exports of 50 largest exporters of manufactures, selected years

	1995	2000	2015
Developed Economies	*75.51%*	*65.87%*	*55.00%*
EU15	42.13%	38.66%	30.83%
New EU members	1.94%	3.49%	4.74%
Other European	2.31%	1.74%	1.76%
Japan	12.11%	8.47%	5.80%
AUS, CAN, NZL	3.83%	3.19%	2.17%
USA	13.20%	10.32%	9.70%
Developing Economies	*20.82%*	*30.57%*	*42.10%*
China	4.96%	12.12%	20.51%
East Asia - China	10.84%	11.41%	12.89%
India	0.61%	0.89%	1.48%
South Asia - India	0.28%	0.32%	0.51%
Western Asia	1.00%	1.83%	2.42%
Mexico	1.70%	2.27%	3.00%
South America	0.90%	1.10%	0.81%
South Africa	0.28%	0.38%	0.30%
Africa - ZAF	0.25%	0.25%	0.17%
Economies in transition	*0.55%*	*1.14%*	*0.87%*
Total Share of World Exports	***96.88%***	***97.58%***	***97.97%***
Memo:			
World exports (US$ Billion)	3,667.6	7,151.1	10,824.7

Source: Author's calculations based on BACI, CEPII.

Note: Includes sections 5 to 8 of SITC, excluding section 68, non-ferrous metals.

As we are focusing manufacture exports and considering that sporadic data points may skew the analysis, the rest of the analysis considers only countries that exported more than US$100 billion cumulative in the period 1995-2016. The analysis excludes economies in transition [10],

[10] The economies in transition that exported more than US$ 100 billion in 1995-1006 are Belarus, Ukraine and the Russian Federation.

including the new EU members, classified as transition economies in the 1990s[11], given the emphasis on the relationship between developing and developed economies and the role of China.

[11] The new EU members, previously classified as economies in transition, that exported more than US$ 100 billion in 1995-1006 are Bulgaria, Croatia, Czech Rep., Estonia, Hungary, Lithuania, Poland, Romania, Slovakia, and Slovenia.

Table 7: 50 Major Manufacture Exporters, Percent of World Manufacture Exports

		1995		2005		2015
Developed Economies	1	Croatia	0.09%	Greece	0.14%	Bulgaria	0.14%
	2	New Zealand	0.13%	Slovenia	0.22%	Slovenia	0.21%
	3	Greece	0.16%	Norway	0.31%	Australia	0.25%
	4	Romania	0.18%	Australia	0.33%	Norway	0.27%
	5	Slovenia	0.21%	Romania	0.34%	Portugal	0.39%
	6	Slovakia	0.22%	Slovakia	0.37%	Finland	0.46%
	7	Hungary	0.29%	Portugal	0.44%	Romania	0.46%
	8	Norway	0.40%	Denmark	0.71%	Denmark	0.54%
	9	Australia	0.40%	Hungary	0.73%	Slovakia	0.56%
	10	Poland	0.46%	Finland	0.84%	Hungary	0.79%
	11	Czech Rep.	0.47%	Poland	0.91%	Sweden	1.00%
	12	Portugal	0.51%	Czech Rep.	0.92%	Austria	1.08%
	13	Denmark	0.79%	Austria	1.26%	Czech Rep.	1.21%
	14	Finland	0.91%	Switzerland	1.43%	Ireland	1.22%
	15	Ireland	0.95%	Sweden	1.52%	Poland	1.36%
	16	Austria	1.25%	Ireland	1.66%	Switzerland	1.49%
	17	Sweden	1.78%	Spain	2.07%	Spain	1.78%
	18	Spain	1.90%	Belgium-Luxembourg	2.70%	Canada	1.92%
	19	Switzerland	1.91%	Netherlands	2.85%	Belgium-Luxembourg	2.04%
	20	Netherlands	2.94%	Canada	2.87%	Netherlands	2.44%
	21	Belgium-Luxembourg	3.05%	United Kingdom	3.71%	United Kingdom	2.73%
	22	Canada	3.30%	Italy	4.27%	Italy	3.41%
	23	United Kingdom	4.80%	France	4.91%	France	3.68%
	24	Italy	5.26%	Japan	8.47%	Japan	5.80%
	25	France	5.86%	USA	10.32%	USA	9.70%
	26	Germany	11.97%	Germany	11.58%	Germany	10.07%
	27	Japan	12.11%				
	28	USA	13.20%				
Developing Economies	1	Bangladesh	0.11%	Morocco	0.12%	Cambodia	0.13%
	2	Tunisia	0.12%	Tunisia	0.12%	Argentina	0.15%
	3	Morocco	0.12%	Bangladesh	0.14%	Morocco	0.17%
	4	Pakistan	0.17%	Pakistan	0.17%	Pakistan	0.18%
	5	Argentina	0.20%	Argentina	0.18%	South Africa	0.30%
	6	Saudi Arabia	0.21%	Viet Nam	0.30%	Bangladesh	0.33%
	7	South Africa	0.28%	Saudi Arabia	0.30%	Israel	0.40%
	8	Israel	0.33%	United Arab Emirates	0.32%	Saudi Arabia	0.46%
	9	Philippines	0.38%	Israel	0.34%	United Arab Emirates	0.51%
	10	Turkey	0.46%	South Africa	0.38%	Philippines	0.59%
	11	India	0.61%	Indonesia	0.73%	Hong Kong SAR China	0.65%
	12	Brazil	0.70%	Philippines	0.77%	Brazil	0.66%
	13	Indonesia	0.73%	Turkey	0.87%	Indonesia	0.73%
	14	Thailand	1.10%	India	0.89%	Turkey	1.05%
	15	Hong Kong SAR China	1.66%	Brazil	0.92%	Viet Nam	1.41%
	16	Mexico	1.70%	Hong Kong SAR China	0.93%	India	1.48%
	17	Malaysia	1.74%	Thailand	1.31%	Thailand	1.61%
	18	Singapore	2.15%	Singapore	1.75%	Singapore	1.64%
	19	Rep. of Korea	3.08%	Malaysia	1.83%	Malaysia	1.67%
	20	China	4.96%	Mexico	2.27%	Mexico	3.00%
	21			Rep. of Korea	3.79%	Rep. of Korea	4.45%
	22			China	12.12%	China	20.51%
	1	Ukraine	0.11%	Ukraine	0.38%	Ukraine	0.19%
	2	Russian Federation	0.43%	Russian Federation	0.76%	Russian Federation	0.67%

Source: Author's calculations based on BACI CEPII.

Thus, the analysis below is done for 52 developed and developing economies, which represent 90.44 percent of the total cumulative manufacture goods in the period 1995-2016

exported by 223 countries in the database: 22 developed economies (EU-15, Australia, Canada, New Zealand, Japan, United States of America, Norway and Switzerland) and 30 developing economies (4 in Africa: Egypt, Tunisia, Morocco and South Africa; 4 in South America: Argentina, Brazil, Chile, Colombia; 3 in Caribbean and Central America: Costa Rica, Dominican Rep., Mexico; 10 in East Asia: China, Cambodia, Viet Nam, Philippines, Indonesia, Hong Kong SAR China, Thailand, Malaysia, Singapore, Republic of Korea; 5 in South Asia: India, Sri Lanka, Iran, Pakistan, Bangladesh; and 4 in Western Asia: United Arab Emirates, Saudi Arabia, Israel, Turkey).

The data is converted it into HS6 equivalencies, using the correspondence tables published by the United Nations[12]. A first complication comes from the fact that the tables are presented at SITC 5 digits. This means that the same SITC at 3 digits can be included in two of more different HS6 and vice versa. While not perfect, the approximation used here is to assign each HS6 to the first SITC in the correspondence list. This avoids duplicates in the equivalency exercise.

The next step is to construct the price indices aggregating products according to the relevant classification (See Appendix A). Thus, each country will have a price index, base 2000=100, for each group of products. The method used to calculate the price index is the Fisher index. It is defined as the geometric average of the Laspeyres price index (which only uses the base period basket) and the Paasche price index (which only uses the current period basket). To calculate regional aggregates, the country price indices are weighted by the current value of its exports.

[12] Available at https://unstats.un.org/unsd/trade/classifications/correspondence-tables.asp.

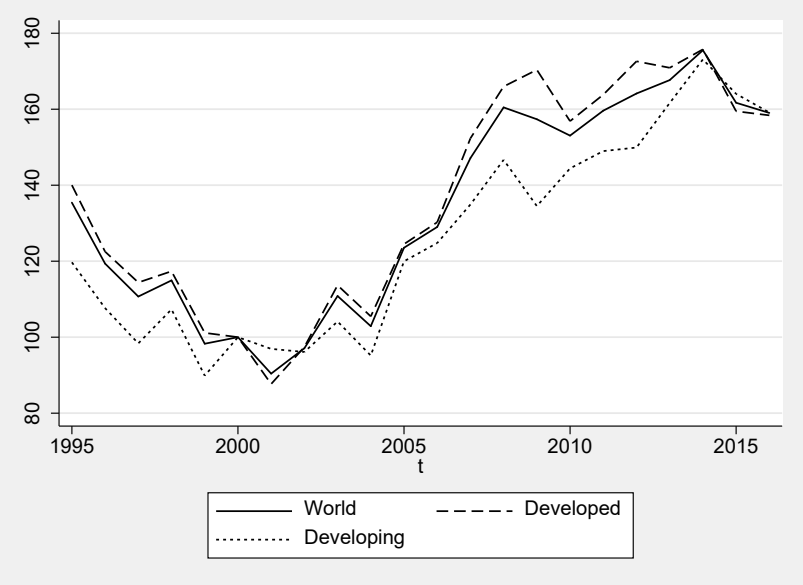
Finally, to avoid biased results caused by outliers, the blocked adaptive computationally efficient outlier nominators (BACON)[13] is used, eliminating outliers on individual product price indices per country, with a 0.15 percentile of the chi-squared distribution as threshold to separate outliers from nonoutliers. This procedure is done again on aggregate manufacture unit value indices per country with a 0.05 percentile of the chi-squared distribution. The decision regarding the percentiles of the chi-square distribution was made to minimize observations to be dropped while ensuring continuity in the data. In both cases estimations were made at 0.05, 0.1 and 0.15 percentiles.

Figure 8 shows a difference in manufacture unit values between developed and developing countries, consistent to that observed in Figure 6. The Figure also suggests that the difference may have decreased after 2014. However, the data may have a bias, due to possible delays in reporting international trade at a disaggregated level.

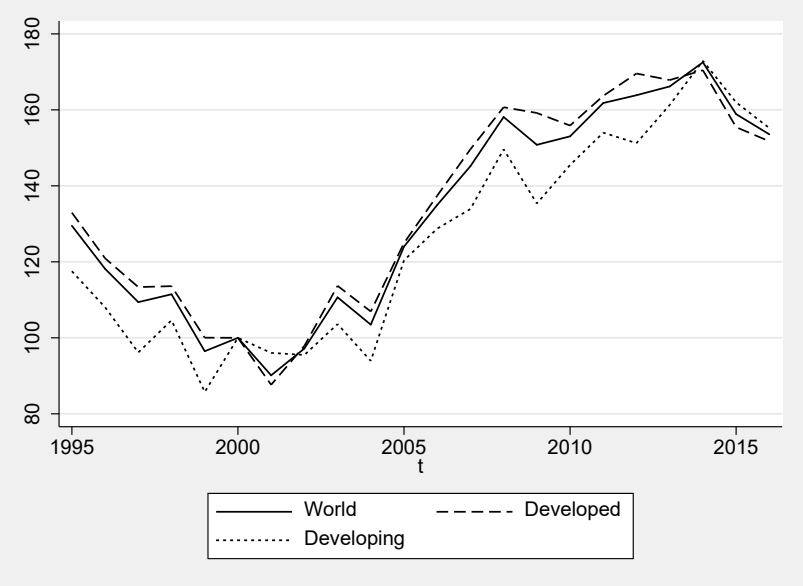
[13] See Billor, Hadi and Velleman (2000).

Figure 8: Manufacture Unit Values, world (ex. transition economies), developing and developed countries, 2000=100

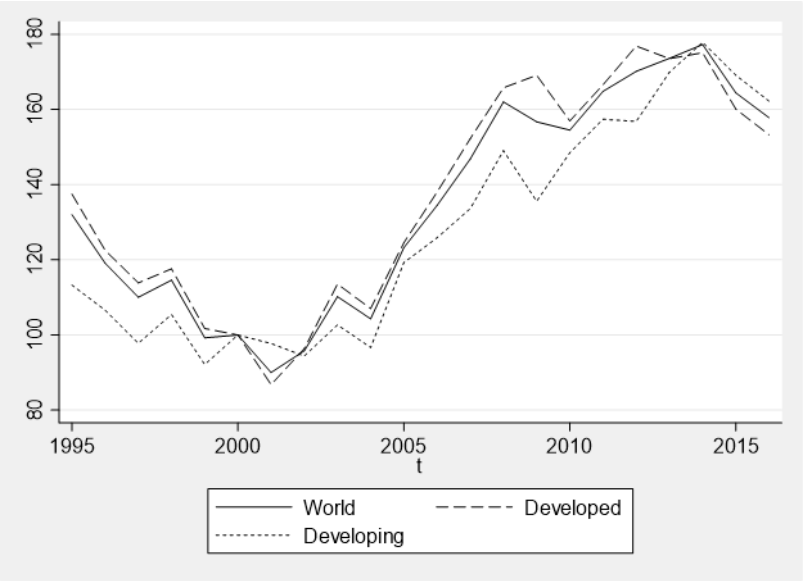
A. UNCTAD's classification



B. Lall's classification (Lall 2001)



C. Broad economic categories (BEC)



Source: Author's calculations based on CEPII's BACI.

This result is consistent within three classifications of international trade statistics, further described and compared in Appendix A:

Part A uses UNCTAD's Trade and Development Report classification of manufactured goods by degree of manufacturing. This classification includes products of sections 5-8 of the Standard International Trade Classification (SITC), excluding SITC 68 (non-ferrous metals). It divides products by skill and technology intensity: Labour and resource-based manufactures and low, medium and high-skill and technology-based manufactures.

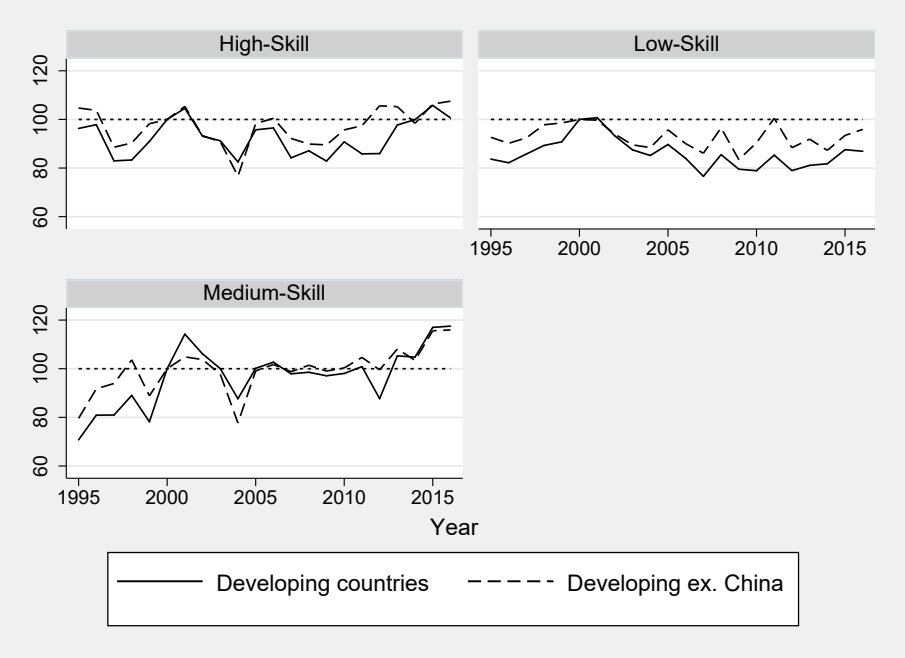
Part B uses Sanjaya Lall's classification by technology level (Lall 2001). This classification includes all SITC sections, dividing them into primary commodities, resource-based manufactures and low, medium and high-tech manufactures. Primary commodities and fuels are excluded in the analysis. Table 10 shows the products not included in UNCTAD's classification.

Part C uses the classification by Broad Economic Categories (BEC). This classification uses the economic activities included in the System of National Accounts (SNA). Those are capital goods, intermediate goods and consumption goods. Primary (not-processed) products and fuels are excluded in the analysis.

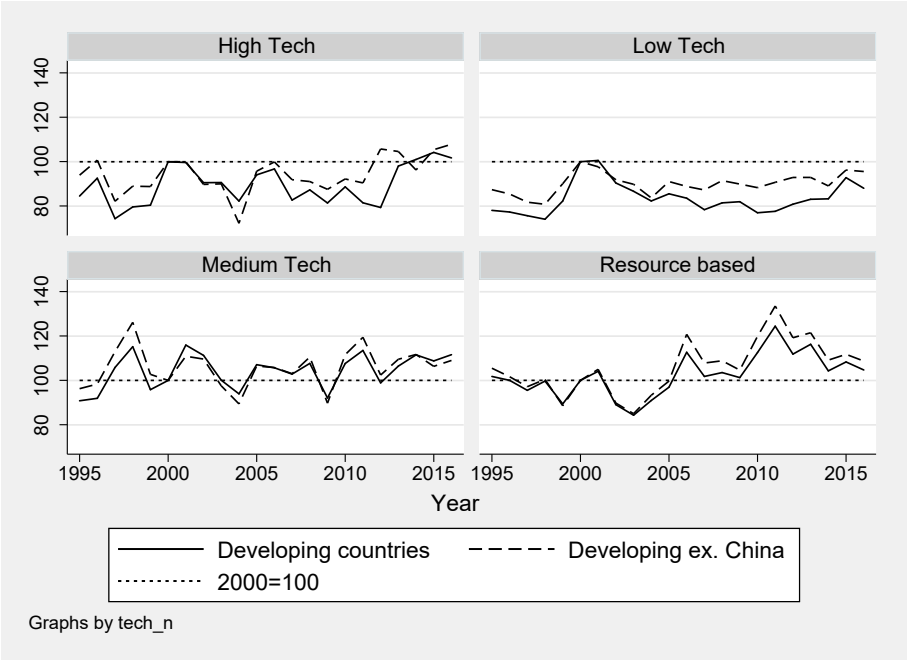
Figure 9 suggests that Milberg and Winkler (2013)'s idea of a Prebisch-Singer (P-S) trap for the 21st century may be valid for manufactures of low and high-skill intensity (Part A). It may also be valid for low and high-tech manufactures (Part B). While the effect is less pronounced, it remains if China is excluded from the aggregate for developing countries. The Figure also suggests that the P-S trap for the 21st century may not be relevant for manufactures of medium skill and technology levels, for which the terms of trade do not increase or decrease.

Figure 9: Terms of trade of developing countries, 2000=100

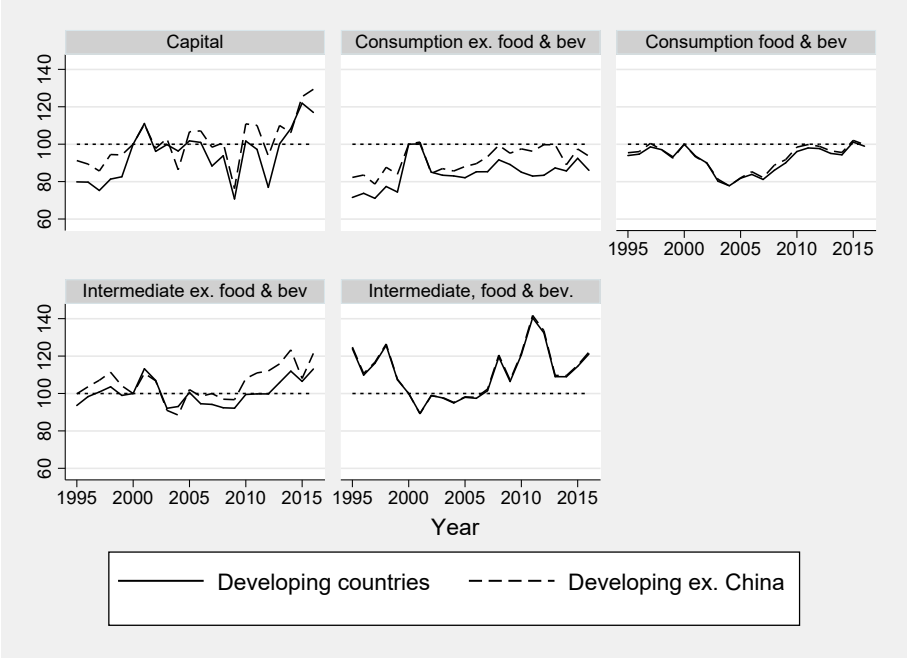
A. By degree of manufacturing skill (UNCTAD), groups



B. Classified by technology level (Lall 2001)



C. By economic classification (United Nations BEC)



Source: Author's calculations based on CEPII's BACI.

Part C shows that for most economic categories, manufactures experienced negative or stagnant terms of trade. The exception is food and beverages processed for industrial use, especially in recent years. Excluding China, the negative terms of trade are milder for consumption and intermediate goods excluding foods but not for food and beverages.

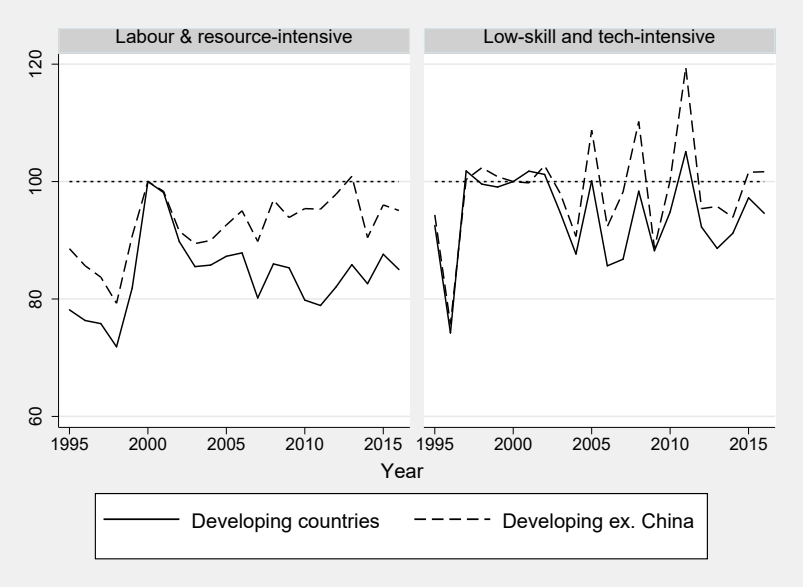
Figure 10 and Table 8 provide further detailed information by categories. Exercises like the ones presented in section B for the United Nations data to determine unit roots were also performed but not reported as they didn't add additional information to the analysis, especially given the short sample from 1995-2016.

Figure 10 and Table 8 Part A show that the manufactures most affected by negative terms of trade are labor and resource intensive and medium skill electronic excluding parts. The only exception with positive terms of trade for developing countries appears to be medium skill electronic parts. As Table A.2 shows, medium skill electronic including and excluding parts include only one product each, making them especially susceptible to the effect of outliers.

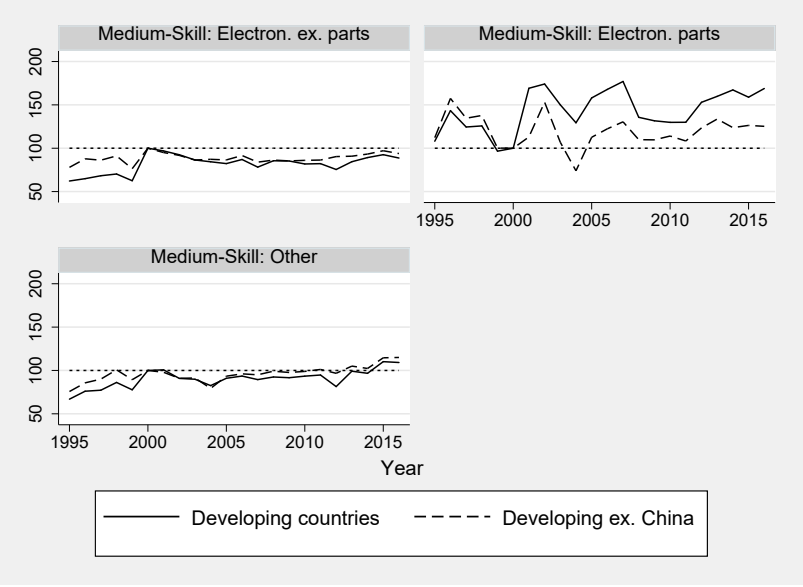
Figure 10: Terms of trade of developing countries, 2000=100

A. By degree of manufacturing skill (UNCTAD), categories

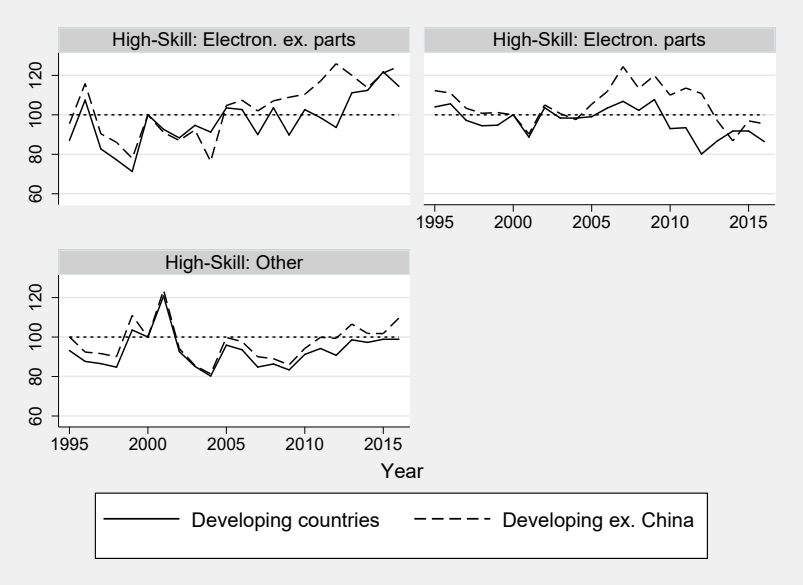
a. Low-skill manufactures



b. Medium-skill manufactures

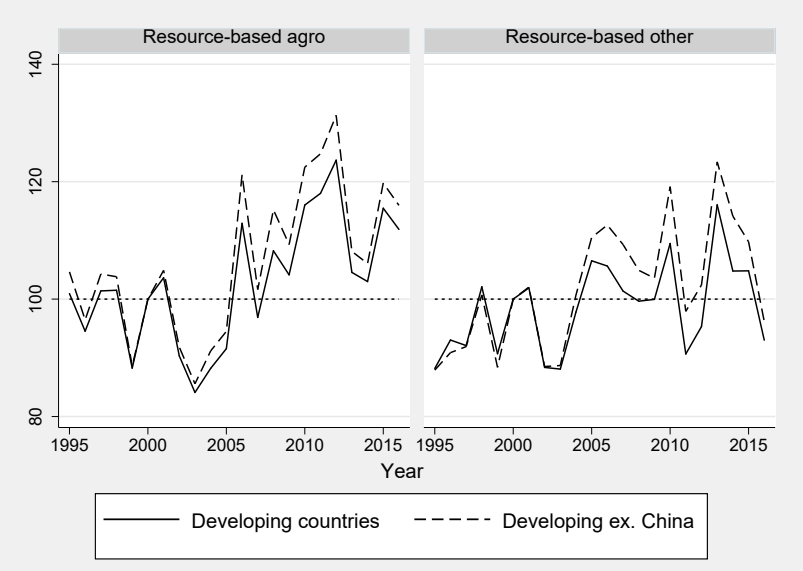


c. High-skill manufactures

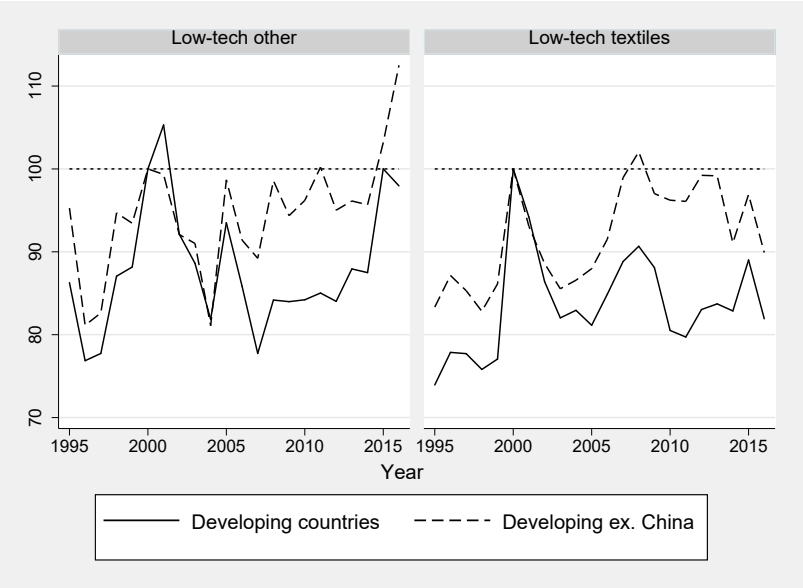


B. By technology level (Lall (2001)'s classification)

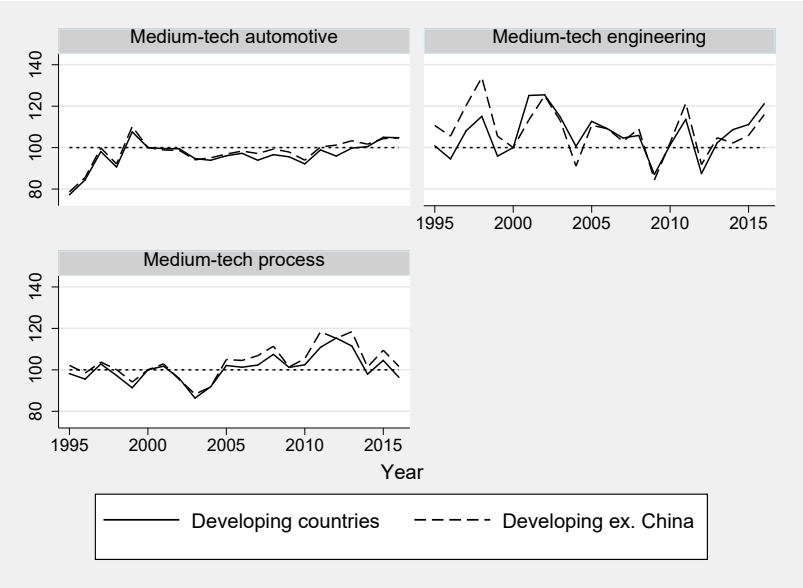
a. Resource-based manufacture



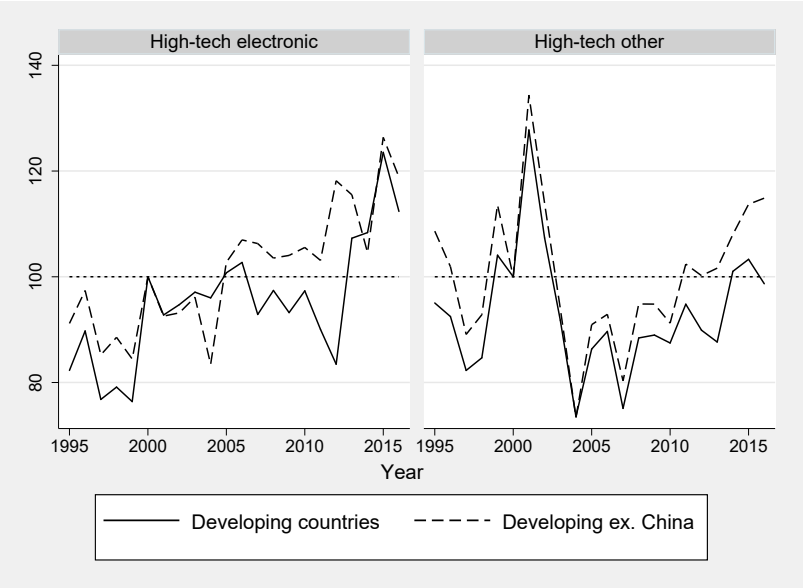
b. Low-tech manufactures



c. Medium-tech manufactures

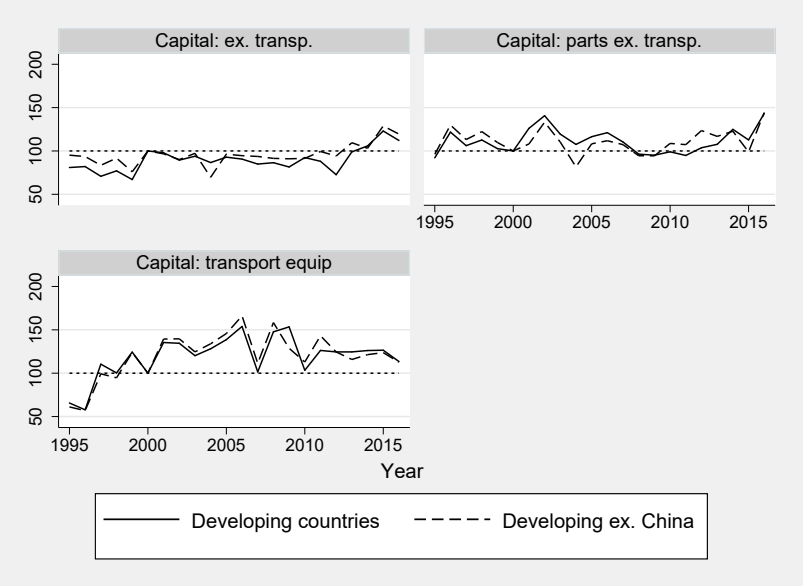


d. High-tech manufactures

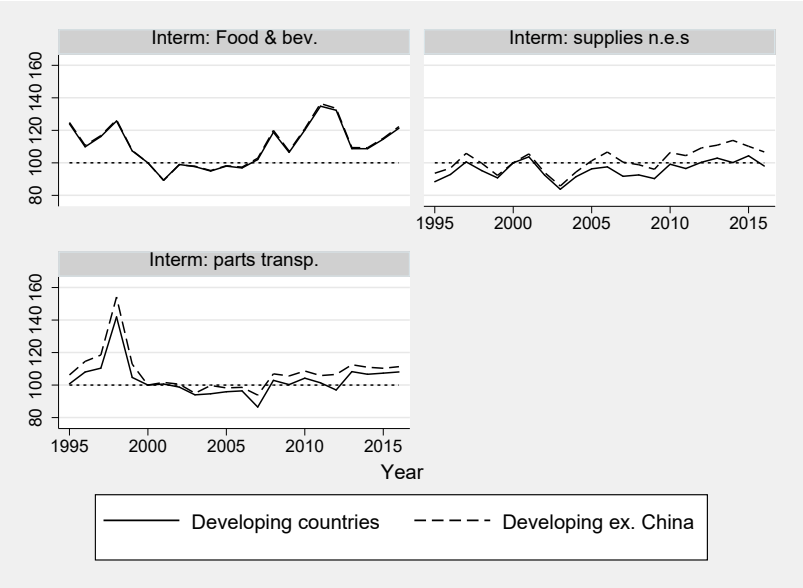


C. By broad economic categories (BEC)

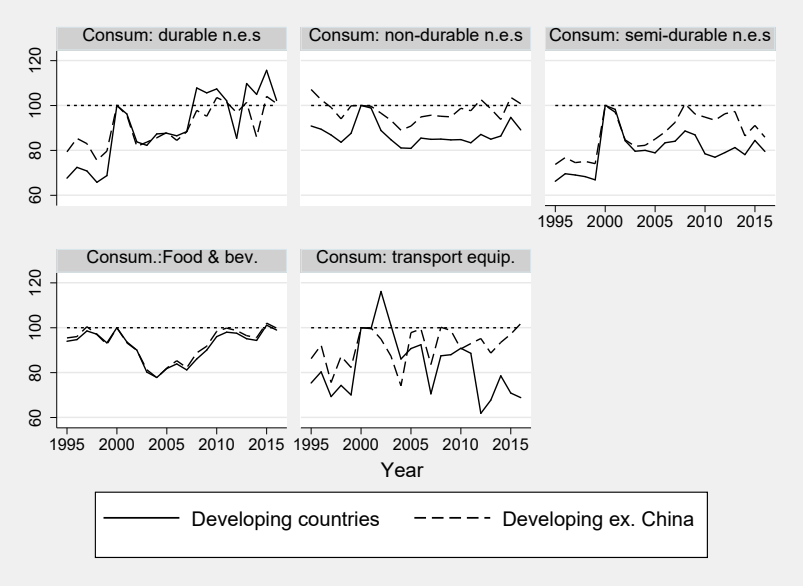
a. Capital



b. Intermediates



c. Consumption



Source: Author's calculations based on CEPII's BACI.

Figure 10 and Table 8 Part B shows that high-tech non-electronic and low-tech are the most affected with negative terms of trade. The only exceptions from negative or stagnant terms of trade are medium-tech engineering and agriculture resource-based manufactures in the last decade.

Figure 10 and Table 8 Part C shows that terms of trade have been negative for most economic categories. The exceptions are capital parts and transport goods and intermediate food and beverages.

Table 8: Manufacture terms of trade, means 1995-2016, base 2000=100

	Mean	Std. Err.	[95% conf. interval]		Mean	Std. Err.	[95% conf. interval]	
	Developing countries				Developing ex. China			
A. By degree of manufacturing								
Labour & resource-intensive	84.16	1.41	81.38	86.95	92.56	1.14	90.32	94.81
Low-skill and tech-intensive	94.34	1.53	91.32	97.36	98.68	1.82	95.09	102.26
Medium-Skill: Electron. ex. part	81.85	2.28	77.36	86.34	88.68	1.19	86.33	91.03
Medium-Skill: Electron. parts	143.57	5.13	133.44	153.69	119.49	3.91	111.78	127.20
Medium-Skill: Other	90.49	2.26	86.03	94.94	96.17	2.00	92.22	100.12
High-Skill: Electron. ex. parts	97.10	2.64	91.88	102.32	103.41	3.15	97.20	109.62
High-Skill: Electron. parts	96.70	1.56	93.62	99.78	104.88	2.00	100.94	108.82
High-Skill: Other	93.10	1.88	89.38	96.82	97.53	2.07	93.45	101.60
B. By technology level								
Resource-based agro	102.69	2.28	98.20	107.18	106.43	2.68	101.15	111.71
Resource-based other	98.61	1.62	95.42	101.81	101.98	2.20	97.64	106.32
Low-tech textiles	83.74	1.33	81.12	86.37	92.03	1.29	89.48	94.57
Low-tech other	87.99	1.60	84.83	91.15	94.63	1.53	91.61	97.65
Medium-tech automotive	96.42	1.41	93.64	99.19	97.80	1.40	95.04	100.56
Medium-tech engineering	106.60	2.25	102.16	111.04	108.13	2.42	103.36	112.91
Medium-tech process	100.64	1.45	97.77	103.51	103.44	1.67	100.15	106.73
High-tech electronic	95.19	2.49	90.28	100.10	101.26	2.48	96.37	106.15
High-tech other	93.19	2.48	88.30	98.08	100.34	2.82	94.77	105.91
C. By economic category								
Capital: ex. transp.	89.76	2.84	84.16	95.36	95.74	2.66	90.49	100.98
Capital: parts ex. transp.	111.56	3.01	105.64	117.49	111.04	3.08	104.98	117.10
Capital: transport equip	118.93	5.19	108.72	129.15	119.89	5.70	108.66	131.13
Interm: parts transp.	103.12	2.22	98.74	107.50	107.85	2.61	102.70	112.99
Interm: Food & bev.	110.29	2.69	104.98	115.59	110.90	2.77	105.44	116.37
Interm: supplies n.e.s	95.85	1.15	93.59	98.11	101.48	1.52	98.49	104.46
Consum: durable n.e.s	90.81	3.26	84.38	97.24	90.77	1.92	86.99	94.54
Consum: non-durable n.e.s	87.41	1.06	85.32	89.51	97.65	0.93	95.83	99.48
Consum: semi-durable n.e.s	80.08	1.90	76.33	83.83	87.63	1.91	83.87	91.39
Consum.:Food & bev.	91.97	1.51	89.00	94.94	92.94	1.53	89.91	95.96
Consum: transport equip.	83.13	2.94	77.35	88.91	91.81	1.69	88.48	95.14

Source: Author's calculations based on CEPII's BACI.

In addition to being lower in average, manufacture unit values may grow less in developing countries than in developed countries. Table 9.A shows that most differences in logarithms are negative and again significant for low-skill resource based and medium-skill electronic. In terms of technology level, Table 9.B suggests that the rate of growth is significantly lower for low-tech manufactures and for high-tech other.

Table 9: Manufacture terms of trade, average growth, base 2000=100

	Mean	Std. Err.	[95% conf. interval]		Mean	Std. Err.	[95% conf. interval]	
	Developing countries				Developing ex. China			
A. By degree of manufacturing								
Labour & resource-intensive	-0.175	0.017	-0.208	-0.143	-0.079	0.013	-0.104	-0.054
Low-skill and tech-intensive	-0.061	0.017	-0.095	-0.028	-0.017	0.019	-0.054	0.020
Medium-Skill: Electron. ex. part	-0.209	0.029	-0.266	-0.152	-0.122	0.014	-0.149	-0.095
Medium-Skill: Electron. parts	0.347	0.038	0.272	0.422	0.166	0.034	0.099	0.234
Medium-Skill: Other	-0.107	0.026	-0.157	-0.056	-0.044	0.021	-0.085	-0.002
High-Skill: Electron. ex. parts	-0.037	0.028	-0.092	0.017	0.023	0.031	-0.039	0.085
High-Skill: Electron. parts	-0.036	0.016	-0.069	-0.004	0.044	0.019	0.006	0.081
High-Skill: Other	-0.076	0.019	-0.114	-0.037	-0.030	0.021	-0.070	0.011
B. By technology level								
Resource-based agro	0.021	0.022	-0.023	0.065	0.006	0.024	-0.042	0.054
Resource-based other	-0.017	0.016	-0.049	0.015	-0.005	0.028	-0.060	0.051
Low-tech textiles	-0.180	0.016	-0.211	-0.149	-0.058	0.016	-0.090	-0.026
Low-tech other	-0.131	0.018	-0.166	-0.096	-0.085	0.014	-0.113	-0.057
Medium-tech automotive	-0.039	0.015	-0.069	-0.009	-0.025	0.015	-0.054	0.005
Medium-tech engineering	0.059	0.021	0.017	0.101	0.073	0.023	0.028	0.117
Medium-tech process	0.004	0.014	-0.024	0.033	0.031	0.016	-0.001	0.063
High-tech electronic	-0.056	0.026	-0.108	-0.005	0.056	0.025	0.006	0.105
High-tech other	-0.078	0.026	-0.128	-0.027	0.015	0.021	-0.027	0.057
C. By economic category								
Capital: ex. transp.	-0.118	0.031	-0.180	-0.057	-0.118	0.031	-0.180	-0.057
Capital: parts ex. transp.	0.102	0.026	0.050	0.154	0.102	0.026	0.050	0.154
Capital: transport equip	0.149	0.052	0.047	0.250	0.149	0.052	0.047	0.250
Interm: parts transp.	0.026	0.020	-0.013	0.065	0.026	0.020	-0.013	0.065
Interm: Food & bev.	0.092	0.024	0.044	0.140	0.092	0.024	0.044	0.140
Interm: supplies n.e.s	-0.044	0.012	-0.068	-0.020	-0.044	0.012	-0.068	-0.020
Consum: durable n.e.s	-0.111	0.037	-0.184	-0.037	-0.111	0.037	-0.184	-0.037
Consum: non-durable n.e.s	-0.136	0.012	-0.159	-0.113	-0.136	0.012	-0.159	-0.113
Consum: semi-durable n.e.s	-0.228	0.024	-0.274	-0.182	-0.228	0.024	-0.274	-0.182
Consum.:Food & bev.	-0.087	0.017	-0.120	-0.053	-0.087	0.017	-0.120	-0.053
Consum: transport equip.	-0.198	0.035	-0.266	-0.129	-0.198	0.035	-0.266	-0.129

Source: Author's calculations based on CEPII's BACI.

5 Conclusion

This paper shows that the manufacture terms of trade of developing countries have deteriorated or stagnated. It argues that asymmetries within global value chains are behind the deterioration of manufacture terms of trade for developing countries. In a sense, China's entrance in global value chains may have been a catalyst for a negative trend that was already set in. The manufacture terms of trade decline would be a consequence of the corporate strategy shift that allowed developed countries' firms to raise profits while keeping price increases low by reducing costs, raising flexibility and offloading risks (Milberg and Winkler 2013) towards developing countries' producers. This strategy may have cut short the rise of the rest (Amsden 2001), reinstating or perpetuating the center-periphery system that characterized the traditional international division of labour (Prebisch 1962). With this strategy, the center reclaimed its position in the production of manufactures by offshoring production to the periphery, while specializing in the more rentable parts of the business.

Appendix A: International Trade Classifications

UNCTAD

UNCTAD's Trade and Development Report classification of manufactured goods by degree of manufacturing distinguishes manufactured products according to the mix of different skill, technology and capital intensities and scale characteristics (UNCTAD 2002, Annexes to chapter III)[14]. The classification is divided into 4 groups:

i. Labour and resource-based manufactures

ii. Low skill non-resource-based manufactures

iii. Medium skill and technology intensive manufactures

   a. Electronic and electric excluding parts

   b. Electronic and electric parts

   c. Other

iv. High-skill and technology intensive manufactures

   a. Electronic and electric excluding parts

   b. Electronic and electric parts

   c. Other

This classification uses the United Nations definition of manufactures (sections 5 through 8 of the SITC). These sections are: chemicals and related products, manufactured goods classified chiefly by material, machinery and transport equipment and miscellaneous manufactured articles. The classification further excludes SITC 68 (non-ferrous metals), taking care of one of the

[14] See UNCTAD (2002) Trade and Development Report 2002, Annexes to chapter III.

criticisms coming from the empirical literature (Athukorala 1993, Rowthorn 1997) as presented in Table 1 above.

Table 3.10: Comparison of UNCTAD and Lall's classifications, SITC sections 5 through 8

A. Labour and resource-based manufactures

Code	UNCTAD (2002) classfication	Lall (2000) classification
	LOW-SKILL MANUFACTURES	
	Labour and resource-based	
633	Cork manufactures	Resource-based: agro-based
634	Veneers, plywood, and other wood, worked, n.e.s.	Resource-based: agro-based
635	Wood manufacture, n.e.s.	Resource-based: agro-based
641	Paper and paperboard	Resource-based: agro-based
611	Leather	Low-tech: textile, garm. & footw.
612	Manufactures of leather, n.e.s.; saddlery & harness	Low-tech: textile, garm. & footw.
613	Furskins, tanned or dressed, ex. those of 8483	Low-tech: textile, garm. & footw.
651	Textile yarn	Low-tech: textile, garm. & footw.
652	Cotton fabrics, woven	Low-tech: textile, garm. & footw.
654	Other textile fabrics, woven	Low-tech: textile, garm. & footw.
655	Knitted or crocheted fabrics, n.e.s.	Low-tech: textile, garm. & footw.
656	Tulles, trimmings, lace, ribbons & other small wares	Low-tech: textile, garm. & footw.
657	Special yarn, special textile fabrics & related	Low-tech: textile, garm. & footw.
658	Made-up articles, of textile materials, n.e.s.	Low-tech: textile, garm. & footw.
659	Floor coverings, etc.	Low-tech: textile, garm. & footw.
831	Travel goods, handbags & similar containers	Low-tech: textile, garm. & footw.
841	Men's clothing of textile fabrics, not knitted	Low-tech: textile, garm. & footw.
842	Women's clothing, of textile fabrics	Low-tech: textile, garm. & footw.
843	Men's or boy's clothing, of textile, knitted, croche.	Low-tech: textile, garm. & footw.
844	Women's clothing, of textile, knitted or crocheted	Low-tech: textile, garm. & footw.
845	Articles of apparel, of textile fabrics, n.e.s.	Low-tech: textile, garm. & footw.
846	Clothing accessories, of textile fabrics	Low-tech: textile, garm. & footw.
848	Articles of apparel, clothing access., ex. textile	Low-tech: textile, garm. & footw.
851	Footwear	Low-tech: textile, garm. & footw.
642	Paper & paperboard, cut to shape or size, articles	Low-tech: other products
665	Glassware	Low-tech: other products
666	Pottery	Low-tech: other products
821	Furniture & parts	Low-tech: other products
653	Fabrics, woven, of man-made fabrics	Medium-tech: process

B. Low skill and non-resource-based manufactures

Code	UNCTAD (2002) classfication	Lall (2000) classification
	LOW-SKILL MANUFACTURES (cont.)	
	Low skill non-resource based	
661	Lime, cement, fabrica. constr. mat. (ex. glass, clay)	Resource-based: other
662	Clay construction, refracto. construction materials	Resource-based: other
663	Mineral manufactures, n.e.s.	Resource-based: other
664	Glass	Resource-based: other
673	Flat-rolled prod., iron, non-alloy steel, not coated	Low-tech: other products
674	Flat-rolled prod., iron, non-alloy steel, coated, clad	Low-tech: other products
675	Flat-rolled products of alloy steel	Low-tech: other products
676	Iron & steel bars, rods, angles, shapes & sections	Low-tech: other products
677	Rails & railway track construction mat., iron, steel	Low-tech: other products
678	Wire of iron or steel	Low-tech: other products
691	Structures & parts, n.e.s., of iron, steel, aluminium	Low-tech: other products
692	Metal containers for storage or transport	Low-tech: other products
693	Wire products (ex. electrical) and fencing grills	Low-tech: other products
694	Nails, screws, nuts, bolts, rivets & the like, of metal	Low-tech: other products
695	Tools for use in the hand or in machine	Low-tech: other products
696	Cutlery	Low-tech: other products
697	Household equipment of base metal, n.e.s.	Low-tech: other products
699	Manufactures of base metal, n.e.s.	Low-tech: other products
895	Office & stationery supplies, n.e.s.	Low-tech: other products
899	Miscellaneous manufactured articles, n.e.s.	Low-tech: other products
785	Motorcycles & cycles	Medium tech: automotive
671	Pig iron & spiegeleisen, sponge iron, powder & granu	Medium-tech: process
672	Ingots, primary forms, of iron or steel; semi-finis.	Medium-tech: process
679	Tubes, pipes & hollow profiles, fittings, iron, steel	Medium-tech: process
786	Trailers & semi-trailers	Medium-tech: process
791	Railway vehicles & associated equipment	Medium-tech: process
793	Ships, boats & floating structures	Medium-tech: engineering

C. Medium-skill manufactures

Code	UNCTAD (2002) classfication	Lall (2000) classification
	MEDIUM-SKILL MANUFACTURES	
	Medium-skill: Elect., no parts	
775	Household type equipment, electrical or not, n.e.s.	Medium-tech: engineering
	Medium-skill.: Elect. Parts	
772	Apparatus for electrical circuits; board, panels	Medium-tech: engineering
	Medium-skill: Other	
621	Materials of rubber (pastes, plates, sheets, etc.)	Resource-based: agro-based
625	Rubber tyres, tyre treads or flaps & inner tubes	Resource-based: agro-based
629	Articles of rubber, n.e.s.	Resource-based: agro-based
893	Articles, n.e.s., of plastics	Low-tech: other products
894	Baby carriages, toys, games & sporting goods	Low-tech: other products
781	Motor vehicles for the transport of persons	Medium tech: automotive
782	Motor vehic. for transport of goods, special purpo.	Medium tech: automotive
783	Road motor vehicles, n.e.s.	Medium tech: automotive
784	Parts & accessories of vehicles of 722, 781, 782, 783	Medium tech: automotive
711	Vapour generating boilers, auxiliary plant; parts	Medium-tech: engineering
713	Internal combustion piston engines, parts, n.e.s.	Medium-tech: engineering
714	Engines & motors, non-electric; parts, n.e.s.	Medium-tech: engineering
721	Agricultural machinery (ex. tractors) & parts	Medium-tech: engineering
722	Tractors (ex. those of 71414 & 74415)	Medium-tech: engineering
723	Civil engineering & contractors' plant & equipment	Medium-tech: engineering
724	Textile & leather machinery, & parts thereof, n.e.s.	Medium-tech: engineering
725	Paper mill, pulp mill machinery; paper articles man.	Medium-tech: engineering
726	Printing & bookbinding machinery, & parts thereof	Medium-tech: engineering
727	Food-processing machines (ex. domestic)	Medium-tech: engineering
728	Other machinery for particular industries, n.e.s.	Medium-tech: engineering
731	Machine-tools working by removing material	Medium-tech: engineering
733	Mach.-tools for working metal, ex. removing mate.	Medium-tech: engineering
735	Parts, n.e.s., & accessories for machines of 731, 733	Medium-tech: engineering
737	Metalworking machinery (ex.machine-tools) & parts	Medium-tech: engineering

C. Medium-skill manufactures (cont.)

Code	UNCTAD (2002) classfication	Lall (2000) classification
	MEDIUM-SKILL MANUFACTURES (cont.)	
	Medium-skill: Other (cont.)	
741	Heating & cooling equipment & parts thereof, n.e.s.	Medium-tech: engineering
742	Pumps for liquids	Medium-tech: engineering
743	Pumps (ex. liquid), gas compressors & fans; centr.	Medium-tech: engineering
744	Mechanical handling equipment, & parts, n.e.s.	Medium-tech: engineering
745	Other non-electr. machinery, tools & mechan. appar.	Medium-tech: engineering
746	Ball or roller bearings	Medium-tech: engineering
747	Appliances for pipes, boiler shells, tanks, vats, etc.	Medium-tech: engineering
748	Transmis. shafts	Medium-tech: engineering
749	Non-electric parts & accessor. of machinery, n.e.s.	Medium-tech: engineering
773	Equipment for distributing electricity, n.e.s.	Medium-tech: engineering
811	Prefabricated buildings	Medium-tech: engineering
812	Sanitary, plumbing, heating fixtures, fittings, n.e.s.	Medium-tech: engineering
813	Lighting fixtures & fittings, n.e.s.	Medium-tech: engineering
716	Rotating electric plant & parts thereof, n.e.s.	High-tech: electro. & and electric
718	Other pow er generating machinery & parts, n.e.s.	High-tech: electro. & and electric
771	Electric pow er machinery, and parts thereof	High-tech: electro. & and electric
774	Electro-diagnostic appa. for medical sciences, etc.	High-tech: electro. & and electric
778	Electrical machinery & apparatus, n.e.s.	High-tech: electro. & and electric
712	Steam turbines & other vapour turbin., parts, n.e.s.	High-tech : other

D. High-skill manufactures

Code	UNCTAD (2002) classfication	Lall (2000) classification
	HIGH-SKILL MANUFACTURES	
	High-skill.: Elect., no parts	
762	Radio-broadcast receivers, w hether or not combined	Medium-tech: engineering
763	Sound recorders or reproducers	Medium-tech: engineering
751	Office machines	High-tech: electro. & and electric
752	Automatic data processing machines, n.e.s.	High-tech: electro. & and electric
761	Television receivers, w hether or not combined	High-tech: electro. & and electric
	High-skill: Elect. Parts	
759	Parts, accessories for machines of groups 751, 752	High-tech: electro. & and electric
764	Telecommunication equipment, n.e.s.; & parts, n.e.s.	High-tech: electro. & and electric
776	Cathode valves & tubes	High-tech: electro. & and electric
	High-skill: Other	
511	Hydrocarbons, n.e.s., & halogenated, nitr. derivative	Resource-based: other
514	Nitrogen-function compounds	Resource-based: other
515	Organo-inorganic, heterocycl. compounds, nucl. acids	Resource-based: other
516	Other organic chemicals	Resource-based: other
522	Inorganic chemical elements, oxides & halogen salts	Resource-based: other
523	Metallic salts & peroxysalts, of inorganic acids	Resource-based: other
524	Other inorganic chemicals	Resource-based: other
531	Synth. organic colouring matter & colouring lakes	Resource-based: other
532	Dyeing & tanning extracts, synth. tanning materials	Resource-based: other
551	Essential oils, perfume & flavour materials	Resource-based: other
592	Starche, w heat gluten; albuminoidal substances; glues	Resource-based: other
897	Jew ellery & articles of precious materia., n.e.s.	Low -tech: other products
898	Musical instruments, parts; records, tapes & similar	Low -tech: other products
512	Alcohols, phenols, halogenat., sulfonat., nitrat. der.	Medium-tech: process
513	Carboxylic acids, anhydrides, halides, per.; derivati.	Medium-tech: process
533	Pigments, paints, varnishes and related materials	Medium-tech: process
553	Perfumery, cosmetics or toilet prepar. (ex. soaps)	Medium-tech: process
554	Soaps, cleansing and polishing preparations	Medium-tech: process
562	Fertilizers (other than those of group 272)	Medium-tech: process

D. High-skill manufactures (cont.)

	HIGH-SKILL MANUFACTURES (cont.)	
	High-skill: Other (cont.)	
571	Polymers of ethylene, in primary forms	Medium-tech: process
572	Polymers of styrene, in primary forms	Medium-tech: process
573	Polymers of vinyl chloride or halogenated olefins	Medium-tech: process
574	Polyethers, epoxide resins; polycarbonat., polyesters	Medium-tech: process
575	Other plastics, in primary forms	Medium-tech: process
579	Waste, parings and scrap, of plastics	Medium-tech: process
581	Tubes, pipes and hoses of plastics	Medium-tech: process
582	Plates, sheets, films, foil & strip, of plastics	Medium-tech: process
583	Monofilaments, of plastics, cross-section > 1mm	Medium-tech: process
591	Insectides & similar products, for retail sale	Medium-tech: process
593	Explosives and pyrotechnic products	Medium-tech: process
597	Prepared addit. for miner. oils; lubricat., de-icing	Medium-tech: process
598	Miscellaneous chemical products, n.e.s.	Medium-tech: process
882	Cinematographic & photographic supplies	Medium-tech: process
872	Instruments & appliances, n.e.s., for medical, etc.	Medium-tech: engineering
873	Meters & counters, n.e.s.	Medium-tech: engineering
884	Optical goods, n.e.s.	Medium-tech: engineering
885	Watches & clocks	Medium-tech: engineering
891	Arms & ammunition	Medium-tech: engineering
525	Radio-actives and associated materials	High-tech : other
541	Medicinal and pharmaceutical products, ex. 542	High-tech : other
542	Medicaments (incl. veterinary medicaments)	High-tech : other
792	Aircraft & associated equipment; spacecraft, etc.	High-tech : other
871	Optical instruments & apparatus, n.e.s.	High-tech : other
874	Measuring, analysing & controlling apparatus, n.e.s.	High-tech : other
881	Photographic apparatus & equipment, n.e.s.	High-tech : other
883	Cinematograph films, exposed & developed	Unclassified products
892	Printed matter	Unclassified products
896	Works of art, collectors' pieces & antiques	Unclassified products

Source: Author’s processing based on http://unctadstat.unctad.org/EN/Classifications.html

Lall's classification (2001)

To complement the analysis by skill-intensity, we use Sanjaya Lall's classification by technology level (Lall 2001). Lall's classification is not restricted to sections 5 through 8 of the SITC. It includes all 9 sections of SITC.

It is divided into 5 main groups:

i. Primary commodities
ii. Resource-based manufactures:
    a. Agriculture
    b. Other.
iii. Low-technology manufactures:
    a. Textiles, apparel and footwear
    b. Other
iv. Medium-technology manufactures:
    a. Automotive
    b. Process
    c. Other
v. High-technology manufactures
    a. Electric and electronic
    b. Other

Table 10 presents a comparison between this classification and the classification by level of technology presented in Lall (2001) for sections 5 through 8. Both UNCTAD's and Lall's classification have been updated to convert the original list in SITC Rev.2 into SITC Rev.3, to

extend its coverage to all commodities and to ensure consistency with existing UNCTAD product groups[15]. In Table 11 we present those not classified as primary commodities by Lall, excluded from UNCTAD's classification.

[15] See http://unctadstat.unctad.org/EN/Classifications.html

Table 11: Lall (2001) classification of manufactures: items from SITC sections 0 through 4 and 9

SITC-3 code	Lall (2000) classification of manufactures
	Resource-based: agro-based
016	Meat, edible meat offal, salted, dried; flours, meals
017	Meat, edible meat offal, prepared, preserved, n.e.s.
023	Butter and other fats and oils derived from milk
024	Cheese and curd
035	Fish, dried, salted or in brine; smoked fish
037	Fish, aqua. invertebrates, prepared, preserved, n.e.s.
046	Meal and flour of wheat and flour of meslin
047	Other cereal meals and flour
048	Cereal preparations, flour of fruits or vegetables
056	Vegetables, roots, tubers, prepared, preserved, n.e.s.
058	Fruit, preserved, and fruit preparations (no juice)
059	Fruit and vegetable juices, unfermented, no spirit
061	Sugar, molasses and honey
062	Sugar confectionery
073	Chocolate, food preparations with cocoa, n.e.s.
098	Edible products and preparations, n.e.s.
111	Non-alcoholic beverages, n.e.s.
112	Alcoholic beverages
122	Tobacco, manufactured
232	Synthetic rubber
247	Wood in the rough or roughly squared
248	Wood simply worked, and railway sleepers of wood
251	Pulp and waste paper
264	Jute, other textile bast fibre, n.e.s., not spun; tow
265	Vegetable textile fibres, not spun; waste of them
269	Worn clothing and other worn textile articles
421	Fixed vegetable fats & oils, crude, refined, fractio.
422	Fixed vegetable fats & oils, crude, refined, fract.
431	Animal or veg. oils & fats, processed, n.e.s.; mixt.

SITC-3 code	Lall (2000) classification of manufactures (cont.)
	Resource-based manufactures: other
281	Iron ore and concentrates
282	Ferrous waste, scrape; remelting ingots, iron, steel
283	Copper ores and concentrates; copper mattes, cemen
284	Nickel ores & concentrates; nickel mattes, etc.
285	Aluminium ores and concentrates (incl. alumina)
286	Ores and concentrates of uranium or thorium
287	Ores and concentrates of base metals, n.e.s.
288	Non-ferrous base metal waste and scrap, n.e.s.
289	Ores & concentrates of precious metals; waste, scrap
411	Animals oils and fats
667	Pearls, precious & semi-precious stones
	Medium technology: process
266	Synthetic fibres suitable for spinning
267	Other man-made fibres suitable for spinning

Source: Author's processing based on http://unctadstat.unctad.org/EN/Classifications.html

BEC

The United Nations classification of Broad Economic Categories (BEC)[16] differentiates between capital, intermediate and consumer goods. The current publication provides links between BEC and the Harmonized Commodity Description and Coding System (2002 edition) as well as to the basic classes of goods in the System of National Accounts (consumption goods, intermediate goods, capital goods).

Excluding primary products and fuels, the groups are as follow:

1. **Capital goods:**
    i. Code 41: Capital goods (except transport equipment)
    ii. Code 521: Transport equipment, industrial
2. **Consumption goods**
    i. Code 122: Food and beverages, processed, mainly for household consumption
    ii. Code 522: Transport equipment, non-industrial
    iii. Code 61: Consumer goods not elsewhere specified, durable
    iv. Code 62: Consumer goods not elsewhere specified, semi-durable
    v. Code 63: Consumer goods not elsewhere specified, non-durable
3. **Intermediate goods**
    i. Code 121: Food and beverages, processed, mainly for industry
    ii. Code 22: Industrial supplies not elsewhere specified, processed

[16] Available at https://unstats.un.org/unsd/trade/classifications/bec.asp
https://unstats.un.org/unsd/tradekb/Knowledgebase/50090/Intermediate-Goods-in-Trade-Statistics

iii. Code 42: Parts and accessories of capital goods (except transport equipment)

iv. Code 53: Parts and accessories of transport equipment

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