GLOBAL PRODUCTION CHAINS AND VALUE ADDED: CHINA'S POSITION IN THE CONSUMER ELECTRONIC INDUSTRY

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The objective of this article is to map China's presence in global production chains in the electronics industry, with special emphasis given to value added. It discusses whether China is upwards in the global value hierarchies and if the country is getting distance from the traditional contractor manufacturing position, generally responsible for standardized activities with less qualification and less value added. In order to do so, the article presents the concept of global value chains, characterizing its actors and the position of the lead firm in aggregating value. In the sequence, it draws a map of Chinese foreign trade, reinforcing the relevance of regional integration to its global insertion and underlining the distinctions between processing and ordinary trade. Once reviewing the literature about the value added of Chinese exports, the article comes to some relevant conclusions about the recent domestic value added performance in the electronics sector. Finally, the article presents two case studies on Chinese lead firms in the sector analyzed, Lenovo and Huawei, in order to illustrate the diversity of strategies for the creation of lead firms in that country.

Keywords: global productive chains; value added; electronic industry; China.

CADEIAS PRODUTIVAS GLOBAIS E AGREGAÇÃO DE VALOR: A POSIÇÃO DA CHINA NA INDÚSTRIA ELETROELETRÔNICA DE CONSUMO

O objetivo deste artigo é mapear a presença da China nas cadeias globais de produção da indústria eletroeletrônica de consumo, com atenção especial à problemática da agregação de valor. Discute-se se o país está ou não avançando na hierarquia das cadeias de valor e se distanciando da posição de mero montador contratado, responsável pelas atividades padronizadas e de menor qualificação. Para tanto, apresenta-se o conceito de cadeias de valor globais (CVGs), caracterizando-se os atores e a centralidade da firma líder na agregação de valor. A seguir, mapeia-se a geografia do comércio exterior chinês. Destaca-se a relevância da integração regional para a inserção global e traçam-se as distinções entre o comércio para processamento e o comércio ordinário. Ao rever a literatura existente sobre agregação de valor das exportações chinesas, o artigo chega a algumas conclusões relevantes sobre a trajetória do valor adicionado (VA) domesticamente no segmento de eletroeletrônicos de consumo. Por fim, o artigo apresenta estudos de caso sobre duas firmas líderes na indústria eletrônica chinesa, Lenovo e Huawei, a fim de ilustrar a diversidade de estratégias para a criação de firmas líderes no país.

Palavras-chave: cadeias produtivas globais; valor agregado; indústria eletroeletrônica; China.

JEL: F 14; L 23; L 60; O 14.

The Perspective of the World Review, 4 (3): 5-44 [2012]

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1 INTRODUCTION

The fragmentation of the manufacturing processes in the last decades has significantly changed the global commerce. An important part of the interchange has been taking place within internationally distributed industries, leading to the slicing up of the value chain. The so-called global productive chains have reached their state of art within the consumer electronic industry, in which the manufacturing process can be easily spread out in different and independent productive stages, setting up a modular industrial architecture. Other than for the raw material purchases and the outsourcing of intermediary goods, these complex articulated chains of commerce and investments characterize themselves by the fragmentation of parts, components and service production and, essentially by the hierarchical distribution associated with the capability of adding value. This new design, originally boosted by the investments made by Japan on the Asian tigers during the eighties and by the North American remarkable demand for final use products, has gained a new dimension with the meteoric expansion of the Chinese industry and with its exporting process strategies (Medeiros, 2010).

The purpose of this article is to identify the presence of China in global production chains on the consumer electronic industry, with special focus on the issue of value added. The slicing of the manufacturing process allows that the holders of intangible assets (trademark, Research & Development, design & conception, commercialization) retain the major portion of the value added, leaving for the developing countries the less qualified and standardized activities – on their turn subject to high competition and low profit margins and value added. Such division of work intensifies the inequalities in the value chain, creating traps for the less developed countries. As already summarized by Medeiros, on the one side, the imports of intermediary goods may displace local suppliers, imposing a negative effect over jobs and income; on the other hand, they increase the access of exporters to external markets, bringing positive effects over the same variables. The key question, therefore, "is the degree in which the expansion of the industrial exports resulting from the manufacturing integration allows the increase of the industrial value added and, consequently, the internal income" (Medeiros, 2010, p.259).

The fast growth of the Chinese foreign trade is well-known, in respect to its diversification and sophistication of the manufactured exports. From a major textile and simple manufacture exporter in the 80s, the country became mainly a seller of electrical and electronic goods during the nineties and of machines as of the following decade. It is not by accident that the "Made in China" is the label more commonly found in products available around the world.

The connection between aggregated exports and value added, however, is quite less evident. A country with an export list full of final products of medium and high technology may, also, be a mere assembler, having only lightly

processed re-exported merchandise and keeping a high technological content on its imports. This is the classic case of the Mexican *maquiladoras*, which are the anti-example of competitive insertion in the global value chains. It is also the case of the Apple family products (MacBooks, iPods and iPads) that carry on a label a little closer to reality and which mentions the beginning and the end of the chain: "Designed by Apple in California / Assembled in China".

In the case of China, there is a significant disagreement in the literature whether the country is or is not making progress in the hierarchy of global value chains and whether it is distancing itself from its low rank in the classic case of the iPod. On the one side, the low profit margins of the domestic electronic industry and the fact that two thirds of the manufacture exports come from the companies with foreign investment, would be an evidence that little progress have been made, according to Sturgeon & Kawakami (2010) and Song (2007). In spite of the unprecedented swiftness through which China got itself industrialized, the country would be facing difficulties in order to move beyond the low aggregated value niches and increase its profit margins.

Other authors, however, argue that China's insertion in the electronic global chains does not represent a classic case of an export program with no technical progress. For Unctad (2005) and Medeiros (2010), along with the traditional policies to encourage its insertion in the global chains (such as tariff exemptions for the importation of components destined to the manufacturing of exportable end products), the country matched a macro-economic regime based on very high level of investments, capital control, depreciated exchange rate and a technological and industrial policy which allowed the creation of a link between exports and the expansion of the internal market, leading to a continuous rate of high growth. In other words, China would have combined the export procedure strategy with the search for higher domestic autonomy, keeping a concomitant expansion of the industrial value added thanks to the policies on technological absorption and increase of the urban industrial salaries. Besides, the fast development of its internal market has allowed the country to overcome the limits arising out of a specialization focused exclusively on low labor costs, and opened valuable opportunities for the enlargement of its rising national brands.

Effectively, what makes the Chinese journey quite differentiated (…) is the effort for absorption of the technical progress by the local companies and to shift their kind of specialization. The aggressive policy of technological absorption of foreign companies in partnership with Chinese companies determines, jointly with the classically Japanese and Korean efforts to form "national champions" vertically integrated, a distinctive characteristic of China and totally different from the passive insertion in the value chains which typically characterizes the processing export [countries]. Although it is still globally modest, it is remarkable

the fact that the P&D effort in China is more intense within the state companies and collective companies (Medeiros, 2010, p. 284).

In order to properly delineate China´s position in the value added chain in the electronic industry, this article reviews the literature that has quantified the value added of exports by sector and examines both the processing export industry as well as those called "ordinary" industry (with domestic supplies). This is because the presence of basic assembly lines based on suppliers networks known in the literature as CM (contract manufacturers), EMS (electronics manufacturing services) or ODM (original design manufacturing) is predominant in the Chinese electronic export industry. Preferential customs policies for processed exports have led to an important differentiation in the intensity of import components for the exporting industry in comparison with the one aimed for the internal market. In other words, the companies import parts and other intermediary components from abroad with countless tariff incentives guaranteed by the central or local government, and after the production and assembly, they export the final product for the global market (Koopman, Wang & Wei, 2008). As the same benefits are not valid for the consumption goods destined to the domestic market, the national content, in these cases, tends to be higher.

In the following section, it is debated the concept of the global value chains which is used as a conceptual framework in this article, showing actors and the centrality of the leader company in adding value. In section three, it is briefly presented the geography of the Chinese foreign trade and its triangular nature, pointing out the importance of the regional integration for the global insertion and the distinctions between trade for processing and the ordinary commerce. Section four reviews the existing literature about the value added on the Chinese export and comes to some significant conclusions on the tendencies of the domestically value added of exports in the segment of consumption electronics. Section five develops two case studies about leading companies in the Chinese electronic industry, focusing on the Lenovo and Huawei cases. The last section summarizes the conclusions.

2 PRODUCTION CHAINS: WHAT THEY ARE AND WHAT ARE THEIR IMPLICATIONS

The act of dividing production into distinct units or processes is not, at first, something new and, much less, limited to Asia or the electronics industry. As Flores (2010) summarized, the combination of different processes or suppliers to create a final product is, long since, part of the logic and the practice of production. What can be considered a modern phenomenon is "a better and more rigid division of procedures, together with the division of all the production process for different places in the world, even with different owners (…). Essential for the process division, the different group of operations needs to be efficiently de-

tailed so they can be executed 'anywhere', its several parts and products being eventually combined to compose a (final) product, in one or more countries" (Flores, 2010, p. 59).

Besides the organized division of production and the codification of processes/products that supports this fragmentation, there are specific relationships between the companies involved which are necessary to advance the process in the direction of a "productive integration." Nevertheless, according to what Machado (2010) points out, the phenomenon under study here is more than a simple purchase and sale of goods and services. It is about an "intermediate case" between the simple *outsourcing* (acquisition of goods and services produced by third parties) and the vertical integration (result of the merge and acquisitions intra-company). At productive integration, the relationships between the companies involved alliances, partnerships, cooperation, and strategic agreements with motivations sometimes distinct from short-term market logic as, for example, the agreements for the transfer of technology.

The global production chains are, in reality, a complex system of value added. Each producer acquires inputs and adds value to the intermediate good in the form of profits and labor payment, which, on the other hand, will compose the costs of the next production phase. However, as the trade statistics are measured in raw terms, including both the intermediate and the final goods, they count *n* times the value of intermediate goods which cross the national borders more than one time. That is why a net exporter of final high technology goods does not necessarily add much value, especially if their role in the chain is simply that of as assembler (more details at section 4).

One of the key theoretical references for the Asian productive integration, developed by Akamatsu (1961) and that became known as the "flying gooses" model, suggested that the advanced countries (in the case of Japan), when dividing the productive process and leaving stages of intensive labor for developing countries in the region, were also sharing technology and innovation. In a second phase of the development process, these countries could gradually move away from the labor-intensive industries and step up in technology sectors and higher hierarchies of value added, as South Korea, Singapore and Hong Kong did.[1]

Also following the Akamatsu model, Lemoine and Unal-Kesenci (2004) sustain that, for developing countries, the import of components and the assembly can be the fastest way to acquire advanced technology and join the global

1. The "flying gooses' model" was criticized by Medeiros (2001) for expecting a peaceful integration and high technologic progress without taking into consideration the domestic demand component. In the revision used by us, besides the centrality given to the domestic demand we also stress the importance of the State stimulus in technology absorption and in the promotion of micro and macro policies that may facilitate the incorporation of foreign technology.

production chains with high international demand. They argue that the extraordinary Chinese performance in the foreign trade is due to its involvement in the production segmentation processes, which allowed the country to rapidly diversify the exports and, especially, become stronger in the machine and equipment sectors. Using data until 2001, the authors conclude, however, that the sophistication of the export agenda did not help in the development of "traditional" sectors based on domestic inputs, which would be evidence that the nexus between the export assembly industry (processing) and the domestic or ordinary industry were still very weak. This article questions Lemoine e Unal-Kesenci's conclusion, and using data from 1997, 2002 and 2007 shows that from 2007 on there is a significant change in the value added pattern (section 4).

A step to be followed in the characterization of the productive division was the development of the concept of production chains, making the value added along the chain a key element in the analysis. The academics of global value chains (GVC) emphasize that the analysis of the global integration processes must be done considering three dimensions: *i*) the governance scheme between companies, or the character of the *links* between tasks (or phases) of the value chain; *ii*) how the power of companies, suppliers, unions, workers, regulating agents, the State and other actors involved in the chain is distributed and exercised; and *iii*) the role played by the absorption of technologies by the different players (Gereffi, Humphrey & Sturgeon, 2005; Sturgeon, Van Biesebroeck & Gereffi, 2008). In short, the analytical value chain allows the understanding of the governance dimensions, the power of agents and institutions.

Through this analytical scope, the next sub-section characterizes the relationships between different companies and production phases and tries to offer a general framework to access the relative power of the different agents from a value added perspective. From the perspective of the general structure of governance, we know that the electronics industry chain is driven by the buyer – brands like Apple, that are not usually factory owners, but whose demand is so great that it directly coordinates some global production chains. The power disparity between the chain's players, as it was suggested, will bring this analysis closer to its captured value dimension.

2.1 Governance and power in the electronics industry's value chains

Several characteristics of the electronics industry allow it to be the most dynamic and geographically extensive global production chain among all the other productive sectors. A first simple reason is that for the parts and components of electronic goods, as well as for the majority of final products, the value/weight ratio is high, which makes the long distance transportation relatively cheap.[2]

2. Final products such as notebooks and components of high value added frequently use air transportation (Sturgeon & Kawakami, 2010, p. 9).

The agility and relatively low costs of transport allow the companies to perform its "arbitration of operational costs" in a global scale, exploring the different advantages of labor, scale and the national policies of investment stimulus.

A second reason for the global characterisctic of the electronics industry lays on the production chain architecture, essentially modulated, with its main products and productive processes being deeply formalized, codified, standardized and computerized.[3] The standardization involves the product design, several aspects of production (such as assembly, test performance and inspections) until the logistic control and production planning. Sturgeon and Kawakami argue that this modularity was possible because the myriad of electronic goods that proliferated especially from the 1970s is deep rooted in the North-American and European military industry from the 1950s and 1960s, which facilitated the development of standards for the description of components, systems and production processes. The codification, standardization and, therefore, the high degree of modularity allows the system's components and other elements to be replaced without the need for redesign, in the same manner as suppliers can be easily replaced with no changes in the product (Sturgeon & Kawakami, 2010, p. 9-10).

The characterization of the main business actors involved and the inter-company relations is key at the global value chains scheme (GVC).[4] There are evidently other actors involved that are not mentioned here, such as software vendors and distributors, but a simplified scheme such as the one that will be further exposed will allow a clearer discussion about the value capture between the companies involved.

The first and most important players are the *lead firms*, those which are responsible for the brand, intellectual property, knowledge of the market, and the marketing of products and customer service. These firms lead the value chain through its "buying power", generally associated to the brand, the technological advantages and financial capabilities, in turn related to its market penetration power, which allow large scale orders. Some examples of the major lead firms are presented in the third column of table 1. Although incomplete and static, the table illustrates that the majority of the consumer electronics lead companies is based in the United States, Japan and some countries in Eastern Europe. The most ancient and well established exceptions are two lead South Korean firms (Samsung and LG), but recently, the emergence of new Asian brands draws

3. See *The Economist*, "A third industrial revolution: special report", April 21st, 2012, available online at: <http://www.economist.com/node/21552901>.

4. We are especially following in this section the work of Sturgeon e Kawakami (2010) e Linden *et. al*. (2007).

our attention.[5] One of them is Acer, active in the personal computers market, headquartered in Taiwan. And three other brands from continental China: Lenovo, also active in the personal computers sector, the company became globally known with the purchase of IBM's personal computer's division (PCs) in 2004; Huawei, the second major global producer of equipment and telecommunication networks in 2011, right behind Ericsson; and ZTE, a competitor of Huawei.

In some specific industries, such as personal computers and mobile phones, there is a second essential player, frequently able to achieve higher profit margins than the lead firms: they are the leaders of technological platforms. The most notorious case is Intel, platform leader in the personal computer industry which can, unilaterally, alter central points of a GVC because of its market power and technological dominance (Baldwin & Clark, 2000). What makes Apple an essentially particular case in this industry is the fact that it occupies both the position of lead firm and lead platform, given that its products' operational system is under its property.

TABLE 1
Main segments, products and lead firms in the consumer electronics industry

Main segments	Examples of final products	Examples of lead firms
1) Computers	Desk computers and notebooks	Acer, Apple, Dell, Fujitsu, HP, IBM, Lenovo, Siemens
2) Peripherals and other office equipment	Printers, fax machines, copiers, scanners	Acer, Cannon, Epson, Fujitsu, HP, Kodak, Lexmark, Sharp, Xerox
3) Other consumer electronics	Televisions, consoles for electronic games, audio and video equipment	Apple, Hitachi, LG, NEC, Nintendo, Philips, Samsumg, Sharp, Sony, TCL, Toshiba, Vizio
4) Servers and devices for data storage	Internal, external and portable systems of storage and backup	EMC, Hitachi, HP LeCie, Maxtor Quantum, Seagate, Toshiba
5) Telecommunications and data networks	Public and private telecommunications, mobile phone and internet infrastructure, mobile telephones	Alcatel, Cisco, Ericsson, Huawei, Motorola, Nokia, Nortel, ZTE

Source: Based on Sturgeon & Kawakami (2010), with changes made by the author. It excludes electronics for the auto industry, space and military industry, medical products and industrial automation.

5. In South Korea, the development process of local brands, strongly supported by the State (such as Samsung, LG, Hyunday) through *chaebols,* is one of the classical examples in the literature as success cases of "late development". In Taiwan, on the other hand, with the exception of Acer, which became the second major personal computer brand on the world, the island has not distance itself from the position of contract manufacturer. On the contrary, this position has established itself with the expansion of its operations in continental China. According to Sturgeon & Kawakami (2010), the direct competition with its clients could put future orders at risk. The difficult balance lied in knowing how to remain a supplier, expand its operations in China, advance the assembly (EMS type) to also aggregate *design* (ODM) and, still, create its own brands. As Sturgeon and Kawakami summarize, the distinctions between South Korea and Taiwan reflect differences in strategy. As a result, the authors defend that Taiwan is making the transition to a "compressed development" model, which is not a simple variation of "late development" (Sturgeon & Kawakami, 2010, p. 17).

The third players in the chain are the companies hired for production (EMS) or also for the design (ODM) of products of which they do not own the brand. The exponential growth of contract manufacturer (CM) in general is one of the most obvious transformations caused by the global value chains. It is notorious that, besides the CM be mainly headquartered in Taiwan, the United States, Canada, Singapore and some other industrialized countries, its factories are spread throughout developing countries with an abundance of cheap labor. The plants installed in continental China were especially noted because of the impressive production scale and, in recent years, because of the problematic work conditions in dormitory-factories that led not only to protests, but also to numerous suicide cases.[6]

The services performed by contract manufacturers include the purchase of components, the assembly of circuit boards, the final assembly of products and testing. The largest electronics production and assembly company in the world is Foxconn, with its headquarters in Taiwan and factories in China, Vietnam, Czech Republic and a factory under negotiation in Brazil. It is important to note that the United States comes in second place as the host country for assembly companies, which means stating that the country is not only the headquarter of the main lead firms, but that it also in second place as the headquarter of the assembly companies. When design services are also present, the contract manufacturers are called ODM. This was a path chosen by many large companies from Taiwan, according to table 2: to concentrate not only in production but also include design services. This is particularly possible at the personal computers industry, according to Sturgeon and Lee (2005).

TABLE 2
Five main hired producers (HP) in different regions (2009)

HP	Types of services	Revenue in 2009 (US$ millions)
Taiwan		
Foxconn	EMS	44,065
Quanta Computer	ODM	23,265
Compal Electronics	ODM	19,424
Wistron	ODM	16,226
Inventec	ODM	12,349

(Continues)

6. See *Le Monde Diplomatique Brasil*, "Na China, a vida segundo a Apple", 20.07.2010, available online at: <http://www.diplomatique.org.br/artigo.php?id=1193>.

(Continued)

HP	Types of services	Revenue in 2009 (US$ millions)
North America		
Flextronics (the United States & Singapore)	EMS	30,949
Jabil Circuit (the United States)	EMS	11,685
Celestica (Canada)	EMS	6,092
Sanmina-SCI (the United States)	EMS	5,177
Benchmark Electronics (the United States)	EMS	2,089
Others		
Venture (Singapore)	EMS	2,428
Elcoteq (Luxembourg)	EMS	2,090
SIIX (Japan)	EMS	1,360
Beyonics (Singapore)	EMS	1,120
Zollner Elektronik (Germany)	EMS	970

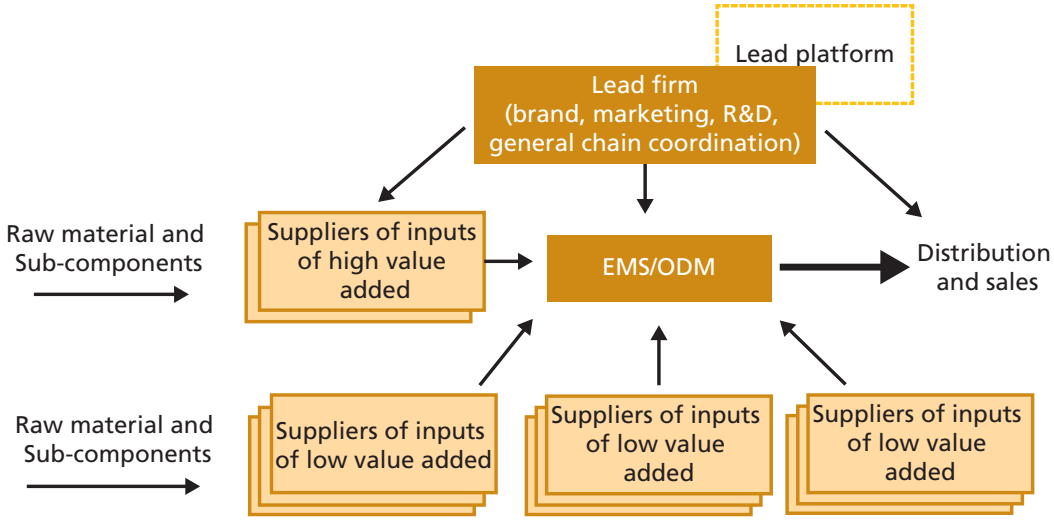
Source: Sturgeon & Kawakami (2010, p.13).

The key aspect in characterizing ODMs or EMS is that, besides disposing of an expressive market share (both from components' demand and production of final goods perspectives), these firms have narrow profit margins and low market power once they are easily replaceable and do not dispose of the buyer's advantages. Even if they acquire expressive volumes of components and parts, their buying power is low given that the purchases are made on behalf of the lead firm. In addition, contracts for key components such as micro-processors of high value added are negotiated directly between the lead firm and the semiconductor manufacturing companies. "As a result, the electronics contract manufacturing sector has long been characterized by intense competition, low profitability and dramatic consolidation, even as it has experienced rapid growth" (Sturgeon & Kawakami, 2010, p. 14).

The firms that provide EMS or ODM services are, in short, the delivery points of a series of components of low value added, such as resistors, capacitors and other easily replaced that, because of the low cost, reserve to their suppliers low gross profit margins. Following the production chain map from Linden *et. al*. (2007), there are still a few components of high value added, such as visual displays, integrated circuits and hard disks that, because of the technological sophistication and the degree of innovation, help to differentiate the final product. In virtue of its high cost and the relevance of the brand, these last components generally represent an important share of the value added, as in the iPod case, which will be described below. At the main axis of value addition is, as expected, the lead firm. Using a similar map as reference,

the authors estimate the value added at each stage of the iPod's chain, as it will be discussed in section four.

FIGURE 1
Stylized production chain of the consumer electronics industry



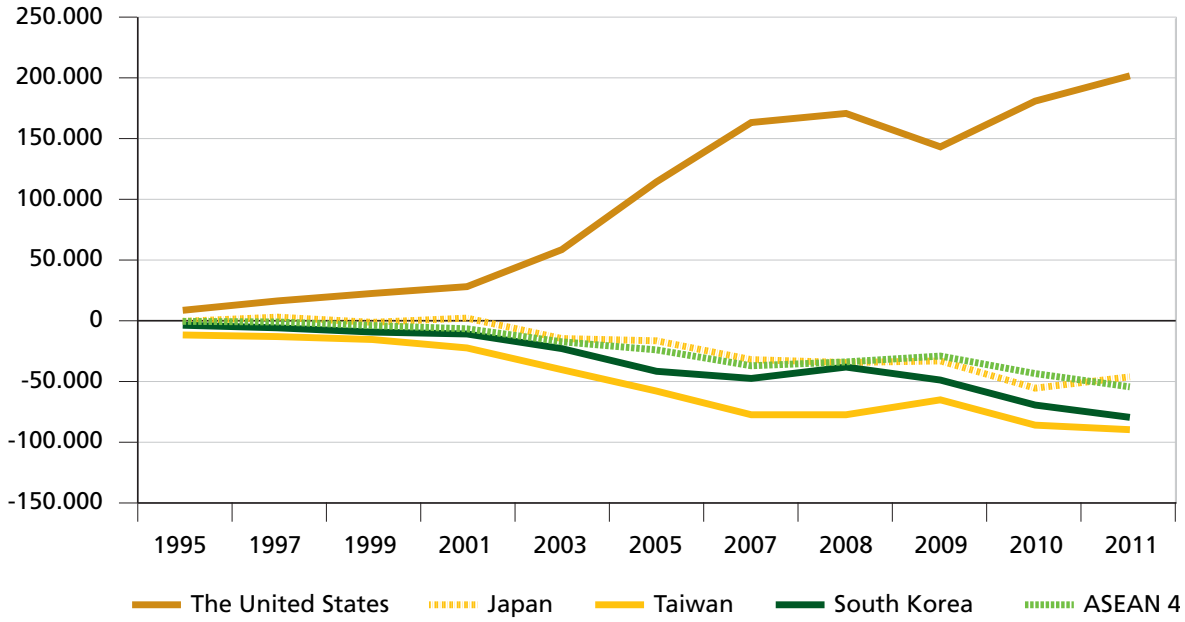
Source: Own elaboration based on Linden et. al. (2007)'s productive chain map.

3 PROCESSED EXPORTS, ORDINARY EXPORTS AND THE INSERTOIN OF THE CHINESE FOREIGN TRADE INTO THE GLOBAL CHAINS

The commercial and financial triangulation that links China to the United States and Europe, on the one hand, and to the countries in East Asia in the other, was already widely discussed in the literature. Characterized by Holst (2002) and Tong & Zheng (2008) as a "triangular commerce", by Medeiros (2007) as the "China as a double pole at the world's economy" and by Runbaugh & Blancher (2004) as a "transmission belt" of goods and investments, the authors discuss the Chinese position as a "final factory" for the production of goods that largely provides to the Eastern central economies, and, on the other hand, its position as an importer of machines, parts, pieces and components from other East Asian countries.

The commercial result is that the gigantic surpluses that China has been accumulated with the central countries (and notably with the United States) have been accompanied by deficits (more modest, however, guaranteeing China a general commercial surplus in the balance of trade) with the majority of neighboring countries in East and Southeast Asia – particularly Taiwan, South Korea, Japan and the Association of Southeast Asian Nations (ASEAN 4 – Thailand, Malaysia, Philippines and Indonesia) – which, as a result of the segmentation of the region's production, established themselves as major suppliers of parts, pieces, components and machines for the Chinese industry.

GRAPH 1
China' balance of trade per country or group of countries (US$ millions) – data reported by China
(US$ millions)



	1995	1997	1999	2001	2003	2005	2007	2008	2009	2010	2011
The United States	8,610.1	16,439.0	22,517.2	28,137.7	58,682.1	114,439.1	163,567.9	171,023.6	143,341.8	181,046.1	201,886.9
Japan	-537.8	2,843.7	-1,352.7	2,153.2	-14,739.4	-16,421.4	-31,934.1	-34,446.7	-33,047.2	-55,692.1	-46,299.1
Taiwan	-11,686.1	-13,042.4	-15,576.8	-22,337.6	-40,356.1	-58,130.7	-77,567.3	-77,460.9	-65,219	-86,058.7	-89,801.6
South Korea	-3,605.3	-5,802.7	-9,418.5	-10,858.1	-23,033.2	-41,712.6	-47,653.0	-38,205.9	-48,875.4	-69,572.9	-79,796.5
ASEAN 4	-508.1	-905.7	-4,077	-6,737.8	-17,323.6	-23,928.0	-37,114.1	-33,909.0	-29,184.0	-43,601.7	-54,448.8
Thailand	141.0	-512.7	-1,345.1	-2,376.7	-4,998.9	-6,172.5	-10,691.2	-10,020.1	-11,619.8	-13,452.1	-13,345.2
Malaysia	-789.5	-573.1	-1,931.8	-2,982.8	-7,845.5	-9,486.8	-11,007.8	-10,646.2	-12,704.1	-26,628.1	-34,250.6
Philippines	754.3	1,012.7	471.7	-326.0	-3,214.1	-8,182.0	-15,619.9	-10,372.5	-3,357.8	-4,679.9	-3,736.9
Indonesia	-614.0	-832.5	-1,271.8	-1,052.1	-1,265.0	-86.5	204.8	-2,870.2	-1,502.3	1,158.4	-2,116.1

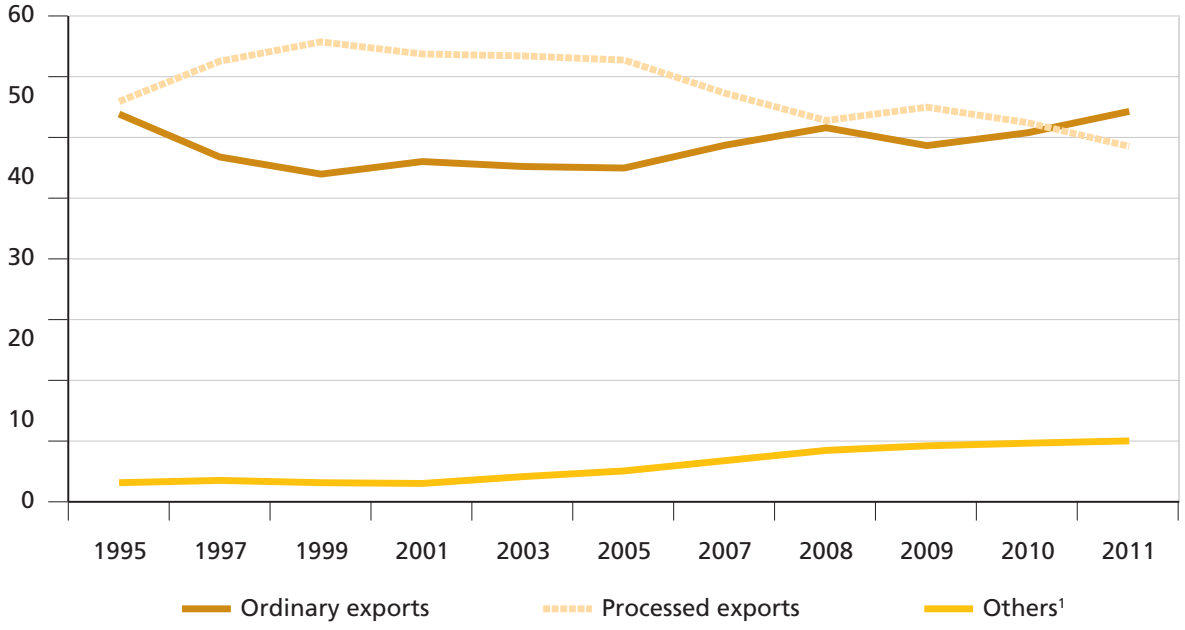
Sources: China Statistical Yearbook, several years, and the UN Comtrade for data from 2010 and 2011.

The triangulation had a fundamental implication for the regional integration of East Asia: when establishing themselves as ultimate buyers in the markets that are external to the region, the productive complementarity could advance with no restrictions from the Asian countries' external accounts perspective. In other words, the Asian productive integration, differently than the Mercosur, was consolidated with a relatively low level of tensions in the external accounts of the countries involved.[7] And, evidently, it also means to state that "the successful Chinese trade is crucially connected to the global processes of production fragmentation" (Flores, 2010, p. 73).

7. See Medeiros (2010) for a comparison between the Asian and the Mercosur integration.

Combined with the triangular character, a second essential characteristic of the Chinese foreign trade resides on the fact that a significant part of its external sales are "processed exports", goods that use parts, pieces and components (processed imports) with tariff advantages that will serve as inputs for the country's industry and that, after processing, will be exported.[8] From the mid-1980s, the Chinese authorities have used a myriad of instruments to promote such exports, including tariff exemptions or reductions for the processing of imports. The distinct tariff policy led to a segmented trade regime, in which the processed imports are explicitly differentiated from the "ordinary exports" (produced with local inputs). According to the official data, the processed exports reached the sealing of 57% of the total exports in 1999, against 41% of ordinary exports in the same year, and it has continually declined since then. Besides the fallback, the processed exports in 2011 represented 44% of the total exports, against 48% of the ordinary exports.[9]

GRAPH 2
2A – Exports according to the commercial regime
(In % of the total)



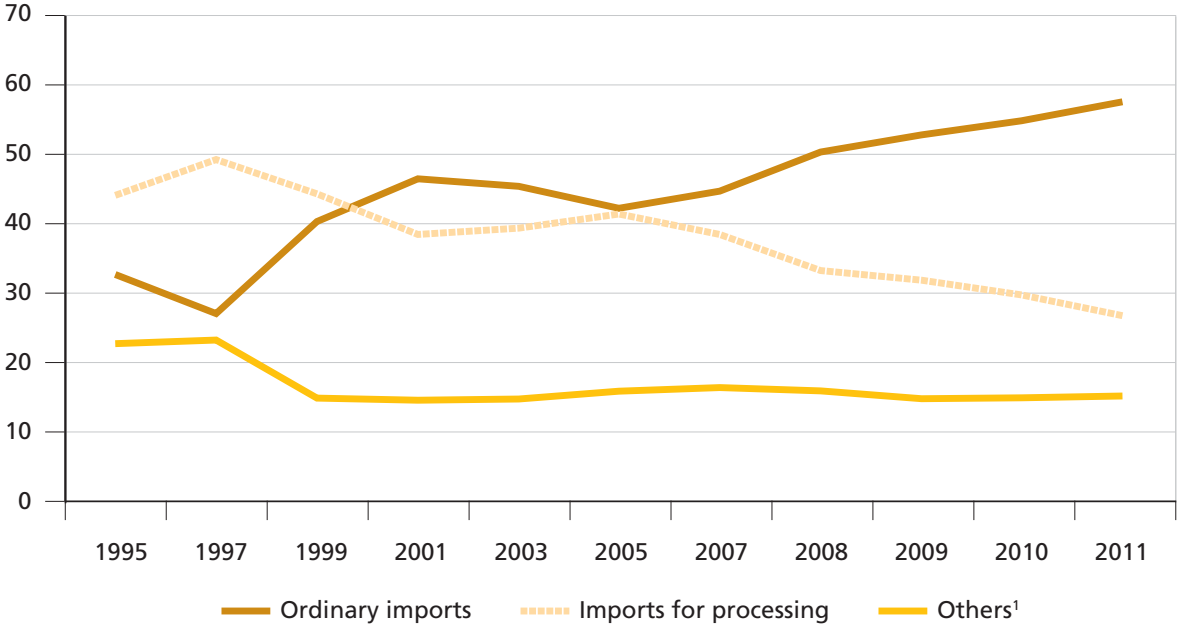
8. According to the definition of the General Customs Administration of China, "customs procedure under which certain goods can be brought into China Customs territory for manufacturing or processing with subsequent exportation" (Jin, 2006, p. 6).

9. The normal and processed trade statistics are released in HS of 8 digits. In the calculations included in this article, the processed exports include the trade regimes that appear under the definition of "process & assembling" and "process with imported materials" at the statistical yearbooks. These data are considered relatively precise because they involve tariff exemptions and tax reductions, depending on the value added and are, therefore, under the intense monitoring of the customs authorities.

	1995	1997	1999	2001	2003	2005	2007	2008	2009	2010	2011
Ordinary exports	47.99	42.71	40.62	42.16	41.56	41.37	44.17	46.33	44.12	45.70	48.33
Processed exports	49.55	54.52	56.92	55.44	55.19	54.69	50.61	47.20	48.85	46.94	44.01
Others (*)	2.46	2.77	2.47	2.40	3.25	3.95	5.22	6.47	7.03	7.37	7.66

2B – Imports according to the trade regime

(In % of the total)



	1995	1997	1999	2001	2003	2005	2007	2008	2009	2010	2011
Ordinary imports	32.84	27.22	40.46	46.60	45.51	42.37	44.81	50.43	52.91	54.94	57.66
Imp. for processing	44.23	49.34	44.43	38.60	39.49	41.54	38.59	33.42	32.06	29.91	26.96
Others[1]	22.93	23.43	15.12	14.80	14.99	16.09	16.60	16.15	15.03	15.16	15.39

Source: General Customs Administration of China, own calculations.
Note: [1] Others include donations, other external aid, lease, goods on consignment, compensations, projects hire, etc.

It is important to make an observation here about the Chinese processing industry. When the special economic zones were created in the Chinese coast in the 1980s, its primary objective was to create effective channels for the absorption of two key components for the economic development and that are classically rare in underdeveloped countries: strong currency and more advanced production technologies. This means that the processing industry is not, classically, the locus of the value aggregation in the production chain. Its goal is to attract dollars to prevent imbalances and crisis in external accounts and absorb the production, management and marketing knowhow and, above all, technology, creating the possibility of a rise in the value added scale in subsequent phases, through the

sophistication of this processing industry itself (nationalizing the production of components with higher value added) and, preferably, through the creation of national leading brands. Given the country's commercial surplus and the collection of reserves in foreign currency, is unquestionable that the first goal of the processing industries (collect foreign currency) has been reached. The absorption of advance technologies, on the other hand, is a harder element to measure, subject to frequent disputes.

It is relevant to note that in 2011, for the first time since the rise of the Chinese export *boom*, the ordinary exports had a larger share in comparison with processed exports in the Chinese foreign trade. For Zhang (2012), the "normal" exports became majoritarian in 2011 due to a new feature of the Chinese export profile, continuously concentrated in heavy industry and capital-intensive products, in particularly machines and steel products, which make less use of the global value chains than the electronics industry, for example. Zhang argues that another reason is that the domestic content of processed exports is growing rapidly. In line with this argument, at the import side, the purchase of goods for processing have persistently retreated since 2005, falling from 41.5% of the total amount imported on that same year to 27% in 2011. The impact that these changes have had on the value added of Chinese exports will be discussed in the following session.

4 CHINA'S PLACE IN THE VALUE ADDED HIERARCHY OF GLOBAL CHAINS

Some of the most remarkable studies about China's position in the global value chains were dedicated to specific products, as in the widely commented case of the iPod. The Apple products in general are classical examples of the insertion in the lower hierarchical spheres of value for the developing countries. Its productive architecture illustrates the important share of the lead firm and, in this case, also the lead platform, in capturing value in the global chains, while the countries concentrating in assembly even if registering relevant commercial surpluses in the balance of trade, retain a very small share of the value added.

Dedrick *et al.* (2008) and Linden *et al.* (2007), when dissociating the value captured by the iPod through its gross profits,[10] conclude that Apple, alone, captures 36% of the value of an iPod 30 GB of the 5th generation sold in the USA, in the form of gross profit margins, even if the major part of the industrial production is manufactured in China by a multinational headquartered in

10. Gross margins do not include the share of the value for the labor and, therefore, are different than the concept of value added. Formally, the value added of a company is defined as the value of its production minus the value of the intermediate goods acquired to produce, being, therefore, generally equal to the returns of the production factors. Similarly, the value added by a product in a country (called domestic value added or domestic content) is the value of the product minus the value of the components imported used directly or indirectly for its production.

Taiwan (in this case, Foxconn). At second place in appropriation of gross profits is Toshiba, responsible for the 30 GB hard disk (which, alone, represents half of the components costs) and by the video module (display module, which represents 14% of the components costs). The authors estimate that, in the aggregate value, 12% of the iPod 30 GB's value stays, therefore, in Japan, in the form of gross profits, host country of the companies responsible for the components with a higher value added. The gross margins for Taiwan, host country of the assembly companies, are only 2%.

These studies do not reveal what value share of an iPod goes to labor, in the form of salaries and, therefore, the Chinese share is not evident, and is hidden behind the total costs with other parts, pieces, components and direct salaries, that add 37% of the iPod value in the aggregate. In any case, the conclusion is that, when not owning the brand, and when concentrating itself in components of low value added (the 'commodities' of the electronics industry) and in the assembly, China captures a very small share of the final value, even if its commercial surplus is high. The "winners" of this chain in terms of gains in value are, respectively, the United States, holder of the brand, and Japan, responsible for the components of high value added (such as the hard disk). And, in the case of the United States, such advantage in terms of the appropriation of profits, is not seen in the country's balance of trade.

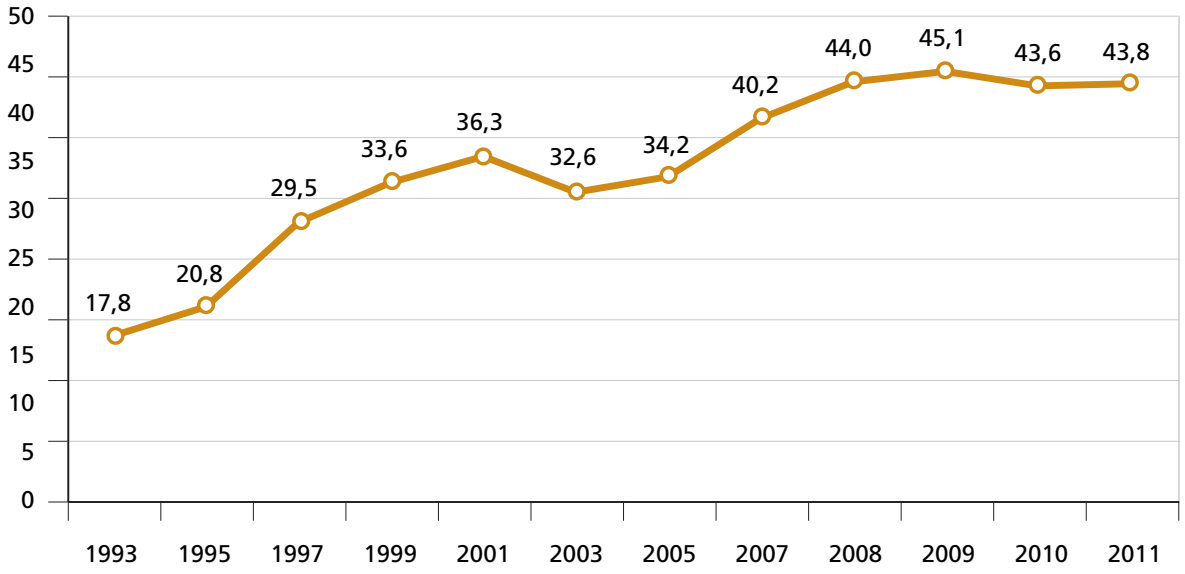
The iPod is an example of the productive integration model with low value added for the countries that do not dispose of neither the brand (in this case detained by the United States), neither concentrate themselves in more technologically sophisticated components (here, Japan). China is, then, at the final end of the hierarchy, given that the most sophisticated components are imported, and the brand holders and the unattainable assets are foreign.

But when the analysis is extended beyond the iPod case and the recent literature based on totally on the Chinese agenda is also revised, the conclusion is that the country has expanded the value added of its exports, especially since the last decade. Koopman, Wang & Wei (2008) and (2012) and Lau *et al*. (2006), using distinct methodologies, estimate the value added domestically by the Chinese exports using the data from the foreign trade and the country's product-input matrix.[11] In general, for the period between 1995 and 2007, these studies point out to a domestic value added between 35% and 60% of the total exports, and, speaking exclusively of the processed exports, something around 20% and 40%.

11. All use the product-input matrix of 2002, an exception is the work from 2012, which uses the 2007 matrix.

These results are not very distinct from the calculation performed below using only the aggregated statistics of foreign trade and, particularly, for the processed exports. Calculated as the difference between the value of processed exports (*Pexp*) and the imports for processing (*Pimp*) divided by the value of the processed exports [(*Pexp-Pimp*)/*Pexp*], the value added of processed exports in relation to the inputs imported for processing would have gone from 17.8% in 1993 to 43.8% in 2011. The peak would be reached in 2009, when the value added domestically had reached 45.1%. This means that, on the other hand, the foreign share of the value added of Chinese processed exports would be around 55%.

GRAPH 3
Value added domestically by processed exports, according to data collected from the Chinese customs
(in % of the total exported)



Source: General Customs Administration of China, own calculations.

More sophisticated calculations were done by the economic literature, crossing the data from the product-input matrix and the Chinese foreign trade, as already mentioned. The most relevant contributions until now seem to be the studies of Koopman, Wang & Wei (2008; 2012), which will be detailed below, and that developed a specially useful methodology for China because it separates the value addes for the processing industry from the normal or ordinary industry – or, according to the authors' definition, a model to estimate the shares of the value added domestically in the case of countries in which the processed exports are disseminated or predominant. The authors use data from the input-output matrix of 1997, 2002 and 2007, released by the National Statistics Office, in

order to detail the total exports and imports by sector, and the data from the foreign trade released by the Customs General Administration to determine the relative share of processed and ordinary exports in each sector. They divided, thus, the national economy in a block for processing and another for normal, each one with its own input-output structure.[12]

The conclusions that can be reached from the results shown by Koopman, Wang & Wei (2012) are relevant. First of all, as expected, the domestic VA of the processed exports is substantially lower than the VA of the ordinary industry. However, it is exactly the domestic VA of processed exports that is growing faster, increasing the weighted sum of the total Chinese exports' VA. They calculate that the domestic VA of the total exports, which had been around 54% in the first two yeas analyzed (1997 and 2002), increased to 60.6% in 2007. In the case of manufactured goods exports, the increase is more expressive, with the domestic VA going from 50% to 60% within the same period. The growth, as already pointed out, is especially significant for the processed exports, increasing from 21.0% to 37.3% between 1997 and 2007 (table 3). The increase in the value added in the processing industry is another significant fact, which suggests that countries initially situated in the lower end of the value hierarchy can ascend through the national production of more sophisticated pieces, parts and components.

The ordinary exports, on the other hand, had a retreat in the domestic VA from 94.8% to 84.0% in the average between 1997 and 2007, which, in fact, reflects the non-processing industry's expansion towards more sophisticated sectors that necessarily demand a higher level of verticalization in production. In reality, a domestic VA that is extraordinarily high in the ordinary industries (as in the case of 1997, near 95%) is an indicator of low integration between these industries and, more importantly, of the predominance of technologically delayed sectors. The domestic content of textiles and basic goods as the *coque*, for example, remains around 90%, while the domestic content of the heavy industry, even if not so integrated to the global chains as the electronics industry, oscillates between 70%-80%.

12. The following data are directly observable though the input-output matrices: raw product of the sector *i*, goods *i* used as intermediary inputs for the setor *j*, value added in the sector *j*, total imports of goods by the sector *i*, and final total demand excluded the exports of goods *i*. The authors combined the data from the input-output tables with the trade shares processed to determine the values of: imports of goods by the sector *i* used as intermediary inputs to produce processed exports, imports of goods for the domestic production and normal exports, normal exports by the sector *i*, and processed exports by the sector *i*. More details about the model, including the formulas, can be found in Koopman, Wang & Wei (2012, p. 3-6).

TABLE 3
Domestic and foreign value added of the total, ordinary and processed exports
(In % of the total exported)

	Total exports			Ordinary exports			Processed exports		
	1997	2002	2007	1997	2002	2007	1997	2002	2007
Total goods									
Domestic VA	54.0	53.9	60.6	94.8	89.6	84.0	21.0	25.4	37.3
Foreign VA	46.0	46.1	39.4	5.2	10.4	16.0	79.0	74.6	62.7
Manufactures									
Domestic VA	50.0	51.3	59.7	94.5	89.0	83.6	20.7	24.8	37.0
Foreign VA	50.0	48.7	40.3	5.5	11.0	16.4	79.4	75.2	63.0

Source: Calculations by Koopman, Wang & Wei (2012). Developed by the author.

The VA results according to the companies' property regime (state owned, collective, private, 100% foreign or joint ventures) that are represented in the following table are less precise because they were calculated through the exclusive use of data from each sector's foreign trade (the input-output tables do not differentiate the companies' property regime). As it was also expected, these estimates show that the exports of companies that are 100% foreign have the lowest domestic VA, but it has been increasing relatively fast: going from 33.4% in 2002 to 44.1% in 2007. The fastest growth of the domestic VA was, however, obtained by the joint ventures between foreign and Chinese companies, increasing from 43.6% in 2002 to 56.9% in 2007. The exports from private Chinese companies, on the other hand, carry the highest domestic content and went from 83.9% to 80.8% in the years observed, while the state owned companies remained around 70% in both years.

The most remarkable element in the following table seems to be the growth in the domestic content of exports produced by joint ventures or by companies with completely foreign capital, with an increase of more than 10 percentage points between 2002 and 2007. This result suggests that foreign exporter companies, traditionally at the lower end of the value hierarchy by property regime, are using more intermediary inputs manufactured in China at its final product, leading to an increase of domestic content, as Koopman, Wang & Wei (2012, p. 8) also point out: "This is presumably also linked to more multinationals moving their upstream production to China."

TABLE 4
Value added domestically by the exports according to the companies' property regime (In %)

Companies by property status	Share of processed exp. in the total exported	VA of ordinary exports	VA of processed exports	VA – weighted sum	Share of the exp. in the total exported
2002					
Foreign	87.5	90.1	25.3	33.4	28.9
Joint ventures	70.5	89.4	24.5	43.6	22.9
State owned	32.2	89.6	26.4	69.3	38.1
Collective	27.4	89.6	28.2	72.8	5.8
Private	9.0	89.6	26.3	83.9	4.3
All companies	55.7	89.3	26.1	53.9	100
2007					
Foreign	83.0	83.8	36.0	44.1	38.1
Joint ventures	59.5	83.6	38.7	56.9	17.7
State owned	25.8	83.4	39.5	72.1	18.9
Collective	24.0	83.1	42.0	73.3	4.0
Private	9.6	84.9	42.0	80.8	21.3
All companies	50.0	83.9	38.7	60.6	100

Source: Calculations by Koopman, Wang & Wei (2012). Developed by the author.

Finally, tables 5A and 5B, with sectorial data organized according the weighted sum of the domestic value, allow us to the tendency among different sectors. The first general conclusion, supporting what had been discussed in regards to table 3, is that there is an improvement in the domestic value in all sectors. In 2002, among the 57 manufacturing sectors included in the input-output table, fifteen had a domestic VA share lower than 50% and, collectively, responded for 35% of the Chinese total exports on that same year. In 2007, the number of sectors with a VA share lower than 50% had declined to ten, and its share of the total Chinese exports had retreated to 32%.

At the opposite side, the number of industries with a high domestic VA increased significantly between 2002 and 2007. The number of sectors with a share of domestic VA higher than 75% went from 12 to 25 and its share of the total exports increased from 10% in 2002 to more than 30% in 2007. Among such sectors with a high domestic VA (those which are at the end of the tables, sorted in ascending order), besides the traditional labor-intensive industries, such as textiles and furniture, capital-intensive industries begin to surface, such as the auto industry, industrial machinery and steel products, a result of the economic advancement and its expansion towards more sophisticated segments.

TABLE 5
5A – Value added domestically by the exports manufactured, by sector (2002)
(In %)

Description of the industry	Decomposition of the VA (%)			Processed exp. (%)	Foreign companies exp. (%)	Total exp. (%)
	Ordinary	Processed	Weighted sum			
Telecommunications equipment	87,5	5,3	12,5	91,2	88,4	3,2
Ship building	82,3	14,7	17,5	95,8	21,0	0,6
Computers	83,6	18,7	19,3	99,1	89,7	7,0
Office and cultural equipment	79,7	19,3	23,3	93,4	71,6	4,3
Electric household appliances	88,2	6,8	23,9	79,1	56,9	1,9
Household audio-visual appliances	82,5	21,3	27,0	90,6	62,3	5,2
Printing, reproduction and recording equipment	91,1	19,7	31,9	83,0	62,7	0,3
Plastics	84,4	10,3	36,6	64,5	51,2	2,4
Electronic components	84,6	32,8	38,1	89,3	87,5	3,4
Steel production	89,0	12,8	44,3	58,8	86,1	0,0
Generators	85,2	32,0	44,3	76,8	55,8	0,9
Other electronic and telecommunication equipment	97,8	36,0	45,3	84,9	84,9	1,8
Rubber	90,6	12,2	48,9	53,1	44,4	1,6
Non-ferrous metal pressing	86,2	7,5	49,3	46,9	48,7	0,4
Measuring equipment	85,8	32,9	49,5	68,6	51,8	1,8
Paper and paper products	90,8	12,4	51,1	50,7	57,0	0,5
Furniture	88,3	12,5	52,5	47,2	56,8	1,7
Articles for sports, cultural activities, etc.	87,5	38,2	52,7	70,6	56,3	3,3
Non-ferrous metal foundry	88,9	10,6	53,6	45,0	17,4	0,8
Ferroalloy	83,6	13,0	54,8	40,8	13,1	0,2
Synthetic materials	80,5	37,1	55,2	58,3	65,4	0,3
Refined oil and nuclear fuel	79,4	5,5	55,7	32,1	24,9	0,8
Metallic products	90,3	10,2	55,7	43,2	45,6	4,4
Other transportation equipment	86,0	12,7	55,8	41,2	50,5	1,2
Other electrical machines and equipment	88,4	40,1	56,2	66,8	60,1	5,6
Special chemical products	82,9	31,4	58,7	46,9	48,4	0,8
Other manufactured products	89,2	31,3	59,0	52,2	37,6	1,7
Wool textiles	91,1	8,8	60,1	37,8	42,6	0,3
Inks, printing ink, pigments etc.	83,5	8,3	61,6	29,1	44,4	0,4

(Continues)

(Continued)

Description of the industry	Decomposition of the VA (%)			Processed exp. (%)	Foreign companies exp. (%)	Total exp. (%)
	Ordinary	Processed	Weighted sum			
Motor vehicles	89,6	10,0	61,6	35,2	48,2	0,8
Glass and its products	86,8	16,5	63,6	33,0	48,8	0,5
Leather, furs and related products	91,9	40,4	63,9	54,3	50,3	4,5
Chemical products for daily use	85,3	26,8	64,1	36,3	43,6	0,4
Clothing	91,3	34,3	65,6	45,1	39,2	7,0
Chemical fibers	80,2	9,2	65,7	20,5	29,2	0,0
Other special industrial equip.	89,3	32,0	66,4	39,9	44,0	1,3
Boilers, motors and turbines	85,9	13,1	66,5	26,7	28,4	0,4
Other industrial machines	90,1	38,6	67,6	43,7	43,7	3,5
Cast iron	86,8	11,0	68,8	23,7	3,0	0,1
Railroad transportation equipment	83,9	14,6	70,1	19,9	5,9	0,1
Wood products, bamboo, rattan and straw	87,8	11,3	72,8	19,6	45,6	1,0
Fabrics and knitting articles	90,6	34,7	72,9	31,6	34,2	5,8
Machines for agriculture, forestry, fishing etc.	85,7	13,9	72,9	17,8	20,8	0,1
Pesticides	77,0	11,5	72,9	6,3	14,4	0,2
Other textiles	89,5	11,7	74,3	19,5	19,5	0,3
Production of textiles	90,1	28,9	75,5	24,0	31,8	1,4
Cotton textiles	91.8	35.6	75.7	28.7	28.8	3.3
Fire resistant materials	90.5	15.4	76.2	19.1	49.8	0.1
Machines for metallurgy	87.2	18.8	78.1	13.3	27.0	0.2
Drugs	90.2	24.3	79.1	16.9	28.7	0.7
Ceramics and porcelain	88.2	14.8	79.8	11.4	33.1	0.7
Other mineral and non-metallic products	90.4	16.7	80.1	14.0	35.7	0.4
Fertilizers	84.4	9.7	81.1	4.5	21.7	0.1
Basic chemical raw material	87.1	43.7	82.0	11.7	18.8	2.0
Laminated steel	90.2	40.5	82.3	16.0	16.8	0.3
Cement, lime and plaster	91.0	20.3	86.0	7.0	77.7	0.1
Coque	91.4	13.2	89.4	2.6	5.3	0.3
Total commercialized	**89.6**	**25.4**	**53.9**	**55.7**	**51.8**	**92.4**

Source: Calculations by Koopman, Wang & Wei (2012). Developed by the author.
The sectors/segments selected in the table follow the same sectors/segments represented in the Chinese product-input matrices from 2002 and 2007, and fit the Chinese four digits classification for economic activities.

5B – Value added domestically by the exports manufactured, by sector (2007)
(In %)

Description of the industry	Decomposition of the VA (%)			Processed exp. (%)	Foreign companies exp. (%)	Total exp. (%)
	Ordinary	Processed	Weighted Sum			
Household audio-visual appliances	75,9	29,6	32,6	93,4	79,1	2,5
Computers	75,7	33,0	33,9	97,9	93,3	11,3
Office and cultural equipment	74,1	33,1	36,5	91,7	86,4	1,6
Other electronic and telecommunication equipment.	68,0	34,7	39,7	84,8	81,6	1,4
Telecommunications equipment	75,2	35,3	43,6	79,3	83,6	5,9
Ship building	83,9	39,1	43,8	89,4	16,5	1,1
Refined oil and nuclear fuel	68,7	20,1	44,4	50,1	27,3	0,7
Measuring equipment	80,0	37,8	45,8	81,2	73,3	2,5
Synthetic materials	76,4	34,0	47,7	67,7	66,1	0,6
Electric household appliances	82,0	35,6	51,8	65,1	61,7	2,7
Other electrical machines and equipment	80,3	33,7	52,1	60,5	65,9	4,9
Rubber	81,8	27,0	53,4	51,8	41,9	1,7
Plastics	80,8	31,1	55,1	51,7	54,7	1,7
Articles for sports, cultural activities etc.	83,0	45,6	58,4	66,0	64,9	2,1
Special chemical products	76,7	34,0	61,6	35,3	51,2	0,8
Chemical fibers	76,4	51,9	62,6	56,2	48,7	0,3
Other special industrial equip	82,5	43,0	65,2	43,8	54,7	2,7
Generators	80,3	51,2	66,6	47,2	50,3	0,7
Railroad transportation equipment	77,7	54,1	69,0	37,0	12,2	0,1
Leather, furs and related products	90,4	40,4	69,2	42,5	46,0	2,4
Paper and paper products	85,5	57,6	69,2	58,4	62,8	0,4
Metallic products	85,1	39,7	70,1	32,9	49,5	4,4
Boilers, motors and turbines	81,6	38,7	70,6	25,6	37,8	0,5
Non-ferrous metal pressing	78,6	56,1	71,2	32,7	41,4	1,0
Other manufactured products	86,5	48,1	72,3	36,8	41,5	1,6
Inks, printing ink, pigments etc.	76,5	56,8	72,6	20,1	47,3	0,3
Pesticides	73,9	53,6	72,9	4,8	19,5	0,1
Chemical products for daily use	80,8	58,4	73,3	33,5	55,5	0,3
Non-ferrous metal pressing	76,2	56,4	73,3	14,6	19,6	0,8
Other transportation equipment	81,0	54,9	73,8	27,8	46,5	0,9
Chemical basic inputs	80,8	42,5	74,9	15,6	26,4	1,9
Motor vehicles	84,0	47,4	75,3	23,7	42,0	2,0
Machines for agriculture, forestry, fishing, etc.	80,6	57,7	75,6	21,9	32,7	0,1
Other industrial machines	83,6	56,2	75,6	29,0	49,9	3,4
Cast iron	75,9	50,6	75,6	1,1	24,3	0,1

(Continues)

(Continued)

Description of the industry	Decomposition of the VA (%)			Processed exp. (%)	Foreign companies exp. (%)	Total exp. (%)
	Ordinary	Processed	Weighted Sum			
Ferroalloy	75,7	53,3	75,6	0,4	8,8	0,4
Furniture	86,7	56,1	76,2	34,2	56,0	2,0
Printing, reproduction and recording equipment	86,4	61,0	76,5	39,0	44,4	0,2
Glass and its products	83,3	59,0	76,7	27,2	46,4	0,6
Wool textiles	89,4	57,9	76,9	39,8	46,8	0,2
Machines for metallurgy	81,2	56,8	77,3	16,0	36,4	0,3
Laminated steel	80,0	52,9	77,8	8,3	22,6	3,8
Fertilizers	81,0	57,3	77,9	13,2	9,5	0,3
Cotton textiles	88,0	45,8	78,9	21,5	26,1	2,1
Clothing	89,5	53,9	79,0	29,7	36,9	4,6
Drugs	87,6	37,5	80,3	14,5	32,3	0,8
Wood, bamboo, rattan and straw products	84.6	58.4	80.4	16.1	33.1	1.0
Steel production	80.8	51.7	80.8	0.2	7.1	0.3
Ceramics and porcelain	83.4	58.2	82.0	5.2	29.9	0.5
Production of textiles	88.4	54.9	82.4	18.1	35.1	1.8
Textiles and kitting articles	88.2	51.6	82.5	15.6	25.7	5.7
Other mineral and non-metallic products	86.0	56.6	83.0	10.1	25.1	0.5
Other textiles	86.6	56.8	83.9	9.0	14.7	0.2
Fire resistant materials	86.6	55.1	84.7	5.8	51.6	0.1
Cement, lime and plaster	89.0	52.9	88.4	1.7	29.6	0.1
Coque	89.6		89.6	0.0	11.4	0.3
Total commercialized	**84.0**	**37.3**	**60.6**	**50.1**	**55.7**	**91.3**

Source: Calculations by Koopman, Wang & Wei (2012). Developed by the author.
The sectors/segments selected in the table follow the same sectors/segments represented in the Chinese product-input matrices from 2002 and 2007, and fit the Chinese four digits classification for economic activities.

In second place, in the main segments of the consumer electrical and electronics and cars exports, the Chinese improvement in the aggregation of value is clear, representing a phenomenon almost widespread. These sectors, with processed exports generally representing more than two thirds of the total exports and that, were also among the ones with the fastest growth within that period. All the following segments showed an improvement in the weighted sum of the value added between 2002 and 2007: computers, telecommunications equipment, household electrical appliances, household audio-visual appliances, motor vehicles, and office, and educational and cultural equipment. Together, they represent 26% of all Chinese exports in 2007. The only segment in which the weighted sum of domestic VA fell is the other electronic and telecommunication equipment.

There are different reasons for the improvement in the value added in the segments listed. In all cases, but at different paces, the VA share of the processing industry improved. On the other hand, in some cases, the improvement was also followed by an expansion of the ordinary and/or Chinese capital industry, as in the case of telecommunication equipment and motor vehicles. Not by chance, these are two of the sectors with the greatest expansion of national Chinese brands, especially Huawei, ZTE, Haier and Gree.

The segment with the fastest progress is the telecommunication equipment, which alone represented 5.9% of the total exports in 2007. Its share in the weighted sum of the domestic VA grew significantly, going from 12.5% to 43.6% within the period analyzed. In this case, there are two relevant movements in course: the value added of the processed exports grew very fast (from 5.3% to 35.3%) and, at the same time, the share of the Chinese capital industry in exports, together with the Chinese ordinary exports, grew significantly. This suggests a general progress of the segment in terms of value added, both at the processing industry and the Chinese ordinary and capital industries. This justifies the choice of Huawei, the main Chinese telecommunications company, for the brief case study presented in the following section.

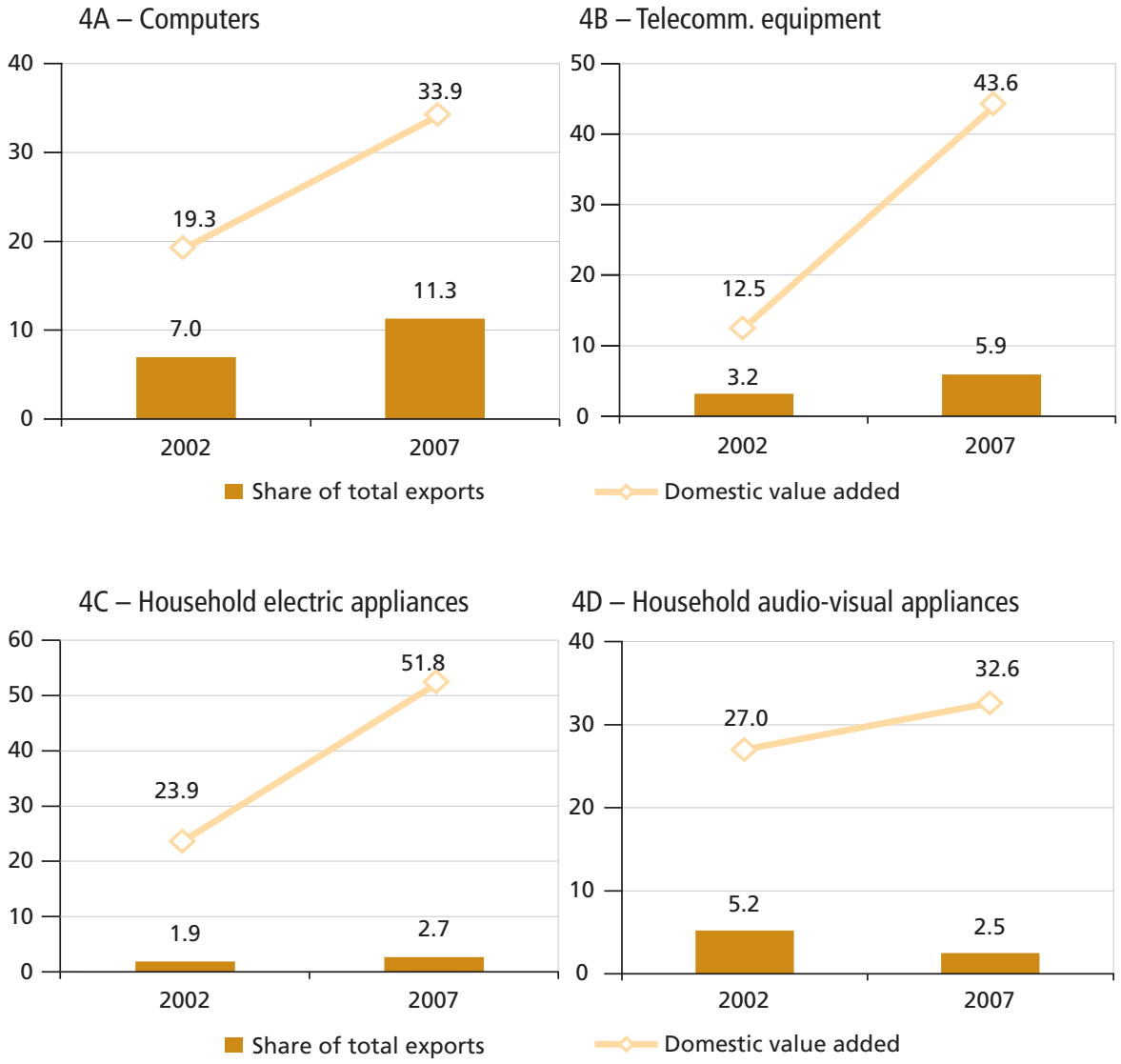
A similar phenomenon occurred with the motor vehicle sector, where the expansion of the VA added in the processing industry was expressive (from 10% to 47.4%) and was accompanied by a retreat in the share of both the foreign firms and the processed exports in the total exports. These last ones dropped from 35.2% to 23.7% of the total, what shows that the automotive industry is much less integrated into the global value chains than the electronics industry.

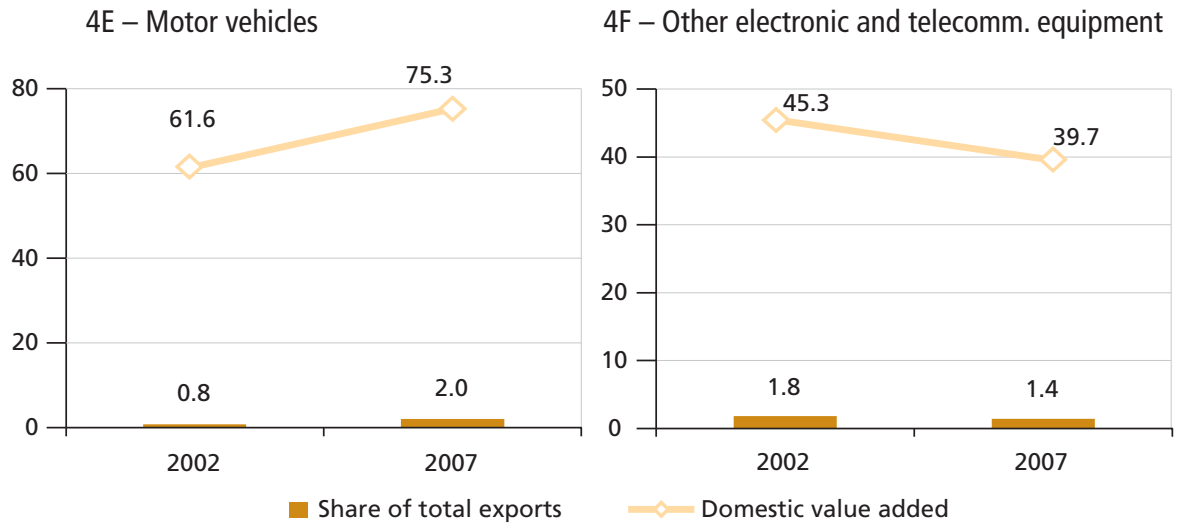
A different pattern was observed in the computer segment, which alone represented 11.3% of the total Chinese exports in 2007. The improvement in the value added was also significant, going from 19.3% to 33.9%, but in this case, the Chinese brands do not seem to have played an important part in the change, given that the share of foreign companies in the total exports continued to increase in the period, from 89.7% to 93.3%. The improvement in the domestic value in this segment was a result of the improvement in the value added of processed exports, which went from 18.7% to 33%. These data do not capture, however, the recent external sales boost of Lenovo, which begin to grow very fast after 2008. Within that period, the Chinese multinational's share in the global market of PCs went from 7% to 13% according to the data provided by Gartner consulting.[13] Given its recent central position in the global PC industry and its path, very different than Huawei's, the company will be subject to another case study in the next section.

13. Gartner Press Release January, 15th, 2009, available at: <http://www.gartner.com/it/page.jsp?id=856712> (last access in May 23rd, 2012) and data from the graph 5 as follows.

Within the household electric appliances sector, the pattern observed for computers is repeated: strong rise in the VA of processed exports, increasing the weighted sum of the total VA, but accompanied by a slight increase in the participation of foreign firms. However, in this segment, differently than the computers, the Chinese firms still detain a relevant share of the export market, around 40%.

GRAPH 4
Value added domestically by exports in selected segments from the electrical and electronics industry and other commodities
(In %)





Source: Developed by the author based on the data from the previous tables (5A and 5B).

In sum, the improvement in the value added of Chinese exports was accompanied by two important phenomena within the perspective of the country's rise in the global value chain's hierarchy: there was an expressive increase in the domestic content of processed exports and a growing participation of ordinary exports in more technologically sophisticated sectors, especially in the heavy industry. Such increase in the domestic content of processed exports was caused by different phenomena, depending on the sectors observed. In some of them, as computers, the behavior was driven by foreign firms, which have introduced more sophisticated stages in the production process in China. That is what Zhang (2012) observes, when commenting on the results from Koopman *et al.* (2010) and the growth in the value added of processed exports:

> this reflects the fact that more of the value chain of many products is now located within China: suppliers of parts are increasingly setting up shop to be close to the location of final assembly. Foreign companies are setting up R&D centers and moving the production to more sophisticated parts to China (Zhang, 2012, p. 2-3).

In other cases, and the telecommunications sector is an emblematic example, the improvement in domestic content came with the increasing participation of the Chinese capital industry in the total exported. And, in this case, the growth of the total value added is much more significant than the behavior of the computers segment, for example. The key factor is that the gain in value added occurred with the formation of lead firms, and not only with the inclusion of more sophisticated components in the work of EMS or ODM.

It seems important to remember that the main goal of the Chinese processing industry is to be a channel for the absorption of strong currency and technology. As mentioned earlier, if the success of the first goal is unquestionable given the

dimension of Chinese reserves and its commercial surplus, the technological progress of local brands is, on the other hand, subject to many controversies. This article will now observe the Chinese capital electronics industry, supposedly benefitted from technology and knowhow absorbed by the assembly industry, holder of local brands that began arriving in the West through Huawei, ZTE, Lenovo, TCL and Gree. This is the national industry that will be investigated in more detail because it has the potential to ascend structurally in the CGV's hierarchy.

5 LEAD FIRMS IN THE CHINESE ELECTRICAL AND ELECTRONICS INDUSTRY

Learning how to progress in the rank from EMS or ODM firms without a brand to domestically develop lead firms that are able to join the global chain seems to be the key element for countries that wish to advance in the hierarchy of value added (section 2). Assembly plants of western brands of high international value and low value added in China (such as the Apple line) or mass manufacturers of low cost appliances, operating with low margins, and focused on the domestic market (that absorb business models and technologies from abroad and adapt its products for the Chinese consumer market)[14] can be shortcuts to the fast accumulation of capital. But they do not ensure a relevant position within the global value chains. Nevertheless, has China being successful in creating lead firms in recent years? Is there any pattern for the emergence of such brands?

Even if we look only to the electronics and information technology sectors, it is impossible to establish a single model for the property structure or the internationalization of Chinese lead companies. What they all have in common is the intense State support from its foundation to its present, the innovation (including deliberate copy) and the wide penetration in the Chinese internal market before their international expansion.

In fact, the internal market is a fertile ground for the consolidation and emergence of lead national brands. China is not only the major producer of electronic goods, but in recent years has become the largest consumer of several durable goods, such as automobiles and personal computers, surpassing the United States' consumption in 2010.[15] Such internal market has favored several

14. This second model, called "incremental innovation" by both consulting companies GaveKal and RedTech Advisors, has been a shortcut for many Chinese firms. They benefit not only from its ability to innovate, but from the low cost, mature distribution chain, knowledge of the Market and extraordinary domestic demand.

15. In 2010, the country consumed 13.5 million cars, against 10.4 million in the United States. In the second quarter of 2011, China surpassed the United States in the personal computer sectors, being responsible for 22% of the global consumption of PCs, against 21% consumed by North-Americans. See *Bloomberg*, "China ends US's reign as largest auto market", January 11th, 2010, and *The Wall Street Journal*, "China passes US as the world's biggest PC market", August 24th, 2011.

Chinese lead brands, allowing them relevant or leading presence in the domestic market, as is the case of Lenovo, Huawei, ZTE, Gree, Haier and TCL in the electronics and information technology sectors.[16]

Next, two case studies about emerging Chinese companies in these two sectors have been used: Lenovo, which became the second major global PC brand in market share in 2011, and Huawei, which since 2010 is the second major provider of infrastructure equipment for mobile telecommunication and one of the Chinese companies with more resources invested in R&D. With very distinct strategies, the case of the two companies may shed some light over the diversity of paths being tested for the development of local bands.

5.1 Case study I: Lenovo

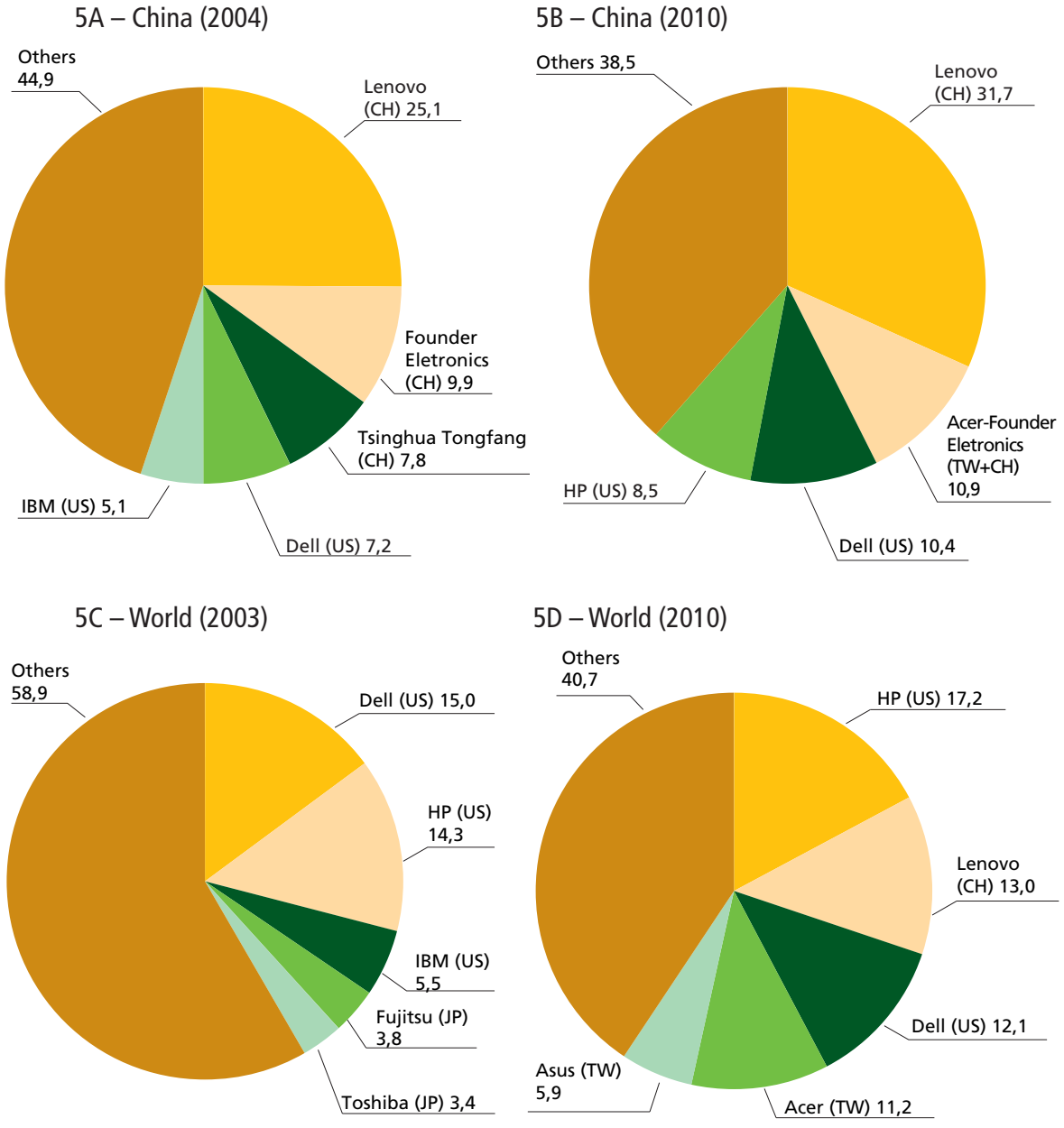
Lenovo combined intense state support with aggressive acquisitions or international joint ventures (from IBM in the United States to NEC in Japan), which made its property structure, internal architecture, leadership and innovation sources very distinct from the "national champions" models that were developed in Japan and South Korea. Besides becoming the second major PC brand in the world in 2011, the company has operated with low profit margins and grew especially in the sectors which the north-American traditional lead firms (IBM, Dell e HP) have neglected exactly as a result of its low margins.

Originally called Legend, the company was founded in 1984 by the Institute of Computer Science of the Chinese Academy of Sciences as part of an effort from the Chinese government to develop an advanced national industry in technologically sophisticated fields. Simultaneous to the research and development work, the company also focused on the production of foreign computers, automatically turning these profits into R&D in creation of its own production line. The State support happened along the 1990s and took several forms. Early in the decade, when the internal demand for PCs was irrelevant, the government demand was responsible for driving Legend's sales. One of the most important instruments to stimulate the national information technology industry (IT) were the so-called "Golden Projects", several e-government projects aiming at the construction of an IT infrastructure in all State agencies, schools and hospitals, with projects going from internet business services to tax evasion control (Hatford, 2000). In 1994, the government launched another stimulus program, now to support the national brands, and Legend was one of the main beneficiaries through expressive loans.

16. The internationalization of Chinese companies is even stronger in the raw material and basic products sectors, driven by great state-owned companies as CNOOC, Sinopec, PetroChina, Baosteel and State Grid, and is part of a movement with strategic dimensions that is beyond this article's scope of analysis.

From the mid-1990s, besides governmental purchases, Legend benefitted from the protection of the internal market, and soon became the major producer of personal computers, boards and integrated systems in China.[17] It was when the company opened its capital in the Honk Kong stock market, always ensuring, at the same time, the State's major share through the Academy of Sciences. Between 1997-98, when the demand for PCs had its first high, the company rapidly established itself as the major Chinese supplier, with approximately 22% of the market. The company's share in the Chinese consumer Market increased to 25.1% in 2004 and to 31.7% in 2010 (graph 5).

GRAPH 5
Market share in the personal computers segment[1]



Note: [1] Personal computers include desktops, laptops and netbooks, but not tablets, these later ones dominated by Apple.
Source: IDC and Gartner.

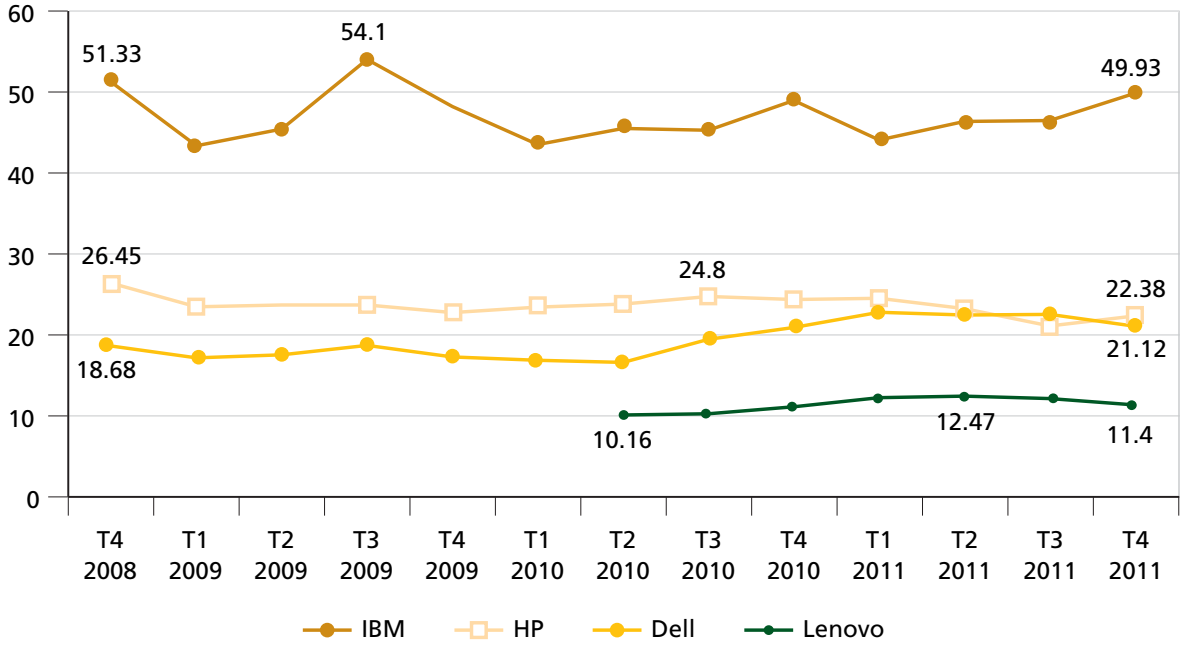
17. Today, the company's line of products include notebooks, desk computers, servers, equipment for data storage, peripherals, smart televisions, digital products, cell phones etc.

As the restrictions to imports started to be abandoned, Legend began a bold acquisition process not only to remain competitive in China but particularly to expand globally. The purchase of IBM's PC division in 2004, which caused its transformation into Lenovo, provided not only the knowhow of a brand consolidated in the West, but especially a large R&D center in the United States and another one in Japan; three assembly plants in China and one in India; regional distribution networks around the world; and a group of business and financial development and corporate planning in Singapore. When it comes to property, it is important to note that besides highly internationalized, the company remains semi-public. In 2009, 45% of Lenovo shares were negotiated in the market; 42% belonged to Legend Holding; 7% to investment banks; and 6% to IBM. The company is still semi-public because the Chinese Academy of Sciences detains 65% of Legend Holdings and, therefore, keeps its share of 27% from Lenovo (Ling, 2006; Sturgeon & Kawakami, 2010).

Lenovo's fast paced growth in the global market, reaching the second position in the PC's global market share in 2010 (graph 5), reflects, on the one hand, the rapid expansion of the company in developing countries but, on the other, the departure of its competitors from this segment. In fact, the company has concentrated its expansion in China, the largest global market, and also in the large countries with a fast development, especially Brazil, Russia e India. On the other hand, there was an explicit retraction of traditional competitors, notably HP and Dell, that publicly announced they are concentrating in sectors with higher profit margins and less volume, such as more sophisticated IT services and equipment. These movements reflect a structural change in the personal computers segment, seen for a long time as one of the top IT sectors, and now concentrated in low cost product and small margins. Certainly, the prompt arrival of Asus, focused on low cost netbooks, is a proof of this change.

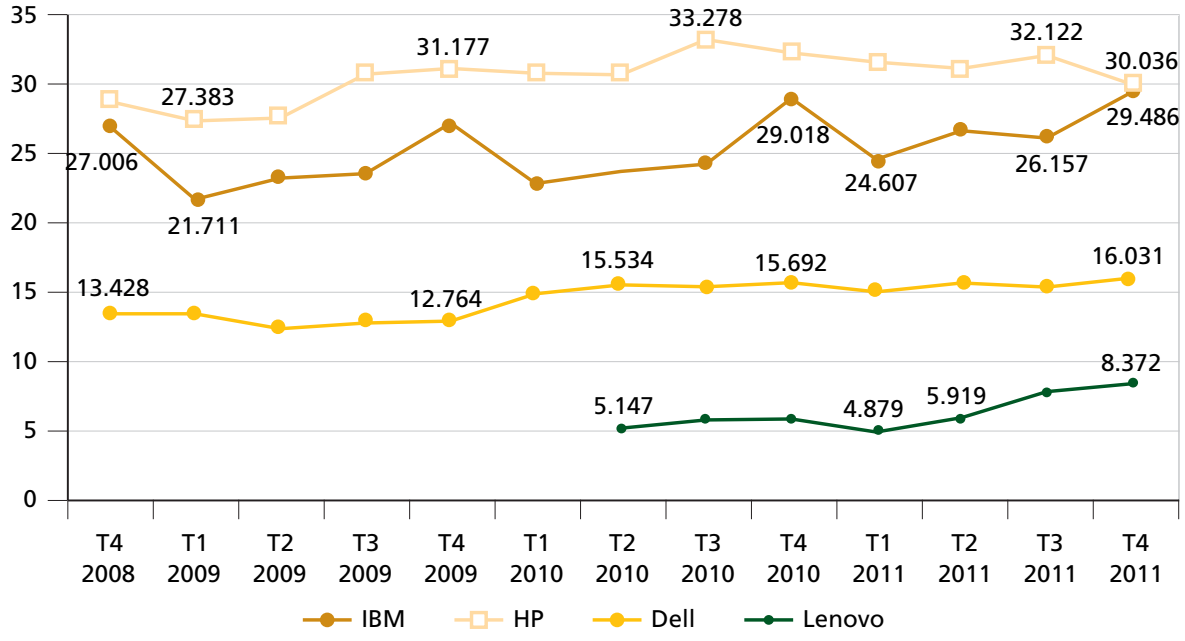
Lenovo's gross profit margins, when compared to its direct competitors – around 11% between 2010 and 2011, against margins around 20% to 23% for HP and Dell in the same period – are evidences of the sector's structural change and the low margins currently guaranteed by the personal computer sector. The same occurs in regards to revenue. Besides the growth, Lenovo's revenues in the last quarter of 2011, around US$ 8 billion, are significantly lower that Dell's (US$ 16 billion) and that the revenues of IBM and HP (both around US$ 30 billion).

GRAPH 6
Gross profit margins of the main suppliers of systems and hardware for PCs
(In %)



Source: PWC, available at: <http://www.pwc.com/gx/en/technology/scorecard/systems-and-pchardware.jhtml>.

GRAPH 7
Revenues of the main suppliers of systems and hardware for PCs
(In US$ millions)

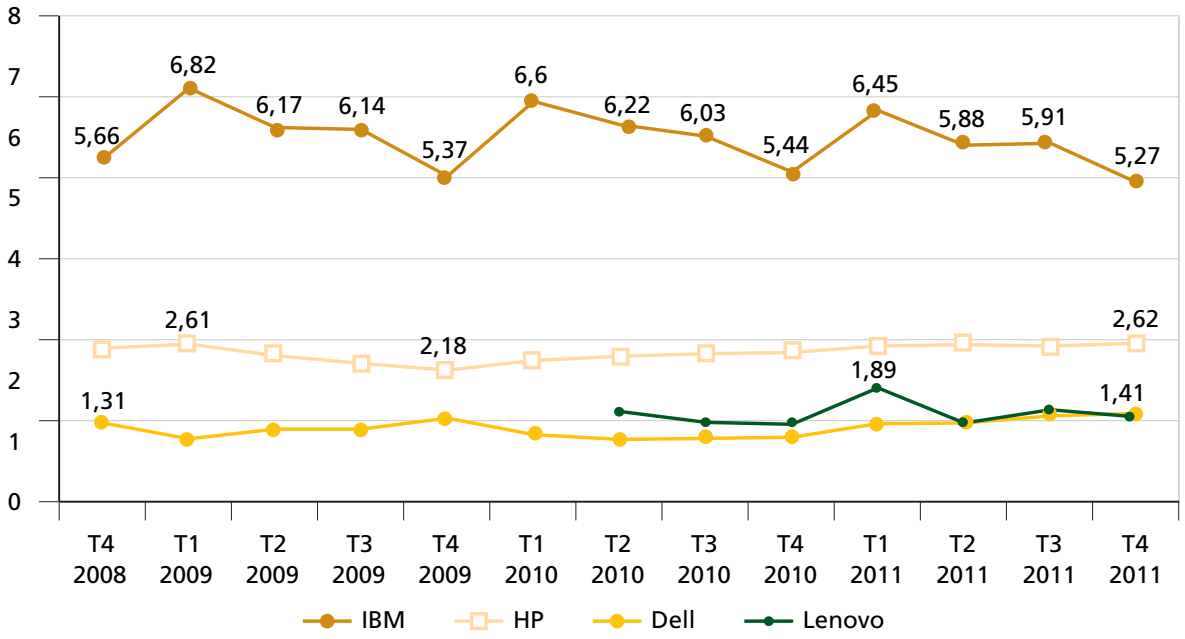


Source: PWC, available at: <http://www.pwc.com/gx/en/technology/scorecard/systems-and-pchardware.jhtml>.

Lenovo's second place in the market share of personal computers is, therefore, a relative success that proves the main challenge for local IT bands: the fast pace of

the technological change that characterizes the sector. The company has presented a moderate investment in R&D: approximately 1.5% of its sales in 2011, very close to what Dell invests and below the baseline of 2.5% that HP and Asus invest, this latter growing expressively in the global market (Redtech Advisors, 2011).

GRAPH 8
R&D as a share of the total sales
(In %)



Source: PWC, available at: <http://www.pwc.com/gx/en/technology/scorecard/systems-and-pchardware.jhtml>.

The company has, since 2011, publicly announced that it wishes to expand its participation in more profitable sectors and mature markets.[18] In 2011, the company made other international moves: acquired Medion AG, a German manufacturer of consumer electronics and multimedia, and announced the formation of a joint venture with the Japanese firm NEC Corp, creating the NEC Lenovo Japan Group, a partner that aims at Lenovo's expansion in the personal computer sector in Japan. Lenovo kept 51% of the new joint venture, while NEC kept the remaining 49%.

5.2 Case study II: Huawei

Huawei is a case of an endogenously Chinese company, headquartered in Shenzhen, Guangdong, with capacity for relevant innovation and its own technological development, with R&D centers in China, India, Russia, Germany, the United States and Sweden. Its expenses with R&D reached 11.6% of the revenues in 2011 (table 6), which do not exclude, however, frequent cases of accusations of patent and

18. See, for example, the statements of President Liu Chuanzhi at: China Daily, August 19th, 2011, "Lenovo posts record US$ 5.9b sales revenue."

copyright infringement, as in the most notorious case of its dispute with Cisco.[19] The company was founded in 1988 by Ren Zhengfei, a former official of the body of engineers from the People's Liberation Army who remains the Chief Executive Officer (CEO) since then. From an importer of PBX equipment, when created, the company started manufacturing equipment and, in the early 1990s, began selling other telephone appliances all around China. Gradually, Huawei entered the transmission equipment and telecommunications network sectors. In 2011, it was the second major supplier of equipment for telecommunications network in the world, both in market share and revenues, behind the Swedish Ericsson and before Alcatel-Lucent, Nokia, Siemens, Networks and ZTE, providing equipment and operational services for internet and telephone companies and operators, besides rapidly penetrating the sector of final user appliances, especially in the smartphones market.

In 1996, the company began its international expansion, competing with Cisco, Ericsson and Fujitsu in low income countries such as Bangladesh, Iraq and Nigeria, in which the low cost is a key element. At the turn of the century, Huawei started to also compete in developed markets, and since 2004, its external sales exceeded its domestic sales. With half of its employees outside China, its revenues have grown abroad very fast (table 7). Its clients include some of the major telephone operators, as British Telecom, Vodafone, Telefonica, Deutsche Telekom, France Telecom, China Mobile and Vivo, in Brazil (PWC, 2005; Huawei, 2012).

In 2010, Huawei had 15.7% of the telecommunication network's global infrastructure market, against a 19.6% share detained by Ericsson.[20] The distance between the two competitors became practically irrelevant in 2011, when both reached US$ 32 billion in revenue and the difference represented something around two weeks of Huawei's sales (table 6).

TABLE 6
Ericsson and Huawei's financial performance in 2010 and 2011
(In billions and in %)

	Ericsson		Huawei	
	2011 (US$)[1]	2011 (US$)[1]	2011 (CNY)	2010 (CNY)
Revenue	32.9	32.4	203.9	182.5
Gross profit	11.6	12.1	76.4	80.4
Gross profit margin (%)	35.1	37.5	37.5	44.0
R&D (as a % of revenues)	14.4	11.6	11.6	9.7

Note: [1] The exchange rate from 12.31.2011 was used to make the conversion of the Swedish krona and the renminbi to the Dollar.
Sources: Huawei Investment & Holding (2012), annual report, available at: <http://www.huawei.com/ucmf/groups/public/documents/attachments/hw_126991.pdf>, Ericsson (2012), annual report, available at: <http://www.ericsson.com/thecompany/investors/financial_reports/2011/annual11/>.

19. See PWC (2005) for details.

20. Business Week, April 18th, 2011, available at: <http://www.businessweek.com/news/2011-04-18/huawei-closes-in-on-ericsson-as-sales-triple-over-five-years.html>.

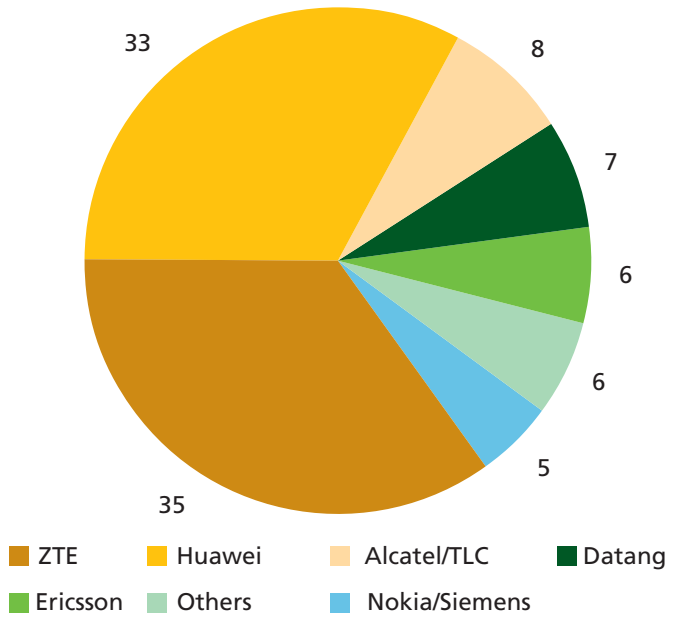
TABLE 7
Huawei's revenue in China and abroad in 2010 and 2011
(in billions of CNY)

	2011	2010	Var. (%)
China	65.6	62.1	5.5
Exterior	138.4	120.4	14.9
Total	**203.9**	**182.5**	**11.7**

Source: Huawei Investment & Holding (2011), annual report, available at: <http://www.huawei.com/ucmf/groups/public/documents/attachments/hw_126991.pdf>.

Together with ZTE (second major Chinese telecommunications company of State origin), Huawei dominates the IT market in China. In the third generation of mobile networks, and using a standard developed domestically,[21] both Chinese companies had 68% of the domestic market in 2010 (graph 9).

GRAPH 9
Chinese Market share in the 3G mobile internet networks segment (2010)
(In %)



Source: RedTech (2011).

Besides its success in China, developing countries and Europe, Huawei faces a strong resistance to penetrate the United States because of the North-American authorities' caution with information security and control. Officially presented as a private company, Huawei's ownership is frequently under speculation. The company has no open capital in any stock market and, officially, 1.42% of its capital is detained by the founder and CEO, Ren Zhengfei. The other 98.56%

21. See RedTech (2011) for more details.

of the capital, according to the company information, are the property of approximately 61 thousand Chinese employees, being managed by the Shenzhen Huawei Investment Holdings Co Ltd. Union. The shares are divided among employees according to performance criteria, responsibility and results, and complement the company's incentive structure. Only Chinese employees may hold such shares (Saarinen, 2010). As the details on the distribution of shares are not released, North-American authorities, including the Pentagon, accuse the company of being associated with the Chinese People's Liberation Army.[22] Therefore, it is relevant to note that even with the North-American protectionism and Huawei's insignificant presence in the United States, the company had reached the second place in the telecommunications' infrastructure equipment sector.

6 CONCLUSIONS

Chinese exports not only became more sophisticated in the last decade but are also currently adding more value domestically. Differently than what the literature using data from the early 21st Century[23] suggested, the most recent estimates state that the country is rising in the value added chain, both as a result of the growing participation of ordinary exports in more sophisticated sectors and segments, and the increase in the value added by processed exports. According to Koopman, Wang & Wei (2012), the value added from the total exports, which was approximately 54% both in 1997 and 2002, increased to 60.6% in 2007. This increase was pushed by the processing industry, with its value going from 25.4% in 2002 to 37.3% in 2007, and by the increase in ordinary exports within the total exports.

Especially in the electronic and automobile industries, the growth of the Chinese exports' value added is a clear phenomenon. All these sectors showed an improvement in domestic value added between 2002 and 2007: personal computers (from 19.3% to 33.9%, respectively), telecommunications equipment (from 12.5% to 43.6%), household electrical appliances (from 23.9% to 51.8%), household audiovisual appliances (from 27.0% to 32.6%), motor vehicles (from 61.6% to 75.3%), and office, educational and cultural equipment (from 23.3% to 36.5%). There is still plenty of space for the extension of the domestic VA in most segments, and there are no signs that this increasing trend is saturated. Nevertheless, even if there are no data about the domestic VA from 2007 on, the business data for processing suggest that the ordinary exports kept growing in the subsequent years (from 44% in 2007 to 48% in 2011) and the imports for processing suffered an important drop within that same period (from 38% to 27%).

22. *The Wall Street Journal*, "US works to counter electronic spy risks", December 12th, 2011.
23. Lemoine and Unal-Kesenci (2004) is the most cited reference.

Telecommunication equipment, which alone represented almost 6% of the total exports, was the segment with the most relevant progress. Its value added grew expressively, from 12.5% to 43.6% between 2002 and 2007. In this case, both the value added of processed exports increased rapidly (from 5.3% to 35.3%) and, at the same time, the Chinese capital industry share within exports, together with the ordinary exports, grew significantly. This suggests, as previously mentioned, a generalized progress of this sector, from a value added perspective, both for the processing industry and the ordinary and Chinese-capitalized industries. And it justified our choice for Huawei in the case study developed for this article.

In other segments, such as personal computers and household electrical appliances, the behavior was influenced by foreign firms, which introduced to China more sophisticated steps in the production process. The strong increase in the value added of processed exports, influencing the weighted sum of the total VA, was accompanied by a slight increase in the participation of foreign companies within exports. As a result of the growing and recent participation of Lenovo in the personal computers sector, our expectation is that the future data also show an increase in the participation of Chinese firms in the PC's exports.

Both brief case studies in the previous section tried to illustrate the diversity of paths for the emergence of Chinese lead firms. In the case of Lenovo, the combination of State support with aggressive acquisitions or international joint ventures made its ownership structure, internal architecture, and leadership and innovation sources radically different from the models developed in Japan and South Korea, for example, and Huawei's pattern. Lenovo's narrow profit margins and its dominance in the sector which has been neglected by traditional lead firms is also another difference in comparison to Huawei, which has grown within the most advanced sectors and competed directly with traditional lead brands. The expectation is that this consolidation and emergence of new Chinese lead firms will keep growing, being benefitted by a large internal market, varied forms of governmental support, access to credit and strong capacity for capital accumulation.

There are extremely relevant changes in course with: *i*) the Chinese rise in the value added chain of processed exports; *ii*) sophistication and expansion of its ordinary exports; and *iii*) internationalization of its lead firms, according to what this article tried to highlight. Based on the findings presented here, the challenges to Brazil are evidently great and represent a vast field for future researches.

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