The densification of Chinese production chains in the context of vertically fragmented production

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Abstract: The process of productive densification is illustrated by the greater involvement of local actors (companies and workers) in value chains, at the same time a lower degree of industrial density is commonly presented as an attribute of the economies most integrated into global value chains (GVC). This paper contributes to the characterization of the productive densification of a given country in a way that is not limited to a proxy of GVC participation. We argue that a narrow focus on the GVC literature has resulted in a misleading picture of supply-chain densification through GVC participation indicators. To illustrate our analysis, China is an intriguing case study. In the context of fragmented and internationally dispersed production networks, our key research questions are: how can we understand the changes in China's industrial density in light of the transition from export-led to domestic demand-driven growth? And to what extent has the densification of the Chinese supply chain occurred mainly in less technology-driven industries? Based on data from the World Input-Output database for the period between 2000 and 2014, we add evidence regarding how the changes of industrial density occurred considering different components of final demand and how this phenomenon occurred at industry-level, as we measured China's import intensity and applied an exercise of structural decomposition of import content. Our results indicated that China has promoted the supply-chain densification over the post-Global Financial Crisis period, especially of high-technology oriented industries, fostering domestic demand for final and intermediate goods and services produced domestically. This means that strengthening local actors' productive links is consistent with the Chinese development strategy of reducing dependence on imported inputs, increasing the share of intermediate and final goods and services produced domestically, and spurring China`s local production importance in innovative industries.
Keywords: densification; global value chains; input-output analysis; structural decomposition; import intensity; China.

A densificação das cadeias produtivas chinesas no contexto da produção verticalmente fragmentada

Resumo

O processo de densificação produtiva é ilustrado pelo maior envolvimento de atores locais (empresas e trabalhadores) nas cadeias de valor, ao passo que um menor grau de densidade industrial é comumente apresentado como um atributo das economias mais integradas nas cadeias globais de valor (CGV). Este artigo contribui para a caracterização da densificação produtiva de um determinado país sem se limitar a uma *proxy* de participação nas CGV. Argumentamos que um foco restrito na literatura de CGV resultou em uma imagem enganosa da densificação das cadeias de valor. Para ilustrar nossa análise, a China é um estudo de caso intrigante. No contexto de redes de produção fragmentadas e internacionalmente dispersas, nossas principais perguntas de pesquisa são: como podemos entender as mudanças na densidade industrial da China à luz da transição do crescimento orientado pela exportação para o crescimento impulsionado pela demanda doméstica? E até que ponto a densificação das cadeias de valor chinesa ocorreu principalmente em indústrias menos intensivas em tecnologia? Com base nos dados da *World Input-Output database* para o período entre 2000 e 2014, este estudo apresenta evidências sobre como as mudanças na densidade industrial ocorreram considerando diferentes componentes da demanda final e como esse fenômeno apresenta-se no nível da indústria, ao medir a intensidade de importações e realizar o exercício de decomposição estrutural do conteúdo importado da China. Nossos resultados indicaram que a China promoveu a densificação das cadeias de valor durante o período pós-Crise Financeira Global, especialmente nas indústrias de alta tecnologia, promovendo a demanda doméstica por bens e serviços finais e intermediários produzidos no país. Isso significa que o fortalecimento dos vínculos produtivos dos atores locais é consistente com a estratégia de desenvolvimento chinesa de reduzir a dependência de insumos importados, aumentar a participação de bens e serviços intermediários e finais produzidos internamente e estimular a importância da produção local da China em indústrias inovadoras.
Palavras-chave: densificação; cadeias globais de valor; análise insumo-produto; decomposição estrutural; intensidade de importação; China.
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1. Introduction

The last decades have witnessed significant changes in how the world production and international trade are organized, with countries becoming specialized in specific parts and tasks along global value chains (GVCs). This means that GVCs are an expression of an unprecedented vertically fragmentation of production in an interconnected global economy, where the production of most goods relies on several stages located in different countries and intermediate inputs are crossing borders multiple times. In fact, production networks that supplied a given industrial segment and used to be largely domestic, forming dense inter-industrial linkages with several local actors engaged, are now increasingly supplied by imported inputs and components. This lower degree of productive density[1] is commonly presented as an attribute of the economies most integrated in GVCs.

Within the GVC approach, a country may participate in GVCs in two distinct ways: i) using imported intermediate inputs to produce exports; and/or ii) exporting intermediate goods that are used as inputs by another country to produce goods for exports. In this sense, there are two broad measures of GVC participation: i) *VS*: measures the value of imported contents embodied in a country's exports, and ii) *VS1:* measures the value of intermediate exports sent indirectly through other countries to final destinations, i.e. the percentage of exported intermediate goods and services that are used as inputs to produce other countries' exports (Hummels, Ishii and Yi, 2001). On the one hand, the VS share estimates the importance of upstream links and provides a metric of the involvement of a country or industry as a user of foreign inputs (i.e. backward participation). On the other hand, the VS1 share estimates the importance of downstream links and measures the involvement in GVCs from a supplier perspective (i.e. forward participation)[2] (Koopman *et al.*, 2014; De Backer and Miroudot, 2013; Cadestin, Gourdon and Kowalski, 2016).

The production-chain density is commonly depicted from a *proxy* of GVC participation based on value-added trade statistics (Canuto, 2014; Canuto, Fleischhaker and Schellekens, 2015; Inomata and Taglioni, 2019). Considering the ratios of domestic value-added relative to gross exports, Canuto (2014) argues that the Brazilian production chains show high levels of density. Even though this may reflect the Brazilian specialization pattern of high weight of commodities in total exports, the author argues this is also the case for most Brazilian manufacturing branches. Inomata and Taglioni (2016) call attention to both *economic upgrading*[3] and *densification* as key-factors to transform GVC participation into sustainable development. Such a challenge is not only about becoming more competitive in higher value-added activities but also about engaging more local actors (both firms and workers) in GVC networks. The main idea is that value addition for a country in the case of supply-chain densification occurs through scale effects (higher profit income, wage income, and tax revenue), which means, in some cases, that this may come from performing in lower value-added activities on a large scale.

Kuroiwa (2015) argued that the formation of industrial local linkages within a country affects its economy in several ways. That is, industrial deepening promotes structural transformations, contributes to a reduction in trade deficits, increases the international competitiveness of relevant industries, reduces a country`s vulnerabilities regarding external shocks, and constitutes an important channel for technology transfer. In light of the international reconfiguration of production, Berger (2013) investigates the importance of manufacturing in sustaining innovative capabilities in the case of the United States. As manufacturing processes and the generation of innovations are closely connected, the results of the study revealed that the role played by manufacturing is crucial for the continuous improvement of products and processes. In this sense, weakening technology transfer channels could undermine US long-term industrial

[1] This research interchangeably uses several terms related to the process of involving more local actors, firms and workers, in supply chains, these are: *productive* densification, *industrial* densification, *supply-chain* densification, and *production-chain* densification.

[2] Despite the existence of both types of GVC participation, the VS is commonly used as an acronym for vertical trade. This is justified by the perception that it is more difficult to compute VS1 than it is to estimate VS. However, when analyzing the vertical specialization of trade (in short, vertical trade), one may also have to consider the domestic-produced exports that are used by another country as inputs in its own exports (i.e. the VS1 side).

[3] The economic perspective of upgrading is usually associated with "moving into higher value-added stages", and it is commonly assumed to be followed by positive spillovers regarding technology and productivity. See Marcato and Baltar (2020) for a critical review of its definitions and quantitative measures.

competitiveness. The implications of their findings go beyond the case of the US. In a broader sense, the loss of industrial density harms a country's innovative capacity.

This research argues that vertical specialization indicators, which are used to capture the role of imported inputs used directly and indirectly in the production process of an exported good, provides critical but limited insights to analyze the degree of productive densification of *exporting industrial segments*. These may not represent the whole picture of the process of productive densification in a given country, as we may find substantive distortions between the industrial composition of its domestic production and its exports, especially when considering the pattern of trade specialization of a given country. With that in mind, one may find that a country with domestic-oriented production may present a different level of industrial density from that captured through narrow-GVC indicators that consider only exports, given the importance (and composition) of other components of final demand.

To illustrate our analysis, China is an intriguing case study. Over the last decade, China has declined its role as the final point in Factory Asia, diversifying and upgrading its industrial structure (Primi and Toselli, 2020). This would be a key dimension of a much broader structural transformation ongoing in China, with the Global Financial Crisis (GFC) as the main dividing point, which is mostly discussed in terms of its change from export-oriented growth to domestic demand-driven growth (Lee, Park and Shin, 2016; Meng *et al.*, 2016). China has expanded in-house production of capital and intermediate goods in a process that has helped to deepen the recent trade slowdown (IMF, 2015; Kee and Tang, 2015; Nakajima *et al.*, 2016). To date, China has risen its international competitiveness and became prominent in adding domestic value to its gross exports, assuming to be less dependent on intermediate imports embodied in its exports and deepening its importance on vertically integrated production networks (Marcato, Baltar and Sarti, 2019). Even so, value-added trade indicators present a limited understanding of China`s productive densification and how this process is associated with different components of Chinese final demand.

This paper contrives to bring evidence to bear on the degree and nature of productive density in the case of China amid hyperglobalization. For that purpose, it uses World Input-Output (WIOD) database to measure China's import intensity and, more specifically, the import content at industry-level, applying the method developed by Bravo e Álvares (2012) for the period between 2000 and 2014. Our analysis thus proceeds by developing a structural decomposition exercise for the variation of the import content of each final demand components in the case of the Chinese economy. In a vertically fragmented production structure, this empirical strategy allows us to overcome the distorted outcomes of studies based on vertical specialization indicators to illustrate the industrial density of Chinese production chains with a greater level of detail without disregarding the importance of domestic-oriented production. This empirical strategy allows us to further investigate whether the densification of Chinese production occurred mostly in less technology-driven industries and how changes in China's supply-chain density are related to different components of final demand.

The implications of our findings go beyond the case of China. Our analysis sheds light on the current portray of inter-industrial linkages in a world dominated by complex and fragmented production processes. For instance, our empirical analysis of the Chinese productive density provides some lessons for the case of countries where domestic demand may play an important role. Finally, our findings have implications for a better understanding regarding the Chinese strategy of strengthening domestic productive links *vis-à-vis* its role in global and regional value chains.

The paper is organized as follows. Section two discusses the methodology for calculating the degree of import intensity, the import for final use as a percentage of total component final demand, and the import content of intermediate goods and services, as well as the structural decomposition exercise. Section three provides some empirical evidence about the changing nature of Chinese inter-industrial connections in the aftermath of China's entry into the World Trade Organization (WTO) and the recent global trade slowdown. Finally, section four concludes.

2. Material and method

In order to provide new evidence about the degree and nature of a country's productive density, we apply a method that allows it to be captured not only for the participation in GVCs but also for domestic-oriented production. In that sense, we apply the method proposed by Bravo and Álvarez (2012), which extended the

indicator proposed by Hummels Ishii and Yi (2001) initially used only for exports to the other components of final demand. More specifically, Bravo and Álvarez (2012, p. 88) proposed an indicator of "import intensity" for a given component of final demand, which "is defined as the sum of import content and of the relative weight of final imports of goods and services in the total of that demand component". The import content is the proportion of output value that relates to imported intermediate inputs. In this way, the import intensity estimates how much of the total supply or apparent consumption – whether for final goods or intermediate goods – is of foreign origin.

Usually, the indicators found in the literature assess the direct substitution between goods according to their origin. However, the acquisition of imported goods has successive (or indirect) effects on the economy. When an activity increases its production, it uses imported inputs from other sectors, which, in turn, comprises domestic and imported inputs. In such a way, there are effects on the chain of imported inputs on other sectors. Both effects (direct and indirect) determine the share of demand in the economy as a whole or in a specific sector that escapes via imports. Such results are possible to be achieved through the tool of the input-output matrix, or more specifically, through the Leontief inverse matrix.

Essentially, three variables are obtained according to the use category: i) import intensity; ii) import content (related to intermediate goods and services); and iii) imports for final use (as a percentage of total component final demand). It is noteworthy that the first item (i) is the sum of the following two. Thus, the first variable points to how much it is necessary to import intermediate and final goods to respond to an increase in final demand. It should also be noted that the analysis takes place for the vectors of total final demand and its components: household consumption, gross fixed capital formation (GFCF), exports[4], by industries.

Thus, the import content, imported intermediate goods to support final demand can be formally defined as:

$$\mathrm{CI}_{\mathrm{j}}^{\mathrm{t}} = \mathbf{i}'\mathbf{A}_{\mathbf{m}}^{\mathbf{t}}\mathbf{L}_{\mathbf{n}}^{\mathbf{t}}\mathbf{q}_{\mathbf{j}}^{\mathbf{t}} \quad (1)$$

Where, CI_j^t: import content for period *t*, for component *j* of final demand, where subscript "*j*" assumes values for total final demand, household consumption, gross formation of fixed capital and exports; $\boldsymbol{i}'$: summation vector, line vector composed of the numeral "1" with dimensions (1 x n); $\boldsymbol{A_m}$: imported technical coefficients, in the dimension industry by industry (n x n); $\boldsymbol{L_n^t}$: Leontief inverse matrix on technical coefficients of domestic origin (n x n); $\boldsymbol{q_j^t}$: vector (n x 1) is the industry composition of total final demand or each of its components.

$$\mathbf{L_n} = (\mathbf{I} - \mathbf{A_n})^{-1} \ (2)$$
$$\mathbf{A_n} = \mathbf{U_n}\hat{\mathbf{x}}^{-1} \ (3)$$
$$\mathbf{A_m} = \mathbf{U_m}\hat{\mathbf{x}}^{-1} \ (4)$$

where, $\boldsymbol{U_m}$: intermediate consumption of imported products; $\boldsymbol{U_n}$ intermediate consumption of domestic products; and $\hat{\boldsymbol{x}}^{-1}$ is the inverse of the diagonal matrix of output by industry vector.

This method provides some analytical gains. Firstly, input-output matrices are used to capture direct and indirect effects of an increase in final demand. Second, the set of information on imports - the entire matrix of imported technical coefficients ($\mathbf{A_m}$) - is richer than the simple row vector of imported intermediate demand usually applied. Moreover, the import content is achieved entirely through the multiplication of matrices and vectors, allowing for the application of structural decomposition exercises. Briefly, structural decomposition can be defined as a technique to fragment the variation of some aspect of the economy into contributions made by several components (Miller and Blair, 2009, cap. 13; Rose and Casler, 1996).

The structural decomposition of the import content for the components of final demand is presented below, starting from **equation 1**. Algebraically, there are several correct ways for the additive

[4] In this study, the government's role over import content will not be emphasized. The government vector, contained in the input-output matrices, reflects only its consumption, that is, disbursements with salaries and expenditures with the public sector maintenance, therefore with low degree of import content.

decomposition of a magnitude. In this text, based on the discussion of Dietzenbacher and Los (1998, p. 317 - 318), we apply the arithmetic mean of two decompositions of the variation between two different periods of time.

The first step of the decomposition is expressed as follows:

$$\Delta CI_j^t = (1/2)\{\mathbf{i}'[\underbrace{(\Delta \mathbf{A_m} \mathbf{L_n^0} \mathbf{q_j^0} + \Delta \mathbf{A_m} \mathbf{L_n^1} \mathbf{q_j^1})}_{\text{Direct effect}} + \underbrace{(\mathbf{A_m^0} \Delta \mathbf{L_n} \mathbf{q_j^1} + \mathbf{A_m^1} \Delta \mathbf{L_n} \mathbf{q_j^0})}_{\text{Technical effect}} + \underbrace{(\mathbf{A_m^0} \mathbf{L_n^0} \Delta \mathbf{q_j} + \mathbf{A_m^1} \mathbf{L_n^1} \mathbf{q_j^0})}_{\text{Composition effect}}]\} \quad (5)$$

As discussed above, the Leontief inverse matrix is calculated from the matrix $\boldsymbol{A_n}$ of domestic technical coefficients, which does not reflect the total demand for inputs in each industry. The Matrix $\boldsymbol{A_n}$ is affected by changes in the import penetration in intermediate demand. In order to separate the effect of changes in the technical coefficient and the effect of import penetration, we can decompose the change in the Inverse Leontief Matrix into two components.

Firstly, we need to calculate the matrix $\boldsymbol{A}$ of total technical coefficients:

$$\boldsymbol{A} = \boldsymbol{A_n} + \boldsymbol{A_m} \quad (6)$$

$$\boldsymbol{\Lambda} = \mathbf{A_n} * \mathbf{A^{-1}} \quad (7)$$

$$\mathbf{A_n} = \boldsymbol{\Lambda} * \mathbf{A} \rightarrow \mathbf{A_m} = (\mathbf{1} - \boldsymbol{\Lambda}) * \mathbf{A} \quad (8)$$

$$\mathbf{A} = \mathbf{A_n} + \mathbf{A_m} \rightarrow \mathbf{A} = \boldsymbol{\Lambda} * \mathbf{A} + (\mathbf{1} - \boldsymbol{\Lambda}) * \mathbf{A} \quad (9)$$

where $\boldsymbol{\Lambda}$: the participation of national technical coefficients in total coefficients;$\mathbf{1}$: $[1]_{nxn}$: matrix composed of the numeral "1", (n x n); *: Hadamard multiplier – the product element-by-element of two matrices of the same dimension. As can be seen above, $\boldsymbol{A_n}$ and $\boldsymbol{A_m}$ are complementary to $\boldsymbol{A}$.

Going back to the variation of the $\mathbf{L_n}$, it is defined as:

$$\Delta \mathbf{L_n} = \mathbf{L_n^1} - \mathbf{L_n^0} \quad (10)$$

Applying the methodology discussed in Miller and Blair (2009) we can rewrite this variation as:

$$\Delta \mathbf{L_n} = \mathbf{L_n^1} (\Delta \mathbf{A_n}) \mathbf{L_n^0} \quad (11)$$

According to equation (8), the variation of the national technical coefficient can be disaggregated into:

$$\Delta \mathbf{A_n} = [(1/2)(((\boldsymbol{\Lambda^1} + \boldsymbol{\Lambda^0}) * \Delta \mathbf{A}) + (\Delta \boldsymbol{\Lambda} * (\mathbf{A^1} + \mathbf{A^0})))] \quad (12)$$

When we replace (12) in (11), we have:

$$\Delta \mathbf{L_n} = \mathbf{L_n^1} \left((1/2)(((\boldsymbol{\Lambda^1} + \boldsymbol{\Lambda^0}) * \Delta \mathbf{A}) + (\Delta \boldsymbol{\Lambda} * (\mathbf{A^1} + \mathbf{A^0}))) \right) \mathbf{L_n^0} \quad (13)$$

And, replacing equation (13) into (5) and applying distributive property of multiplications and reordering algebraically, we find the additive decomposition of the variation of the coefficient in four terms: i) direct effect – changes in the imported technical coefficient matrix; ii) technology effect -represented by change in the total technical coefficient matrix; iii) the densification effect – captured by the variation in the domestic content of technical coefficients; iv) the composition effect – variations in the industry composition of the final demand or of its components. The equation follows:

$$\Delta CI_j^t = (1/2)\left\{ i' \left[\underbrace{\left(\Delta \boldsymbol{A_m L_n^0 q_j^0} + \Delta \boldsymbol{A_m L_n^1 q_j^1} \right)}_{direct\ effect} \right.\right.$$

$$\left. \underbrace{\left(\mathbf{A_m^0}[\mathbf{L_n^1}((1/2)(\mathbf{\Lambda^1} + \mathbf{\Lambda^0}) * \Delta \mathbf{A})\mathbf{L_n^0}]\mathbf{q_j^1} + \mathbf{A_m^1}[\mathbf{L_n^1}((1/2)(\mathbf{\Lambda^1} + \mathbf{\Lambda^0}) * \mathbf{\Delta A})\mathbf{L_n^0}]\mathbf{q_j^0} \right)}_{technological\ effect} + \right.$$

$$+ \underbrace{\left(\mathbf{A_m^0}\left[\mathbf{L_n^1}\left((1/2)\mathbf{\Delta\Lambda} * (\mathbf{A^1} + \mathbf{A^0})\mathrm{L_n^0}\right)\right]\mathbf{q_j^1} + \mathbf{A_m^1}\left[\mathrm{L_n^1}\left((1/2)\mathbf{\Delta\Lambda} * (\mathbf{A^1} + \mathbf{A^0})\mathbf{L_n^0}\right)\right]\mathbf{q_j^0} \right)}_{densification\ effect}$$

$$\left. + \left(\underbrace{\mathbf{A_m^0 L_n^0 \Delta q_j} + \mathbf{A_m^1 L_n^1 \Delta q_j}}_{composition\ effect} \right) \right] \Bigg\} \quad (14)$$

We can also calculate the import content by industry as follows:

$$\mathbf{ci^t} = \mathbf{i'A_m^t L_n^t} \quad (15)$$

where $\mathbf{ci^t}$ is a row vector of import content by industry.

In this case, the same decomposition can be applied. The distinction would be only because it is composed of the first three factors and, therefore, the component of the sector composition effect would not apply.

To explain further each part of the SDA that we are going to implement:

i) **direct effect:** captured by changes in the imported technical coefficients matrix ($\mathbf{A_m}$), measures the immediate variation in imports of inputs as a requirement to changes in output;

The following effects are related to changes in the output:

ii) **technology effect:** captured by changes in the total technical coefficient matrix (**A**), assesses the impact of changes in technical coefficients that reflect changes in the structure of intermediate demand. Therefore, any change in this structure in elements that are associated with greater import content will increase the total import content and *mutatis mutandis*; however, this effect is reduced by the fact that not all of the intermediate requirements of production are domestically produced.

iii) **densification effect:** captured by a change on the domestic component of the national technical coefficients (**Λ**), determines if the change in the structure of the intermediate demand actually affects domestic output. In other words, a positive contribution of the densification factor means that there was an increase domestic production of intermediate goods, but this newly domestically produced inputs lead to an increase in imported inputs to produce it. Therefore, as denser is the domestic linkages; the greater it might be the impact of the densification factor, even though the import technical coefficient decreased, because on might need to import in order to produce inputs.

iv) **composition effect:** captured by changes in the industry composition of the total final demand or of its components ($\mathbf{q_j}$), estimates how a change in the sectorial composition of the final demand might affect the direct or indirect demand of intermediate goods with different import content. A positive contribution means that the change in the composition was towards industries with a greater import content.

Database

The calculation of import intensity makes use of the database from the World Input-Output Database (WIOD) project. This database covers input-output matrices at the level of 56 economic activities for the

period 2000 to 2014 and provides data for 43 countries, including China, at the current dollar[5]. In the description of sectoral results, activities are grouped into 11 sectors according to the taxonomy developed by Torracca and Kupfer (2014)[6]. This classification stands out for pointing out the main activities regarding the intensity of technological flows, competition patterns, innovation and diffusion of new products and techniques; a) *Traditional industries* comprises production of low technological content goods, industries with few requirements of productive scale; production of wage goods, inputs, industrial parts and complements, and manufactured consumer goods; b) *agricultural commodities* includes industries intensive in natural resources and energy, and are generally associated with agribusiness and homogeneous products of high tonnage; c) *Industrial Commodities* comprehends natural resource intensive activities related to mineral extractive industry, metallurgy, and basic chemistry; and d) *Innovative industries* comprehends more sophisticated activities in terms of technology and organization of the production process.

3. Empirical evidence for the case of China

Since the 1990s, the world economy has entered into a new phase of globalization, known as hyperglobalization, characterized by the rapid growth in cross-border flows of goods, services and capital (ECLAC, 2016; Subramanian and Kessler, 2013). Among other aspects, a major driving force of hyperglobalization is the unbundled production, which implies that economies may specialize in specific tasks instead of products or industries. How each country specializes in specific stages of a production sequence is a particular dimension of inter-country production linkages, which is commonly presented as vertical specialization in trade. As GVCs have developed, a multiplicity of lead firm-supplier relations has taken place. Under a new scale of operations and increased technological sophistication, suppliers have established a new set of relations with lead-firms, which involves several degrees of investment, technical support, and long-term contracting and monitoring (Taglioni and Winkler, 2016).

China has emerged as a mega-trader in the process of hyperglobalization in terms of size and interconnectedness. In the past decades, China became an important hub in traditional trade and simple GVC networks through rapid industrial upgrading (Li, Meng and Wang, 2019). This not only reflects its rapid industrialization process and growing trade openness but also may suggest that China is rapidly catching up in terms of contribution to advanced countries' exports of high technology goods (Riad *et al*., 2012). In addition to industrial upgrading, the densification of production chains is a crucial aspect of the economic development process of a country in a world dominated by complex and fragmented production processes. Let us then consider that China`s economic growth can be divided into the export-oriented phase and the domestic demand-driven phase, with the Global Financial Crisis (GFC) as the main turning point (Meng et al., 2016)[7].

In the context of fragmented and internationally dispersed production networks, our key research questions are: how can we understand the changes in the Chinese industrial density in light of the transition from export-led to domestic demand-driven growth? In other words, how the recent change in China's national development strategy affected its dependence on imported final goods and inputs? And to what extent has the densification of the Chinese supply-chain occurred mainly in less technology-driven industries?

3.1 Import intensity for final demand and its components

The GFC is a milestone in the overall downward trend in import intensity of Chinese final demand and of each of its components (household consumption, investment, and exports). Before the outbreak of the global crisis, China has escalated its import intensity in line with that of East Asian countries[8] and the rest

[5] More details about Wiod database can be found in Dietzenbacher *et al.* (2013).
[6] The activity correspondence table can be found in the Appendix.
[7] According to the authors, government spending on domestic infrastructure was the main driver of China`s recovery from the GFC, together with other policies to stimulate domestic demand, such as increasing public sector wages and agricultural price subsidies.
[8] A group of countries composed by Japan, South Korea, and Taiwan.

of the world[9]. This movement was interrupted by the global crisis, with China decreasing its reliance on imported final and intermediate goods at the same time as deepening its importance on vertically integrated production networks. With that in mind, it is worth investigating how this process occurred in each component of China`s final demand, and whether it was not limited to exporting industrial segments.

Figures 1 and **2** show the import intensity of some East Asian countries and China, with the latter presenting an inverted "U" shape for total final demand and each of its components. We estimated that, despite a high import intensity ranging between 20 and 25 percent in the case of final demand, China's investments peaked close to 35 percent to then decline sharply and reach much lower levels (Figure 2) than during the first years of joining WTO.

Our findings show that the import intensity of investments is greater than that of exports and household consumption, respectively. With China's rebalancing away from exports-oriented toward consumption-led growth (Lee, Park and Shin, op. cit; Pei *et al*, 2015), and also with non-tradable services explaining a large part of household consumption, one may say that China is becoming increasingly less dependent on imports. According to our results, it should also be noted that the decrease in China's import intensity takes place for all components of final demand, including household consumption and investments. This means that, in addition to the ongoing reorientation of its pattern of economic growth towards domestic demand-driven growth, China's new normal illustrates a clear movement of producing domestically not only final goods but also parts and components for domestic production processes. That said, and taking into account the size of the Chinese economy, our findings are in line with Boz *et al* (2015) and IMF (2015)'s understandings about the Chinese impact on the current sluggish in world import growth.

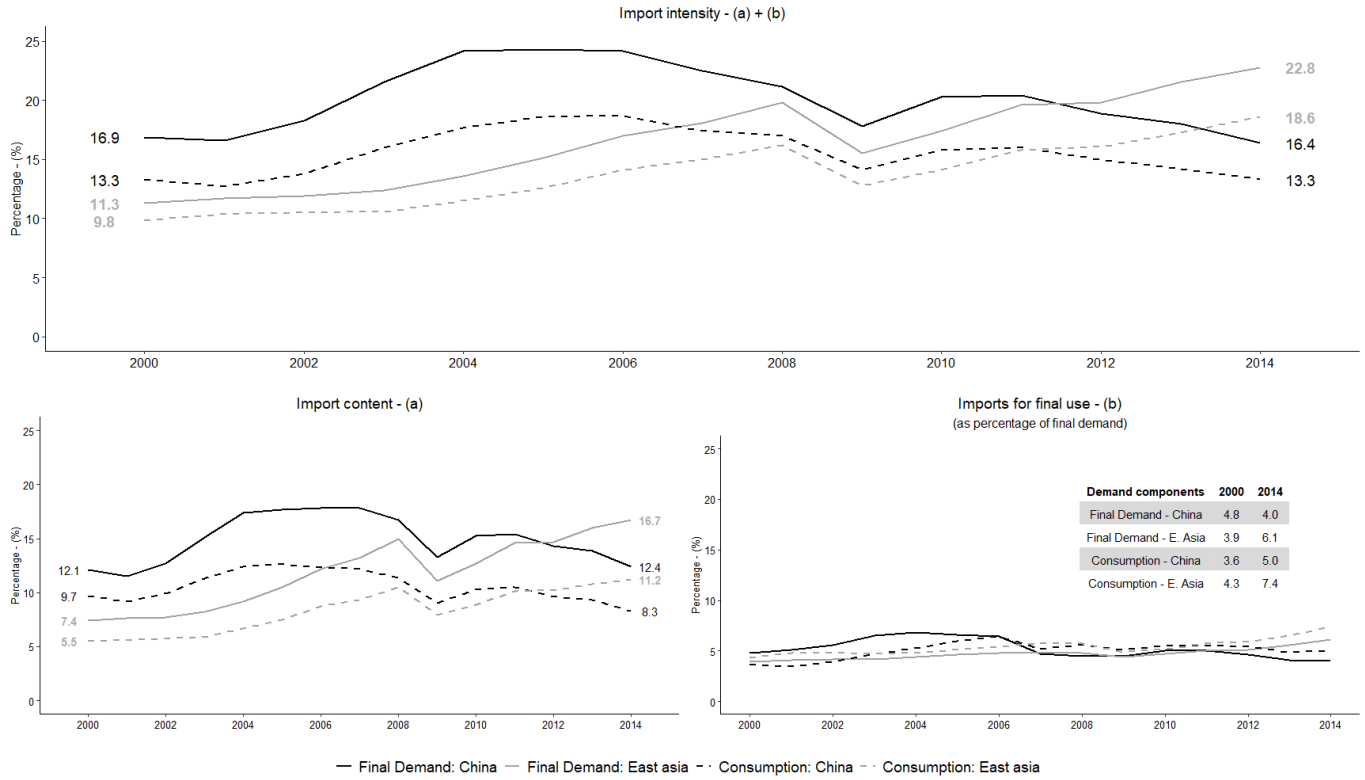
The case of the import intensity of China's exports, which in many cases can be seen as an index for participation in GVCs, reveals to a certain extent some aspects of its regional integration. For the Chinese economy, the level of import intensity of total final demand, household consumption and investment were higher than that in East Asian countries until 2011. From then on, East Asia becomes more import-intensive than the Chinese economy in each component of final demand. However, in the case of exports, there were signs of a greater dependence of imports in East Asian countries even before the global crisis, while China decreased its import intensity of exports and showed a sharp drop in its demand for foreign inputs (19.2% in 2008 to 14.4% in 2014). These findings support the notion that China has declined its role as the final point of Factory Asia and started to produce intermediate goods domestically that will later be processed and consumed or exported, as mentioned above.

More importantly, the ongoing movement of supply-chain densification, with less dependence on imported inputs and final goods and services, was not limited to the exporting industrial segments, as we found in a broader sense (import intensity) and, more specifically, related to intermediate goods and services (import content). It is important to further understand in which strategic industries China has advanced its domestic production of inputs and final goods. This subject will be analyzed in the next subsection.

It is important to call into attention that these indicators are affected by changes in relative prices of imports and each component of final demand. Two features impacted China's import intensity with mixed effects: exchange rate movements, the appreciation of the Yuan from 2005-2015, and the rise of commodity prices, which have a high share in the Chinese import basket. However, the tendency captured above is in accordance with the explicit objective of increasing the local production of intermediates, thus reducing the dependence on imported inputs, and the process of substituting imported goods for domestic ones as local production capabilities increase, as highlighted by Kee and Tang (2016).

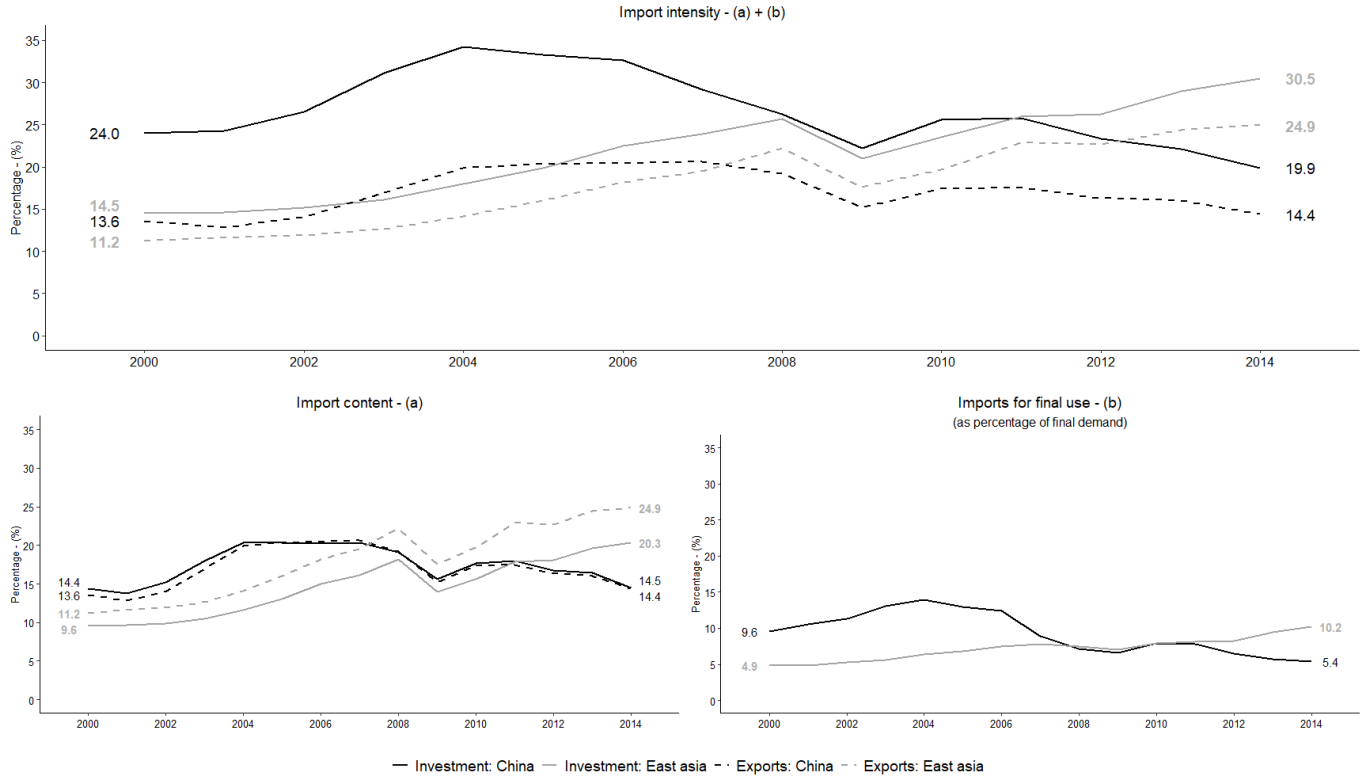
[9] A comparative study of import intensity among major economic blocs and countries, including China, can be found in Montanha (2019, chap. 3).

Figure 1 - Import intensity, import content, and imports for final use - final demand and household consumption, China and East Asia - (%)



Source: Own elaboration based on WIOD database. *Note: details on the values represented in Figures 1 and 2, see the Appendix (Tables A2 and A3).*

Figure 2 - Import intensity, import content, and imports for final use - investment and exports, China and East Asia - (%)



Source: Own elaboration based on WIOD database. *Note: for export there's no import content in the database.*

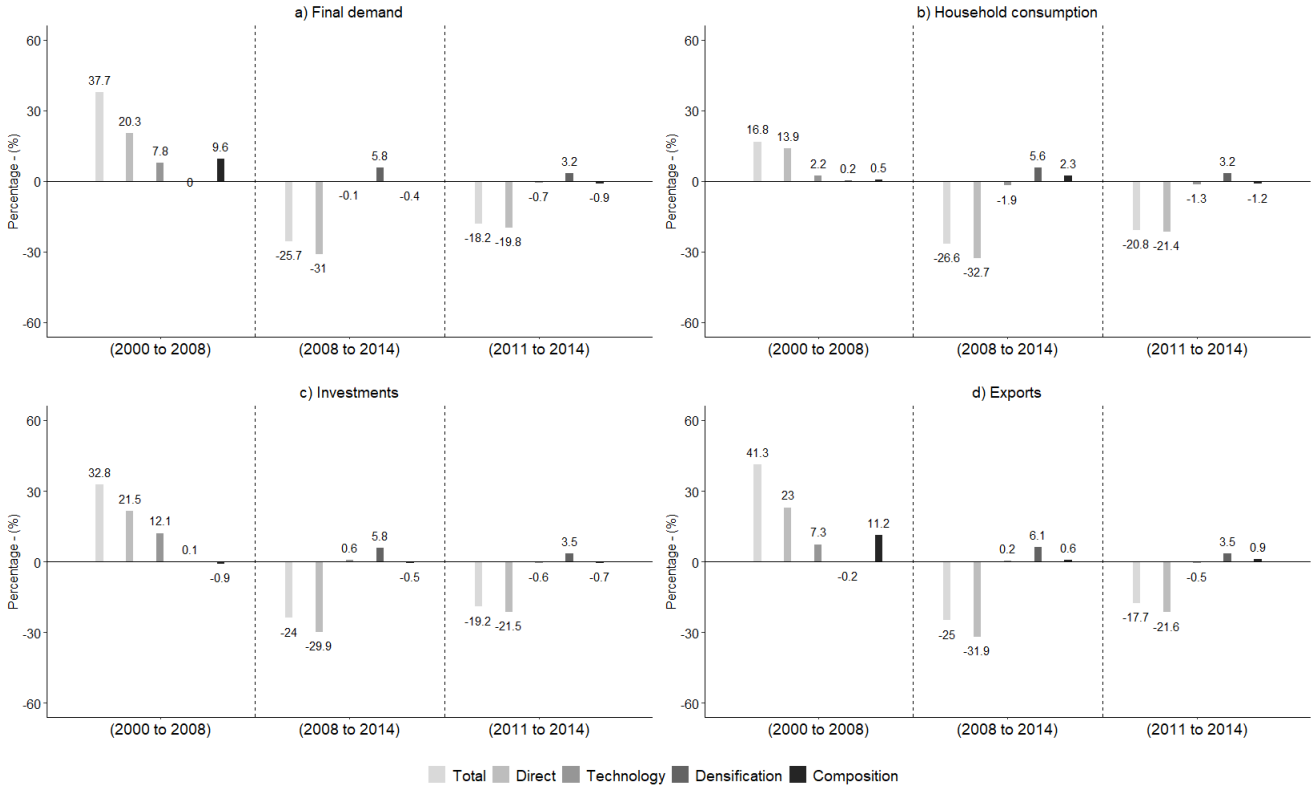
Considering the case of total final demand (Figure 1), we found that China's import intensity decreased from 21.1% to 16.4%, i.e. 4.7 pp. between 2008 and 2014. For its part, imports for final use's contraction was relatively smaller, only half a percentage point (from 4.5% in 2008 to 4.0% in 2014), compared to the import content related to intermediate goods and services. Timmer *et al* (2016) pointed that the Chinese import intensity has declined in the 2000s, with the "factor China" playing an important role, as the Chinese economy were moving towards services activities and started to produce domestically final goods that were previously imported. Our results are consistent with Timmer *et al* (2016)'s findings and add another important feature, as it is possible to show that such movement runs simultaneously and at a greater pace in the case of intermediate goods and services in the post-GFC period.

To further understand this trajectory, we provide a structural decomposition exercise of China's import content. Between 2008 and 2014, China's import content of final demand decreased 25.7%, and it was mainly driven by direct effects (-31,0 pp) (**Figure 3a**).

Especially important to our purposes, China's production chain has increased the degree of industrial density, which is seen by a positive densification factor along this period. In this sense, the densification factor reduced the rate at which the import content declined. Although it might sound counterintuitive, a positive contribution of the densification factor means that there is an increase in imported inputs related to the new domestic produced intermediate goods. Therefore, as denser is the domestic linkages, the greater it might be the impact of the densification factor, even though the import content decreased. To give an example, suppose that China produces the same product in two different time steps, with all its inputs being imported at time 0. A negative direct effect on the import content means that China started to produce some of its components domestically at time 1. However, if those components have some imported inputs, the densification factor would be positive, since China will have to import other inputs to produce the components that are domestically produced at time 1.

For the same period (2008-2014), the structural decomposition exercise showed a similar pattern when comparing the different components of final demand. As can be seen in Figure 3, the downturn of the import content occurs in a similar way for all components of final demand, and, in fact, this pattern remained in the most recent period of 2011-2014, in contrast to the one from the period before the GFC.

Figure 3 - Growth rate of China's import content, according to structural effects - (%)



Source: Own elaboration based on WIOD database.

Similar exercises of structural decomposition are provided by Timmer et al. (2016). Based on WIOD database, the authors have constructed a structural decomposition model for the import intensity of global demand (both intermediate and final goods and services) that is comprised of two factors: i) international production fragmentation, and ii) changes in final demand. Put it differently, the first factor accounts for changes in GVCs, and the second factor accounts for changes in final demand structures. Their findings show that both factors had similar importance after the global crisis. Overall, the halt in cross-border dispersion of components of production processes and changes in the participation of activities in final demand were pointed out as relevant factors for the decline in the Chinese import intensity in recent years. More specifically, services activities begin to represent an increasing share in final demand, diminishing the Chinese import content.

Despite the differences between both structural decomposition exercises, the ongoing decrease of Chinese import content in recent years could be explained by the increase of parts and components being produced domestically. In short, import substitution seems to be the main driver for the fall in China's import content for each component of final demand. First, a major decrease in the role played by imported inputs was responsible for that decline, as reported by the sharp drop in direct effect, as discussed here (-31% between 2008 and 2014, in the case of final demand). That said, it could not only reflect a brief stalling of the international production fragmentation but rather a far more reaching process. Second, our results show only a mild role for changes in the sectoral share of final demand (composition effect). For instance, in the case of exports, its composition effect had a positive effect only in the first period analyzed (11.2 pp between 2000 and 2008), which means that the share of products with a higher import content of intermediate products increased in the composition of exports. For the second period, only household consumption seems to have a relevant composition effect of (2.3 pp), which might be related to the change in the consumption basket (Woetzel *et al*., 2017; Meng *et al*., 2016).

3.2 Empirical evidence at industry-level

The Chinese import intensity at the industry-level follows two distinct patterns, with the GFC as the main dividing point. Figure 4 illustrates the trajectory of China`s import content and imports for final use by industry-level for selected years. Overall, in the post-GFC period, there was a strong reduction in imports for final use, following the development previously identified as "China-factor" (Timmer *et al*, 2016). Although, in the case of traditional industries we found a stable trajectory and even a slight increase in the imports for final use in the case of *agriculture, trade* and *utilities*. Such increases are considered small when compared to the observed decrease in the import content. In the case of intermediate goods and services, we found a widespread increase in China's import content between 2000 and 2008, while experienced a sharp drop from 2008 to 2014. More interestingly, in the case of intermediate demand, we found that the GFC seems to have accelerated an ongoing process of decreasing China`s import content across all industries (Table A4 of the Appendix). We will then discuss in more detail the results for the case of *industrial commodities (IC), traditional industries (TI),* and *innovative industries (II)*.

The IC group consists of industries that generally depend on mining and includes some manufacturing industries such as basic metals, rubber and plastics products, chemicals and coke and refined petroleum products. China is highly dependent on imports of such goods. We found an increase of 17 pp (from 31.5% to 49.2%) between 2000 and 2008 of IC's import intensity. One must consider that throughout the 2000s, especially until the GFC, these goods experienced a sharp increase in their international prices. Even though the increase in China's import content, up to some extent, reflects the upward prices' movement, it should be noted that price changes do not explain the entire picture. China greatly increased its dependence on raw materials and industrial commodities during the first decade of the 21st century. For instance, China's oil consumption was fueled by the big boost of heavy industry during this period, such as metallurgy, cement, aluminum, electricity, and chemicals, and turned China into the largest producer of energy-intensive goods. Along with the innovative industry, IC showed the greatest increase in the import content in the pre-GFC period. Over the post-GFC period, IC's import intensity decreased around 18.4 pp (Figure 1a and 1b), with a sharper fall in imports for final use (14.5 pp) than that of import content. In that sense, the "China effect"

mentioned above was noticeable, with China producing a larger share of final goods and importing gross raw materials, aiming at future local processing.

Traditional industries (TI) are considered labor-intensive activities that require less technological content in their production process. TI`s import intensity followed the general pattern portrayed in this research, that is, an increase over the 2000s, with the GFC as a turning point. It might worth noting that TI's import intensity levels are considerably low compared to CI and II's (considering the year of 2000, for example, we found that TI's was 16% compared to 31.5% and 42.8%, respectively). Between 2000 and 2008, TI's import intensity increased by 3.5 pp, which was mainly explained by the increase in imports for final use (2.2 pp)[10]. Between 2008 and 2014, TI's import intensity has reduced by 3.2 pp, considering a surprising positive variation of its imports for final use (0.4pp) and a negative contribution of its import content (-3.6pp).

TI's level of import intensity remains almost the same throughout the entire analyzed period, as one my find opposite contributions of intermediate and final goods. More specifically, a notable feature was the contribution of a negative variation in the import content to the import intensity in the post-GFC period and not of imports for final use (from 7.3 in 2008 to 7.7 in 2014). Surprisingly, such behavior was not found in the case of the other two industries. This picture can be consistent with China's offshoring part of its production of lower unit value goods to lower-wage countries along the Mekong River valley, especially Vietnam, Laos, and Cambodia (Pinto, 2015). Since the onset of the GFC, Chinese wages have increased faster than almost all other major economies (Wei *et al*., 2016). Facing rising labor costs and competitive pressures, we have seen developing countries in Southeast Asia engaging as producers of final goods of traditional industry, especially textiles, footwear, and assembly factory.

Technology-intensive industries are responsible for the production of more sophisticated goods and services. Such industries require a higher level of technological development, with basic infrastructure for research and development (R&D) and qualified labor. For this reason, they are configured as the industries of greatest technological sophistication and are grouped in the so-called "innovative industry" (II). We identified II with the highest import intensity throughout the analyzed period, although it also showed the greatest variation over time. For instance, between 2000 and 2006, the import intensity increased by almost 20 pp, while its import intensity decreased by almost 30 pp between 2006 and 2014. It is worth noting that this significant increase in the pre-GFC period was driven exclusively by intermediate goods and services, and the imports for final use even showed a negative variation. In the post-GFC period, the II experienced the largest reduction in the import content among all the industries analyzed (-6.7 pp).

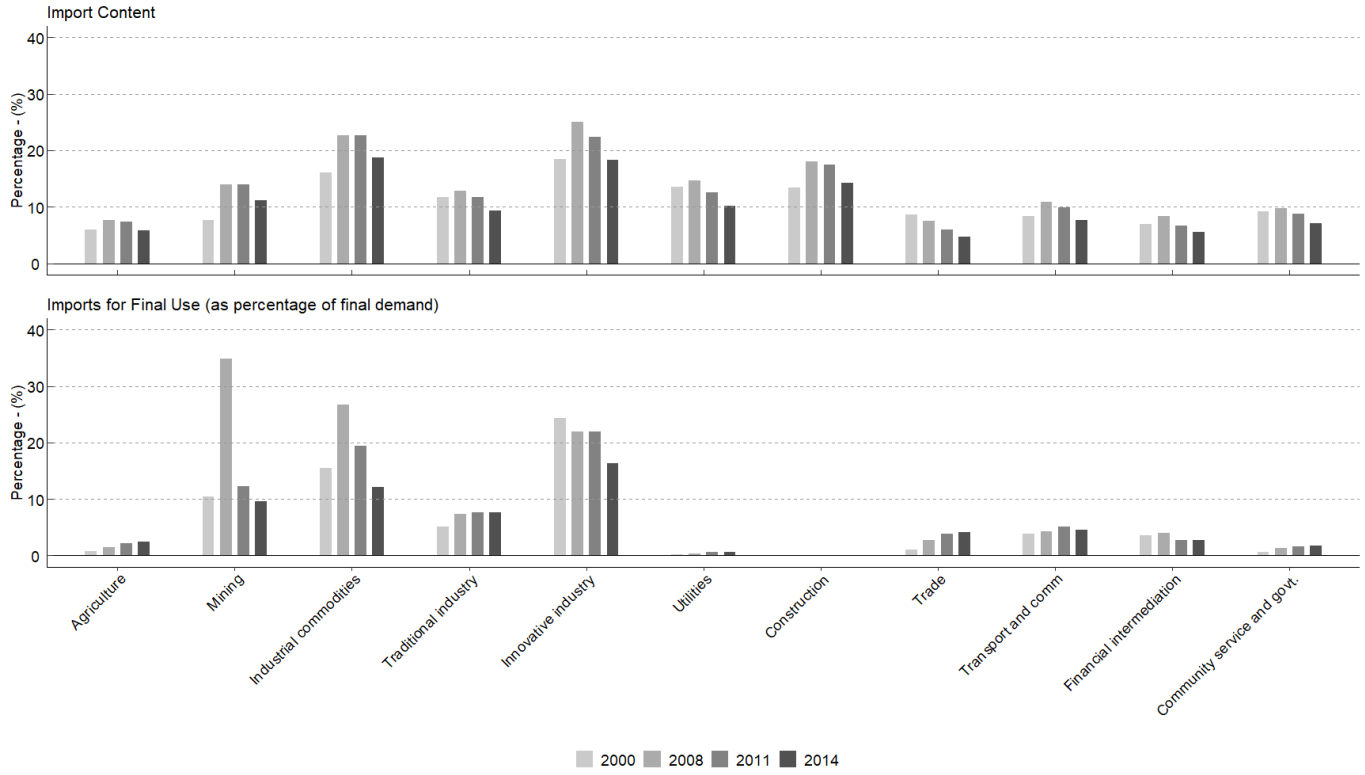
Let us bear in mind that this general picture illustrated by Figure 4 is influenced by a number of factors, including the economic policies of the Chinese government. Alon *et al*. (2012) call attention to the "Going Global" strategy, launched in 1999, right before the country joined the WTO in 2001. The strategy was a major political initiative aiming to internationalize and increase the Chinese state-owned enterprises in number and size. In such a frame, the firms enjoyed a range of governments' benefits, such as information sharing networks, domestic tax breaks, cheap land, and low-interest rate funding from state-owned banks. Further, these authors pointed out that the Chinese government internationalizes their firms in order to improve competitiveness in their own domestic market, since the internationalization supports scale economy gains, improve technological and managerial skills, and provide new sources of raw materials and distribution networks.

In the post-GFC period, it is also possible to identify changes in the Chinese economic policies that may have impacted the trajectory of their import intensity. As discussed by Yang and Stoltenberg (2014), the GFC led the Chinese government to rethink the pros and cons of Chinese insertion into the global economy. Essentially, the authors argued that the Chinese government moved towards a greater set of fiscal stimuli as China`s exports dropped. One of the main objectives of this new economic orientation was to reduce China`s reliance on exports and to develop western China, while uplifting domestic consumption to improve citizens' quality of life, as well as, increasing energy efficiency and environmental protection. Yet, it could be set forth that the GFC and the subsequent decline of world demand stirred the Chinese growth

[10] Further details on the values of the indicators of import intensity, import coefficient and import content are described in detail in the Appendix.

vector towards their domestic market. In a nutshell, these goals pointed to a greater role of China`s domestic market, with an emphasis on technological advancement and indigenous innovation. This could be achieved through the promotion of large public-funded construction projects and investments in science and technology. In 2015, the Chinese government launched the 'Made in China 2025' (MIC2025) initiative, revealing an ambitious plan to guide China's industrial modernization and lessening its dependency on imported technology. In light of these developments, China's supply-chain densification may have been a crucial step towards the next phase of Chinese insertion into the global economy through the internationalization of Chinese companies, and more importantly, to the ongoing emergence of Chinese brands into international markets.

Figure 4 - Import content and imports for final use, China at industry-level (%)



Source: Own elaboration based on WIOD database.

To investigate in greater detail the extent to which the densification of the Chinese supply chain structure occurred in more or less complex economic activities, we developed an exercise of structural decomposition regarding the import content by industry. Table 1 shows that the industries with the greatest positive variation in the import content during the pre-GFC period were IC and II, both with 6.6 pp, followed by mining and construction. It is worth noting that, in the case of IC, the direct effect played a more important role than in the case of innovative industries (6.0 pp out of 6.6 pp compared to 4.8 pp out of 6.6 pp). This means that there was a greater immediate variation in the import of intermediate goods and services as a requirement for an effective increase in domestic production to occur. In addition, in the pre-GFC period, the innovative industry had a technology effect of almost 2.0 pp, indicating a possible change in the technical coefficient matrix, that is, a greater use of inputs with an import content higher than the average of domestic production.

The case of the innovative industry draws attention: considering a variation of its import content of -6.7 pp between 2008 and 2014, we have a positive variation of the densification effect of 1.8pp. and a negative direct effect of 8.6 pp. These combined effects are a strong indication that the country has advanced in the supply chain stages of technology-oriented industries, domestically producing a greater share of the parts and components that were previously imported and which will be processed later. That is, increasing the degree of densification of its productive structure, especially in chains of greater technological

sophistication. It is worth noting that the densification of Chinese production chains can also be seen in other industries, but this process gains greater magnitude in the case of innovative industries.

In light of the reality of GVCs, the supply-chain densification of knowledge-intensive intermediates may have been a fundamental step towards the internationalization of Chinese companies in a competitive international market. By increasing in-house production of technologically sophisticated components, China is overcoming traditional competitive advantages that used to be the foundation of international competitiveness.

Table 1 - Structural decomposition of import content by industry, China - percentage point (pp)

	From 2000 to 2008				From 2008 to 2014				From 2011 to 2014			
	Total	Direct	Technology	Densification	**Total**	Direct	Technology	Densification	**Total**	Direct	Technology	Densification
Agriculture	**1,8**	1,5	0,3	-0,1	**-1,9**	-2,4	0,1	0,4	**-1,6**	-1,8	0,0	0,3
Mining	**6,3**	4,5	1,9	-0,2	**-2,7**	-3,5	0,0	0,7	**-2,9**	-3,2	-0,2	0,5
Industrial commodities	**6,6**	6,0	0,8	-0,2	**-3,9**	-5,5	0,6	1,0	**-4,0**	-5,2	0,4	0,8
Traditional industries	**1,2**	0,3	0,7	0,2	**-3,6**	-4,1	-0,2	0,6	**-2,4**	-2,7	0,0	0,4
Innovative industries	**6,6**	4,8	1,9	-0,1	**-6,7**	-8,6	0,1	1,8	**-4,1**	-4,6	-0,3	0,8
Utilities	**1,0**	2,7	-1,4	-0,3	**-4,4**	-4,8	-0,5	0,9	**-2,3**	-2,3	-0,4	0,4
Construction	**4,6**	2,5	2,0	0,1	**-3,8**	-4,9	0,2	0,9	**-3,3**	-3,9	0,0	0,6
Trade	**-1,2**	0,3	-1,5	0,0	**-2,8**	-2,6	-0,6	0,4	**-1,3**	-1,2	-0,2	0,2
Transport and comm	**2,6**	1,8	0,8	0,0	**-3,2**	-3,6	-0,3	0,7	**-2,2**	-2,1	-0,4	0,3
Financial intermediation	**1,3**	1,1	0,3	0,0	**-2,8**	-2,9	-0,4	0,5	**-1,1**	-1,2	-0,1	0,2
Serv. community and govt.	**0,6**	1,1	-0,5	0,0	**-2,8**	-3,1	-0,3	0,5	**-1,8**	-1,8	-0,2	0,3

Source: Own elaboration based on WIOD database.

4. Concluding remarks

This paper contributes to the current characterization of the productive density of a given country in a way that is not limited to a proxy of GVC participation. We argued that a narrow focus on the GVC literature has resulted in a misleading picture of supply-chain densification through GVC participation indicators. By measuring the import intensity and applying an exercise of structural decomposition of the import content, this paper adds evidence regarding how the loss or gain of industrial density occurs for each component of final demand and how this phenomenon occurred at industry-level, going beyond its application to the Chinese case.

Bearing in mind that the process of productive densification is illustrated by the greater involvement of local actors (companies and workers) in value chains, this may mean, in some cases, that carrying out activities with lower value-added on a larger scale can ensure a country's greater domestic value-added, as pointed out by Taglioni and Winkler (2016). But this does not seem to be the main feature of the densification process of Chinese production chains, as we have discussed. Put simply, our results indicated that China has promoted the supply-chain densification of intermediate inputs over the post-GFC period, especially of high-technology oriented industries, while fostering domestic demand for final and intermediate goods and services produced domestically. This means that strengthening local actors' productive links was consistent with the development strategy of reducing Chinese dependence on imported inputs, increasing intermediate goods and services produced domestically, and spurring China`s local production importance in innovative industries. Furthermore, if the loss of industrial density can affect a country's innovative capacity, as argued by Berger (2013), this may not be a concern in the case of the Chinese economy.

China has reoriented its growth pattern towards its domestic market, taking advantage of its large scale as well as recent changes in Chinese consumption patterns. In the midst of the world trade slowdown, we investigated how productive densification was related to the components of final demand other than exports. In the case of exports, comparing the trajectory of China's import intensity to that of East Asian countries, our results indicated that, even before the GFC, China has acted less and less as the final point of Factory Asia. Furthermore, China's decreasing import intensity takes place for all components of final

demand, including household consumption and investments. Thus China's "new normal" illustrates a clear movement of producing domestically not only final goods but also parts and components for further domestic processing.

The structural decomposition exercise of China`s import content showed a sharp drop in the direct effect, which means that the decline in imported inputs played a significant role in China`s decreasing import content in the post-GFC period. Besides that, the densification factor had a positive contribution during the post-GFC period, and this occurred in a similar way for different components of demand. This means that, as the production chain has increased its degree of industrial density, there was an increase in imported inputs related to the new domestic produced intermediate goods. These results led us to seek to understand in which strategic industries China has advanced its domestic production of inputs.

Both innovative industries and industrial commodities' import content showed the largest increases over the pre-GFC period. In the case of the former, we identified the highest levels of import intensity as well as the largest changes between 2000 and 2014. Considering intermediate goods and services, the innovative industries' import content showed the largest drop over the post-GFC period. The China-effect was more visible in the case of industrial commodities, with a sharp fall in the degree of imports for final use in the post-GFC. Traditional industries, on the other hand, showed the lowest levels of import intensity and, more interestingly, we showed that the recent decline in the import content was not followed by that of imports for final use. This picture may reflect the ongoing internationalization process of lower-added stages to lower-wages countries over the East Asian region.

Last but not least, our structural decomposition exercise at industry-level adds evidence to China's cross-industries process of deepening industrial densification, especially with China advancing in supply chain stages of technology-oriented industries. This analysis provides a rich basis for future research on how supply-chain densification of knowledge-intensive intermediates could entail a broader internationalization of Chinese companies in competitive international markets; we hypothesize that lowering China's dependency on imported inputs will positively affect technological advancement and indigenous innovation. Finally, we consider that the development of local supplier bases and the formation of industrial linkages in complex GVCs that engage various local actors are crucial in terms of growth and international competitiveness in subsequent periods.

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Appendix

Table A1. Correspondence between industry description level 11 and level 56 (WIOD database)

Industry Description - level 11	Industry Code	Industry Description - level 56
Agriculture	A01	Crop and animal production, hunting and related service activities
	A02	Forestry and logging
	A03	Fishing and aquaculture
Mining	B	Mining and quarrying
Industrial commodities	C19	Manufacture of coke and refined petroleum products
	C20	Manufacture of chemicals and chemical products
	C22	Manufacture of rubber and plastic products
	C23	Manufacture of other non-metallic mineral products
	C24	Manufacture of basic metals
	C25	Manufacture of fabricated metal products, except machinery and equipment
Traditional industry	C10-C12	Manufacture of food products, beverages and tobacco products
	C13-C15	Manufacture of textiles, wearing apparel and leather products
	C16	Manufacture of wood and of products of wood and cork
	C17	Manufacture of paper and paper products
	C18	Printing and reproduction of recorded media
	C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
	C31_C32	Manufacture of furniture; other manufacturing
Innovative industry	C26	Manufacture of computer, electronic and optical products
	C27	Manufacture of electrical equipment
	C28	Manufacture of machinery and equipment n.e.c.
	C29	Manufacture of motor vehicles, trailers and semi-trailers
	C30	Manufacture of other transport equipment
	C33	Repair and installation of machinery and equipment
	D35	Electricity, gas, steam and air conditioning supply
Utilities	E36	Water collection, treatment and supply
	E37-E39	Sewerage; waste collection, treatment and disposal activities
Construcion	F	Construction
Trade	G45	Wholesale and retail trade and repair of motor vehicles and motorcycles
	G46	Wholesale trade, except of motor vehicles and motorcycles
	G47	Retail trade, except of motor vehicles and motorcycles
	I	Accommodation and food service activities
Transport and comm	H49	Land transport and transport via pipelines
	H50	Water transport
	H51	Air transport
	H52	Warehousing and support activities for transportation
	H53	Postal and courier activities
	J58	Publishing activities
	J59_J60	Motion picture, video and television programme production, programming and broadcasting activities
	J61	Telecommunications
Financial intermediation	J62_J63	Computer programming, consultancy and related activities; information service activities
	K65	Insurance, reinsurance and pension funding, except compulsory social security
	K66	Activities auxiliary to financial services and insurance activities
	L68	Real estate activities
	M69_M70	Legal and accounting activities; activities of head offices; management consultancy activities
	M71	Architectural and engineering activities; technical testing and analysis
	M72	Scientific research and development
	M73	Advertising and market research
	M74_M75	Other professional, scientific and technical activities; veterinary activities
	N	Administrative and support service activities
	K64	Financial service activities, except insurance and pension funding
Community service, govt.	O84	Public administration and defence; compulsory social security
	P85	Education
	Q	Human health and social work activities
	R_S	Other service activities
	T	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use
	U	Activities of extraterritorial organizations and bodies

Source: Own elaboration based on Torracca and Kupfer (2014).

Table A2: Import intensity, import content and imports for final use, for demand components, China - (%)

Years	Import intensity (C = A + B)				Import content (A)				Imports for final use (B)			
	Final Demand	Household consumption	GFCF	Exports	Final Demand	Household consumption	GFCF	Exports	Final Demand	Household consumption	GFCF	Exports
2000	16,9	13,3	24,0	13,6	12,1	9,7	14,4	13,6	4,8	3,6	9,6	-
2001	16,7	12,8	24,3	12,8	11,5	9,2	13,8	12,8	5,1	3,5	10,5	-
2002	18,3	13,8	26,6	14,0	12,7	9,9	15,2	14,0	5,6	3,9	11,3	-
2003	21,6	16,0	31,1	17,0	15,1	11,3	18,0	17,0	6,5	4,7	13,1	-
2004	24,2	17,7	34,2	19,9	17,4	12,4	20,3	19,9	6,8	5,3	13,9	-
2005	24,2	18,5	33,4	20,3	17,7	12,6	20,3	20,3	6,6	6,0	13,0	-
2006	24,2	18,7	32,6	20,4	17,8	12,3	20,2	20,4	6,4	6,4	12,4	-
2007	22,5	17,4	29,2	20,6	17,8	12,2	20,3	20,6	4,7	5,2	8,9	-
2008	21,1	17,0	26,3	19,2	16,7	11,4	19,1	19,2	4,5	5,6	7,2	-
2009	17,8	14,1	22,2	15,2	13,3	9,0	15,6	15,2	4,5	5,1	6,6	-
2010	20,3	15,8	25,5	17,4	15,3	10,3	17,7	17,4	5,0	5,5	7,9	-
2011	20,5	16,1	25,7	17,5	15,4	10,5	18,0	17,5	5,0	5,5	7,8	-
2012	18,9	15,0	23,3	16,3	14,3	9,6	16,8	16,3	4,6	5,4	6,5	-
2013	18,0	14,2	22,1	16,0	13,9	9,3	16,4	16,0	4,1	4,9	5,7	-
2014	16,4	13,4	19,9	14,4	12,4	8,3	14,5	14,4	4,0	5,0	5,4	-

Source: Own elaboration based on WIOD database.

Table A3: Structural decomposition for components of demand, China - percentage point (pp)

	Periods	Total	Direct	Technology	Densification	Composition
Final demand	(2000 to 2008)	4,6	2,5	0,9	0,0	1,2
	(2008 to 2014)	-4,3	-5,2	0,0	1,0	-0,1
	(2011 to 2014)	-3,0	-3,3	-0,1	0,5	-0,1
Household Consumption	(2000 to 2008)	1,6	1,4	0,2	0,0	0,0
	(2008 to 2014)	-3,0	-3,7	-0,2	0,6	0,3
	(2011 to 2014)	-2,2	-2,3	-0,1	0,3	-0,1
GFCF	(2000 to 2008)	4,7	3,1	1,7	0,0	-0,1
	(2008 to 2014)	-4,6	-5,7	0,1	1,1	-0,1
	(2011 to 2014)	-3,5	-3,9	-0,1	0,6	-0,1
Exports	(2000 to 2008)	5,6	3,1	1,0	0,0	1,5
	(2008 to 2014)	-4,8	-6,1	0,0	1,2	0,1
	(2011 to 2014)	-3,1	-3,8	-0,1	0,6	0,2

Source: Wiod database, own elaboration

Table A4: Import content, imports for final use and import intensity by industry-level, China (2000-2014) - (%)

Sectors	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Import Content (A)															
Agriculture	5,9	5,7	6,3	7,4	8,2	8,3	8,2	8,1	7,6	6,1	7,1	7,3	6,7	6,4	5,8
Mining	7,6	7,5	8,3	10,3	12,6	13,9	14,1	14,5	13,9	11,9	13,6	14,0	13,1	12,5	11,1
Industrial commodities	16,0	14,9	16,1	19,3	22,6	23,2	23,2	23,3	22,6	18,7	21,7	22,7	21,5	20,9	18,7
Traditional Industry	11,7	11,2	12,0	13,5	14,9	14,7	14,5	14,2	12,9	10,2	11,6	11,7	10,5	10,2	9,3
Innovative Industry	18,4	17,4	18,9	22,7	25,7	26,2	26,4	26,9	25,0	20,1	22,5	22,4	21,0	20,5	18,3
Utilities	13,6	12,9	13,9	16,0	17,8	17,4	16,8	15,9	14,6	11,4	12,6	12,5	11,7	11,3	10,2
Construction	13,4	13,0	14,5	17,0	19,0	18,8	18,8	18,9	18,0	14,8	17,0	17,5	16,4	16,0	14,2
Trade and comm	8,7	7,8	7,9	8,4	8,8	7,4	7,7	8,3	7,5	5,8	6,2	6,0	5,4	5,2	4,7
Transport	8,4	8,3	9,2	10,8	12,4	13,5	12,8	11,9	10,9	8,7	9,8	9,9	9,1	8,7	7,7
Financial intermediation	7,0	7,1	8,2	9,4	10,7	11,6	10,3	9,3	8,3	6,2	6,7	6,6	6,1	5,9	5,5
Community services and govt.	9,2	8,2	8,1	9,3	10,4	10,6	10,5	10,8	9,8	7,8	8,7	8,8	8,0	7,7	7,1
Imports for final use (B)															
Agriculture	0,7	0,7	0,8	0,9	0,9	1,1	1,3	1,3	1,4	1,7	2,0	2,1	2,3	2,3	2,4
Mining	10,5	10,3	15,4	20,3	27,4	30,2	46,2	17,4	34,8	30,0	29,3	12,3	11,3	10,8	9,6
Industrial commodities	15,5	16,6	18,2	22,6	20,3	21,6	22,7	20,6	26,7	18,6	20,2	19,4	17,2	13,4	12,1
Traditional Industry	5,1	5,2	5,4	6,5	7,9	8,9	9,6	7,7	7,3	6,9	7,4	7,7	7,2	6,9	7,7
Innovative Industry	24,4	26,8	29,7	34,4	36,3	34,6	35,5	27,3	21,9	19,9	22,7	22,0	19,0	16,6	16,4
Utilities	0,2	0,2	0,3	0,2	0,2	0,2	0,2	0,2	0,3	0,5	0,6	0,6	0,7	0,6	0,6
Construction	0,0	0,0	0,0	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,0	0,0	0,0	0,0	0,0
Trade and comm	1,1	1,3	1,7	2,0	2,3	2,8	2,9	2,8	2,8	3,1	3,8	3,8	4,0	3,9	4,1
Transport	3,9	3,8	4,1	4,1	4,4	3,2	3,7	3,8	4,3	4,4	4,8	5,1	5,0	4,6	4,5
Financial intermediation	3,6	3,4	4,1	3,7	3,8	4,6	4,3	3,8	4,0	3,1	2,5	2,8	2,7	2,6	2,8
Community services and govt.	0,6	0,6	0,7	0,8	1,0	1,8	1,8	1,1	1,3	1,3	1,4	1,6	1,7	1,8	1,7
Import intensity (C = A + B)															
Agriculture	6,5	6,4	7,0	8,3	9,2	9,3	9,4	9,4	9,0	7,9	9,1	9,4	9,0	8,6	8,1
Mining	18,1	17,8	23,6	30,7	40,1	44,0	60,3	31,9	48,7	41,9	42,9	26,3	24,4	23,3	20,8
Industrial commodities	31,5	31,5	34,3	41,8	42,9	44,8	45,9	43,9	49,2	37,2	41,9	42,1	38,7	34,3	30,8
Traditional Industry	16,7	16,4	17,4	20,0	22,8	23,6	24,0	21,9	20,2	17,1	19,0	19,4	17,6	17,2	17,0
Innovative Industry	42,8	44,2	48,6	57,1	62,0	60,9	61,9	54,3	47,0	40,0	45,2	44,4	40,0	37,1	34,7
Utilities	13,8	13,1	14,2	16,3	18,0	17,6	17,0	16,2	14,9	11,9	13,2	13,1	12,4	11,9	10,7
Construction	13,4	13,1	14,6	17,1	19,1	18,8	18,9	19,0	18,0	14,9	17,0	17,5	16,4	16,1	14,2
Trade and comm	9,9	9,1	9,7	10,3	11,0	10,2	10,6	11,1	10,3	9,0	9,9	9,8	9,4	9,1	8,8
Transport	12,3	12,1	13,3	14,9	16,8	16,7	16,5	15,7	15,2	13,0	14,5	15,0	14,0	13,3	12,2
Financial intermediation	10,6	10,5	12,3	13,1	14,5	16,2	14,6	13,1	12,3	9,3	9,1	9,4	8,8	8,4	8,2
Community services and govt.	9,8	8,8	8,9	10,1	11,4	12,4	12,3	11,9	11,2	9,1	10,1	10,4	9,7	9,5	8,7

Source: Own elaboration based on WIOD database.