

**SERVICES VALUE ADDED IN EXPORTS: A COMPARATIVE ANALYSIS
BETWEEN BRAZIL AND THE UNITED KINGDOM FROM 2000 TO 2014**

PPGE – UFJF

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2021

JOYCE APARECIDA GUIMARÃES SILVA

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Dissertation Project presented by academic Joyce Aparecida Guimarães Silva to the Post-Graduate Program in Economics at the Federal University of Juiz de Fora, for qualification process, under the orientation of Prof. Dr. Fernando Salgueiro Perobelli.

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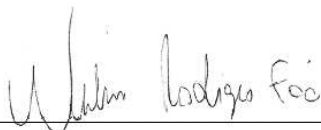
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Resumo: Nos últimos anos observa-se um aumento do setor de serviços nos países e essa expansão tem sido acompanhada por um aumento nas transações de serviços internacionais. Dessa forma, o objetivo principal deste trabalho é mensurar o valor adicionado de serviços nas exportações do Brasil e do Reino Unido no período entre 2000 a 2014, além de realizar uma análise comparativa, a fim de identificar o papel dos serviços nas economias de forma sistêmica. Os resultados obtidos indicam uma diferença nítida entre os países analisados no que diz respeito às exportações do setor de serviços, enquanto para o Brasil o setor pode ser considerado como insumo intermediário para as exportações dos setores de não-serviços, para o Reino Unido, como “produto” final exportado. Além disso, conclui-se que o setor de serviços vem ganhando espaço e importância para a economia brasileira, indicando um potencial latente do setor em promover o crescimento econômico do país e, por isso, não pode ser tratado como agente secundário pelas políticas públicas de desenvolvimento.

Palavras-Chave: Insumo-Produto; Valor Adicionado; Exportações; Serviços

Abstract: In the last few years, it is observed a rise in the service sector in countries and an increase in international services transactions has accompanied this expansion. Thus, the main objective of this work is to measure the services value added in exports from Brazil and the United Kingdom, from 2000 to 2014, and do a comparative analysis to identify the role of services systemically. The results indicate a clear difference among the countries analysed with regard to exports in the service sector, while for Brazil the sector can be considered as an intermediate input for exports from the non-service sectors; to the United Kingdom, as final exported product. Also, it is concluded that the service sector has been gaining space and importance for the Brazilian economy, indicating a latent potential of the sector in promoting the country's economic growth and, therefore, cannot be treated as a secondary player by public policies of development.

Key-words: Input-Output; Added Value; Exports; Services

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1. Introduction

In almost all countries, the services sector has been growing and, as pointed by Cuadrado-Roura (2013a), this expansion has been accompanied by an increase in international services transactions. The share of services exports in total exports is rising faster than the share of goods exports (MASHAYEKHI *et al.*, 2017). This increase is linked with economic growth and economic development, as the expansion in trade in services contributes to poverty reduction (CERNAT, 2017; CATTANEO *et al.*, 2010), as it is a catalyst for job creation in developing countries (CLEELAND, 2017; OECD; WTO, 2017). Furthermore, the services trade is related to exports diversification and the role of the sector as inputs to goods' production (OECD; WTO, 2017).

One aspect of the observed increase in services international transactions is the production fragmentation process, which inflates the presence of the services in manufacturing production as the outsourcing fragmentation provides an increase in the demand of the firms' sector. In this way, there are more services been traded than the gross exports statistics show, once these do not consider the indirect services traded (BOHN; BRAKMAN; DIETZENBACHER, 2018). Hence, the analysis in terms of value added for services trade is important and highlights the interdependence among sectors, as advertised by Fan and Yang (2016); and Marshall and Wood (1995). Accordingly, the manufacture and services are mutually interdependent, and trade in goods and services is more connected.

In line with this, it is observed that the share of the service sector in international trade is more evident when we analyse the transactions in terms of value added, that is, the share of services in total exports is higher than the share of goods when the international trade is analysed by the value added instead by gross value (CURZAL, 2017). An advantage of this type of analysis is that it is possible to measure the services embedded in the trade of goods, once most of services are exported indirectly (OECD; WTO, 2017). Moreover, we can measure how much of value added of services are embedded in services sector exports.

Besides, many authors obtained results to show up the importance of the service sector for countries' economies (BOHN; BRAKMAN; DIETZENBACHER, 2018; CURZAL, 2017; FAN; YANG, 2016; MASHAYEKHI *et al.*, 2017), which ignore the heterogeneity of the sector, and to identify the role of the sector in international transactions in other economic activities

(HADDAD, 2019; HADDAD; ARAÚJO, 2020). However, all these authors neglect the changes that have occurred over the years once they performed their analysis for the sector in an aggregate way and/ or for only a period.

As a way to contribute to the aforementioned literature, the main objective of this work is to identify, in a systemic way, the main characteristics of the services sector trade for Brazil and the United Kingdom, countries that despite being classified in different stages of development, in 2010 had a similar share of services in GDP and labour forces composition (DANIELS, 2013). Besides, we can consider the United Kingdom as a service economy, as pointed by Cuadrado-Roura (2013a), and Brazil as a country which the service sector still starting to demand more qualification and new forms of work (CARDOSO, 2014).

Moreover, we measure the services value added, the total employment, and the employees' compensation embedded in exports to achieve it. In this way we expect to do an intra and inter-sectoral analyses, considering the heterogeneity existent in services sector and measuring the real role played by these activities.

The methodology used is based on the approach recommended by Haddad (2019) and initially proposed by Johnson and Noguera (2012), with some adaptations for the dataset used, as we further discuss. From this methodology it is possible to measure the value added, the employment, and the employees' compensation embedded in exports intra and inter-sectors. The database includes the National Input-Output Tables for Brazil and the United Kingdom, besides employee compensation and the number of employees in each sector. The source for the first one is the World Input-Output Database (WIOD), and for the last two is the World Input-Output Database – Social Economic Accounts (WIOD – SEA). The period regarded in the analysis runs from 2000 to 2014, and we work with 56 disaggregated activities of the economic sectors.

Thus, we seek to collaborate with recent studies on the service sector, mainly in treating the sector itself and its interactions with other sectors of the economy in terms of services value added in exports. Also, it includes the analysis of the labour market variables embedded in exports. With these results we aim to be able to identify not only the role played by the service sector in each country analysed, but also the opportunities and the benefits that this sector is capable of furthering for the economy.

Beyond this introductory section, the work is structured as follows: chapter 2 will present the literature review, highlighting the main issues about the evolution of the role and the participation of the service sector in the economy and international trade. In the third chapter, we present the methodology and the database to be used. In the fourth chapter, the results founded, and, finally, in the fifth chapter, the conclusions about the study.

2. Literature review

Over the years, it is possible to observe an evolution of the service sector. The rise of post-Fordism society brought forth many changes in this sector's role and its importance to economic development. On this matter, some theorists (BAUMOL, 1967; FUCHS, 1968; WALKER, 1985) believed in a secondary role played by this sector in economic development, putting industry changes as the main driver of growth. On the other hand, some authors (BALDWIN; FORSLID, 2020; BELL, 1999a; KON, 2013; NUSBAUMER, 1984) admit that the service sector plays a major role in economic development, responsible for technological changes that lead to growth. The main goals here are to present these theories, the evolution of them, and cite, not exhaustively, papers that analyse the services sector.

In the first group of authors, Baumol (1967) emphasizes that there are two types of services activities: the first one is progressive, capital intensive and has high technological content; while the second is stagnant, labour intensive, and with low technological content. The main difference between them resides in the role of labour. Still, both have low productivity, and the author attributes this to the observed growth of the service sector in the economy. Besides that, due to the difficulty in incorporating technological changes and the need for more workers, that is, higher costs, the service sector does not contribute to economic development and make more difficult the output growth.

In line with Baumol (1967), Fuchs (1968) also explains the service sector's growth from its low productivity and greater need for workers. Fuchs also defends that the difference between industry and service consists of the qualification of labour, that is, in the each sector's human capital. Thus, because of this difference industry has faster technological changes and guide economic development.

In turn, Walker (1985), attributes the growth of the service sector to the recent division of labour. For Walker, most services are the classic activities of an industrial society. Walker believes that the services are produced for use in the production of goods and that all goods production requires some labour service. However, the difference in productivity between service and goods production drags economic growth once manufacture has higher productivity than services.

For these authors, the existing gap in productivity between manufacture and services is the main reason for the first sector to lead and the second to slow down economic development. In contrast with these authors, Nusbaumer (1984) believes in a post-industrial society which has three main pillars, (i) work based on knowledge; (ii) communication and information are essentials since the last one is the means and purpose of the service sector; (iii) services and good productions are complementary, that is, intellectual and manual work complement each other. For Nusbaumer, in a post-industrial society, knowledge is the basis of value generation. Thus, in this sense, services generate externalities capable of reducing costs and increasing productivity in goods production. Therefore, services do not delay economic development but contribute positively to the same. Besides, the separation made by theorists like Baumol is simplistic. It does not consider the intrinsic relation between services and production of goods.

In line with Nusbaumer (1984), Bell (1999) believes in a post-industrial society based on and guided by the service sector. Based on Fisher's proposal in 1939 about economic development, Bell structures a framework about social structures changes and, consequently, economic development. For Bell, there are three stages about society and economic development: first, there is a pre-industrial society, where the main sector is the one regarding primary activities with an unskilled worker (extractive, agriculture, mining, fishing, and timber), which has as an axial principle the traditionalism of land and resource limitation. Second, the industrial society, based on secondary activities (goods-producing and processing), with semi-skilled workers and the economic growth guided by state or private control on investment decisions. Lastly, the third stage is the post-industrial society, whose main sectors are the tertiary (transportation and utilities), quaternary (trade, finance, insurance, and real state) and quinary (health, research, education, government, and recreation). The last two sectors modify Fischer's theory since the author does not consider quaternary and quinary activities. The post-industrial society has an axial principle the centrality and codification of theoretical knowledge, with highly skilled workers and technology based on information.

The change from one society to another is by transforming the pattern of occupations. As society develops, more skilled workers are needed and the growing the use of information and technology. So, for Bell (1999), in the post-industrial society, the service sector guides the economic development since it is the sector where most of skilled workers and technology holders are concentrated.

Another author that also gave the service sector a major role in economic development was Kon (2013). Based on Schumpeter's theory about the technological changes being the guide of economic development, she shows that the service sector is an essential prerequisite to achieve it. Kon states this based on the principle that services activities concentrate the technological changes, the intellectual and human capital, in a similar way as Bell (1999). Besides that, the author argues that innovations in the service sector occur because they are demanded as inputs in the production of goods. On the other hand, to work, these innovations require manufactured products. Thus, for Kon, the service sector's relevance as an inducer of economic growth and development is established.

A further work that also discusses the service sector's main role was Baldwin and Forslid (2020). For them, society is no longer post-industrial. However, a sheltered service society where the technological breakthrough is machine learning and the development was easier if it is service-led. Hence the service-led development path was no more an exception, but a norm, just like India. In this society, digital technologies make it simpler for people to provide services in the international context and workers in developing countries are migrating from agriculture and manufacturing to exported-oriented service sectors. Besides, most of the services have lower costs in developing nations than developed countries, representing an export opportunity for less advanced economies and an import opportunity for developed countries.

Thus, for these authors, the service sector plays the main role in economic development. These activities are responsible for technological change, which is essential. Besides that, the production of goods and services are mutually interdependent, and trade in goods and services are more and more inseparable (FAN; YANG, 2016; MARSHALL; WOOD, 1995), so the discussion about economic development cannot leave the service sector aside or in the background, as some theorists do.

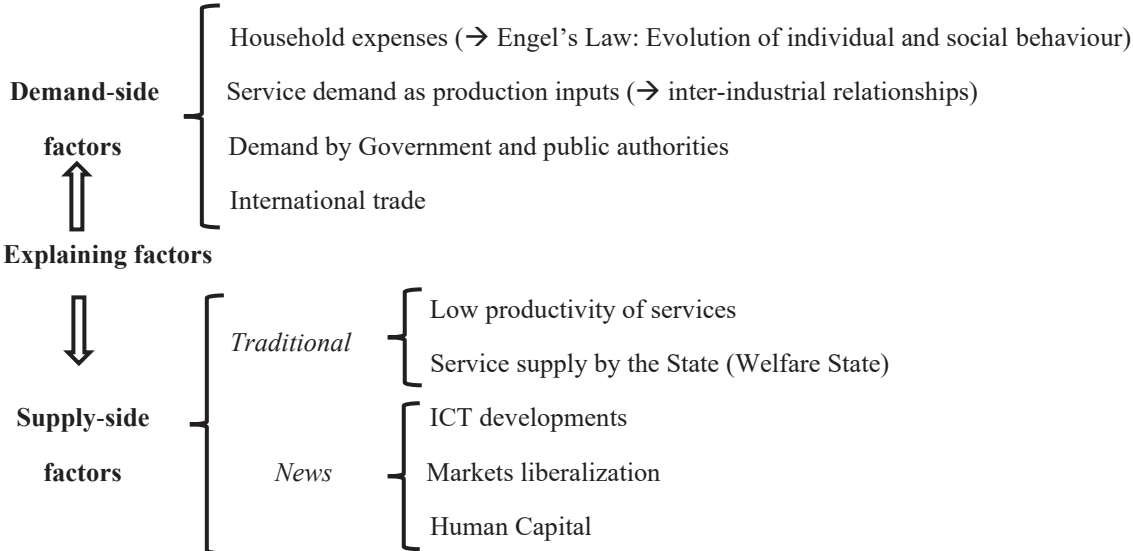
The service sector is an important player in today's economy and society, and it is capable of encouraging economic development. However, why the service sector has grown? Many factors are behind the expansion of the sector, Cuadrado-Roura (2013b) has pointed some of them. A short scheme can be seen in Figure 1.

There are factors by demand and supply side. About the supply-side factors, the first traditional factor is in line with Baumol (1967), who pointed out that the growth in the service

sector occurred based on the productivity difference between services and manufacture. Besides that, the news factors are more correlated with the exposed by Bell (1999), who believes that the service sector has grown up because of the need for more skilled workers (human capital) and more technology (ICT developments).

For the demand-side factors, two of them are more important for this work, first is the service demand as production inputs; second is the international trade. Both of these factors were related to each other, once the outsourcing and offshoring processes rise, firms demand more services. Hence the inter-industrial relationship intensifies, and the international service transactions increase, as pointed by Cuadrado-Roura (2013b). Besides that, a rising of service in international transactions leads to the growth in the service sector (CUADRADO-ROURA, 2013a).

Figure 1 – Factor explaining service growth



Source: Cuadrado-Roura (2013b)

The share of services in exports is more expressive when the international trade is analysed by the value added instead by the gross value (CURZAL, 2017). According to Curzal (2017), in 2009, the countries that lead exports of value added services are Luxemburg (85.13%), Greece (69.01%), Ireland (61.95%), Latvia (60.05%) and United Kingdom (57.74%). Also, looking for the gross value of exports the ranking of the main exports consists of Hong Kong (89.05%), Luxemburg (83.07%), Malta (65.45%), Greece (65.30%) and Ireland (47.45%). However, it stands out that, as pointed by the author, for small economies the

participation of the service sector expected to be high, which is the case in countries like Luxemburg, Ireland, and Singapore.

More authors find results similar to those found by Curzal (2017). Mashayekhi *et al.* (2017) pointed that the share of services exports in total exports increased more than the share of goods exports between 2005 and 2016. For the same period, the directly exported value added of services has increased. Besides, these authors found that there are different trade profiles according to countries' income levels. Heuser and Mattoo (2017), in its turn, highlighted that the share of services in value added trade besides varying across countries; it is generally high and larger than the share of services in gross trade.

In turn, Cernat (2017) states that services exports are not just linked with economic growth, but also to economic development, once the increase in trade on services has been correlated with poverty reduction, as a catalyst for job creation, mainly for women. Moreover, Cernat (2017) pointed the trade in service as less susceptible to economic fluctuations, since for the year 2014, international trade in this sector showed a steady growth of 5.00% compared to a 0.50% increase in trade in goods.

In line with these papers, some authors analyse the trade on the service sector using the input-output framework. Fan and Yang (2016) focus on China services exports, once this country is, as they said, "the biggest trade entity in the world", and the manufactured of the world. The obtained results show up the importance of the service sector for China economies, in value added terms, service trade is bigger than the main forms of trade in goods, which are second the authors processing trade and normal trade. More than that, the authors found that for 2012 of total value added exported by China, the share of services was 20.80%, while manufacturing was 78.00%.

With the focus on European Union, North America, and East Asia regions, Bohn, Brakman, and Dietzenbacher (2018) use the input-output framework proposed by Johnson and Noguera (2012) to analyse the World Input-Output Databases (WIOD) from 2000 to 2014 for the countries of these regions. The authors pointed out that it is important to analyse trade in terms of value added because are more services being traded than gross exports statistics shows once gross exports only consider direct but not indirect services traded. The main results they found show that the trade in value added of services grown more than manufacturing for the European Union and North America, on the other hand, for East Asia the manufacturing grown

more. The authors also highlighted that the rising contributions of services in value added exports might reflect the growing importance of this sector in the European Union and other developed economies.

In line with the framework used by Bohn, Brakman, and Dietzenbacher (2018), Haddad (2019) propose a methodological framework to obtain the value added in exports of Brazil and apply this method to characterize exports of services value added in this country. The main results found by Haddad show that the share of services in total domestic value added exported is 48.23% and the share of the sector in employment related to direct exports is 60.60%. The method proposed by Haddad also allows getting the use of factors in services exports, like the female employment associated, which from some sectors (other services, financial services, and distribution services) has a share above 45.00%.

Using and adapting the input-output frameworks proposed by Johnson and Noguera (2012) and Haddad (2019), Haddad and Araújo (2020) analyse the value added of services incorporated in goods exports for a selected group of Latin America countries, which is Brazil, Chile, Colombia, and Mexico. With the results found, the authors conclude that for these emerging countries services exports are mainly dominated by lower-valued activities. The trade in this sector face lower costs than manufacturing and mining industries. Besides, in line with Cernat (2017) and Mashayekhi *et al.* (2017), Haddad e Araújo (2020) pointed out that the trade in services has grown faster than the trade in goods.

In line with that, this work proposes to measure the services value added in exports for Brazil and the United Kingdom from 2000 to 2014 and do a comparative analysis to identify the service sector's real role in these economies. Thus, this analysis contributes to the literature since, in addition to being performed in an inter-temporal cut, the database to be used enables the analysis of the sector's heterogeneities, since it is possible to obtain information for the sectors of the economy broken down into 56 activities. Thus, therefore, to measure the role of the service sector in a systemic way for these two countries.

The choice of countries was based on the fact that while the United Kingdom can be considered as a service economy (CUADRADO-ROURA, 2013a), Brazil still going through the process of productive restructuring in which the service sector begins to demand more qualification and new forms of work (CARDOSO, 2014). Also, in 2010 these two countries have similar indicators about the service sector, as sad by Daniels (2013), the sector represents

67,4% of Brazil's GDP, while in the United Kingdom this number was 77,5%, besides in terms of labour force composition the service sector represents 66% in Brazil, and 80,4% in the United Kingdom. In general, despite being on different development paths, the two countries have some similarities regarding the service sector. Furthermore, with this study, we try to explore in addition to these similarities, and the differences in the services sector between Brazil and the United Kingdom.

3. Methodology and database

The method used in this study is based on the approach proposed by Haddad (2019) to measure the services value added in exports (JOHNSON; NOGUERA, 2012) for Brazil and the United Kingdom from 2000 to 2014. Some adaptations are necessary so that the proposed approach is applied to the WIOD database. This section aims to present the methodology and the database to be used. We stress that we do not distinguish the destination of exports; our interest is concerned with the origin of the good or service traded.

3.1. Input-Output framework

We present the framework of input-output analysis. Haddad (2019) suggested that we use the national input-output matrix, and Figure 2 shows a simplified scheme of it. We recognise that the use of the national input-output matrix has their limitation, as do not possibilite us to know the origin of the imported inputs, so we consider that the value added content in exports are equivalent to the value added generated by the country, using your own technologies.

From Figure 2 it is possible to observe some of the basic relations of the input-output methodology. Firstly, we have the identity described by the equation (1), and from that relation, it is possible to establish that the sum of the intermediate consumption (**Z**) with the final demand (**Y**) is equal to the total output (**x**), as shown in equation (2).

$$\mathbf{x}_j + \mathbf{hh} + \mathbf{g} + \mathbf{i} + \mathbf{exp} = \mathbf{x}_i + \mathbf{imports} + \mathbf{taxes} + \mathbf{va} \quad (1)$$

$$\forall j = 1, 2, 3, \dots, n \text{ and } \forall i = 1, 2, 3, \dots, n$$

Where:

x_j is the total output of sector j;

hh is the production consumed by the households;

g is the production consumed by the government;

i is the production destined to investment;

exp is the production destined to exports;

x_i is the total output of sector i;

imports is the import of sectors;

taxes is the net indirect taxes paid by sectors;

va is the value added generated by the sector when producing.

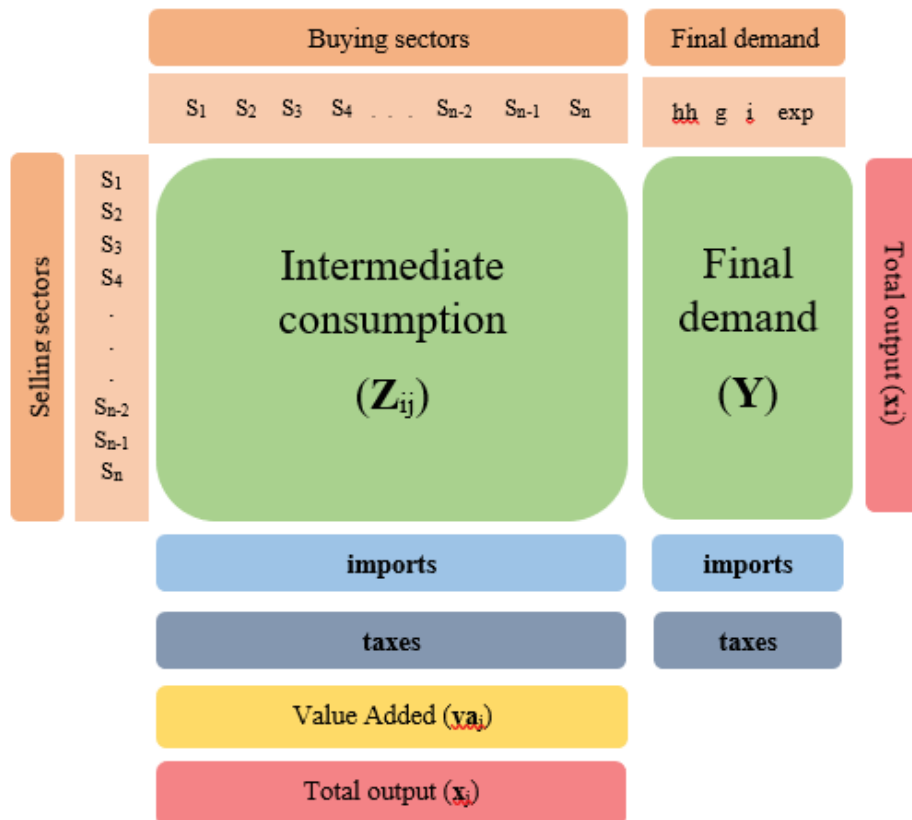
$$\sum_{j=1}^n Z_{ij} + Y_i = x_i, \forall j = 1, 2, 3, \dots, n \text{ and } \forall i = 1, 2, 3, \dots, n \quad (2)$$

Where:

Z_{ij} is the intermediate consumption, that is, the flow between sectors i and j ;

Y_i is the final demand for products in sector i .

Figure 2 – Input-Output matrix scheme



Note: **hh** – Final consumption expenditure by households; **g** – Final consumption expenditure by the government; **i** – Investments; **exp** – Exports.

Sources: Own elaboration.

Another basic and relevant relation is the technical coefficient (a_{ij}), defined in equation (3), which indicates the quantity of input of sector i is needed to produce one unit by sector j .

This information is important for the next step of the input-output methodology, the Leontief inverse. Each element can be interpreted as the total production of sector i which is necessary to produce one unit of final demand in sector j (MILLER; BLAIR, 2009).

$$\mathbf{a}_{ij} = \frac{z_{ij}}{x_j}, \forall j = 1, 2, 3, \dots, n \text{ and } \forall i = 1, 2, 3, \dots, n \quad (3)$$

Rewriting the equation (3), it is possible to obtain the following relation:

$$\sum_{j=1}^n \mathbf{a}_{ij} \mathbf{x}_j + \mathbf{Y}_i = \mathbf{x}_i, \forall j = 1, 2, 3, \dots, n \text{ and } \forall i = 1, 2, 3, \dots, n \quad (4)$$

Which can be represented by the matrix format as:

$$\mathbf{A}\mathbf{x} + \mathbf{Y} = \mathbf{x} \quad (5)$$

Isolating \mathbf{Y} ,

$$(\mathbf{I} - \mathbf{A})\mathbf{x} = \mathbf{Y} \quad (6)$$

Where:

\mathbf{I} is an $n \times n$ identity matrix;

\mathbf{A} is the technical coefficients matrix;

\mathbf{x} is the total output;

\mathbf{Y} is the final demand.

Rearranging the equation (6) it is possible to get the Leontief inverse (\mathbf{L}), as shown in equation (8).

$$\mathbf{x} = (\mathbf{I} - \mathbf{A})^{-1}\mathbf{Y} \quad (7)$$

$$\mathbf{L} = (\mathbf{I} - \mathbf{A})^{-1} \quad (8)$$

3.2. Measurement of domestic value added in exports

As pointed in the last section, the input-output model and the Leontief model can be expressed as:

$$\mathbf{x} = (\mathbf{I} - \mathbf{A})^{-1}\mathbf{Y} = \mathbf{L}\mathbf{Y} \quad (9)$$

We will initially consider the national input-output model with two and two groups of sectors, services, and non-services activities, and 56 products, so we consider the fact that than a sector may produce more than one product (HADDAD, 2019). Additionally, from final demand, we consider the column of exports (**exp**) as a specific vector; thus, rewriting the equation (9), the model can be represented as:

$$\begin{bmatrix} \mathbf{x}^1 \\ \mathbf{x}^2 \end{bmatrix} = \begin{bmatrix} \mathbf{a}^{11} & \mathbf{a}^{12} \\ \mathbf{a}^{21} & \mathbf{a}^{22} \end{bmatrix} \begin{bmatrix} \mathbf{x}^1 \\ \mathbf{x}^2 \end{bmatrix} + \begin{bmatrix} \mathbf{y}^1 & \mathbf{y}^{1,\text{exp}} \\ \mathbf{y}^2 & \mathbf{y}^{2,\text{exp}} \end{bmatrix} \mathbf{i} \quad (10)$$

Where $s = 1$ represents the sub-group of sectors 1, and $s = 2$, the sub-group 2. Moreover, the equation (10), can be rewritten as:

$$\begin{bmatrix} \mathbf{x}^1 \\ \mathbf{x}^2 \end{bmatrix} = \left\{ \begin{bmatrix} \mathbf{I} & \mathbf{0} \\ \mathbf{0} & \mathbf{I} \end{bmatrix} - \begin{bmatrix} \mathbf{a}^{11} & \mathbf{a}^{12} \\ \mathbf{a}^{21} & \mathbf{a}^{22} \end{bmatrix} \right\}^{-1} \begin{bmatrix} \mathbf{y}^1 & \mathbf{y}^{1,\text{exp}} \\ \mathbf{y}^2 & \mathbf{y}^{2,\text{exp}} \end{bmatrix} \mathbf{i} = \begin{bmatrix} \mathbf{I}^{11} & \mathbf{I}^{12} \\ \mathbf{I}^{21} & \mathbf{I}^{22} \end{bmatrix} \begin{bmatrix} \mathbf{y}^1 & \mathbf{y}^{1,\text{exp}} \\ \mathbf{y}^2 & \mathbf{y}^{2,\text{exp}} \end{bmatrix} \mathbf{i} \quad (11)$$

Where, the matrix **Y** is decomposed into two columns, isolating the exports ($\mathbf{y}^{s,\text{exp}}$)¹ from other components of final demand (\mathbf{y}^s). Also, \mathbf{i} is a column vector of 1's of the appropriate dimension.

Thus, the value-added in the sub-group of sectors 1, that is for the non-service sector, can be expressed as:

$$\mathbf{va}_1 = \mathbf{v}_1(\mathbf{I} - \mathbf{A})^{-1}\mathbf{y}\mathbf{i} \quad (12)$$

Where \mathbf{v}_1 is a row vector with the ratios of value added (\mathbf{va}_j) to total output in industries (\mathbf{x}_j) belong to sub-group 1 (non-services) as first elements ($\hat{\mathbf{v}}_1$) and zeros elsewhere ($\mathbf{v}_1 = [\hat{\mathbf{v}}_1 \mathbf{0}]$), that is:

$$\mathbf{v}_1 = \frac{\mathbf{va}_j^1}{\mathbf{x}_j^1}, \forall j = 1, 2, 3, \dots, n \quad (13)$$

Similarly, for the industries in sub-group 2, services sector, the value-added can be represented by:

$$\mathbf{va}_2 = \mathbf{v}_2(\mathbf{I} - \mathbf{A})^{-1}\mathbf{y}\mathbf{i} \quad (14)$$

¹ Where s represents the sub-group of sectors, $s = 1$ for non-services and $s = 2$ for services.

Where v_2 is a row vector with the ratios of value added (\mathbf{va}_j) to total output in industries (\mathbf{x}_j) belong to sub-group 2 (services) as first elements (\hat{v}_2) and zeros elsewhere ($\mathbf{v}_2 = [0 \ \hat{v}_2]$), that is:

$$\mathbf{v}_2 = \frac{\mathbf{va}_j^2}{\mathbf{x}_j^2}, \forall j = 1, 2, 3, \dots, n \quad (15)$$

To get the intra-group value added in exports from each sub-group, consider only the export information in the final demand factor. So, the value added generated by non-services sector for the non-services sector (sub-group 1) exports can be represented as:

$$\mathbf{va}_{11,\text{exp}} = \mathbf{v}_1(\mathbf{I} - \mathbf{A})^{-1} \begin{bmatrix} \mathbf{y}^{1,\text{exp}} \\ 0 \end{bmatrix} \quad (16)$$

Similarly, for the services sector (sub-group 2), the intra-group value-added can be expressed as:

$$\mathbf{va}_{22,\text{exp}} = \mathbf{v}_2(\mathbf{I} - \mathbf{A})^{-1} \begin{bmatrix} 0 \\ \mathbf{y}^{2,\text{exp}} \end{bmatrix} \quad (17)$$

Given the importance of the interindustry interdependence in the input-output framework, it is relevant to obtain the inter-group value added in exports: the effects of exports of services (sub-group 2) on value added generated by non-services (sub-group 1) activities, and vice-versa. The following equations can express this relation.

$$\mathbf{va}_{21,\text{exp}} = \mathbf{v}_2(\mathbf{I} - \mathbf{A})^{-1} \begin{bmatrix} \mathbf{y}^{1,\text{exp}} \\ 0 \end{bmatrix} \quad (18)$$

$$\mathbf{va}_{12,\text{exp}} = \mathbf{v}_1(\mathbf{I} - \mathbf{A})^{-1} \begin{bmatrix} 0 \\ \mathbf{y}^{2,\text{exp}} \end{bmatrix} \quad (19)$$

So, from equation (16) to (19) we have the domestic value added (DVA) in exports from each component in \mathbf{y} , where equations (16) and (18) presents the results of total value added embedded in exports of goods, and equations (17) and (19) the total value added embedded in exports of services.

3.3. Measurement of labour market information in exports: total employment and compensation of employees

The equation presented before can be adapted to measure the content of other variables in export flows, for example, it is possible to quantify total employment and the compensation

of employees embedded in countries exports. We only need to replace the vector of ratios of value added, \mathbf{v}_1 and \mathbf{v}_2 , by the other variables' ratios to get this information.

So, following this, to determinate the total intra-group employment (**emp**) embedded in exports in sub-group 1 (non-services) of sector 1 (non-services), just rewrite the equation (16) as follows:

$$\mathbf{emp}_{11,\text{exp}} = \mathbf{e}_1(\mathbf{I} - \mathbf{A})^{-1} \begin{bmatrix} \mathbf{y}^{1,\text{exp}} \\ 0 \end{bmatrix} \quad (20)$$

Where \mathbf{e}_1 is a row vector with employment coefficient in activities belonging to the sub-group of sectors 1, non-services activities, as first elements ($\hat{\mathbf{e}}_1$) and zeros elsewhere ($\mathbf{e}_1 = [\hat{\mathbf{e}}_1 \ 0]$). Furthermore, \mathbf{e}_1 is calculated as follows:

$$\mathbf{e}_1 = \frac{E_j^1}{x_j^1}, \forall j = 1, 2, 3, \dots, n \quad (21)$$

Where:

E is the number of employees;

x is the total output.

Similarly, to this and equations to measure the value-added embedded in exports, it is possible to compute intra-group for exports in sub-group 2 (services) of sectors 2 (services), equation 22, services activities, as well as the inter-group effects (equations 23 and 24).

$$\mathbf{emp}_{22,\text{exp}} = \mathbf{e}_2(\mathbf{I} - \mathbf{A})^{-1} \begin{bmatrix} 0 \\ \mathbf{y}^{2,\text{exp}} \end{bmatrix} \quad (22)$$

$$\mathbf{emp}_{21,\text{exp}} = \mathbf{e}_2(\mathbf{I} - \mathbf{A})^{-1} \begin{bmatrix} \mathbf{y}^{1,\text{exp}} \\ 0 \end{bmatrix} \quad (23)$$

$$\mathbf{emp}_{12,\text{exp}} = \mathbf{e}_1(\mathbf{I} - \mathbf{A})^{-1} \begin{bmatrix} 0 \\ \mathbf{y}^{2,\text{exp}} \end{bmatrix} \quad (24)$$

Where, similarly to equation (21), \mathbf{e}_2 is a row vector with employment coefficient in activities belonging to the sub-group of sectors 2, non-services activities, as first elements ($\hat{\mathbf{e}}_2$) and zeros elsewhere ($\mathbf{e}_2 = [0 \ \hat{\mathbf{e}}_2]$), and is calculated as follows:

$$\mathbf{e}_2 = \frac{\mathbf{E}_j^2}{x_j^2}, \forall j = 1, 2, 3, \dots, n \quad (25)$$

In the same way, it is possible to determine the compensation of employees (**wag**) embedded in exports, intra (equations 26 and 28) and inter (equations 27 and 29) sub-group. For sub-group of sectors 1, non-services activities, we have:

$$\mathbf{wag}_{11,\text{exp}} = \mathbf{w}_1(\mathbf{I} - \mathbf{A})^{-1} \begin{bmatrix} \mathbf{y}^{1,\text{exp}} \\ 0 \end{bmatrix} \quad (26)$$

$$\mathbf{wag}_{21,\text{exp}} = \mathbf{w}_2(\mathbf{I} - \mathbf{A})^{-1} \begin{bmatrix} \mathbf{y}^{1,\text{exp}} \\ 0 \end{bmatrix} \quad (27)$$

Moreover, for the sub-group of sectors 2, services activities, we have:

$$\mathbf{wag}_{22,\text{exp}} = \mathbf{w}_2(\mathbf{I} - \mathbf{A})^{-1} \begin{bmatrix} 0 \\ \mathbf{y}^{2,\text{exp}} \end{bmatrix} \quad (28)$$

$$\mathbf{wag}_{12,\text{exp}} = \mathbf{w}_1(\mathbf{I} - \mathbf{A})^{-1} \begin{bmatrix} 0 \\ \mathbf{y}^{2,\text{exp}} \end{bmatrix} \quad (29)$$

Where \mathbf{w}_1 and \mathbf{w}_2 are a row vectors with compensation coefficients in activities belonging to their respective sub-groups, for \mathbf{w}_1 as first elements (\widehat{w}_1) and zeros elsewhere ($\mathbf{w}_1 = [\widehat{w}_1 \ 0]$), and for \mathbf{w}_2 as first elements (\widehat{w}_2) and zeros elsewhere ($\mathbf{w}_2 = [0 \ \widehat{w}_2]$). These coefficients, w_1 and w_2 , are calculated as follows:

$$\mathbf{w}_1 = \frac{c_j^1}{va_j^1}, \forall j = 1, 2, 3, \dots, n \quad (30)$$

$$\mathbf{w}_2 = \frac{c_j^1}{va_j^2}, \forall j = 1, 2, 3, \dots, n \quad (31)$$

Where:

C is the total compensation of employees in sub-group of sectors;

va is the value added generated by the sector when producing.

3.4. Database

To achieve the proposed objective of this study we use the database shows in Table 1, the mains source is the World Input-Output Database (WIOD), where it is possible to find the information used disaggregated in 56 sectors, where 27 are non-services activities, that is,

agriculture, mining and manufacturing, and the others 29 are services sectors (see Appendix A).

From National Input-Output tables we calculate the exports vector, the value added (\mathbf{va}_j) and the total output (\mathbf{x}_j) and obtained the results from equation (16) to (19), that is, the value added embedded in exports intra- and inter-groups. Using the compensation of employees and some information from the input-output table, we get which part of the value added exported is relative to employees' compensation, equations (26) to (29). Lastly, using the number of employees in each sector we obtain the amount of labour employed by each activity embedded in value added exports of services and non-services, equations (20) to (24), except (21).

Table 1 -Database

Variable	Source	Period
National Input-Output tables (in millions of US dollars)	World Input-Output Table (WIOD)	2000 to 2014
Compensation of employees (in millions of national currency)	World Input-Output Table (WIOD) – Social Economic Accounts	2000 to 2014
Number of employees (thousands)	World Input-Output Table (WIOD) – Social Economic Accounts	2000 to 2014

Note: Values in current prices, denoted in millions of US dollars.

Source: Own elaboration.

Table 2 presents some descriptive statistics for the countries we will analyze, Brazil and the United Kingdom. It is possible to note that there are clear differences between the two countries, first looking for the degree of openness² and the share in international trade³, we note the United Kingdom as a country with more representativeness in international trade than Brazil. For the total exports of each country, it is possible to observe that for Brazil the non-services exports have the major share in both, 2000 and 2014; while for the United Kingdom this is true only for 2000, since in 2014 the service's activities export more than non-services sectors, rising their share for 53,40%.

Also, in Table 2 we have a few statistics for labour market information. It is possible to see that the service sector in both countries is responsible for more than 60% of the employed population, reaching 84% for the United Kingdom in 2014, which lead us to conclude that the

² Degree of openness = (Imports + Exports)/(GDP); source of database is OECD Data.

³ Share in international trade = (Country Imports + Country Exports)/(World Imports + World Exports); source of database is OECD Data.

service sector is one that employs most and generate more jobs, as pointed by World Trade Organization in Aid for Trade at a Glance 2017. In Brazil, the sectors responsible for these results are household activities as employers, retail and wholesale trade, education and public administration, and services labour intensive. For the United Kingdom, the major sectors are human health and social work activities, retail trade, administrative and support services, public administration, and accommodation and food services activities.

Table 2 – Descriptive statistics

	Brazil		United Kingdom	
	2000	2014	2000	2014
Degree of openness	24,86%	26,92%	66,03%	57,19%
Share in international trade	0,60%	0,75%	1,56%	1,32%
Share of services in total exports	15,07%	13,54%	31,07%	53,40%
Share of non-services in total exports	84,93%	86,46%	68,93%	46,60%
Share of services in total employment	63,72%	67,26%	78,13%	84,80%
Share of non-services in total employment	36,28%	32,74%	21,87%	15,20%
Employee compensation of services (US dólar)	\$4.243,41	\$12.668,09	\$31.797,60	\$51.986,55
Employee compensation of non-services (US dólar)	\$3.164,71	\$8.846,35	\$39.262,92	\$76.287,37

Source: Own elaboration.

The service sector is that one that pays more in Brazil, 34% more in 2000 and 43% in 2014, being the public administration activities, education, financial service activities, human health and social work and retail trade that it pays more. For the United Kingdom, even though employs the most, the activities that pay more the employee are non-services sectors, about 19% less in 2000 and 32% in 2014, and looking for the services sectors the education, human health and social work, public administration activities, retail and wholesale trade, and administrative and support activities that it pays more.

4. Results

This section presents the results from the estimation of equations show in the previous section. We focus on this moment to understand the characteristics of exports from the countries analysed, based on the value added in exports for each group of sectors. In the next topic, 4.1, we present the results obtained to measurement of domestic value added in exports. In section 4.2, we have the results of the measurement of labour market information in exports (total employment and employees' compensation).

4.1. Measurement of domestic value added in exports

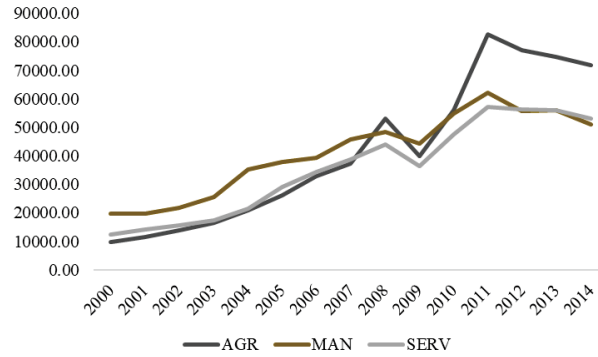
We present the results from the equations 16 to 19: the intra- and inter-group value added in exports from each group of analysis, services, and non-services, with the last one divided into agriculture and manufacture. First, we analyse the value added in exports of non-services, equations 16 and 17, where in general it is possible to observe the impact of 2008 crisis, which shook the world economy and one of the most important impact is the collapse in international trade (LEVCHENKO; LEWIS; TESAR, 2010).

In Figure 3 it is possible to observe the value-added in exports of non-services in gross terms for Brazil, in millions of US dollars (panel *a*), and the share of this in the total value added (panel *b*). From these panels we conclude that the Brazilian exports are mostly agricultural. This sector is the one with the highest share in the value added exported by the non-services sectors. Also, observing the services value added embedded, it follows that the sector is used as an intermediate input for non-services' exports, once services have a high share, as can be seen in panel *b*, greater than that of manufacturing activities in 2014.

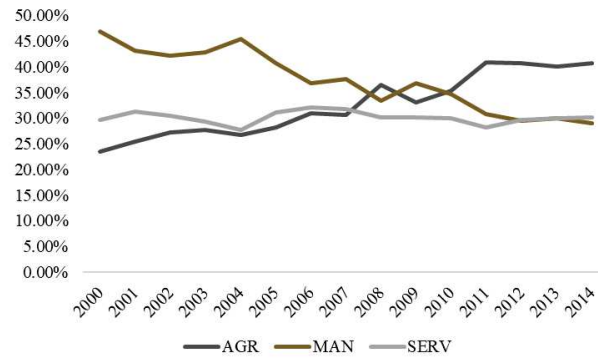
In Figure 4 we can observe the same results for the United Kingdom. The conclusion is that the British exports are mostly from the manufacturing industry, which adds value to itself with low share of the service sector. It is also possible to see that the services value added embedded in exports of non-services for the United Kingdom did not recover from the 2008 crisis, both millions of US dollars and participation tax. For this economy, the non-services activities have a few backward linkages with the service sector.

Figure 3 – Value added embedded in exports of non-services for Brazil

Panel a – Value added in exports



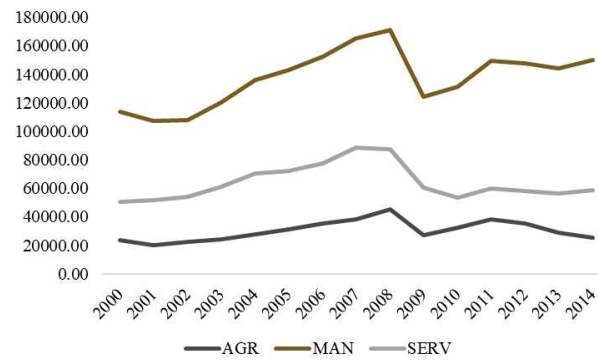
Panel b – Share of the sector in value added in exports



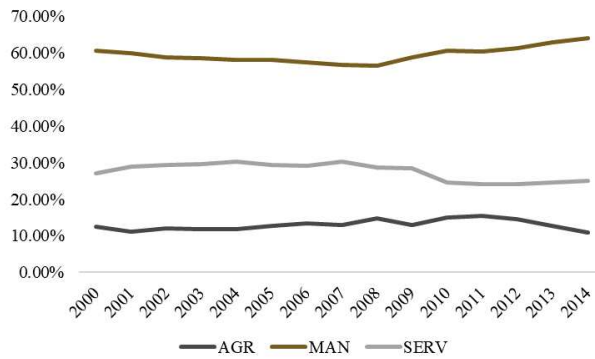
Source: Own elaboration.

Figure 4 – Value added embedded in exports of non-services for the United Kingdom

Panel a – Value added in exports



Panel b – Share of the sector in value added in exports

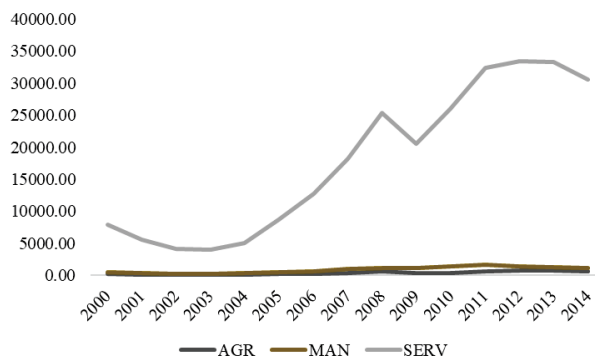


Source: Own elaboration.

Figure 5 shows the value-added in exports of services in gross terms for Brazil, in millions of US dollars (panel *a*), and the share of this in the total value added (panel *b*). From these results, it is concluded that the service sector adds value to itself with low backward dependence on other sectors. Also, the administrative and support services activities are the one that most contributes to the value added embedded in exports of services in Brazil, a traditional labour-intensive and low added value activity.

Figure 5 – Value added embedded in exports of services for Brazil

Panel a – Value added in exports



Panel b – Share of the sector in value added in exports

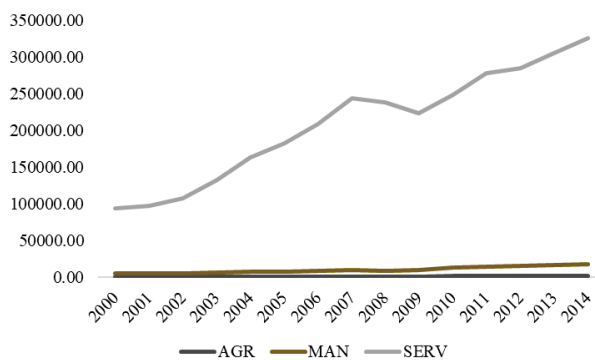


Source: Own elaboration.

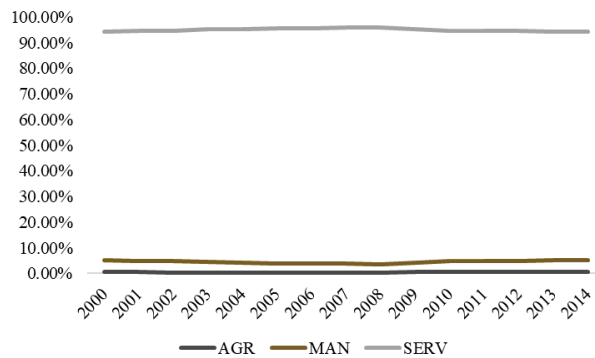
Figure 6 observed the results for the United Kingdom for value added in exports of services, in millions of US dollars (panel *a*), and the share of this in the total value added (panel *b*). The conclusions about the results are like those obtained for Brazil, also it is possible to observe the growth in the participation of manufacturing activities in services exports in millions of US dollars, mostly after 2009, as can be seen in panel *a*. Besides, the service activities with the highest value added in exports are the financial services activities, except for insurance and pension funding, traditionally knowledge-intensive and with highly added value.

Figure 6 – Value added embedded in exports of services for the United Kingdom

Panel a – Value added in exports



Panel b – Share of the sector in value added in exports



Source: Own elaboration.

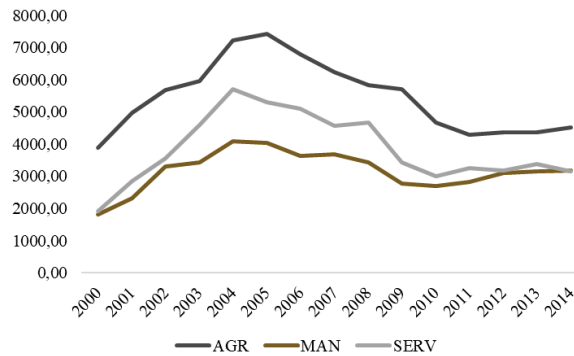
With these results, it is concluded that for Brazil, the service sector plays a role as intermediate input for non-services activities, not as final product to be exported, which can improve the performance of the other sectors and enhance the goods exports (OECD; WTO, 2017). For the United Kingdom, is the opposite, the service sector figures as final product and low forward linkages with the non-services sectors in the production chain. Besides, the difference in monetary magnitude between Brazil and the United Kingdom is clear when we look at the value added exported by the two economies.

4.2. Measurement of labour market information in exports: total employment and compensation of employees

4.2.1. Total employment

This section presents the results for the total employment embedded in exports of services and non-services activities for Brazil and the United Kingdom. In Figure 7 it is possible to observe that the agriculture is the sector with more employment embedded in non-services exports for Brazil. At the same time the manufacture is the sector with fewer employees working in the exported goods production chain. Besides, the service sector has more employment embedded in exports of non-services than manufacture, approximately 30%. The major activities responsible for this are wholesale and retail trade, and legal and accounting activities. With these results we see the service sector as an important player in creating services for Brazil, and, more than that, as an important input for the export of non-services.

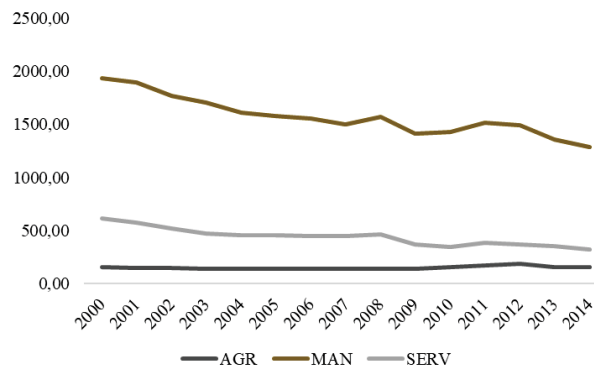
Figure 7 – Total employment embedded in exports of non-services for Brazil



Source: Own elaboration.

For the United Kingdom, based on Figure 8, it is possible to conclude that the major player for non-services exports is the manufacturing sector, responsible for more than 70% of total employment embedded in these exports. The service sector alongside agriculture has secondary roles for non-service activities, about 20% and 10%, respectively. The major manufacturing activities responsible for these results are manufacture of machinery and equipment, metal products, and transport equipment.

Figure 8 – Total employment embedded in exports of non-services for the United Kingdom

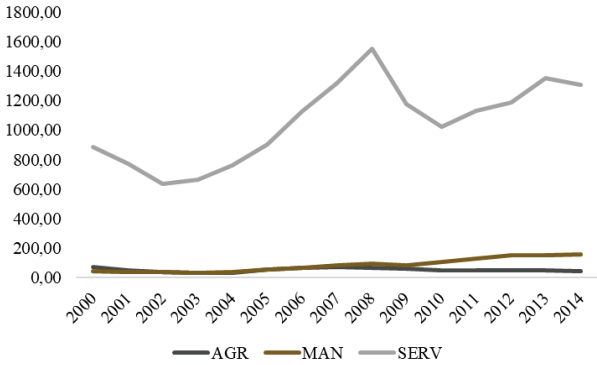


Source: Own elaboration.

Looking for the exports of services for Brazil, Figure 9 shows that the service’s activities are those with the largest number of employees involved in producing services for export. The major activities responsible for these result for service employment are administrative and support service, retail trade, accommodation and food service, and legal and accounting

activities. The roles of manufacture and agriculture are secondary; these two sectors together represent about 13% of total employment embedded in exports of services for Brazil.

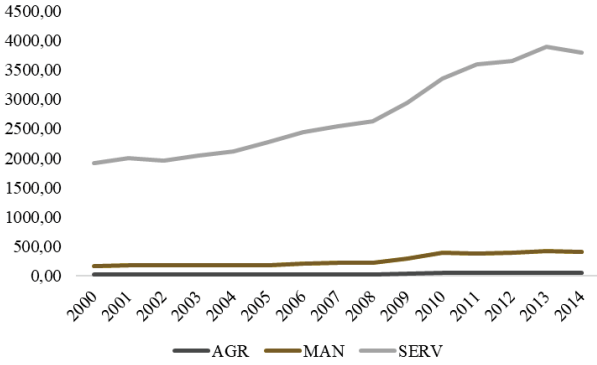
Figure 9 – Total employment embedded in exports of services for Brazil



Source: Own elaboration.

For the United Kingdom, as shown in Figure 10, the results are like those in Brazil, except that there is an increasing trend in the total employment of the service sector embedded in the services exports. The activities responsible for this result are administrative and support, wholesale trade, and activities auxiliary to financial services and insurance activities.

Figure 10 – Total employment embedded in exports of services for the United Kingdom



Source: Own elaboration.

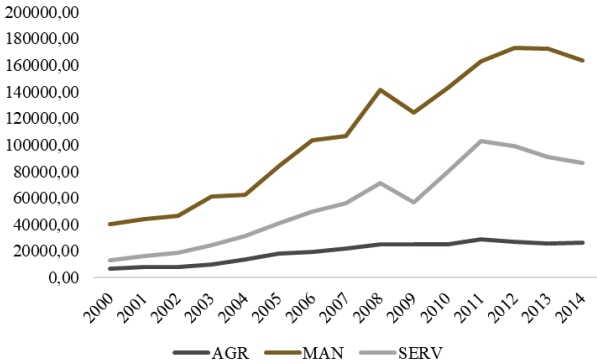
With these results it is clear the differences between the two countries. At the same time for Brazil the service sector looks like an input for the non-services exports, for the United Kingdom the sector figures as an output, that is, the sector is at the end of the added value production chain. Also, the service’s activities it has the major share in total employment embedded in exports are not among those that also employ the most in both countries. These

results can be explained by the fact that the service’s activities that most employed in the two countries are, in general, non-tradable, activities of households as employers and public administration, for Brazil, and human health and social work, and public administration, for the United Kingdom.

4.2.2. Compensation of employees

This section presents the compensation of employees embedded in total value added exported by the countries, Brazil, and the United Kingdom. Figure 11 shows that for Brazil, most of the compensation of employees embedded in exports of non-services it is from manufacture (60%), followed by services (30%) and agriculture (10%). The major activities responsible for these results are manufacture of food products, beverages, tobacco, chemicals, and basic metals, besides water transport, of the services sector.

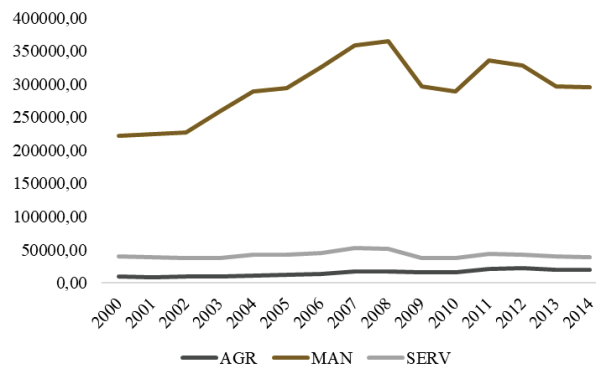
Figure 11 – Compensation of employees embedded in exports of non-services for Brazil



Source: Own elaboration.

In Figure 12 it is possible to see that like Brazil, the manufacture is the sector with the highest compensation of employees embedded in exports of non-services, about 80%, and the main activities are manufacture of machinery and equipment, of motor vehicles, trailers and semi-trailers, of other transport equipment, and chemicals. Unlike Brazil, the service sector represents only 10%, approximately, of the compensation embedded in non-services exports. Once again, the service sector is acting strongly in the export of non-services in Brazil and participating in the background in the United Kingdom.

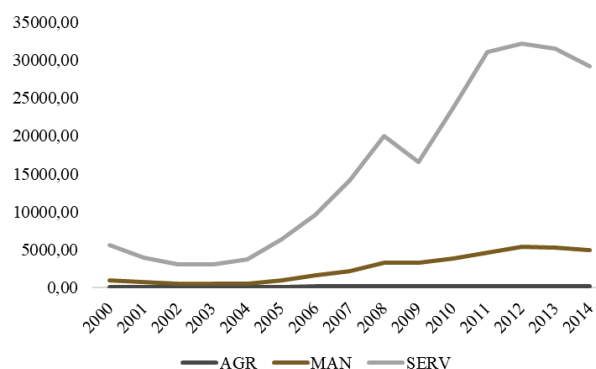
Figure 12 – Compensation of employees embedded in exports of non-services for United Kingdom



Source: Own elaboration.

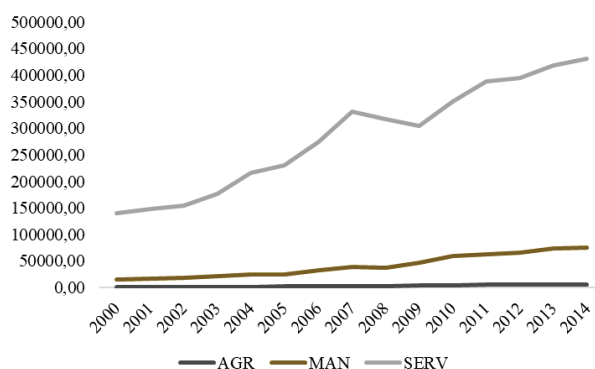
The Figure 13 and Figure 14 are like Figure 5, and Figure 6, Panel a, which lead us to conclude that the major services value added exported by both countries is from the compensation of employees in the sector activities. The value added embedded in services exports is mostly the employee’s compensation, which means, services with high value added are services in which worker is better paid. The activities that contribute the most for the results saw in Figure 13 for Brazil are administrative and support, legal and accounting, architectural and engineering, and air transport. For the United Kingdom (Figure 14), these activities are wholesale trade, administrative and support, activities auxiliary to financial services, and financial services.

Figure 13 – Compensation of employees embedded in exports of services for Brazil



Source: Own elaboration.

Figure 14 – Compensation of employees embedded in exports of services for the United Kingdom



Source: Own elaboration.

This result reinforces the exposure by Cernat (2017) that the service sector as a catalyst for job creation in developing countries, since it cannot only employ more people in countries like Brazil (see Figure 7 and Figure 9), but also contributes to the countries' income. Also, it is important to observe that the most employ sectors are not, in general, those who have major compensation of employees embedded in exports of services. Which leads us to conclude that the activities which pay better are more intensive in human capital, knowledge than in workforce, which means that the services with higher value added in exports are those with a more qualified workforce, since these activities are knowledge-intensive (GLÜKER; HAMMER, 2013).

Table 3 shows the growth rate of the results presented in sections 4.1 and 4.2 between 2000 and 2014. The service sector presents an expressive increase for Brazil in all statistics analysed; at the same time for the United Kingdom, the sector lost employment and employees' compensation embedded in exports. Moreover, reinforcing the results aforementioned, from Table 3 we conclude that the service sector in Brazil has been gaining space and increasing its importance for Brazilian exports, economy.

We can observe that for the United Kingdom, there is a migration of the workforce from the non-services to the service sector. Since besides the negative growth rate of the services employment in exports, there was an increase of 102,65% in all employment embedded in services exports, an at the same time a reduction of 34,68% in non-services exports. For Brazil, we saw an increase in both, employment embedded in non-services and services exports.

Table 3 – Growth rate 2000 to 2014

Statistic	Group of sectors	Brazil	United Kingdom
Non-services DVA in exports	Non-services	▲ 316,95%	▲ 28,00%
	Services	▲ 142,09%	▲ 234,39%
Services DVA in exports	Non-services	▲ 327,51%	▲ 15,42%
	Services	▲ 288,86%	▲ 246,14%
Non-services total employment in exports	Non-services	▲ 34,14%	▼ -31,02%
	Services	▲ 65,17%	▼ -47,22%
Services total employment in exports	Non-services	▲ 75,05%	▲ 154,12%
	Services	▲ 47,32%	▲ 97,66%
Non-services total employment in exports	Non-services	▲ 304,29%	▲ 36,26%
	Services	▲ 567,93%	▼ -1,46%
Services compensation of	Non-services	▲ 375,93%	▲ 379,40%
	Services	▲ 418,78%	▲ 207,25%

Note: Long-term observations; and level variables.

Source: Own elaboration.

Comparing Brazil to the United Kingdom, it is possible to observe that there is a latent potential of the Brazilian economy in what concerns the service sector. For Brazil, as we aforementioned, the service sector has an important role both for non-services and services exports, with regards DVA and labour (employment and employees' compensation).

5. Conclusions

This study's proposal was to implement a systemic analysis about the role and importance of the services sector in exports of non-services and services for Brazil and the United Kingdom, seeking to establish the main characteristics of the sector in both countries. To achieve this goal we measure the services value added, the total employment, and the compensation of employees embedded in exports, using the information of World Input-Output Database (WIOD) for the period between 2000 and 2014.

The choice of the countries analysed was based on the fact that even though Brazil and United Kingdom have similar indicators about the share of the service sector in their economies (DANIELS, 2013), these two countries have clear differences in their economic structures. Since the United Kingdom can be called as service economy (CUADRADO-ROURA, 2013a), Brazil still going through a process of restructuring production. The service sector is rise space and increase its importance for the country's structure (CARDOSO, 2014).

The methodology used was based on Haddad (2019) and allowed us to conclude that for Brazil the service sector acts as an input for the non-services exports, since it besides generating value for the non-services exports, there is a considerable amount of labour in the service sector working in the production of exported goods. Consequently, a big part of the value added embedded in non-services exports comes from the compensations of employees of the service sector. Already for the United Kingdom, the service activity has few linkages with non-services activities, that is, for the British economy the service is the final product exported. Besides, for the two countries analyzed it was possible to observe that the services activities that employ more labour are not that those that have greater participation of employees and compensation embedded in services exports.

It is interesting to notice the differences, in real terms, between Brazil and the United Kingdom. However, as noted above, have similar participation indicators in the service sector, the European country has, on average, nine times more services, twice as much employee, and ten times more compensation embedded in services exports than Brazil. These facts allow us to conclude that although Brazil has similarities with the United Kingdom, the country's exports have low services embedded in its exports, both, services and non-services.

The service sector is gaining force in Brazil and increasingly assuming a leading role, but, compared to the United Kingdom, a developed country, Brazil is still far from what we can call the “ideal”. During the restructuring process of production, more and more qualified labour is employed in the service sector, in such a way as to make it a diversified sector with high value added. Thus, developed not only the service sector, but also non-services activities, which use the sector as an input in your production chain.

The importance of the service sector is clear for Brazilian economy. As a sector which contributes for economic growth, jobs creations and open economic opportunities for country exports (CATTANEO *et al.*, 2010; OECD; WTO, 2017), the services sector can not be left aside by the policy makers. If this happened, achieve the goals of development and growth can become even more difficult (OECD; WTO, 2017), also the politics must to consider that the service sector represents an export opportunity for developing countries, like Brazil, and an import opportunity for developed countries, like the United Kingdom (BALDWIN; FORSLID, 2020).

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APPENDIX A – Description of sectors and their corresponding groups⁴

Group	Sector code	Description
Non-service	A01	Crop and animal production, hunting, and related service activities
Non-service	A02	Forestry and logging
Non-service	A03	Fishing and aquaculture
Non-service	B	Mining and quarrying
Non-service	C10-C12	Manufacture of food products, beverages and tobacco products
Non-service	C13-C15	Manufacture of textiles, wearing apparel and leather products
Non-service	C16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
Non-service	C17	Manufacture of paper and paper products
Non-service	C18	Printing and reproduction of recorded media
Non-service	C19	Manufacture of coke and refined petroleum products
Non-service	C20	Manufacture of chemicals and chemical products
Non-service	C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
Non-service	C22	Manufacture of rubber and plastic products
Non-service	C23	Manufacture of other non-metallic mineral products
Non-service	C24	Manufacture of basic metals
Non-service	C25	Manufacture of fabricated metal products, except machinery and equipment
Non-service	C26	Manufacture of computer, electronic and optical products
Non-service	C27	Manufacture of electrical equipment
Non-service	C28	Manufacture of machinery and equipment n.e.c.

⁴ 56 sectors classified according the International Standard Industrial Classification revision 4 (ISIC Rev. 4).

Non-service	C29	Manufacture of motor vehicles, trailers and semi-trailers
Non-service	C30	Manufacture of other transport equipment
Non-service	C31_C32	Manufacture of furniture; other manufacturing
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Non-service	C33	Repair and installation of machinery and equipment
Non-service	D35	Electricity, gas, steam and air conditioning supply
Non-service	E36	Water collection, treatment and supply
Non-service	E37-E39	Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services
Non-service	F	Construction
Service	G45	Wholesale and retail trade and repair of motor vehicles and motorcycles
Service	G46	Wholesale trade, except of motor vehicles and motorcycles
Service	G47	Retail trade, except of motor vehicles and motorcycles
Service	H49	Land transport and transport via pipelines
Service	H50	Water transport
Service	H51	Air transport
Service	H52	Warehousing and support activities for transportation
Service	H53	Postal and courier activities
Service	I	Accommodation and food service activities
Service	J58	Publishing activities
Service	J59_J60	Motion picture, video and television programme production, sound recording and music publishing activities; programming and broadcasting activities
Service	J61	Telecommunications
Service	J62_J63	Computer programming, consultancy and related activities; information service activities
Service	K64	Financial service activities, except insurance and pension funding
Service	K65	Insurance, reinsurance and pension funding, except compulsory social security
Service	K66	Activities auxiliary to financial services and insurance activities

Service	L68	Real estate activities
Service	M69_M70	Legal and accounting activities; activities of head offices; management consultancy activities
Service	M71	Architectural and engineering activities; technical testing and analysis
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Service	M72	Scientific research and development
Service	M73	Advertising and market research
Service	M74_M75	Other professional, scientific and technical activities; veterinary activities
Service	N	Administrative and support service activities
Service	O84	Public administration and defence; compulsory social security
Service	P85	Education
Service	Q	Human health and social work activities
Service	R_S	Other service activities
Service	T	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use
Service	U	Activities of extraterritorial organizations and bodies
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