Portuguese Exports in the Global Value Chains[1]

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ABSTRACT

A very important part of world production is nowadays organized along Global Value Chains (GVCs). The success of individual countries in the global economy depends on their ability to combine domestic and foreign value added in order to produce exports, which are later embodied in other products or consumed as final goods and services. The pervasiveness of GVCs strongly affects the interpretation of classical international trade measures computed in gross terms, emerging the need to assess trade flows in value added terms. This article analyzes the participation of the Portuguese economy in GVCs in the period 1995-2011. On the one hand, the level of foreign value added in exports indicates the degree of integration in GVCs. On the other hand, the re-export of national value added incorporated in imports provides indications on the positioning in the value chain.

1. Introduction

Global Value Chains (GVCs) became the paradigm for the production of most goods and services around the world. Production is nowadays vertically fragmented across different countries, *i.e.*, parts and components are produced in distinct locations and are assembled either sequentially along the supply chain or in a final location. The international fragmentation of production has always existed, being associated with the import of manufactured goods to be later incorporated in exports.[4] However, the reduction of transport and communication costs, the acceleration of technological progress and the removal of political and economic barriers to trade greatly increased the opportunities for international fragmentation of production. The growth observed in GVCs in the recent decades interlinks with the strong expansion of international trade and foreign direct investment flows, as well as with the growing importance of transnational corporations, which are the main players in the organization these activities.

The economic literature has been making progress in the measurement and mapping of this phenomenon. Building on the initial contributions by Feenstra and Hanson (1999) and Hummels *et al.* (2001), broader frameworks for computing the foreign and domestic content in exports have been suggested by Koopman *et al.* (2010), Johnson and Noguera (2012) and Stehrer (2012).These broader measurement frameworks rely on global input-output (I-O) matrices, which identify the sources and uses of output in the economy, decomposing by sectors and partner countries.

This article analyzes the integration of Portuguese exports on GVCs and provides indications about their positioning in these chains in the period 1995-2011. This period covers the accession of Portugal to the European Monetary Union in 1999, the great trade collapse of 2008/2009 and the beginning of the Economic and Financial Assistance Program to the Portuguese economy in 2011.

The level of integration in GVCs is associated with the import content of exports, while the positioning in the value chain can be related with the re-export of domestic value added embodied in imports. The re-export of value added implies a larger presence in the initial and final stages of the productive process, where most of value added is typically created. The interpretation of trade in value added indicators is now essentially established but the consequences of GVCs for the

assessment of external accounts' performance and overall competitiveness must be underlined. The participation in GVCs constitutes, in general, a necessary condition for the success of firms and their ability to position on tasks that involve high creation of value is truly crucial to determine income growth prospects in the economy.

This article shows that the participation of the Portuguese economy in GVCs is still limited, especially if compared with that of other EU members with similar size. Albeit foreign value added in exports increased from 1995 to 2007, there was a significant reduction in 2009, which had still not been recovered by 2011. In addition, the re-export of domestic value added embodied in imports is very small, indicating the need for a repositioning in stages of the value chain that create larger value added. The foreign value added in exports is larger in intra-EU trade and its main geographical origins are Spain, Germany and the "Rest of the world".[5] In sectoral terms, manufacturing presents the largest share of foreign value added in Portuguese exports.

Other studies have analyzed the import content of Portuguese exports, though using only domestic I-O tables. For example, Amador and Cabral (2008) examine the vertical specialization of the Portuguese economy from 1980 to 2002 and Cardoso *et al.* (2013) discuss the import content of global demand in the last three decades. As for studies focusing on the participation in GVCs and exports of value added in other European countries, recent examples are Stehrer and Stöllinger (2013) for Austria, Duprez and Dresse (2013) for Belgium and Cappariello and Felettigh (2014) for Italy.

In methodological terms, international trade flows associated with the operation of GVCs cannot be explained by the classic concept of comparative advantages defined at the country level. Instead, they should be modeled in terms of the capability of firms to integrate value added from different origins. Although articles by Jones and Kierzkowski (2001, 2005), Deardorff (2001, 2005), Markusen (2006) and Baldwin and Robert-Nicoud (2014) have formalized some dimensions of international fragmentation of production, a full theoretical model of GVCs is still missing.

The paper is organized as follows. Section 2 presents the database and the methodology used to measure value added in exports. Section 3 presents the main aggregate results for Portugal and provides some comparison with other euro area countries. Next, section 4 looks at the foreign value added embodied in exports from the perspective of its geographical origin. Section 5 develops the analysis along the sectoral dimension. Finally, section 6 presents some concluding remarks.

2. The nature of GVCs and their measurement

This section briefly discusses the nature of GVCs and reviews the methodology underlying the computation of the foreign value added content in a country's gross exports (FVAiX). In addition, the measure of domestic value added in imports (DVAiM) and the re-exported domestic value added in imports (RDVAiE), *i.e.*, the domestic value added that returns back home embedded in imports and is subsequently exported, are also presented.

The concept of GVC is based on the idea that domestic value added combines with foreign value added in order to produce exports, which are later embodied in other products or consumed as final goods and services. Therefore, imports of intermediate products to be embodied in exports are an important part of the production process, making the gross value of exports much larger than their domestic value added component. In addition, the domestic value added embodied in exports can circulate in the global economy as part of intermediate products used along the

production chain and part of it can return to the domestic economy in this process. The domestic value added that returns home through imports can be either recombined with domestic and foreign value added and re-exported or consumed as part of a final product or service. Chart 1 presents these dynamic linkages in a stylized way, highlighting the fact that international flows of value added provide a clearer picture of international trade than the classical gross trade measures.

One of the consequences of the enlargement and strengthening of GVCs is the strong growth of trade flows in the world economy, mostly driven by intermediate products that circulate around the world as part of complex production chains. Panel a) of chart 2 plots the path of nominal exports and imports of goods and services in Portugal in the period 1995-2013, showing that nominal trade flows grew more that the GDP. Panel b) plots the path of international trade flows but only in the subset of intermediate and energy goods. The growth rate of these flows is more in line with GDP up to the mid-2000s but grows substantially faster in more recent years. Although this pattern is affected by the adjustment process of the Portuguese economy, which led to lower GDP growth in recent years and a stronger orientation towards exports, it also signals the participation of the Portuguese economy in GVCs.

The computation of coefficients of trade in value added requires the existence of a global I-O matrix. Although the internal organization of a global I-O matrix is similar to that of classical I-O matrices, its information content is much larger because country-sector pairs of inputs are disentangled along country-sector pairs of outputs. Chart 3 presents the structure of a global I-O matrix in a stylized manner. Each column lists the intermediates (domestic and imported, by geographic origin) used in the production of the respective sector in a given country, as well as the value added generated, summing up to the value of output. Each line decomposes the usage of output in each industry in a given country along intermediate consumption for other sector--country pairs and final consumption. The construction of global I-O matrices combines supply and use tables for individual countries with bilateral trade flows at the sectoral level and it is a very demanding process. As a result, there are some limitations in global I-O matrices. For example, in some countries, the allocation of imports to using sectors is based on a straightforward proportionality assumption based on their share within total supply (Dietzenbacher *et al.* (2013)).

Chart 1 • Flows of value added in a global value chain
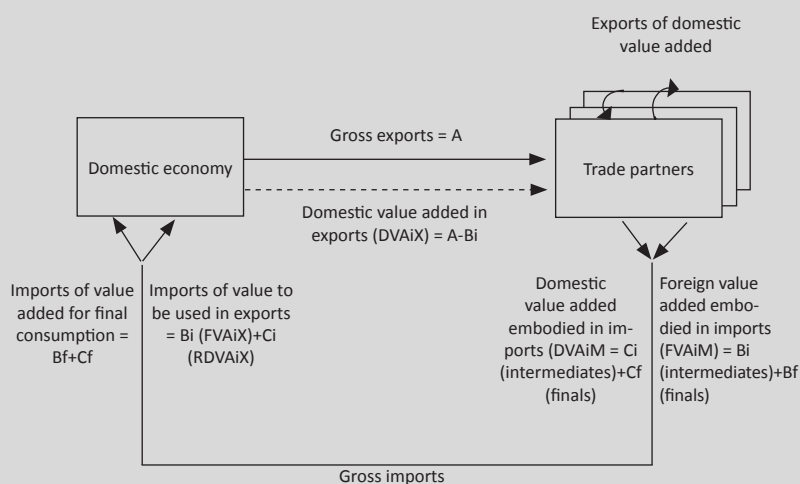
The analysis presented in this article is based on the World Input-Output Database (WIOD), which links national supply and uses tables with bilateral trade data in goods and services to produce a unique global I-O table. This database builds on national official statistics, it covers 27 European Union (EU) countries and 13 other major world economies and comprises 35 sectors, corresponding to a broad NACE classification for the period 1995-2011 (see Timmer *et al.* (2012) and Dietzenbacher *et al.* (2013)).[6]

The coefficients of FVAiX, DVAiM and RDVAiE are useful proxies of the participation of economies in GVCs. We follow Trefler and Zhu (2010) and Stehrer *et al.* (2012) for a stylized presentation of these indicators. The most intuitive way to introduce them involves defining the domestic value added in exports (DVAiX).
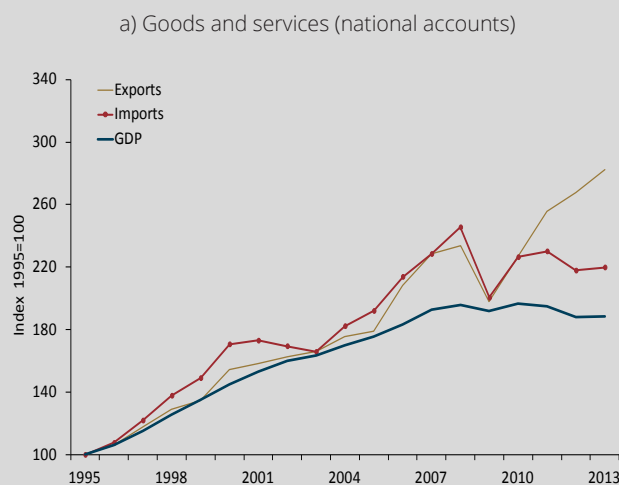
The global Leontief inverse matrix is denoted as $L = (I - A)^{-1}$, with dimension $NC \times NC$, where N stands for the number of sectors and C for the number of countries. Additionally I is the identity matrix and A is the $NC \times NC$ global I-O matrix. The Leontief inverse matrix is the sum of a converging infinite geometric series with common ratio A, that is, $[I - A]^{-1} = [I + A + A^2 + A^3 + ... + A^x]$, when $x \to \infty$.

The vector of value-added coefficients, *i.e.*, value-added created per unit of gross output in country r, is denoted by v^r. This $1 \times NC$ vector contains the value-added coefficients for country r and zeros otherwise. Further, country r's exports are written in a vector e^r, which is of dimension $NC \times 1$ and reports the exports as positive elements and zeros otherwise. The DVAiX basically takes the on-diagonal block in the Leontief inverse for country r, pre-multiplies by the value-added coefficients in each sector and post-multiplies by the values of exports, that is:
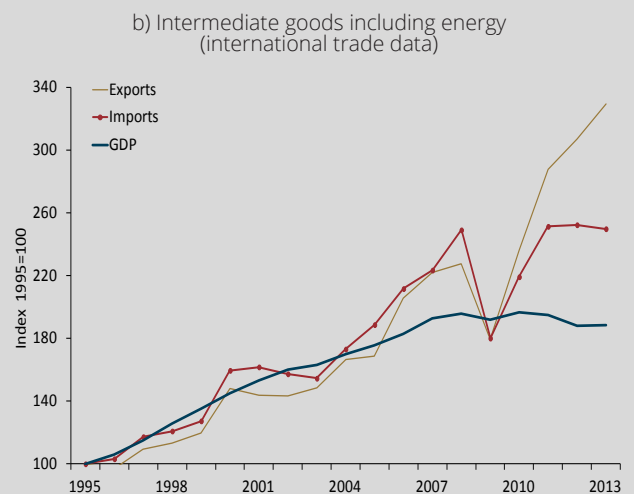
$$\text{DVAiX}^r = v^r L^{rr} e^r \tag{1}$$

The FVAiX provides the value-added directly and indirectly created in the country from which intermediates are imported (source country s) for production of country r's exports and is calculated in a similar way. It implies pre-multiplying the Leontief inverse by the vector containing the value-added coefficients for country s and zeros otherwise, denoted as v^s, and post-multiplying by country r's exports vector.

Chart 2 • Annual nominal growth rate of trade flows

a) Goods and services (national accounts)

b) Intermediate goods including energy (international trade data)

Source: *INE.*

Source: *INE.*

This can be written as:

$$\text{FVAiX}^{sr} = v^s L^{sr} e^r \tag{2}$$

Summing over all partner countries, total foreign value-added embodied in country r's exports is:

$$\text{FVAiX}^r = \sum_{s, s \neq r} v^s L^{sr} e^r \tag{3}$$

This calculation is similar to that suggested by Hummels *et al.* (2001) to evaluate the import content of exports, designated as "vertical specialization". However, in equation 3 the calculation is based on the concept of value-added and uses a global Leontief inverse rather than a basic matrix with the country's import coefficients.

Summing up the domestic and foreign value-added in exports, as presented in equations 1 and 3, provides the value of total exports in gross terms. In fact, through national accounts' identities, the value-added created along the supply chain for the production of the exported good must correspond to factor income generated in domestic and foreign economies. The same procedure can be applied when the value-added content of exports of a particular sector is analyzed. In this case only the exports of the selected sector are included in the export vector e^r.

It should be noted that the calculations consider a country's total exports, *i.e.*, both exports of intermediates and final goods. Although intermediate goods do not account for the calculation of total value-added, this is justified from a national accounting perspective. In fact, to include only exports of final goods would be misleading. For example, a country exporting only raw materials would show zero value-added in exports, in a context where the production of raw materials genuinely creates domestic income. In other words, the consideration of exports of intermediates and final goods leads to double counting in overall trade statistics (which is precisely the motivation for the proposal of value-added measures) but from an individual country's perspective both types of exports have to be considered as sources of value-added (see Koopman *et al.* (2010), Stehrer *et al.* (2012) and Stehrer (2012), for detailed discussions).

Chart 3 • Structure of a global input-ouput matrix

		Country 1	Country 2	...	Country 1	Country 2	...	
		Sector 1 Sector 2 ...	Sector 1 Sector 2 ...		Final consumption	Final consumption		Total use of output
Country 1	Sector 1 Sector 2 ...	Use of domestic inputs (classical single country input-output table)	Use of foreign inputs		Final use of domestic products	Final use of exports of country 1 (imports country 2)		Sum of lines
Country 2	Sector 1 Sector 2 ...	Use of foreign inputs	Use of domestic inputs (classical single country input-output table)		Final use of exports of country 2 (imports country 1)	Final use of domestic products		
...	...	... ...	... ...		...	...		
Value-added		Use of primary inputs	Use of primary inputs		Final use of primary inputs	Final use of primary inputs		
Gross output		Sum of columns	Sum of columns					

In order to discuss the characteristics of GVCs it is useful to calculate the domestic value-added that returns to the country (embodied in imports), which is incorporated again in goods and services that are exported. This would be the case of a country exporting prototypes of parts and components for automobiles, which would be produced abroad and re-imported for final assembly before being exported as final products.

The calculation of the DVAiM involves a strategy similar to the one presented above, denoting country r's imports by m^r. This vector of dimension $NC \times 1$ includes bilateral imports values of country r from other countries as positive entries and zeros otherwise. The domestic value-added in a country's imports is computed as:

$$\text{DVAiM}^r = v^r L^{rs} m^r \tag{4}$$

Equation 4 picks up the off-diagonal blocks of the rows of country r in the global inverse Leontief, which are pre-multiplied by input coefficients of this country and post-multiplied by its bilateral imports.[7] Finally, the coefficient that proxies RDVAiE departs from the principle that exports use domestic value added in a given proportion, independently of whether such domestic value added is being exported for the first time or re-exported (after being imported as part of intermediate products), that is:

$$\text{RDVAiX}^r = \text{DVAiX}^r . \frac{\text{Im}^r}{Ie^r} \text{DVAiM}^r \tag{5}$$

where I is a unitary vector of dimension $1 \times NC$.

3. Value added in exports

The coefficient of FVAiX increased in the Portuguese economy from 27.6 per cent in 1995 to 31.4 per cent in 2007 (table 1). There was a significant reduction in 2009, also visible in other economies, as a result of the great trade collapse. The events that lead to the economic and financial crisis had a strong impact on international trade due to GVCs. The so-called "Bullwhip effect" refers that the variance of sales in the final customer are smaller than those faced by the producers upstream in the supply chain.[8] More recently, although gross exports have been growing fast, the FVAiX in the Portuguese economy did not recover to its pre-crisis level. This somewhat contrasts with the experience of other countries. Amador *et al.* (2013) show that such a recovery took place in the euro area and the US. One explanation for this path lies on the structure of

Table 1 • Measures of participation in global value chains

| | Foreign value added in exports (FVAiX) (% exports) | | | | | | DVAiM | RDVAiE |
	Total	Intra euro area 17	Extra euro area 17	Agriculture	Manufactu-ring	Services		
1995	27.6	37.9	11.3	11.3	31.2	15.4	0.17	0.16
2000	30.0	43.0	12.6	14.2	34.7	15.4	0.21	0.22
2007	31.4	44.5	14.9	17.1	37.3	17.1	0.31	0.28
2009	27.5	37.5	13.2	16.2	32.3	16.4	0.24	0.29
2011	27.9	40.1	13.7	17.0	33.0	16.5	0.26	0.25

Source: Authors' calculations.
Notes: DVAiM – Domestic value added in imports (as a percentage of total imports); RDVAiX – Reexported domestic value added in exports (as a percentage of total exports).

Portuguese recent export growth, which has benefited from the contribution of extra EU markets and some non-manufacturing sectors. Table 1 shows that FVAiX outside the euro area is one-third of that of exports to euro area countries, which links with the fact that GVCs have a strong regional nature, with significant importance in Europe. In the same vein, FVAiX in services and agriculture is half of that in manufacturing. Therefore, composition effects play an important role in the recent path of overall Portuguese FVAiX.
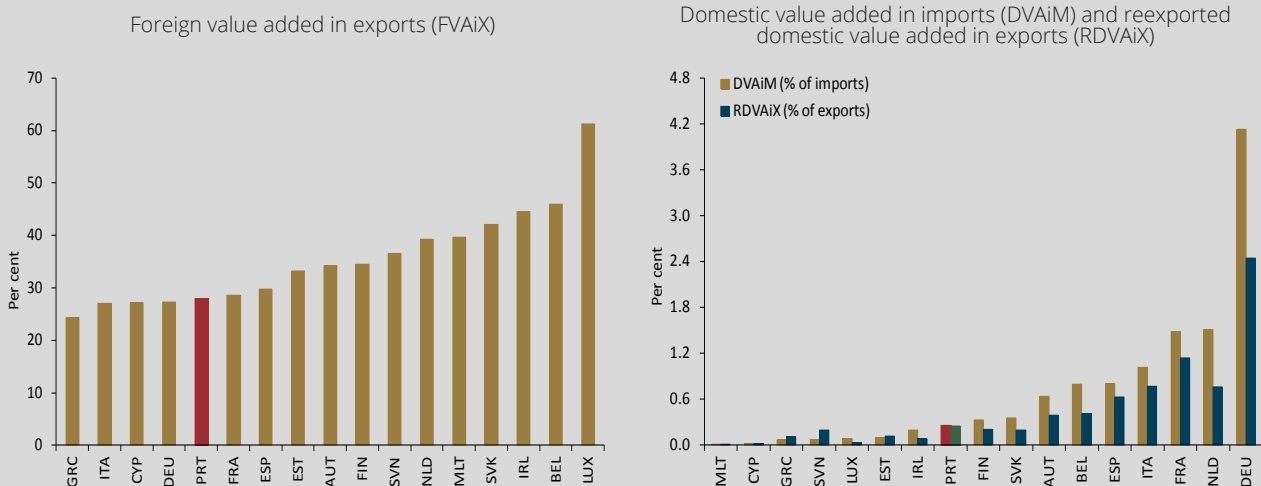
The last two columns of table 1 present the coefficients of DVAiM and RDVAiE for the Portuguese economy, which are small and broadly stable in the period under analysis. These indices reflect a reduced incidence of activities placed in the initial and final stages of the production chain, where there is typically a high incorporation of value added, *i.e.*, low usage of processing activities from abroad. In addition, these small indices reflect the low specialization in products that are widely used as inputs in most sectors (*e.g.*, energy products) and also the relatively small scale of the Portuguese economy. Larger economies tend to export a broader range of products and such scale amplifies the pervasiveness of their value added.

Chart 4 compares the level of the indices referred above across euro area countries. In this context, the Portuguese economy presents an intermediate position, though showing a bias towards lower levels of FVAiX.[9] As for DVAiM and RDVAiE, Portugal is also in an intermediate position, though coefficients are much lower than those of the countries with the highest values. The Portuguese RDVAiE is one-tenth of that of Germany, one-fifth of that of France and one-third of that of the Netherlands, countries largely engaged in processing and logistics.

4. Geographic dimension

One important dimension of the analysis is the decomposition of FVAiX according to countries of origin. Chart 5 presents this breakdown for Portugal in 2011. The foreign value added coming from the euro area to be incorporated in exports represented about 15 per cent of gross exports, *i.e.*, about half of total FVAiX in 2011. In 1995 the share of the euro area in total FVAiX was about 60 per cent. The second largest origin of FVAiX is the block "Rest of the world", which represented about 6 and 8 per cent of gross exports in 1995 and 2011, respectively.

Chart 4 • Measures of participation in global value chains (2011)

Foreign value added in exports (FVAiX)

Domestic value added in imports (DVAiM) and reexported domestic value added in exports (RDVAiX)

Source: Authors' calculations.

Amongst the set of sources of FVAiX outside the euro area, some relevant patterns exist. Firstly, UK, Denmark and Sweden decreased their importance, while recent EU members that are outside the euro area slightly gained relevance. Secondly, China moved from virtually zero to 1 per cent of total FVAiX from 1995 to 2011.

As for individual countries inside the euro area, the foreign value added coming from Spain and Germany to be used in exports represented in 2011 about 6 and 3 per cent of gross exports, respectively. In addition, as seen in gross export flows, Spain has significantly increased its importance as a source of value added that is embodied in national exports, while Germany has decreased. Therefore, there is evidence pointing towards some strengthening of Iberian GVCs in the period under analysis.

Another approach is to examine the geographical origin of the value added embodied in Portuguese exports directed to Spain and Germany, which are the main destinations of gross exports. Table 2 presents this breakdown signaling shares higher than 2 per cent in grey. Not-surprisingly, most of the value added embodied in Portuguese exports to Spain and Germany is originated in these same countries, which is in line with the nature of GVCs. The increasing role of Spain is visible from 1995 to 2011, while Germany decreased its share in the same period, even in exports directed to itself. The significant share of the "Rest of the world" is partially explained by its role as supplier of energy, which is embodied in virtually all activities. Furthermore, the relative importance of France, Italy and the block composed by UK, Denmark and Sweden has significantly decreased in the period under analysis.

Another aspect that is worth mentioning is the existence of positive shares (though small) for a large number of countries, *i.e.*, Portugal uses diversified value added in its exports to Spain and Germany, which is a symptom of how intricate are GVCs in the world economy. With the exception of very small countries like Cyprus, Estonia, Malta and Slovenia, shares reach at least 0.1 per cent of total Portuguese exports to the two selected countries. Even a small economy like Luxembourg reaches this threshold, probably due to its relevance as provider of financial services in the world economy.

Panel a) of chart 6 presents the Portuguese coefficients of DVAiM from each country in the sample as a percentage of imports from to the respective country in 2011. The striking result is the comparatively large coefficient obtained for Spain (0.4 and 0.6 per cent in 1995 and 2011,

Chart 5 • Foreign value added in Portuguese exports in 2011
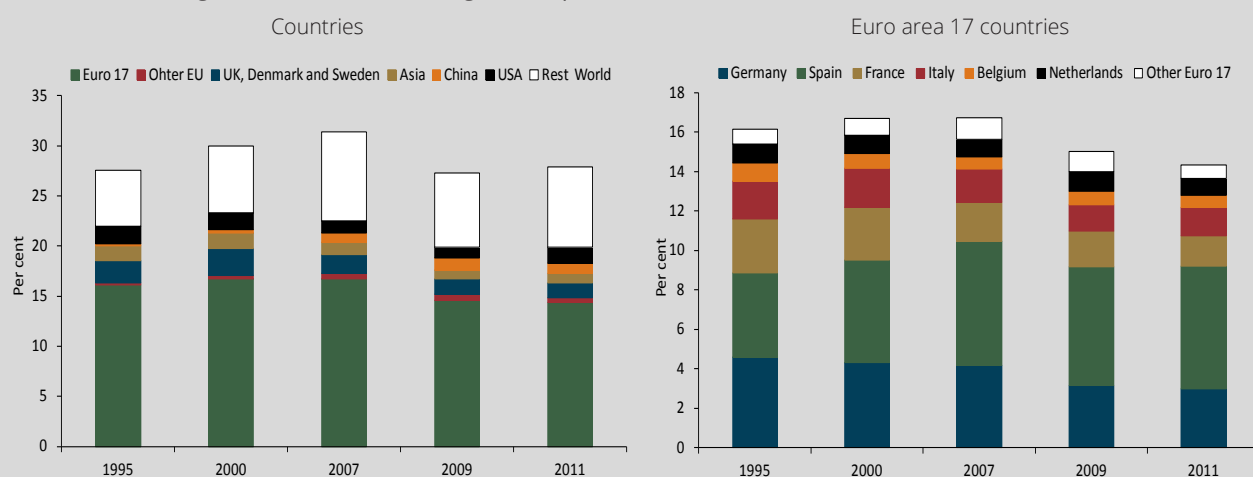
Source: Authors' calculations.

respectively), *i.e.*, almost three times larger than what is observed for the second country. This reveals the strong integration of the Iberian economies also translated into GVCs. Moreover, the coefficients of DVAiM for extra-EU countries are notoriously small. Panel b) of chart 6 presents the contributions of the different countries to the aggregate DVAiM coefficient in table 1. The very large role of Spain in Portuguese DVAiM emerges in an even clearer way, increasing from 1995 to 2007 but reducing since then (panel c) of chart 6).

As for the RDVAiE coefficient, is not possible to perform a geographical decomposition because it involves a complex representation of origins and destinations of Portuguese value added across the set of countries in the sample.

5. Sectoral dimension

This section discusses the sectoral dimension of GVCs in the Portuguese economy. Table 3 provides the details on the FVAiX for the different sectors and periods, with values above 25 per cent shaded in gray. As expected, the coefficients are higher in the manufacturing sector, notoriously in "Coke and petroleum" since this activity largely embodies external energy inputs. The second largest coefficient is that of "Transport equipment", which is typically highlighted in the empirical literature because the automotive industry is one example of strong integration in GVCs.[10] The same is valid for the sector "Electrical and optical equipment", though in a smaller scale. The

Table 2 • Decomposition of foreign value added in Portuguese exports to Spain and Germany
| As a percentage of exports to these countries

	Germany					Spain				
	1995	2000	2007	2009	2011	1995	2000	2007	2009	2011
Austria	0.3	0.3	0.4	0.3	0.3	0.2	0.2	0.3	0.3	0.2
Belgium	1.0	0.9	0.7	0.8	0.7	1.0	0.8	0.7	0.7	0.6
Cyprus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Germany	6.1	6.1	5.6	4.0	3.9	4.7	4.1	4.1	3.3	3.1
Spain	4.8	6.3	7.5	7.1	7.6	4.8	5.5	7.0	6.5	6.6
Estonia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Finland	0.2	0.3	0.3	0.2	0.1	0.3	0.2	0.2	0.2	0.1
France	3.1	3.4	2.4	2.1	1.9	2.9	2.6	2.1	1.9	1.6
Greece	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0
Ireland	0.1	0.2	0.4	0.4	0.2	0.1	0.2	0.3	0.4	0.2
Italy	2.4	2.6	2.1	1.7	1.8	1.8	1.9	1.8	1.4	1.5
Luxembourg	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Malta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Netherlands	1.1	1.1	1.1	1.2	1.1	1.0	0.9	0.9	1.0	0.9
Portugal (DVAiX)	69.1	64.9	65.3	70.7	69.6	70.5	68.1	67.0	71.9	71.3
Slovakia	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1
Slovenia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UK, Sweden and Denmark	2.6	3.0	2.1	1.7	1.7	2.3	2.9	1.9	1.6	1.5
New EU members, not members of the Euro	0.3	0.5	0.7	0.8	0.6	0.2	0.3	0.6	0.6	0.5
USA	1.9	2.0	1.3	1.3	1.6	1.7	1.6	1.3	1.3	1.6
China	0.2	0.4	1.1	0.9	1.3	0.2	0.3	0.9	0.8	1.0
Asia	2.3	2.1	1.4	1.0	1.2	1.4	1.3	1.2	0.9	1.0
Rest of the World	4.3	5.7	7.3	5.7	6.2	6.9	8.7	9.6	7.2	8.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

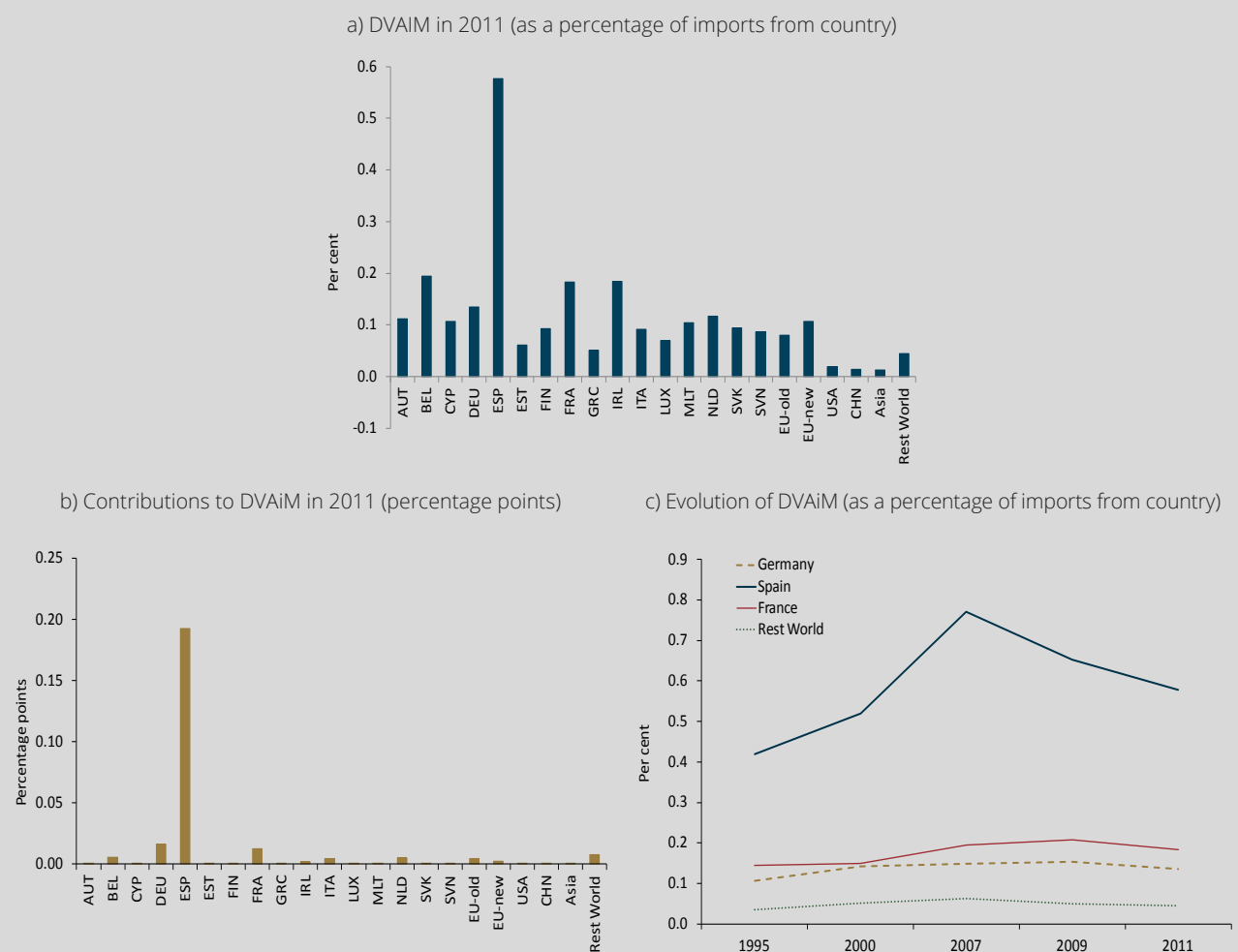Source: Authors' calculations.
Note: Cells with values higher than 2 per cent are shaded in gray.

only non-manufacturing sector that surpasses this threshold is "Air Transport", where imports of energy and business services play an important role.

The sectoral and geographical dimensions of the analysis can be crossed in order to identify additional patterns. Chart 7 takes the eleven main sectors in terms of the level of foreign value added embodied in Portuguese exports and decomposes along its main geographical origins. These sectors represent about 78 per cent of total Portuguese FVAiX in 2011. In all sectors except "Coke and petroleum", the euro area is the origin of more than 40 per cent of FAViX. This share is smaller in "Air Transport" and, to a lesser extent, in "Food", where the importance of US and "Rest of the world" as sources of value added embodied in Portuguese exports is larger. As it would be expected, in what concerns the FVAiX in "Coke and petroleum" the share of the "Rest of the world" is larger than 80 per cent.

As for the change in the share of the different countries as origins of foreign value added embodied in Portuguese exports from 1995 to 2011 (Chart 8), it is worthwhile signaling the growing role of China, though still accounting for low levels, as well as the growing role of "Rest of the world". Conversely, the euro area has reduced its share in many of the selected sectors. Most notably, in sectors "Rubber and plastics", "Air transport", "Chemicals" and "Textiles", the euro area

Chart 6 • Domestic value added in imports (DVAiM)

a) DVAIM in 2011 (as a percentage of imports from country)

b) Contributions to DVAiM in 2011 (percentage points)

c) Evolution of DVAiM (as a percentage of imports from country)

Sources: Authors' calculations.

has reduced its share as source of FVAiX, as a counterpart of important increases in China and "Rest of the world". In addition, the set of countries comprising UK, Denmark and Sweden, old EU members that are not in the monetary union, have lost share in all selected sectors. Overall, although international price changes may play a role in these developments, there is some evidence of changes in the architecture of GVCs in the recent years.

6. Concluding remarks

The Portuguese economy initiated its process of economic integration in the beginning of the 1960's with the accession to the European Free Trade Association. This process was deepened with the accession to the European Economic Community in 1986 and the subsequent participation in the euro area in 1999. The degree of openness of the economy increased against a background of stronger liberalization, participation of new players in the world trade system and the emergence of the GVCs as a paradigm for the organization of international production.

At present the Portuguese economy is fully integrated in the world trade system. Nevertheless, there is substantial room to increase the intensity of its participation in GVCs, coming closer to

Table 3 • Foreign value added in exports | As a percentage of exports

	NACE rev 1	1995	2000	2007	2009	2011
Agriculture, Hunting, Forestry and Fishing	AtB	10.6	14.0	17.6	16.6	17.6
Mining and Quarrying	C	12.3	15.5	16.4	15.2	15.5
Food, Beverages and Tobacco	15t16	21.6	23.0	25.5	24.0	25.5
Textiles and Textile Products	17t18	26.8	29.5	25.8	22.1	22.9
Leather, Leather and Footwear	19	28.0	29.5	28.7	24.4	26.8
Wood and Products of Wood and Cork	20	22.6	27.0	25.1	20.7	21.4
Pulp, Paper, Printing and Publishing	21t22	18.9	22.5	24.6	21.9	22.6
Coke, Refined Petroleum and Nuclear Fuel	23	75.9	83.6	77.5	72.7	73.9
Chemicals and Chemical Products	24	28.1	32.9	35.4	32.3	34.8
Rubber and Plastics	25	30.1	35.0	36.3	33.0	35.4
Other Non-Metallic Mineral	26	17.2	19.3	21.8	19.4	20.0
Basic Metals and Fabricated Metal	27t28	31.4	36.8	43.0	35.4	35.9
Machinery, Nec	29	31.1	33.5	35.4	31.8	33.3
Electrical and Optical Equipment	30t33	39.3	42.9	47.2	40.0	37.3
Transport Equipment	34t35	43.6	43.2	46.0	42.2	42.9
Manufacturing, Nec; Recycling	36t37	25.7	30.5	30.4	26.0	26.9
Electricity, Gas and Water Supply	E	12.8	19.5	23.1	21.0	21.2
Construction	F	18.2	20.5	21.0	18.6	19.1
Sale, Maintenance and Repair of Motor Vehicles Retail Sale of Fuel	50	12.2	14.3	12.4	11.7	11.9
Wholesale Trade and Commission Trade, Except of Motor Vehicles	51	12.4	13.1	12.5	11.5	11.6
Retail Trade, Except of Motor Vehicles ; Repair of Household Goods	52	9.4	9.8	9.1	8.5	8.6
Hotels and Restaurants	H	14.4	14.6	13.4	12.8	13.7
Inland Transport	60	12.2	16.5	19.5	18.4	18.6
Water Transport	61	16.7	19.1	24.7	24.1	24.2
Air Transport	62	28.3	26.6	26.8	27.0	27.2
Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies	63	6.2	10.6	13.1	12.8	12.9
Post and Telecommunications	64	9.5	12.6	15.3	13.8	13.0
Financial Intermediation	J	5.8	7.2	6.2	5.9	5.9
Real Estate Activities	70	4.6	4.4	3.7	3.5	3.5
Renting of M&Eq and Other Business Activities	71t74	12.8	12.0	12.8	12.0	12.0
Public Admin and Defence; Compulsory Social Security	L	6.0	7.1	7.9	7.5	7.6
Education	M	3.5	3.7	3.3	3.1	3.2
Health and Social Work	N	13.5	14.3	14.0	12.9	13.6
Other Community, Social and Personal Services	O	17.1	16.3	16.1	15.2	15.4
Total		27.6	30.0	31.4	27.5	27.9

Source: Authors' calculations.

Note: Cells with values higher than 25 per cent are shaded in gray.

the figures recorded by other European countries of similar size. The regional nature of GVCs and the geographic location of the Portuguese economy pose a challenge to this process. Although foreign value added in exports increased from 1995 to 2007, there was a significant reduction in 2009, which had still not been recovered by 2011. Structure effects linked to the geographical and sectoral composition of exports have been playing an important role in this evolution. In addition, the part of domestic value added that is re-exported is relatively small, signaling a positioning in the intermediate stages of the production chain.

The analysis of the sources of foreign value added embodied in exports reveals the dominant role played by the set of euro area countries, notably Germany and, mostly, Spain. The increasing role of the Iberian GVCs is also visible in the relatively large share of Portuguese value added returning to Portugal embodied in the imports of Spanish products. Moreover, the Chinese economy has gained relevance as origin of value added incorporated in national exports, though remaining at low levels. In the sectoral dimension, manufacturing presents the largest share of foreign value added in gross exports. Services have been increasing their share in the period under analysis, mostly in transport sectors.

The orientation towards foreign markets is an important feature in the restructuring process of the Portuguese economy and a necessary condition for higher potential GDP growth. In terms of policy consequences it is important to note that the participation in GVCs is not a sufficient condition to ensure good economic performance. The ability to accelerate real GDP growth through exports depends on the scale of trade but also on the ability to incorporate domestic value added in exports. Therefore, it is crucial to have firms placed in the stages of the GVC where significant value added is created. According to Baldwin (2012), these stages are either pre-fabrication, where R&D, product concept and design are defined, or stages closer to the final user, corresponding to post-fabrication services (sales, marketing and after sales services). Intermediate levels of production, especially assembly, are most likely to add less value added. This dimension of the analysis is still incomplete in the empirical literature of international trade.

There is substantial room for further investigation on the nature, impacts and interpretation of Portuguese international trade from the perspective of GVCs. This research may involve a more precise mapping of GVCs and also the utilization of firm-level data in order to identify the characteristics of successful exporters and their ability to create value added in the global economy.

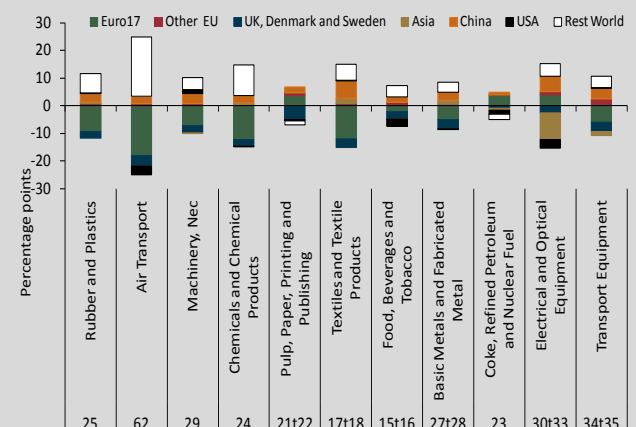Chart 7 • Origin of foreign value added incorporated in main using sectors in 2011
| Per cent
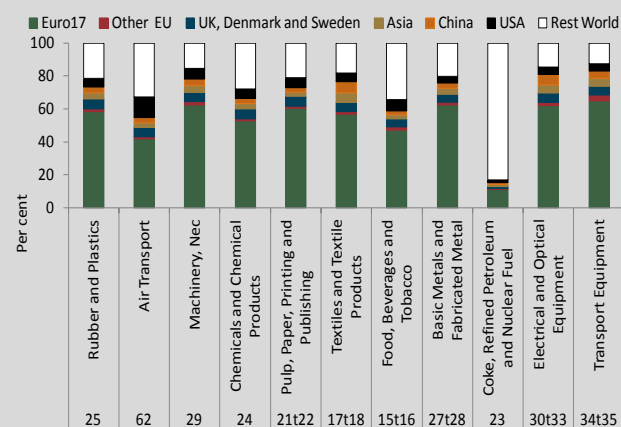
Chart 8 • Change in the origin of foreign value added incorporated in main using sectors from 1995 to 2011
| Percentage points

Source: Authors' calculations.

Notes:

1. The opinions expressed in the article are those of the authors and do not necessarily coincide with those of Banco de Portugal or the Eurosystem. Any errors and omissions are the sole responsibility of the authors.

2. Banco de Portugal, Economics and Research Department.

3. The Vienna Institute for International Economic Studies.

4. See Yeats (1998) for a discussion.

5. The composition of the geographical areas is listed in Appendix A.

6. Given the hypothesis used in the construction of the global input-output matrices, trade flows do not strictly correspond to those in national accounts.

7. Koopman *et al.* (2010) shows that subtracting this re-imported value-added from the domestic value-added content of exports yields the "value added in exports" (VAX) as defined in Johnson e Noguera (2012). See Stehrer (2013), for a detailed bilateral assessment.

8. See Altomonte *et al.* (2012) for an analysis of the "Bullwhip effect" along GVCs in the context of the great trade collapse.

9. Results obtained from the OECD Trade in Value Added Database place Portugal in an intermediate position amongst industrialized economies (Backer e Yamano (2012)).

10. See Lall *et al.* (2004) for an analysis of Electronics and Automobiles sectors in East Asia and Latin America and Timmer *et al.* (2013) for an analysis of GVC income and jobs in German transport equipment production.

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Appendix A

List of geographical areas and countries

Geographical area	Country
Euro area	Austria
	Belgium
	Cyprus
	Germany
	Spain
	Estonia
	Finland
	France
	Greece
	Ireland
	Italy
	Luxembourg
	Malta
	Netherlands
	Portugal
	Slovak Republic
	Slovenia
EU-old (accession before 2004)	Denmark
	Sweden
	UK
EU-new (accession after 2004)	Bulgaria
	Czech Republic
	Hungary
	Latvia
	Lithuania
	Poland
	Romania
	USA
	China
Asia	India
	Indonesia
	Japan
	Korea
	Taiwan
Rest of the World	Australia
	Canada
	Brazil
	Mexico
	Russia
	Turkey