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ABSTRACT

This paper addresses the relation between international trade and employment in Portugal with regard to the labour content of trade in intermediates. It considers both the overall level of employment and labour disaggregated by skills (high-skill, medium-skill and low-skill). The assessment makes use of the newly developed internationally linked input-output (IO) database named World Input-Output Database (WIOD), complemented with the Socio-Economic Accounts (SEA) for skill-types of labour. The period analysed – 1995-2009 - is the longest possible taking into account the two databases used. The amount of labour required to produce imported intermediates (exported intermediates) is taken as a proxy to the job effect of downward (upward) embeddedness of the country into Global Value Chains (GVCs). We conclude that intermediates' exports are basically intensive in low-skilled labour although presenting a tendency to skill-upgrading during the period analysed, while intermediates' imports are proportionally much more intensive in skilled labour, predominantly of a medium skill level, an expected result in a country of an intermediate level of development. We also concluded that the estimated net labour content of jobs in trade in intermediates in the final year of the period analysed was globally negative in 51 thousand jobs. Main net losses were observed with Brazil, People's Republic of China and India, while main net gains were observed with Spain and France.

Key-words: labour content of trade; Global Value Chains; Portugal; trade in intermediates.

1. Introduction

The significant reduction in transaction costs associated with globalisation, caused mainly by the wide use of Information and Communication Technologies (ICT), allowed for the fragmentation of the stages of production in the second half of the 20th century, particularly since the 1990s, leading to the quick spread of the so called Global Value Chains (GVCs). This fragmentation of production had particular impact on international trade, with cross-border trade in intermediate goods becoming dominant in world merchandise trade. UNCTAD (2013) estimated that value chains administered by multinational enterprises accounted for 80% of global trade in 2010, while the World Economic Forum (2013) concluded that concerted action to reduce supply chain trade barriers could increase global Gross Domestic Product (GDP) up to six times more (by 4.7%) than removing all remaining import tariffs (0.7%).

Given the increasing importance of this phenomenon, many studies aimed to measure the flows of value added traded and capture their impact on trade and growth of firms and countries involved (see, for instance, Keller, 2002 and Baldone et al, 2007). Much less studied is the effect of GVCs on labour and the job structure of an economy, namely in what concerns the amount of labour.

This paper addresses the relation between international trade and employment with regard to the job – overall and by skills (high-skill, medium-skill and low-skill) - content of trade of intermediates (inputs), namely raw materials, industrial parts and components and services. It focuses on the case of Portugal in the period 1995-2009, following the methodology of Stehrer & Stöllinger (2012) to calculate the job content of international trade, which the authors define as "trade in jobs". The job content of international trade compares the amount of labour (number of jobs) that a country uses to produce its exports with the hypothetical amount of jobs that would be required to produce its imports domestically, i.e. with domestic labour input requirements. Jobs linked to imports can be considered as "forgone" (potentially, i.e. assuming that the country can produce the imported inputs).

The assessment makes use of a newly developed internationally linked input-output (IO) database named World Input-Output Database (WIOD). This type of extended

national IO matrices provide data on the interactions between domestic and foreign suppliers (rows) and domestic and foreign users (columns) of domestically produced and imported intermediates and final goods, respectively designated in IO literature by the downstream and upstream approaches[1]. IO matrices are the only reliable source of data to deal with inputs' trade, considering that even when we are working with highly disaggregated levels of information in international trade databases, in order to take into consideration the characteristics of the traded good, some goods can be used both as an intermediate and as a final good, a distinction that only the IO matrices allow to make. The WIOD database is complemented with the Socio-Economic Accounts (SEA) for skill-types of labour. The period analysed was the longest possible given the temporal crossing of the two databases used, as explained in the empirical part of this research.

The amount of labour required to produce imported intermediates (exported intermediates) is taken as a proxy to the job effect of downward (upward) embeddedness of the country into GVCs and a positive net labour content in trading of intermediates signals a positive effect for the country of participation in international value chains.

The paper is organized as follows: section 2 presents a revision of literature on the effects of GVCs on the labour market; section 3 presents the calculations for Portugal; section 4 concludes.

2. Previous studies on the impact of Global Value Chains on the labour market

Only a few authors focused the impact of international fragmentation of production on the labour market, in spite of its importance.

The first studies on this topic focussed the impact on the remuneration of the labour force. It was the case of Feenstra & Hanson (1996, 1999) and Feenstra (1998), who concluded that international fragmentation of production was responsible for a significant share of the increase in demand for high-skilled labour force in the manufacturing industries of the United States (US) in the 1980s. Later on, Feenstra &

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[1] For information about how these internationally linked IO matrices are built, see annex I.

Hanson (2003) built a simple model of outsourcing to estimate the effects of trade in intermediates on wages in the US between 1979 and 1995 and concluded that the wages of employed workers with less than twelve years of schooling were those that decreased the highest with the relocation of economic activities intensive in low-skilled labour force outside of the country (by 20.2%), while the wages of workers with sixteen years of schooling or more increased by 3.4%. Several other studies presented similar conclusions for other regions: Strauss-Kahn (2003) for France; Geishecker (2006), and Geishecker & Görg (2008) for Germany (the latter also for the United Kingdom, UK, and Denmark); Hijzen (2007) for the UK; Hanson (2007) for Mexico, and Molnar et al (2007) for the Organization for Economic Cooperation and Development (OECD).

In sum, the above mentioned group of authors concluded that remuneration of the labour factor was affected by the relocation of production. However, this impact was not evenly distributed, being clearly differentiated between low-skilled and high-skilled jobs. Usually, the firm relocating usually chooses developing countries, which are intensive in low-skilled, in search for lower salaries. This puts pressure downwards on the remuneration of the low-skilled workers in the relocating (developed) country, while relative demand and salaries for higher-skilled jobs increases and the relative remuneration of low-skilled workers increases in the country (less developed) receiving the economic activity.

Other studies assessed not the change in remuneration of the workforce, but the size of the change in employment. The first authors to make use of this approach were Amiti & Wei (2005) for the services industry in the US and the UK, and Lui & Trefler (2008), for the services industry in the US and its outsourcing to India and the People Republic of China (PRC). In both cases, they found no or small significance of job losses in these countries due to international fragmentation of production. The first authors to find some significance in this regard were McKendrick et al (2000), who empirically concluded that in the case of jobs in the US hard-drive disk industry 80% had migrated to Southeast Asia from the 1970s onwards and by mid-1990s.

None of the authors already mentioned made use of internationally linked IO databases to assess the relationship between GVCs and labour markets. The first authors to work on this topic were Escaith & Timmer (2012), who took advantage of the new source of data provided by the internationally linked IO tables to measure "trade in jobs"

in the German transport equipment sector. In this regard, they showed that, between 1995 and 2008, the large majority of the 1.5 million-increase observed in the number of jobs in industries relevant to respond to the higher demand for German cars occurred outside Germany. In Germany, high-skilled and medium-skilled jobs increased only slightly, while low-skilled jobs decreased marginally.

Stehrer & Stöllinger (2012) tackled the question of how trade affected the demand for labour and the jobs structure of the European economy between 1995 and 2008, by measuring the job embodiment of trade by individual occupations of labour with the facilities provided by the WIOD database. The authors found different realities according to the skill-level of the workforce but, in general, at least in the more developed countries, jobs were lost for low-skilled workers, mainly related to the assembling and manufacturing stages of production, while jobs were gained for high-skilled workers, mainly related to research, development, design and marketing tasks.

3 The labour content of international trade in intermediates in the case of Portugal

This section aims to measure the job content of international trade of intermediates in Portugal in the period 1995-2009 adopting the methodology of Steher & Stollinger (2012).

We use data published by WIOD in its first version. This database was launched on April 16, 2012, coordinated by the University of Groningen, and is considered the most complete of the internationally linked IO databases available. It is based on a set of harmonized supply-and-use tables linked with data on international trade in goods and services. In its first edition, it presents annual data from 1995 to 2011 covering 35 sectors (18 service sectors) – see annex II for a list of sectors - and 40 countries, namely the EU-27 and 13 other major countries (Australia, Brazil, Canada, the PRC, India, Indonesia, Japan, Mexico, Russia, South Korea, Taiwan, Turkey and the US). Most of the data resulted from interpolation by using national accounts and supply-use annual tables, namely the OECD's Bilateral Trade and Trade in Services databases, since national IO

databases were only available for 1995, 2000, 2005 and 2009. Prices are constant and allow for Purchasing Power Parity-conversion[2].

In addition to the data published by the WIOD, we use the SEA, a database built for each one of the 35 sectors, 40 countries and 17 years covered by the WIOD that includes country-specific environmental and socio-economic indicators, such as industry-level data of capital stock, investment, wages and employment (by skill-type) for the period 1995-2009[3]. The WIOD allows estimating how many dollars Portugal imported/exported in inputs, per sector and from/for any given country, while the SEA allows estimating, after some basic arithmetic transformations, the number of persons engaged in the economy, per sector and per skill.

While calculating the jobs embodied in exports of intermediates of country i is straightforward, the amount of labour required to produce imports is, as already mentioned, an hypothetical value that is calculated as follows: first, we estimate the import flows of inputs by country i, which are measured in USD; second, we convert the measurement unit of these flows from USD to amount of labour, namely to number of persons engaged[4], assuming that those imported inputs are produced domestically, i.e. with country i's technology.

The resulting number of jobs of the counterfactual exercise above explained is a *proxy* for the job effect of a country's downward embeddedness into GVCs with reservations that cannot be neglected. First, because we are not using the labour content of imported inputs but the labour content that would be hypothetically used if those inputs were produced domestically. Second, because it omits potential efficiency gains obtained by using those "foregone" resources domestically in more relatively efficient sectors, as already observed by Stehrer & Stöllinger (2012). Third, because the relation between

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[2] For more detailed information about how the WIOD was built, see Timmer et al (2012).

[3] Also published by in http://www.wiod.org/new_site/database/seas.htm. The SEA include the following indicators: (i) gross output by industry at current basic prices; (ii) intermediate inputs at current purchasers' prices; (iii) gross value added at current basic prices; (iv) compensation of employees; (v) labour compensation; (vi) capital compensation; (vii) nominal Gross Fixed Capital Formation (GFCF); (viii) number of persons engaged; (ix) number of employees; (x) total hours worked by persons engaged; (xi) total hours worked by employees; (xii) price levels of gross output; (xiii) price levels of intermediate inputs; (xiv) price levels of gross value added; (xv) price levels of GFCF; (xvi) gross output; (xvii) intermediate inputs; (xviii) gross value added; (xix) real fixed capital stock; (xx) high-skilled labour compensation; (xxi) medium-skilled labour compensation; (xxii) low-skilled labour compensation; (xxiii) hours worked by high-skilled persons engaged; (xxiv) hours worked by medium-skilled persons engaged; and (xxv) hours worked by low-skilled persons engaged.

[4] "Persons engaged" means "salaried employees plus self-employed and family members", according to the SEA published by the WIOD initiative (Timmer et al, 2012).

GVCs and employment is not clear cut, as with GVCs international trade becomes, to use Stehrer & Stöllinger (2012)'s expression, more granular; in fact, internationally traded inputs may incorporate, in turn, imported inputs (the so-called second-round effects of inputs, that can be even of higher order).

In what follows, we will start with the suppliers or downstream approach of the IO internationally linked matrix (subsection 3.1); next, we continue with the users or upstream approach (subsection 3.2); and, finally, we present the net job content of Portuguese international inputs' trade disaggregated by trade partners (section 3.3.).

Despite the focus of our analysis being the trading of inputs, we will consider the whole amount of jobs associated to domestic production in order to provide a more comprehensive view of the Portuguese economy.

In the tables presented in this section, the job content associated to input-imports flows will be designated by "foregone jobs" (potentially, as mentioned above) and the job content of inputs exported will be designated by "gained jobs". Note that in both cases we are evaluating the jobs embodied in inputs' trade and not the impact of trade on the level of employment of a country. At this broader level, it may happen, for instance, that the level of employment in the country remains unchanged despite inputs' trading[5].

We will present calculations for the last year of the period analysed (2009) and the difference between this year and first one considered (1995). Results for the remaining years of the period are available upon request.

3.1. The supplier's approach (or the downstream approach)

Bearing in mind that "foregone jobs" are those mentioned in the Tables of this sub-section as "jobs abroad", Table I below presents the estimated domestic and "foregone jobs" in Portugal in 2009, calculated according to the downstream approach of an IO table. It shows that 4.8 million jobs (persons engaged) in Portugal were based on the demand for products and services in the Portuguese economy in 2009: 3.3 million in

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[5] If imported inputs were produced domestically and labour displaced shifted to other productions with limited adjustment costs and exported inputs were produced for the domestic market with the same labour input requirements.

services (69% of total) and 1.5 million in manufacturing (31%). Of those 4.8 million jobs: (i) 3.1 million were based on the demand for products and services originated in the same sector (64%); (ii) 1.4 million were based on the demand for products and services originated in other sectors of the Portuguese economy (30%); and (iii) 304 thousand were based on the demand for foreign inputs, i.e. "foregone jobs" (6%).

TABLE I - ESTIMATED DOMESTIC AND "FOREGONE JOBS" IN THE PORTUGUESE ECONOMY: SUPPLIERS' APPROACH, PERSONS ENGAGED (IN THOUSANDS, 2009)

	All sectors	Manufacturing sectors	Services
Jobs in the sector producing that good or providing that service (1)	3,097	673	2,424
Jobs in other sectors than the one producing that good or providing that service (2)	1,425	640	785
Jobs in Portugal (1+2)	4,521	1,313	3,209
Jobs abroad (3)	304	167	137
Total jobs (1+2+3)	4,825	1,480	3,346

Source: Author's estimations based on WIOD and SEA, retrieved in January 2014. Due to rounding, numbers presented may not add up precisely to the totals provided.

Table II below shows a similar approach to that of the Table I but disaggregated by job-skills. We observe that, in 2009, the 4.8 million jobs based on the demand for products and services in the Portuguese economy divided in: (i) 0.72 million high-skilled jobs; (ii) 1.02 million medium-skilled jobs; and (iii) 3.09 million low-skilled jobs. Of these, "foregone jobs", i.e. those corresponding to imported inputs, represented 51 thousand high-skilled jobs, 116 thousand medium-skilled jobs and 138 thousand low-skilled jobs, respectively.

	All sectors	Manufacturing	Services
High-skilled jobs in the sector producing that good or providing that service (1)	503	25	478
High-skilled jobs in other sectors than the one producing that good or providing that service (2)	169	49	120
High-skilled jobs in Portugal (1+2)	672	74	597
High-skilled jobs abroad (3)	51	22	29
High-skilled jobs (1+2+3)	**722**	**96**	**626**
Medium-skilled jobs in the sector producing that good or providing that service (4)	614	58	555
Medium-skilled jobs in other sectors than the one producing that good or providing that service (5)	289	103	187
Medium-skilled jobs in Portugal (4+5)	903	161	742
Medium-skilled jobs abroad (6)	116	57	59
Medium-skilled jobs (4+5+6)	**1,018**	**218**	**801**
Low-skilled jobs in the sector producing that good or providing that service (7)	1,980	589	1,391
Low-skilled jobs in other sectors than the one producing that good or providing that service (8)	976	488	479
Low-skilled jobs in Portugal (7+8)	2,947	1,077	1,870
Low-skilled jobs abroad (9)	138	88	49
Low-skilled jobs (7+8+9)	**3,085**	**1,166**	**1,919**
Total jobs (1+2+3+4+5+6+7+8+9)	**4,825**	**1,480**	**3,346**

Source: Authors' estimations based on WIOD and SEA, retrieved in January 2014. Due to rounding, numbers presented may not add up precisely to the totals provided.

A first conclusion about the downward embeddedness of Portugal into GVCs in 2009 is that being the country predominantly an unskilled labour user (with a number of this type of jobs almost 6 times higher than those in the medium-skilled category), the importation of intermediates, proportionally, embodies a type of labour more intensive in

labour skilled, mainly of the medium-skilled category, which represents a number of jobs only slightly smaller than those in the low-skilled category.

Table III and Table IV below estimate the difference in domestic and "foregone jobs" observed between 2009 and 1995, respectively for total of persons engaged and disaggregating by labour skills. Note, that a decrease in the number of jobs, either used in domestic production or in imported inputs, does not necessarily mean a decrease in domestic production/imported inputs as it may be due to technology improvement between the two observed years.

Three main conclusions may be withdrawn from Table III. First, jobs based on the domestic production of the Portuguese economy increased by half a million when comparing those two years. Second, while the number of jobs in the service sectors increased by 804 thousand, the number of jobs in manufacturing decreased by 267 thousand. We can state therefore that jobs in the Portuguese economy were becoming increasingly concentrated in services. Third, the number of jobs in the same sector producing that good or service increased by 381 thousand, while the number of jobs in other sectors increased by 148 thousand and the number of "foregone jobs" increased by 7 thousand (namely in services, where those jobs increased by 16 thousand, since in manufacturing occurred a decrease of 9 thousand jobs). These 7 thousand additional jobs suggest an increasing downward participation of Portugal into GVCs, but in services.

TABLE III - ESTIMATED CHANGE IN DOMESTIC AND IN "FOREGONE JOBS" BY THE PORTUGUESE ECONOMY FROM 1995 TO 2009: SUPPLIERS' APPROACH, PERSONS ENGAGED (IN THOUSANDS)

	All sectors	Manufacturing sectors	Services
Jobs in the sector producing that good or providing that service (1)	381	- 228	610
Jobs in other sectors than the one producing that good or providing that service (2)	148	- 30	178
Total jobs in Portugal (1+2)	529	- 259	788
Jobs abroad (3)	7	- 9	16
Total jobs (1+2+3)	537	- 267	804

Source: Authors' estimations based on WIOD and SEA, retrieved in January 2014. Due to rounding, numbers presented may not add up precisely to the totals provided.

In terms of job-skills (Table IV), we observe (downstream) that, over the period analysed, the number of jobs based on domestic production increased by 332 thousand in high-skilled category and 342 thousand in the medium-skilled one, while the number of low-skilled jobs decreased in 137 thousand. This evolution is more significant if we consider only manufacturing sectors, where the number of jobs based on domestic production increased by 40 thousand in high-skilled category and 26 thousand in the medium-skilled one, with low-skilled jobs decreasing in more than 333 thousand. Therefore, Portugal registers a favourable evolution in terms of skilled labour in the period analysed. Concerning the downward insertion of Portugal into GVCs, the number of "foregone jobs" increased in 21 thousand in high-skilled labour (of which 8 thousand in manufacturing and 13 thousand in services), 4 thousand in medium-skilled labour (corresponding to a decrease of 5 thousand in manufacturing and an increase of 9 thousand in services) and, finally, decreased 18 thousand in the low-skilled category (of which 12 thousand in manufacturing and the remaining in services).

TABLE IV - ESTIMATED CHANGE IN DOMESTIC AND IN "FOREGONE JOBS" BY THE PORTUGUESE ECONOMY FROM 1995 TO 2009: SUPPLIERS' APPROACH, PERSONS ENGAGED DISAGGREGATED PER SKILLS (IN THOUSANDS)

	All sectors	Manufacturing sectors	Services
High-skilled jobs in the sector producing that good or providing that service (1)	227	12	215
High-skilled jobs in other sectors than the one producing that good or providing that service (2)	84	20	63
High-skilled jobs in Portugal (1+2)	311	32	278
High-skilled jobs abroad (3)	21	8	13
High-skilled jobs (1+2+3)	**332**	**40**	**292**
Medium-skilled jobs in the sector producing that good or providing that service (4)	227	1	226
Medium-skilled jobs in other sectors than the one producing that good or providing that service (5)	111	30	80
Medium-skilled jobs in Portugal (4+5)	337	31	306
Medium-skilled jobs abroad (6)	4	- 5	9
Medium-skilled jobs (4+5+6)	**342**	**26**	**316**
Low-skilled jobs in the sector producing that good or providing that service (7)	- 72	- 241	169

	Total		
Low-skilled jobs in other sectors than the one producing that good or providing that service (8)	- 46	- 81	35
Low-skilled jobs in Portugal (7+8)	- 118	- 322	204
Low-skilled jobs abroad (9)	- 18	- 12	- 7
Low-skilled jobs (7+8+9)	**- 137**	**- 333**	**197**
Total jobs (1+2+3+4+5+6+7+8+9)	**537**	**- 267**	**804**

Source: Authors' estimations based on WIOD and SEA, retrieved in January 2014. Due to rounding, numbers presented may not add up precisely to the totals provided.

The pattern of specialization of the Portuguese economy in terms of GVCs that emerge in this (partial) assessment is that inputs imported became increasingly intensive in more skilled labour (specially of a high level), this being the category that increased the most during the period analysed. This evolution is particularly noticeable in the import of services.

Finally, we sought to know which sectors were responsible for the trend presented above. The answer is shown in Table V[6] below in what concerns total persons engaged[7].

TABLE V - ESTIMATED CHANGE IN DOMESTIC AND IN "FOREGONE JOBS" BY THE PORTUGUESE ECONOMY FROM 1995 TO 2009, PER SECTOR: SUPPLIERS' APPROACH, PERSONS ENGAGED (IN 10^3, RANKED FROM HIGHEST TO LOWEST IN TERMS OF TOTAL JOBS)

Code	Sector	Total	Direct jobs	Indirect jobs	Jobs abroad
30	**Renting of machines and equipment and other business activities**	173.4	145.5	27.2	0.7
33	**Health and social work**	123.2	105.9	13.9	3.4
21	**Retail trade, except of motor vehicles, and repair of househ. goods**	91.5	83.8	8.0	- 0.3
22	**Hotels and restaurants**	68.3	62.9	5.2	0.3

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[6] We note those sectors that employed more people (downstream) in 2009, namely: (i) "Construction" (401 thousand); (ii) "Renting of machines and equipment and other business activities" (348 thousand); (iii) "Agriculture, hunting, forestry and fishing" (342 thousand); (iv) "Retail trade" (309 thousand); (v) "Health and social work" (290 thousand); and (vi) "Public Administration" (289 thousand). From 1995 to 2009, it was observed an increase in people employed in services relatively to those employed in manufacturing services. In addition, we identified those sectors that were more intensive in using (i) high-skilled jobs (both direct and indirect jobs), namely "Education", "Financial Intermediation", "Health", and "Renting of machines and equipment", with 54%, 34%, 28% and 28% of the total labour force, respectively; and (ii) low-skilled jobs, namely "Agriculture, hunting, forestry and fishing", "Food, beverage and tobacco", and "Wood, products of wood and cork", with 93%, 86% and 84% of the total labour force, respectively, in 2009.

[7] Data disaggregated by skills are available upon request.

32	Education	65.2	62.4	3.2	- 0.4
18	Construction	61.1	74.5	- 11.2	- 2.2

(...)

28	Financial intermediation	34.7	- 1.4	35.8	0.2
31	Public Administration	33.8	8.8	22.7	2.3
3	Food, beverages and tobacco	27.9	5.0	3.9	19.0

(...)

5	Leather and footwear	- 32.3	- 19.8	- 6.0	- 6.5
4	Textiles	- 106.2	- 55.1	- 41.9	- 9.3
1	Agriculture, hunting, forestry and fishing	- 128.2	- 130.5	- 1.0	3.3

Source: Authors' estimations based on WIOD and SEA, retrieved in January 2014. Nec stands for not elsewhere classified. Highlighted in green and blue are manufacturing and services sectors, respectively.

Table V shows the sectors that contributed most, in the period between 1995-2009, to the increase in direct and indirect domestic jobs (sectors 30, 33, 21, 22, 32, 18), all classified as services, and to the decrease of this type of jobs (sectors 5, 4 and 1), all classified as manufacturing. In terms of "foregone jobs", "Food, beverages and tobacco" was the sector with the highest estimated jobs' increase (almost 19 thousand), followed at distance by "Agriculture, hunting, forestry and fishing" (around 3 thousand) in manufacturing, while "Textiles" and "Leather and footwear" presented the highest reduction.

3.2. The user's approach (or the upstream approach)

The previous estimations were made by following the so-called supplier's approach. A complementary analysis is to estimate the number of jobs in Portugal, including "gained jobs", associated to the user's approach. Note that "gained jobs" are those mentioned in Tables of this sub-section as jobs based on the demand for inputs to be used in the production processes of other countries. i.e. exported inputs.

Table VI below shows, for 2009, nearly 5.1 million jobs (persons engaged)[8] in the Portuguese economy. From these, we estimated that: (i) 2.3 million were based on the demand for inputs from other sectors in the Portuguese economy (45%); (ii) 2.2 million were based on the demand for final consumption in Portugal (43%); (iii) 305 thousand were based on the demand for Portuguese inputs used in the production processes of other countries ("gained jobs") (6%); and (iv) 203 thousand were based on the foreign demand for Portuguese products used in final consumption.

TABLE VI - ESTIMATED DOMESTIC JOBS IN THE PORTUGUESE ECONOMY, INCLUDING "GAINED JOBS": USER'S APPROACH, PERSONS ENGAGED (IN THOUSANDS, 2009)

	All sectors	Manufacturing sectors	Services
Jobs based on the demand for inputs from other sectors in the Portuguese economy (1)	2,337	685	1,652
Jobs based on the demand for final consumption in Portugal (2)	2,247	344	1,902
Jobs in Portugal based on domestic demand (1+2)	4,584	1,030	3,554
Jobs based on the demand for inputs to be used in the production processes of other countries (3)	305	194	112
Jobs based on the demand for final consumption from other countries (4)	203	175	28
Jobs in Portugal based on foreign demand (3+4)	508	369	139
Total jobs (1+2+3+4)	5,090	1,398	3,693

Source: Authors' estimations based on WIOD and SEA, retrieved in January 2014. Due to rounding, numbers presented may not add up precisely to the totals provided.

In Table VII below, which disaggregates Table VI per level of skills, beyond the expected breakdown of the total number of jobs by skills (which must coincide with that of the downward approach, with the correction explained in the Annex 3), we note that jobs used in production of exported inputs ("gained jobs") were mostly of a low-skilled type (29 thousand high-skilled, 57 thousand medium-skilled and 220 thousand low-skilled), This bias towards low-skilled work is much more pronounced in manufacturing. Therefore, the pattern of labour used by Portugal in exported inputs is clearly in line with that of the economy as a whole, as expected.

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[8] The difference between this 5.1 million (estimated according to the upstream approach) and the 4.8 million estimated by following the downstream approach in the previous subsection (see Table I above) is largely conceptual, as explained in Annex 3.

	All sectors	Manufacturing sectors	Services
High-skilled jobs based on the demand for inputs from other sectors in the Portuguese economy (1)	257	24	233
High-skilled jobs based on the demand for final consumption in Portugal (2)	424	12	412
High-skilled jobs in Portugal based on domestic demand (1+2)	681	36	644
High-skilled jobs based on the demand for inputs to be used in the production processes of other countries (3)	29	11	18
High-skilled jobs based on the demand for final consumption from other countries (4)	12	9	3
High-skilled jobs in Portugal based on foreign demand (3+4)	41	19	22
High-skilled total jobs (1+2+3+4)	721	56	666
Medium-skilled jobs based on the demand for inputs from other sectors in the Portuguese economy (5)	434	56	378
Medium-skilled jobs based on the demand for final consumption in Portugal (6)	456	29	427
Medium-skilled jobs in Portugal based on domestic demand (5+6)	890	85	805
Medium-skilled jobs based on the demand for inputs to be used in the production processes of other countries (7)	57	25	32
Medium-skilled jobs based on the demand for final consumption from other countries (8)	28	21	7
Medium-skilled jobs in Portugal based on foreign demand (7+8)	85	46	39
Medium-skilled total jobs (5+6+7+8)	975	131	844
Low-skilled jobs based on the demand for inputs from other sectors in the Portuguese economy (9)	1,647	606	1,041
Low-skilled jobs based on the demand for final consumption in Portugal (10)	1,366	303	1,064
Low-skilled jobs in Portugal based on domestic demand (9+10)	3,014	908	2,105

Low-skilled jobs based on the demand for inputs to be used in the production processes of other countries (11)	220	258	61
Low-skilled jobs based on the demand for final consumption from other countries (12)	163	145	17
Low-skilled jobs in Portugal based on to foreign demand (11+12)	382	304	79
Low-skilled total jobs (9+10+11+12)	3,397	1,212	2,183

Source: Authors' estimations based on WIOD and SEA, retrieved in January 2014. Due to rounding, numbers presented may not add up precisely to the totals provided.

Table VIII below shows the change in domestic jobs in Portugal between 1995 and 2009. We observe that the amount of jobs decreased by 105 thousand due to lower domestic demand for Portuguese inputs (around three quarters of them in manufacturing sectors and one quarter in services), while the amount of jobs increased by 127 thousand due to higher foreign demand, of which 86 thousand correspond to "gained jobs" (67 % in manufacturing and 33% in services). Those estimates point to an increasing upstream participation of Portugal in export activity in general and GVCs in particular, with a clear positive impact on employment.

TABLE VIII – CHANGE IN DOMESTIC JOBS IN THE PORTUGUESE ECONOMY INCLUDING "GAINED JOBS" BETWEEN 1995 AND 2009: USER'S APPROACH, PERSONS ENGAGED (IN THOUSANDS, 2009)

	All sectors	Manuf. sectors	Services
Jobs based on the demand for inputs from other sectors in Portugal (1)	- 118	- 70	- 48
Jobs based on the demand for final consumption in Portugal (2)	13	- 4	17
Jobs in Portugal based on domestic demand (1+2)	- 105	- 73	- 31
Jobs based on the demand for inputs to be used in the production processes of other countries (3)	86	58	28
Jobs based on the demand for final consumption from other countries (4)	41	30	11
Jobs in Portugal based on foreign demand (3+4)	127	88	39
Total jobs (1+2+3+4)	22	15	8

Source: Authors' estimations based on WIOD and SEA, retrieved in January 2014. Due to rounding, numbers presented may not add up precisely to the totals provided.

Table IX below shows the change observed in domestic jobs in Portugal between 2009 and 1995 but now disaggregated according to their level of skills. While domestic demand was associated to a decrease in: (i) nearly 6 thousand high-skilled jobs, (ii) 15 thousand medium–skilled jobs; and (iii) 83 thousand low-skilled jobs in Portugal, foreign demand was associated to an increase in: (i) 8 thousand high-skilled jobs; (ii) 18 thousand medium-skilled jobs; and (iii) 102 thousand low-skilled jobs, of which 6 thousand, 14 thousand and 66 thousand, respectively, corresponded to "gained jobs". Therefore, we conclude that Portuguese trading in exported inputs resulted in a global increase in jobs for all three levels of skills, although with a clear predominance of low-skilled labour, as expected form the characteristics of this economy.

TABLE IX – CHANGE IN DOMESTIC JOBS IN THE PORTUGUESE ECONOMY INCLUDING "GAINED JOBS" BETWEEN 1995 AND 2009: USER'S APPROACH, PERSONS ENGAGED DISAGGREGATED PER SKILLS (IN THOUSANDS, 2009)

	All sectors	Manufacturing sectors	Services
High-skilled jobs based on the demand for inputs from other sectors in the Portuguese economy (1)	- 15	- 3	- 12
High-skilled jobs based on the demand for final consumption in Portugal (2)	9	1	9
High-skilled jobs in Portugal based on domestic demand (1+2)	- 6	- 3	- 3
High-skilled jobs based on the demand for inputs to be used in the production processes of other countries (3)	6	3	3
High-skilled jobs based on the demand for final consumption from other countries (4)	1	1	1
High-skilled jobs in Portugal based on foreign demand (3+4)	8	4	4
High-skilled total jobs (1+2+3+4)	1	1	1
Medium-skilled jobs based on the demand for inputs from other sectors in the Portuguese economy (5)	- 23	- 8	- 14
Medium-skilled jobs based on the demand for final consumption in Portugal (6)	8	1	7
Medium-skilled in Portugal based on domestic demand (5+6)	- 15	- 7	- 8
Medium-skilled jobs based on the demand for inputs to be used in the production processes of other countries (7)	14	7	7
Medium-skilled jobs based on the demand for final consumption from other countries (8)	4	2	2
Medium-skilled jobs in Portugal based on foreign demand (7+8)	18	8	9
Medium-skilled total jobs (5+6+7+8)	3	1	2

	Inputs to the Portuguese economy		
Low-skilled jobs based on the demand for inputs from other sectors in the Portuguese economy (9)	- 80	- 58	- 22
Low-skilled jobs based on the demand for final consumption in Portugal (10)	- 4	- 5	1
Low-skilled jobs in Portugal based on domestic demand (9+10)	- 83	- 63	- 20
Low-skilled jobs based on the demand for inputs to be used in the production processes of other countries (11)	66	48	18
Low-skilled jobs based on the demand for final consumption from other countries (12)	35	28	8
Low-skilled jobs in Portugal based on foreign demand (11+12)	102	76	26
Low-skilled total jobs (9+10+11+12)	18	13	6

Source: Authors' estimations based on WIOD and SEA, retrieved in January 2014. Due to rounding, numbers presented may not add up precisely to the totals provided.

Finally, Table X below shows which sectors were more responsible for the increase in jobs in all three levels of skills between 1995 and 2009 in Portugal in terms of the upstream approach. Focussing our attention in those sectors where the increase in domestic jobs due to the higher demand for Portuguese inputs in other countries was higher, meaning more upstream GVC-embedded sectors in terms of jobs, we conclude that they are characterized by low skilled intensity, namely: (i) "Basic metals and fabricated metals" (with an increase of 14.6 thousand jobs in the period considered, 80% in low-skilled jobs); (ii) "Pulp and paper" (12.2 thousand jobs, 80% also in low-skilled jobs); (iii) "Agriculture, hunting, forestry and fishing" (12.1 thousand jobs, 97% in low-skilled jobs); and (iv) "Wholesale trade" (10.8 thousand jobs, 68% in low-skilled jobs). Those sectors where the decrease in domestic jobs due to lower demand for Portuguese inputs in other countries was more significant, meaning less GVC-embedded in terms of jobs, were: (i) "Wood and cork" (with an decrease of 3.4 thousand jobs in the period considered, 79% in low-skilled jobs); (ii) "Other transport activities" (2,8 thousand jobs, 57% in low-skilled jobs); and (iii) "Textile and textile products" (1.8 thousand jobs, 79% in low-skilled jobs).

TABLE X - CHANGE IN DOMESTIC IN THE PORTUGUESE ECONOMY INCLUDING "GAINED JOBS" BETWEEN 1995 AND 2009 PER SECTOR: USER'S APPROACH, PERSONS ENGAGED (IN THOUSANDS)

Code	Sector	Inputs to the Portuguese economy	Final consumption in Portugal	Inputs to other countries	Final consumption of other countries

12	Basic metals and fabricated metals	-14.7	2.9	14.6	0.3
7	Pulp, paper, printing and publishing	-12.9	1.1	12.2	0.1
1	Agriculture, hunting, forestry and fishing	-12.6	-14.4	12.1	21.9
20	Wholesale trade and commission trade, except motor vehicles and motorcycles	-24.1	10.2	10.8	5.1
13	Machinery, nec	-8.4	2.2	7.4	-1.1
30	Renting of M&Eq and other business activities	8.1	-15.2	6.9	0.4
10	Rubber and plastics	-2.6	-3.7	6.3	0.5
23	Inland transport	-4.6	-2.7	6.0	1.4
22	Hotels and restaurants	2.6	-10.9	5.1	3.1

(...)

27	Post and telecommunications	0.1	1.8	-1.6	-0.3
28	Financial intermediation	-16.4	18.7	-1.6	-0.7
4	Textiles and textile products	-8.1	14.4	-1.8	-2.9
26	Other supporting and auxiliary transport activities and activities of travel agencies	2.9	0.2	-2.8	-0.4
6	Wood and products of wood and cork	2.7	0.8	-3.4	0.1

Source: Authors' estimations based on WIOD and SEA, retrieved in January 2014. Nec stands for not elsewhere classified. Highlighted in green and blue are manufacturing and services sectors, respectively.

Table X registers another interesting pattern: in all sectors but "Renting of machines and equipment and other business activities" and "Textiles and textile products", the amount of jobs used to produce inputs declined when they were produced for the Portuguese economy and increased in the case of production for export, in line with the global tendency to increase export activity put into evidence by Table VIII.

3.3. The labour content of international trade in intermediates by trade partner

Based on the two approaches to estimate the content in jobs of trade in inputs presented in the two previous sub-sections, we now present a measure for Portugal of the net gains in terms of the "trade in jobs" in the year 2009 both for the whole economy and for each one the 40 countries reported in the WIOD database.

This measure consists in simply subtracting the number of "foregone jobs" to the number of "gained jobs". Therefore, it is a measure of net jobs "gain" in intermediates' trade[9]. A positive result means that to produce the exported inputs requires more employment than producing the imported inputs domestically (i.e. with the country´s labour productivity), therefore the balance of GVC embeddedness is favourable in terms of jobs.

Calculations were made for total trade of Portugal and also at the bilateral level, by country of the WIOD database, and they are presented in Table XI below.

TABLE XI – BILATERAL NET JOB CONTENT IN INPUTS' TRADE OF PORTUGAL (2009)
(THOUSAND JOBS)

Country	"Gained jobs" (A)	"Foregone jobs" (B)	(A-B)
Spain	75.9	55.0	20.9
France	29.8	9.8	20.0
US	21.4	7.4	14.0
Germany	30.9	20.6	10.3
Belgium	8.9	4.1	4.8
Ireland	7.4	2.9	4.6
UK	16.2	12.0	4.2
Sweden	3.6	1.2	2.4
Austria	4.0	1.8	2.2
Netherlands	8.9	6.8	2.2
Czech Rep.	3.4	1.6	1.7
Italy	10.3	8.8	1.5
Canada	2.6	1.2	1.4
Finland	2.0	1.2	0.8

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[9] To allow comparisons between time periods and/or other countries the referred difference can be normalized, for instance, by the amount of domestic jobs.

Denmark	1.8	1.0	0.8
Australia	0.6	0.2	0.4
Greece	0.8	0.4	0.4
Luxembourg	0.7	0.3	0.3
Japan	0.9	0.6	0.3
Cyprus	0.1	0.0	0.1
Slovenia	0.2	0.2	0.1
Malta	0.1	0.1	-0.1
Estonia	0.1	0.1	-0.1
Latvia	0.1	0.2	-0.1
Taiwan	0.3	0.5	-0.2
Slovakia	0.5	0.7	-0.2
Poland	2.9	3.1	-0.2
Lithuania	0.1	0.5	-0.4
South Korea	0.3	0.8	-0.5
Hungary	0.8	2.0	-1.2
Turkey	1.8	3.5	-1.7
Mexico	1.1	3.6	-2.6
Russia	1.2	4.4	-3.2
Bulgaria	0.3	5.0	-4.7
Indonesia	0.0	8.0	-7.9
Romania	1.8	10.1	-8.3
India	0.3	25.0	-24.7
PRC	3.4	30.9	-27.5
Brazil	7.9	68.6	-60.7
Total	253.4[10]	304.0	-50.6

Source: Authors' estimations based on WIOD and SEA, retrieved in January 2014.

According to Table XI, Portuguese embeddedness in GVCs led to a net loss of almost 51 thousand jobs, being the highest gains in inputs' trade with Spain and France, and the highest losses in inputs' trade with Brazil, followed by PRC and India.

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[10] This value does not include 53.5 thousand jobs "gained" due to demand for foreign inputs from the RoW. The analogous number of jobs "foregone" due to the Portuguese demand for foreign inputs cannot be estimated because there is no data for the RoW in the SEA.

4.Conclusions

This paper addressed the relation between international trade and labour in Portugal with regard to the job content of trade in intermediates by considering both the overall number of jobs and jobs disaggregated by levels of skills in the period 1995-2009 with two (complementary) approaches: downward and upward.

With regard to the downward approach, the results that we highlight are the following. First, we observed over the period analysed an increase in the number of jobs embodied in inputs' imports in 7 thousand, pointing to an increasing downward participation of the Portuguese economy into GVCs, observed mainly in services. Second, in 2009, Portugal, while being predominantly an unskilled-labour user (with a number of this type of jobs almost 6 times higher than those in the medium-skilled category), imported inputs that were relatively more intensive in skilled labour (with a similar content of medium-skilled and low-skilled jobs). Third, imported inputs became increasingly intensive in high-skilled labour, this being the category that increased the most during the period analysed, particularly noticeable in the import of services. Fourth, the sectors that increased more their downward insertion into GVCs, measured in terms of "foregone jobs", were "Food, beverages and tobacco", followed at distance by "Agriculture, hunting, forestry and fishing" in manufacturing.

In terms of the upstream approach, we highlight the following results. First, "gained jobs" present a strong bias towards low-skilled labour, especially in manufacturing. Therefore, the pattern of labour used by Portugal in exported inputs is clearly in line with that of the economy as a whole, as expected. Second, we observed an increasing upstream participation of Portugal in GVCs, with a clear positive impact on the number of jobs employed in exporting activities. Third, Portuguese trade in exported inputs resulted in a global increase in jobs for all three levels of skills, although with a clear predominance of low-skilled labour, in accordance with the characteristics of the economy. Fourth, globally and in terms of traded inputs, export activity tended to replace production addressed to the domestic market. The sectors where intermediates exported registered a higher increase in the number of jobs embodied were "Basic metals and fabricated metals" "Pulp and paper "Agriculture, hunting, forestry and fishing" and "Wholesale trade".

Finally, we highlight that the increased embeddeness of the country into GVCs led, in the end of the period analysed, to a loss of 51 thousand jobs. This is apparently worrying news for employment but it needs to be verified by calculating the net job content of intermediates in other years.

In any case, we note that results for job content are subject to reservation for two main reasons. First, restrictive assumptions were made to perform this empirical exercise, namely in the case of inputs' imports, as already explained. They imply that Portugal has the resource endowment and technology to produce those imports domestically and that they can be produced with the Portuguese level of labour productivity (labour input requirements). Second, this job content measurement does not capture productivity effects, although they can explain a decrease in jobs through labour saving technological progress.

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Annex I – The structures of an IO table and of internationally-linked IO tables

An IO table, conceived as a supply and use table of national production, provides data on the interactions between suppliers (rows) and users (columns) of (i) domestically produced and consumed intermediates (raw materials, industrial parts and components and services), (ii) domestically produced and consumed final goods, in private final consumption, in Government final consumption or in GFCF; (iii) domestically produced and exported final goods; and (iv) externally produced imported intermediates.

In fact, this matrix is a supply and use table of national production, as referred in Eurostat (2008), and not a supply and use table of total flows in the economy, since information is not presented about imports of final goods, including those re-exported with no value-added in the domestic economy. A supply and use table of total flows would also present an additional row for imports of final goods. This missing information is not relevant, nonetheless, for the purpose of assessing the participation of national production in GVCs.

The basic structure of an IO table is presented below in Figure 1.

Figure 1 - The basic structure of an IO Table

Suppliers \ Users	Agriculture	Mining	Manufactures	Utilities	Construction	Services	Private final consumption	Government final consumption	GFCF	Exports	Industry Output at basic prices
Agriculture	2731	3	8260	36	59	615	962	62	567	8568	21863
Mining	4	282	2013	3979	18	60	28	0	210	5528	12292
Manufactures	3322	291	40218	480	8004	16999	16896	2340	8573	113777	210900
Utilities	983	53	2400	4395	8	3458	6184	14	439	238	18249
Construction	121	70	565	135	14103	9509	405	530	33974	832	60244
Services	2884	1078	28400	1404	9339	106994	126180	87409	16752	55512	435953
Imports	1779	1029	71117	1878	7572	33964	24189	1085	17771	81863	
Net taxes on products	129	67	497	706	249	8651	22908	-152	10233	0	
TOTAL use at purchaser's prices	11953	2873	153470	13013	39599	180250	197752	91288	88519	266318	
Value Added at basic prices	9910	9419	57430	5236	20645	255703					
Industry Output at basic prices	21863	12292	210900	18249	60244	435953					

Source: Wixted et al (2006).

On one hand, rows give information about how a given sector of activity, let's say agriculture (row 1), supplied (i) the production processes of other sectors (i.e. 3 units as inputs in the mining sector, 8,260 units as inputs in the manufactures sector, 36 units as inputs in the utilities sector, 59 units as inputs in the construction sector, and 615 units as inputs in the services sector); (ii) the production process in the same sector (i.e. 2,731 units); (iii) the final consumption in the country (962 units); (iv) the government final consumption in the country (62 units); (v) the GFCF in the country (567 units); and (vi) the exports (8,568).

On the other hand, columns give information about how the production of a given sector of activity, let´s say agriculture (column 1) disaggregated in terms of (i) inputs from other sectors of activity (i.e. 4 units from mining, 3,322 units from manufactures, 983 units from utilities, 121 units from construction and 2,884 units from services); (ii) inputs from the same sector (2,731 units from agriculture); (iii) imported inputs (1,779 units); (iv) taxes on products (129 units); and (v) value added in the sector, at basic prices, representing the sum of wages and salaries (remuneration of labour) plus gross operating surplus (remuneration of capital) (9,910 units).

In the central section of the matrix, highlighted in red, one can find the intermediate goods matrix, which provides data about the interactions between domestic suppliers and domestic users of domestically produced raw materials, industrial components and services. It is by definition a squared matrix and the values recorded can

be either at basic or at purchaser's prices[11]. Highlighted in green, one can observe the total imported inputs. Highlighted in blue are the supplies of goods that are not consumed by domestic industries.

The international linkage between the IO tables of several countries can be observed in Figure 2 below[12]. This extended matrix just builds on the one observed in Figure 1 above by disaggregating: (i) the column called "Exports" in several submatrices that present, for each one of the other countries in the sample and the remaining Rest of the World (RoW) as a whole, information about how the goods and services supplied have been used in those countries as inputs, per sector; as private final consumption; as Government final consumption; and as GFCF. For example, Figure 1 above showed us that agriculture supplied foreign users with 8,568 units. Additionally, Figure 2 shows us how those 8,568 units disaggregate per country and per final use (e.g. that 343 units were used as inputs in the production of manufactures of country B, or that 1,285 units were used as private final consumption in country B).

FIGURE 2 - THE BASIC STRUCTURE OF AN INTERNATIONALLY LINKED IO TABLE (FOR THREE REGIONS; COUNTRY A, COUNTRY B AND REST OF THE WORLD)

Suppliers / Users	Country A Agriculture	Mining	Manufactures	Utilities	Construction	Services	Country B Agriculture	Mining	Manufactures	Utilities	Construction	Services	RoW Agriculture	Mining	Manufactures	Utilities	Construction	Services	Country A Private final consumption	Government final consumption	GFCF	Country B Private final consumption	Government final consumption	GFCF	RoW Private final consumption	Government final consumption	GFCF	Industry output at basic prices
Country A Agriculture	2731	3	8260	36	59	615	171	86	343	171	257	428	343	171	685	343	514	857	962	62	567	1285	86	86	2313	257	171	21863
Mining	4	282	2013	2979	188	60	111	55	221	111	166	276	221	111	442	221	332	553	28	0	210	829	55	55	1493	166	111	12292
Manufactures	3322	291	40218	480	8004	16999	2276	1138	4551	2276	3413	5689	4551	2276	9102	4551	6827	11378	16896	2340	8573	17067	1138	1138	30720	3413	2276	210900
Utilities	983	53	2400	4395	85	3458	5	2	10	5	7	12	10	5	19	10	14	24	6184	14	439	36	2	2	64	7	5	18249
Construction	121	70	565	135	14103	9509	17	8	33	17	25	42	33	17	67	33	50	83	405	530	33974	125	8	8	225	25	17	60244
Services	2884	1078	28400	1404	9339	106994	1110	555	2220	1110	1665	2776	2220	1110	4441	2220	3331	5551	126180	87409	16752	8327	10	10	7	12	1110	435953
Country B Agriculture	71	41	2845	75	303	1359	2048	2	62	27	44	461	246	138	2373	205	678	4904	10	5	7	2	33	33	5	7	12	16397
Mining	18	10	711	19	76	340	3	21	15	2234	141	45	0	0	0	0	0	0	33	17	25	6	2220	2220	17	25	42	9219
Manufactures	71	41	2845	75	303	1359	500	32	301	360	3023	12749	246	138	2373	205	678	4904	2220	1110	1665	416	62	62	1110	1665	2776	158175
Utilities	36	21	1422	38	151	679	300	40	180	1132	64	2594	246	138	2373	234	678	432	62	27	44	0		2220	27	44	461	13687
Construction	53	31	2134	56	227	1019	91	53	42	101	5467	7132	63	1	1213	543	10	5	7	12	0	7	12	62	5	7	12	45183
Services	338	196	13512	357	1439	6453	700	50	213	543	3567	43231	756	43	2373	205	33	17	25	42	0	25	42	0	17	25	42	326965
RoW Agriculture	142	82	5689	150	606	2717	111	2	432	98	333	1365	45	138	1343	53	2220	1110	1665	2776	0	1665	2776	11	1110	1665	2776	24596
Mining	36	21	1422	38	151	679	21	0	1001	54	121	1231	4	0	0	0	62	700	50	213	543	44	461	0	27	44	461	13829
Manufactures	160	93	6401	169	681	3057	250	20	5431	312	999	5998	246	138	2373	205	435	111	700	50	700	213	700	50	50	50	213	237263
Utilities	71	41	2845	75	303	1359	12	0	1645	39	211	221	2	543	2373	22	678	21	111	2	111	432	111	0	2	2	432	20530
Construction	107	62	4267	113	454	2038	10	1	6987	41	6	123	34	42	2373	5	43	250	21	0	21	1001	21	0	0	0	1001	67775
Services	676	391	27024	714	2877	12906	1133	40	91043	600	10003	44327	246	138	2373	205	678	4904	250	20	250	5431	250	250	250	20	5431	490447
Net taxes on products	129	67	497	706	249	8651	97	50	373	530	187	6488	3689	2074	35589	3080	10166	73567	1027	3389	24522	1130	8174	114	2725	38	126	
TOTAL use at purchaser's prices	11953	2873	153470	13013	39599	180250	8965	2155	115103	9760	29699	135188	11068	6223	106768	9239	30499	220701	3080	10166	73567	3389	24522	342	8174	114	377	
Value Added at basic prices	9910	9419	57430	5236	20645	255703	7433	7064	43073	3927	15484	191777	13528	7606	130494	11292	37276	269746										
Industry Output at basic prices	21863	12292	210900	18249	60244	435953	16397	9219	158175	13687	45183	326965	24596	13829	237263	20530	67775	490447										

Source: Authors, based on Timmer et al (2012a).

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[11] While the basic price is the amount receivable by the producer exclusive of taxes payable on products and inclusive of subsidies receivable on products (the equivalent for imported products is the c.i.f. - cost, insurance and freight, that is, the value at the border of the importing country), the purchaser price is the amount payable by the purchaser (it includes trade margins realized by wholesalers and retailers - by definition, their output - as well as transport margins - that is, any transport charges paid separately by the purchaser - and non-deductible value-added tax (definitions by the Data Helpdesk of the World Bank, in https://datahelpdesk.worldbank.org/knowledgebase/articles/114947-what-is-the-difference-between-purchaser-prices-p).

[12] For additional information about how these internationally linked IO matrices are built, see Yamano & Ahmad (2006), Wixted et al (2006), and Timmer et al (2012a).

Analogously, this extended matrix also builds on the matrix observed in Figure 2 above by disaggregating (ii) the row called "Imports" into several submatrices that present, for each one of the other countries in the sample and the remaining RoW as a whole, information about how the domestic production processes of goods and services are supplied with inputs by each one of the other countries, per sector. For instance, in Figure 1 above, the production of the agriculture sector was supplied by inputs produced abroad amounting 1,779 units. Figure 2 additionally allowed us to observe how that amount disaggregated per country and per sector (e.g. 71 units of inputs were originated in the manufacture sector of country B, or that 142 units of inputs were originated in the agriculture sector of countries not covered in the sample).

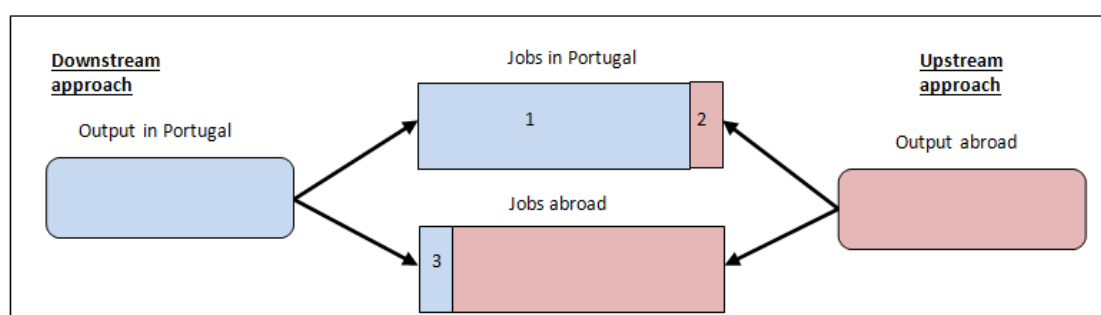### Annex II – List of the 35 sectors included in the WIOD

Code	NACE	Description
1	AtB	Agriculture, Hunting, Forestry and Fishing
2	C	Mining and Quarrying
3	15t16	Food, Beverages and Tobacco
4	17t18	Textiles and Textile Products
5	19	Leather, Leather and Footwear
6	20	Wood and Products of Wood and Cork
7	21t22	Pulp, Paper, Paper , Printing and Publishing
8	23	Coke, Refined Petroleum and Nuclear Fuel
9	24	Chemicals and Chemical Products
10	25	Rubber and Plastics
11	26	Other Non-Metallic Mineral
12	27t28	Basic Metals and Fabricated Metal
13	29	Machinery, Nec
14	30t33	Electrical and Optical Equipment
15	34t35	Transport Equipment
16	36t37	Manufacturing, Nec; Recycling
17	E	Electricity, Gas and Water Supply
18	F	Construction
19	50	Sale, Maintenance and Repair of Motor Vehicles Retail Sale of Fuel
20	51	Wholesale Trade and Commission Trade, Except of Motor Vehicles
21	52	Retail Trade, Except of Motor Vehicles ; Repair of Household Goods
22	H	Hotels and Restaurants
23	60	Inland Transport
24	61	Water Transport
25	62	Air Transport
26	63	Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies
27	64	Post and Telecommunications
28	J	Financial Intermediation
29	70	Real Estate Activities
30	71t74	Renting of M&Eq and Other Business Activities
31	L	Public Admin and Defence; Compulsory Social Security
32	M	Education
33	N	Health and Social Work
34	O	Other Community, Social and Personal Services
35	P	Private Households with Employed Persons

Annex III – The reconciliation of the downstream and the upstream approaches

The difference between the 5.1 million jobs existing in Portugal in 2009 (estimated according to the upstream approach) and the 4.8 million estimated by following the downstream approach in the previous subsection is largely conceptual, as

explained in Figure 3 below. In this figure, we show the reconciliation of both approaches. In one hand, we see in the figure's left side that, following the downstream approach, the output produced in Portugal creates a given demand for domestic and foreign inputs. The domestic and foreign inputs needed are produced with both domestic labour force (blue box #1) and with foreign labour force (blue box #3), respectively. In the other hand, we also see in the figure's right side that, following the upstream approach, the output produced abroad creates a given demand for domestic and foreign inputs. The domestic and foreign inputs needed are produced with both domestic labour force (pink box #2) and with foreign labour force (pink box #4), respectively. Translating those boxes into jobs, the blue box #1 corresponds to the number of jobs existing in Portugal due to domestic demand (downstream approach): 4.521 million according to Table I. The red box #2 corresponds to the number of jobs existing in Portugal due to foreign demand (upstream approach): 0.508 million jobs, according to Table VI. Altogether, we concluded that, in 2009, there were 5.029 million employed persons in Portugal. Two other minor reasons explaining the difference between the 5.029 million and the 5.090 million are: (i) first, the downstream approach does not consider jobs existing due to tax/subsidies, and (ii) second, the upstream approach does not take into account variations in stocks. Finally, the blue box #3 corresponds to the number of jobs existing abroad due to the Portuguese demand for foreign inputs (downstream approach): 0.304 million, according to Table I.

FIGURE 3 - SCHEMATIC OUTLINE OF THE METHODOLOGICAL DIFFERENCES IN THE JOBS ESTIMATED BY THE DOWNSTREAM AND THE UPSTREAM APPROACHES

Source: Authors.