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Restructuring the International Textile Production and Trade Network. The Role of Italy and Portugal.

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Abstract

Production and trade processes in the textile industry have been undergoing tremendous changes in structure due to both changes in technology and in the institutional environment. This paper studies the restructuring process in the textile industry between the two years 1995 and 2009 from the perspective of two major textile producing countries in the EU15, i.e. Italy and Portugal. As a starting point, a detailed descriptive analysis of the global distribution of the textile industry and changes therein is provided. By means of two international textile trade networks (ITTNs), showing (1) trade in value added and (2) trade in labour, we next discuss spatial trade patterns and changes therein. Focusing on the ITTNs, we then figure out how these countries' textile industries were affected in terms of specialisation patterns, movements along the global value chain and vertical specialisation. Combining both qualitative and quantitative aspects of the experienced restructuring process, this paper contributes to a better understanding of the consequences of changes in economic structure resulting from institutional and technological change on national economic structures, but in an international context.

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The Role of Italy and Portugal.

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Keywords: International trade network, concentration, textile industry, structural change, network analysis, multiregional input-output model

JEL: C67, F14, O12

1. Introduction

Recent years have seen rapid advances in information technology going hand in hand with institutional changes targeted towards trade liberalisation. This has led inter alia to a decrease of trade costs such as plummeting costs of communication, transportation and of coordination. Fostered by these changes,

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manufacturing production processes have been fragmenting continuously and internationally, leading to the establishment of global value chains (Timmer et al., 2014). Besides, these fragmentation processes (i.e. the increase in vertical specialisation) induced an increase in trade of intermediate goods and services, exploiting the comparative advantages of firms involved at various stages of the production process, with East-Asian outlets playing an important role in the ongoing relocation processes (Jones et al. 2005 and UNCTAD, 2013). Worldwide competition thus increasingly plays out at the level of production activities *within* industries, rather than in terms of competitive advantages *between* industries: Firms in mature economies tend to relocate their unskilled labour-intensive production activities to lower-wage countries while keeping strategic functions concentrated in a few urban regions, where the high-skilled workers and intangible capital they require are available (Feenstra, 1998 and Baldwin, 2006a). At the same time, distance is still a crucial factor in location decisions as it not only involves trade costs but also time to trade with faraway places.

A prime example for these development trends is the textile industry, which is one of the first industries newly industrialising countries are usually entering, due to its low technology and capital content. It thus has become one of the most internationalised industries and has undergone a tremendous restructuring process during the course of the last two decades. Increased mechanization and automation processes as well as changes in the institutional setting constitute important drivers for the ongoing restructuring process (Kowalski and Molnár, 2009). Particularly noteworthy are the institutional changes within the textile industry: By the end of 1994, the agreement of the World Trade Organization on Textiles and Clothing directed the reduction of quantitative restrictions on imports. This agreement established a ten-year transition period in which trade barriers had to be eliminated step by step in order to keep some protection for high-wage countries. From 2005 onwards, the industry has been operating under the general rules of the General Agreement on Tariffs and Trade, implying that all quotas were finally eliminated. For mature economies this has likely led to increased competitive pressure from low-cost producers such as China, Bangladesh or India. At the same time, phasing-out safeguard measures were introduced in order to mitigate the pressure on developed countries from low-cost producers and finally import quotas were re-introduced in 2008 again, since the international competition for industrialised countries had severe effects on employment in high-wage countries (Adhikari and Yamamoto, 2008).

Facing increased international competition in textile production activities, the European Commission in 2003 initiated a task force, the so-called High Level Group on Textiles and Clothing (European Commission, 2004a and 2004b). Its aim has been to counteract the negative impact of increased international competition on output, employment and value added in European textile producing countries. Policy advice of the High Level Group suggests that firms in Europe can only stabilize employment and value added if they are productive, innovative and are able to modernize their production. Focusing on Italy's and Portugal's textile industry, the High Level Group stresses that "[w]hile the Euro-

Mediterranean Zone provides the conditions necessary to allow the sector to remain an important contributor to European industrial production, policymakers cannot ignore the fact that a permanent process of restructuring and modernisation will continue to lead to falling employment [gross output and value added] for some years to come." (European Commission, 2004b: 7) Our special interest for the developments in Italy and Portugal is owed to (1) the textile industry's significance for their national economic structures, and (2) these two countries' size role for the European textile industry. They are thus expected to have faced the most intense restructuring process, which reflects in the fact that Italy's weight with less than a fifth of EU15-manufacturing (measured in gross output, value added and employment, respectively) was much smaller than its weight in the textile industry – with more than a third of the EU-15 textile production being allocated in Italy in 1995. As concerns Portugal, the importance in absolute figures is not as noteworthy as for Italy. Yet, in 1995 not a single other country in our sample showed a higher share of textiles in the manufacturing sector than Portugal – irrespective whether employment, gross output or value added were taken as a measure.

Seizing this diagnosis, the main purpose of this paper is to study the restructuring process in the textile industry experienced since the assignment of the WTO treaty in 1994 from the perspective of Italy and Portugal. We start by a detailed descriptive analysis of the global distribution of gross output, value added and employment in the textile industry as well as changes therein. To evaluate country-specific and industry-specific aspects of the restructuring process without losing sight of the international context, we develop two international textile trade networks (ITTNs) – one in terms of trade in value added and the other one in terms of trade in labour. Sticking not to trade flows solely in studying the ITTNs is a main advantage of our paper. We limit our investigation of the restructuring process to changes between two years – one at the beginning of the phasing-out (1995) and one at the end of the transition period (2009). Between these two years, the restructuring process is thus expected to unfold its very effects.

Concentrating in a first step on quantitative changes of the restructuring process, we answer the following questions: Has international textile trade become more concentrated or, on the contrary, more fragmented from 1995 to 2009 due to changes in the institutional setting? Which shifts in location do we observe for Italy and Portugal in terms of internationally traded value added and labour? In a second step, we focus more on qualitative aspects of the restructuring process, including (1) specialisation patterns (as well as their development from 1995 to 2009) in textile production, (2) Italy's and Portugal's position in terms of up-/down-streamness and inter-temporal movements along the global value chain of textile production, and (3) possible tendencies towards increased fragmentation or contrary, towards vertical integration. Studying both qualitative and quantitative aspects of the restructuring process, this paper contributes to a better understanding of the consequences of changes in economic structure resulting from institutional and technological change on national economic structures, but in an international context. The paper proceeds as follows. Starting with a short literature survey in sec-

tion 2, in section 3 the method and modelling framework is introduced. This is followed by an explanation on data handling and related preparatory work (section 4). Section 5 discusses empirical results, and section 6 concludes.

2. Literature Survey

Understanding the structure of economies and changes therein constitutes a very old and yet ruling topic in economic research. Both technological and institutional changes are major sources of changes in economic structure. At least since the revolution of information and communication technologies, combined with the global liberalisation of trade, the research focus in studying changes in economic structure has shifted towards an international perspective. The reason is that these changes cannot be well captured any longer without understanding how an economy is embedded in international production and trade.

From a *theoretical perspective*, it is in particular the schools of new economic geography and new trade theory, who study multifaceted aspects of changes in transport and trade costs and their effects on economic structure of a country or an industry in an international context (for a comprehensive overview, see Combes et al., 2008). The production of goods and services, and related to this, resources and skills, are envisaged as internationally fragmented processes. International linkages are thus seen as almost complementary to local linkages within countries. Two distinct but interconnected phenomena in this research area are (1) the establishment and characterisation of global value chains (Gereffi and Korzeniewicz, 1994), and (2) vertical specialisation (Hummels et al., 2001). The development of global value chains and "supply-chain trade" between developed and developing countries (Baldwin and Lopez-Gonzalez, 2013) are likely to have altered not only the ways in which international trade is organized. Baldwin (2012) argues that they have also affected the specialisation and concentration patterns of countries all over the world since the 1990s, and that they have led to "globalisation's second unbundling". As regards models in line with economic geography, the relationship between trade and the concentration of an industry is not considered as linear. For a low-wage industry such as the textile industry, concentration in low-cost periphery is predicted. In this context, Jones and Kierzkowski (1990) introduce the term fragmentation in production. The geographical fragmentation of production has been shown to increase trade in intermediate goods substantially and allow for a finer division of labour (Feenstra and Hanson, 1996). This phenomenon was more recently discussed by Fujita and Thisse (2006 and 2013), who make the relevant distinction that not whole industries, but rather production stages are agglomerated, due to competitive advantages in single stages of the production process. Whether agglomeration of production tasks occurs in economic centres or in the periphery strongly depends on the size of the wage gap between the areas. If wage differentials are large, as in the case of the textile industry, concentration of production that needs only low-skilled workers is expected to take place in the low-wage periphery, whereas economic centres are left with fewer work-

ers who mainly serve in strategic functions of the production process. Thus, countries do not specialise in different industries. Instead, industries allocate different steps of the production process to different countries. Yi (2003) moreover shows that lowering tariffs and quotas can make vertical specialisation more profitable compared to single-location production, as decreasing trade costs have a larger impact on the former than on the latter. Yet, in order to reallocate production, the benefits gained by low labour costs must be greater than the fragmentation costs, such as costs for packaging, tariffs, transportation and communication (Hanson et al., 2005). Studies focusing on the textile industry so far have only separately analysed either the long-term decline in development of EU16 countries leading to a higher concentration in the periphery, namely in Italy and Portugal until the 1990s. Afterwards a retarded decline set in as soon as international quotas were allowed to rise and international competition from low-wage countries increased (see Palan and Schmiedeberg, 2010). A second branch of literature studying the textile industry, focused on the increasing role of developing countries in the fragmentation of especially labour-intensive production tasks (Dunford, 2006). In this context, the increasing importance of global value chains and the decline of trade costs for the relocation of production sites is again emphasised (UNCTAD, 2013).

From a more *methodological* and *analytical* perspective, multiregional I/O-analysis and network analysis are two particular useful tools, whose application allows to study (1) economic structure in an international context and (2) changes therein. In context to our research question, we identify a range of recent papers in the field of multiregional I/O-analysis of special interest, which have focused on restructuring of production, skills and resources to an international level due to institutional and technological changes. However, if concentrating on restructuring processes by working on trade flows solely and thus on export and import values alone, it should be noted that vertical specialisation implies double counting (Hummels et al., 2001 and Daudin et al., 2011).[3] To dilute problems related to this upward bias, we focus on trade in value added and labour in the textile industry (Jones et al., 2013). Doing so allows us to study trade linkages to some degree "net of vertical specialisation" (Daudin et al., 2011). Similar to our paper, also Stehrer (2012) develops two input-output measures for trade in value added and the factor content of trade. He applies them to a world input-output table and within a detailed empirical investigation studies trade patterns across countries. Contrary to our paper, his focus of analysis is on a rather aggregate level and not on a single industry. Furthermore, we consider the use of an inter-temporal framework rather than a static analysis as another advantage of our paper, since then we are able to highlight changes in structure. In a similar vein, Stehrer et al. (2012) as well as Los et al. (2014) focus on an inter-temporal framework and for selected years study interna-

[3] Those traded intermediate goods which already contain a high import content if imported in a specific country do not reflect how much value is added in the importing country. If they are then re-exported, this subsequently leads to a high trade-to-output ratio for the exporting country, even though value added in fact takes place with its import partners. With respect to the textile industry, vertical specialisation likely leads to an increased output share in global textile output for some countries, without a parallel increase in their value added share (and also in their employment share), thereby creating an upward bias.

tional patterns of trade. While the former concentrate on both trade in value added and in employment (heterogeneous labour), the latter analyse only trade in employment of different skill types, by applying a structural decomposition method. Contrary to our paper, also Stehrer et al. (2012) do not focus on an industry level but on a sector level, distinguishing only between the manufacturing and the service sector.

Papers within the field of network analysis, where trade networks are investigated within first, an international context and second, a commodity-specific context include Barigozzi et al. (2010) or more recently, De Benedictis et al. (2014). Both for a weighted directed and binary directed version of the network, characteristic properties of the former are studied. Topological characteristics of the networks are figured out through applying a variety of centrality, density and clustering measures. Different to our paper, the research interest in Barigozzi et al. (2010) and De Benedictis et al. (2014) is not on theoretical phenomena related to international trade and production. Also contrary to our paper, in these works no trade in value added or factor inputs are focused on. Another difference to Barigozzi et al. (2010) and De Benedictis et al. (2014) is that in our paper the development of the network – and hence, the changes in economic structure – do take centre stage. Different to them, we choose not a static time horizon, but an inter-temporal one. Moreover, none of the cited papers rooted in multiregional I/O-analysis or in network analysis do set their focus on the textile industry, which we however, consider a prime example for exploring the restructuring process. Combining the merits of network analysis with a multiregional I/O-framework, this gives us the opportunity to address them.

3. Method

3.1. Concentration Measure

We first aim to measure the degree to which the textile industry is concentrated in a few countries around the world despite the fact that the textile industry is one of the most prominent examples of a globalized industry. This starting point should accentuate the degree (and the change thereof) to which the international production and employment network is concentrated in very few places. We capture absolute concentration by the Hirschman Herfindahl Index (HHI) as it is a direct measure of concentration compared to inequality indices such as the Theil and the Gini Index (Coulter, 1989). The difference between these two categories of indices is important for our example: whereas inequality indices are influenced by adding a country with a negligible share in the textile industry to the sample, a mere concentration index such as the HHI would not report a lower level of concentration (Palan, 2013). One drawback of all absolute measures is that the reference point for concentration is an equiproportional distribution of employment (value added, gross output) as the reference point. For our country sample it is hardly convincing, however, to postulate that all countries, including large countries like China and small countries like Luxembourg, should have the same number of people em-

ployed, level of value added, and gross output in this industry. We use weighting-schemes to counteract this effect.

The unweighted HHI index takes the following form:

$$HHI = \sum_{i=1}^{k} \left(\frac{l_i}{\sum_{i=1}^{k} l_i} \right)^{\alpha} \qquad (1a)$$

In (1a), l denotes a vector of dimension $k \times 1$, and for k countries with $i = 1, \dots, k$ a generic element l_i contains hours worked in the textile industry. Most empirical studies on specialisation and concentration choose $\alpha = 2$ (e.g. Davis, 1998, Storper et al., 2002, Aiginger and Pfaffermayr, 2004, and Beine and Coulombe, 2007), even though it lacks theoretical meaning. In our sample, where there exist large differences with regard to the country size which imply predictable differences in shares of world employment (production) of countries, we opt for introducing a country-weighted index ($cwHHI$) which gives more weight to countries whose share of textile employment (and value added, respectively) is well above their share of manufacturing in world production[4]:

$$cwHHI = \sum_{i=1}^{k} \left(cw^k \frac{l_i}{\sum_{i=1}^{k} l_i} \right)^2 \qquad (1b)$$

with:

$$cw^k = \frac{l_i}{\sum_{j=3}^{16} \bar{l}_j^k}$$ [5]

In (1b), for country k and for n industries, $\bar{l}^k$ is a vector of dimension $n \times 1$, which contains total hours worked in all industries.[6]

Thus, with $\alpha = 2$, the lower bound of the unweighted index is the equi-proportional distribution of the industry across all countries, i.e. $\frac{1}{k}$, and the upper bound is 1, where all employment (production) is concentrated in one country only. When applying the country-weighted Hirschman-Herfindahl index $cwHHI$ with $\alpha = 2$, the upper bound – implying total concentration of production in one single coun-

[4] A good case in point is Portugal, which accounted for only .63 per cent of world textile employment in 1995. This share was still well above its share in manufacturing employment, which was only .33 per cent of world manufacturing employment. Countries such as Germany, which accounts for 2.25 per cent of total manufacturing yet only .57 per cent of textiles, on the contrary, get less weight.

[5] The employment shares with the weighting factors cw^k have to be standardized such that $\sum_{i=1}^{k} cw^k \frac{l_i}{\sum_{i=1}^{k} l_i} = 1$ in order to obtain a country-weighted Hirschman-Herfindahl Index with the same properties as the unweighted index.

[6] Note that in calculating cw^k summation just includes the manufacturing sector, whereas the agriculture, the mining as well as the service sector are excluded due to differences in productivity and economic development of the countries under study. Taking the whole economy as a benchmark would have distortive weighting factors.

try – is 1, and it is $\frac{1}{k}$ when each country's textile share is equivalent to its share in world manufacturing and, moreover, when the textile industry is equally allocated between the countries under study.

3.2. International Textile Trade Networks

To assess characteristics of the restructuring process in the textile industry from the perspective of Italy and Portugal, we construct two international textile trade networks (ITTNs).[7] One network shows value added embodied in international textile trade flows and the other one refers to labour embodied in international textile trade flows. The basic concept for constructing each of our ITTNs is a weighted directed graph G, which consists of a pair (V, X) where V is a finite and non-empty set of elements i called nodes and X is a finite set of elements ih called edges, with $i, h = 1, \ldots, k$. A weighted directed graph is described by two functions $f_1, f_2 : X \to V$ and to each $ih \in X$, a weight $w_{ih} > 0$ is assigned. Per definition a weighted directed graph G contains no self-loops (Harary et al., 1965). In our case, each node of V corresponds to countries involved in international trade of value added, respectively labour, while the set of elements X contains international trade linkages between the nodes, weighted by the real trade volume w_{ih}. To map the ITTNs by means of graph theory, two adjacency matrices A^1 and A^2 are derived, as described in the following.

For k countries, let matrix Z of dimension $k \times k$ include total intra- and international intermediate transaction flows in constant prices of the textile industry. Similarly, matrix F of dimension $k \times k$ contains total intra- and international deliveries to final demand. Thus, one element z_{ih} (f_{ih}) of matrix Z (F) with $i, h = 1, \ldots, k$ shows the constant price value of deliveries of the textile industry from country i to country h, referring to intermediate and final demand deliveries, respectively. For constructing the adjacency matrices of the international textile trade networks, the identity given in (2) is used as a starting point:

$$[Z + F]e = x \qquad (2)$$

In (2), e corresponds to a summation vector of dimension $k \times 1$ and vector x of the same dimension denotes real gross output of the textile industry, which on the one hand is composed of deliveries, first to intermediate, and second to final demand. In a next step, we concatenate matrices Z and F to a single matrix W of dimension $k \times k$, defined as $W \equiv [Z + F]$. Matrix W is then normalised along rows, to obtain output coefficients of intra- and international trade in the textile industry:

$$\overline{W} = diag(x)^{-1} W \qquad (3)$$

[7] Since in the interpretation of our empirical results the manufacturing sector is used as a benchmark for studying the dynamics of the textile industry, we construct two international manufacturing trade networks in parallel to the ITTNs. Thus, methodically, all steps involved in the construction of the ITTNs as described in what follows, as well as the network measures discussed, are applied in the same manner to the construction and discussion of the international manufacturing trade networks.

In (3), $diag(\cdot)$ is used as the symbol for a diagonalised vector. One generic element $\overline{w}_{ih}$ of $\overline{W}$ defines the share of textile deliveries from country i to country h in country h's textile gross output.

As we decide to construct our networks on the basis of trade in value added and hours worked to dilute problems resulting from vertical specialisation, matrix $\overline{W}$ is modified once more. Fist, let v be a vector of dimension $k \times 1$ containing real value added of the textile industry in each country, and second, vector l of the same dimension holds employment for each country $i = 1, \dots, k,$. Combining in a next step $\overline{W}$ with v and l, we obtain the following matrices:

$$W^1 = diag(v)\overline{W} \qquad (4a)$$

$$W^2 = diag(l)\overline{W} \qquad (4b)$$

In (4a) one element w_{ih}^1 of W^1 denotes the constant price value added generated within country i's textile industry, as embodied in its deliveries to country h. Similarly, in (4b) one element w_{ih}^2 of W^2 signalises the labour intensity, measured in hours worked, of country i's exports of textiles to country h. System (4) which shows intra-national and international trade flows of value added and hours worked generated within the textile industry is already quite similar to our two adjacency matrices A^1 (mapping the ITTN in terms of traded value added) and A^2 (mapping the ITTN in terms of labour), except that self-loops finally have to be corrected for. This is finally accomplished by setting each element of intra-national trade to zero. More formally:

$$A^1 = W^1 - diag(w^1) \qquad (5a)$$

$$A^2 = W^2 - diag(w^2) \qquad (5b)$$

In (5), w^1 and w^2 correspond to vectors of dimension $k \times 1$ which include elements of the main diagonal of W^1 and W^2. Based on the adjacency matrices defined in (5), we study both quantitative and qualitative properties of the ITNs.

In network analysis there exist multiple measures to characterise the structure of networks. Distinguishing between measures referring to the structure of the network as a whole (global measures) and measures describing properties of single nodes (local measures), we are first and foremost interested in the latter, since these allow us to zoom into the ITTNs from the perspective of our two case study countries, without at the same time losing sight of the entire network structures. One class of local measures are centrality measures: Depending on the characteristics of the graph, a diversity of popular centrality measures exists.[8] In general centrality measures share the fact that they provide information about "the importance of a vertex [i.e. a node] in a network" (Newman, 2004: 2). In the following we

[8] They include strength (in the weighted case) or degree centrality (in the unweighted, binary case), Eigenvector centrality, closeness and betweenness centrality measures (Borgatti, 2005).

apply strength centrality to the ITTNs, since this constitutes a simple but convenient measure to first of all, determine and compare the level of interaction of single nodes in the ITTNs in terms of our structural variables (value added and labour) based on the intensity of linkages. Since the adjacency matrices are not symmetric in the case of a directed graph, one has to distinguish between in-strength and out-strength for each matrix, defined as follows:

$$s^{1,IN} = (e^T A^1)^T \qquad (6a)$$

$$s^{2,IN} = (e^T A^2)^T \qquad (6b)$$

$$s^{1,OUT} = A^1 e \qquad (6c)$$

$$s^{2,OUT} = A^2 e \qquad (6d)$$

In (6) e denotes the summation vector of dimension $k \times 1$ and in-strength $s_i^{\cdot,IN}$ of a country i, as determined by (6a) and (6b), refers to the volume of imports of value added (labour) embodied in traded textiles, whereas out-strength $s_i^{\cdot,OUT}$, calculated in (6c) and (6d)signalises exports of value added (labour) embodied in traded textiles. The higher in-strength or out-strength for a single node in the ITTNs, the more important is its position in the respective ITTN. Since we want to drill yet deeper into the structure of the ITTNs and changes in structure over time, we excavate strength centrality and derive a few further measures from it. Even though some of these measures are not tools of conventional network analysis, these allow us to figure out both quantitative and qualitative aspects of the ITTNs from the perspective of single nodes (i.e. countries), as discussed in the following.

3.3. Strength Centrality-Based Measures – node analysis

Based on strength centrality, in this section we derive a few further measures to describe the properties of single nodes within the ITTNs. These measures provide information about (1) the net-trade position, (2) the labour and value added intensity, (3) upstreamness and downstreamness and (4) the degree of vertical specialisation of single nodes.

Net-trade Position: The net-trade position of a single country i can be analysed by means of a centrality coefficient, calculated as:

$$c_i^{\cdot} = \frac{s_i^{\cdot,IN}}{s_i^{\cdot,OUT}} \qquad (7)$$

A country i is called an out-central node if $s_i^{\cdot,OUT} > s_i^{\cdot,IN}$ and thus, if it is a net-exporter of product-embodied value added, respectively labour ($c_i^{\cdot} < 1$). If in contrast a single country's product-embodied exports in value added or labour are lower than its imports and its centrality coefficient is no less than 1, implying that $s_i^{\cdot,OUT} \leq s_i^{\cdot,IN}$, it is considered an in-central node. This provides us with information

on the position of a single country within the ITTN and on the significance of textile production within the respective country.

Value Added Intensity and Labour Intensity: Since nodes (i.e. countries) are the same for the two ITTNs, by comparing strength centrality for the ITTN in terms of value added with strength centrality of the ITTN in terms of labour, we get information about the qualitative properties of a country's textile production. More in detail, we are then able to measure the value added- and labour-intensity of textile trade from the perspective of single countries. As a measure for detecting this qualitative property of textile production we use the ratios between in-strength and the ratios between out-strength of the two ITTNs. More formally for a single node i:

$$q_i^{IN} = \frac{s_i^{1,IN}}{s_i^{2,IN}} \qquad (8a)$$

$$q_i^{OUT} = \frac{s_i^{1,OUT}}{s_i^{2,OUT}} \qquad (8b)$$

The higher q_i^{IN} (q_i^{OUT}) for a single country i, the higher the value added-intensity (the lower the labour-intensity) of its imports (exports). If then a single country i is characterized by a comparatively higher labour intensity in its imports than in its exports (i.e. exports are more value added-intensive than imports) such that $q_i^{IN} \leq q_i^{OUT}$, this indicates that the country is involved more in high-quality tasks. Vice versa, if a country imports relatively value added-intensive textile products while exporting labour-intensive textile goods and therefore $q_i^{IN} > q_i^{OUT}$, it specialises in low-quality production tasks.

Since matrix W is derived just by adding matrices Z and F, it follows that the adjacency matrices A^1 and A^2 are also composed of both international real intermediate and international real final demand deliveries of the textile industry. Let $\overline{Z} \equiv Z \oslash W$ and $\overline{F} \equiv F \oslash W$ be two matrices of dimension $k \times k$ where one generic element $\overline{z}_{ih}$ ($\overline{f}_{ih}$) with $i, h = 1, \dots, k$ corresponds to the share of intermediate (final) demand textile deliveries in total textile deliveries from country i to country h. Using this definition, we are able to split in- and out-strength as calculated in (6) further into strength centrality of trade in value added (labour) of intermediate textile goods and into strength centrality of international final demand deliveries within the textile industry. More formally this reads as: $s^{\cdot,IN} = \underbrace{e^T\left(\overline{Z} \otimes A^{\cdot}\right)}_{s_Z^{\cdot,IN}} + \underbrace{e^T\left(\overline{F} \otimes A^{\cdot}\right)}_{s_F^{\cdot,IN}}$ and $s^{\cdot,OUT} = \underbrace{\left(\overline{Z} \otimes A^{\cdot}\right)e}_{s_Z^{\cdot,OUT}} + \underbrace{\left(\overline{F} \otimes A^{\cdot}\right)e}_{s_F^{\cdot,OUT}}$, where sub-scripts Z and F refer to intermediate demand and final demand, respectively. Studying the different versions of strength centrality with respect to intermediate and final demand we gain deeper knowledge about the structural properties of international textile trade in value added and labour. Furthermore, changes in structure between 1995 and 2009 from the perspective of single nodes are capture then.

Upstreamness and Downstreamness: In a next step, we figure out the position of single nodes within the ITTNs as regards their position along the international textile production chain. Assigning single nodes a position along the international textile production chain helps to characterize production patterns in the textile industry. We are thus able to figure out whether single nodes are involved either in downstream production activities or in upstream production activities in terms of value added creation and labour. In particular, differences in position between the two variables are of interest, since this reveals country-specific specialisation patterns in the textile industry. Table 1 summarises the criteria for single nodes to be assigned a position along the international textile production chain.

	$s_{Z}^{\cdot,IN}{}_{i} \leq s_{Z}^{\cdot,OUT}{}_{i}$	$s_{Z}^{\cdot,IN}{}_{i} > s_{Z}^{\cdot,OUT}{}_{i}$
$s_{F}^{\cdot,IN}{}_{i} \leq s_{F}^{\cdot,OUT}{}_{i}$	Up-Stream	Mid-Stream
$s_{F}^{\cdot,IN}{}_{i} > s_{F}^{\cdot,OUT}{}_{i}$	Mid-Stream	Down-Stream

Table 1: Criteria for a single node's position along the international textile production chain.

Following the OECD (2012), a country is thus expected to be located upstream if its intermediate and final demand exports of value added (labour) are higher than its intermediate and final demand imports and thus, if it is a net exporter both in intermediate and final textile goods. On the contrary, for a single country to be a downstream producer, it must hold that it is a net importer in both intermediate and final demand textile goods. Furthermore, a country is located mid-stream in the international textile production chain in the remaining two cases. To distinguish whether a country is a mid-upstream or a mid-downstream producer, its net-trade position as calculated in (7) is decisive. If a country is located midstream in the international textile production chain, to be classified as a mid-upstream producer it holds that $s_i^{\cdot,OUT} > s_i^{\cdot,IN}$. On the contrary, for a mid-downstream producer $s_i^{\cdot,OUT} \leq s_i^{\cdot,IN}$. Hence, only if total out-strength is larger (smaller) than total in-strength and the country is a net exporter (importer) does this qualify it as a mid-upstream (mid-downstream) producer. This signalises that the country is more (less) active in production and relatively less (more) dependent on foreign producers. Furthermore, changes in net-trade positions over time then indicate movements along the international production chain: If a country moves in the downstream direction, its trade surplus shrinks, turns into a trade deficit or the trade deficit rises. Conversely, if a country moves in the upstream direction in the observation period, its trade deficit decreases, turns into a trade surplus, or its trade surplus increases.

Vertical Specialisation: As put forth by Stehrer and Stöllinger (2013: 8), vertical specialisation can be measured "as the value added [labour] created in other countries which enters production in [a specific] country […] as imported intermediate inputs. Vertical specialisation can be calculated with respect to the foreign inputs in production of […] final goods, final goods plus exported intermediates […] or total exports which then include both intermediate and final goods exports (though one might split them up as well)." Keeping this in mind, to measure the degree to which textile production tasks are fragmented in an international context, we calculate the following centrality coefficients:

$$c^{\cdot}_{Z,Z_i} = \frac{s_Z^{\cdot,IN}{}_i}{s_Z^{\cdot,OUT}{}_i} \qquad (9a)$$

$$c^{\cdot}_{Z,F_i} = \frac{s_Z^{\cdot,IN}{}_i}{s_F^{\cdot,OUT}{}_i} \qquad (9b)$$

$$c^{\cdot}_{Z,Z+F_i} = \frac{s_Z^{\cdot,IN}{}_i}{s_i^{\cdot,OUT}} \qquad (9c)$$

The centrality coefficient given in (9a) describes the relation between value added (labour) embodied in imports of intermediate textiles, and the exports of value added (labour) embodied in intermediate textile deliveries. Again, if for a single node i, $c^{\cdot}_{Z,Z_i} \geq 1$, the respective country is a net importer of value added used in intermediate production, respectively hours worked, and conversely, if $c^{\cdot}_{Z,Z_i} < 1$, the country exports more of value added (labour) than it requires itself in its intermediate demand sector. Similarly, in (9b) the centrality coefficient for a single node i $c^{\cdot}_{Z,F_i}$ indicates the import content embodied in final demand exports of value added (labour). Finally, the centrality coefficient given in (9c) measures the extent to which a single node i is dependent on imports of value added and labour, and relates this to its total textile exports (both intermediate and final demand deliveries) of value added and labour. Similar to the measures of vertical specialisation introduced by Hummels et al. (2001), the higher the respective centrality measures, the more vertically specialised is a single country within the international textile production chain.

4. Data

Data is used from the World Input-Output Database (WIOD) due to several reasons. One of its main advantages over other databases is that it includes a wide range of different indicators within a single database. Using only WIOD-data we avoid thus differences in methodology and limited comparability, which would be the case if mixing databases. It offers detailed data on labour, value added and gross output and hence exactly on the three structural variables we need as a basis for the empirical analysis. The database also provides multiregional I/O-tables covering 35 industries and 40 countries and one extra region called "rest of the world" (RoW)[9], classified according to ISIC Rev. 3. The large country sample included in the WIOD is beneficial to our empirical analysis, since in contrast to other databases in this field of research (e.g. OECD), major textile producing countries such as India, China and Indonesia are covered by the sample. Even though the inclusion of the former countries is highly advantageous, a few other leading low-wage textile producers, e.g. Bangladesh or Cambodia, are not

[9] The latter region is added for balancing and calculation purposes (Dietzenbacher et al., 2013) and serves as a proxy for countries not included in the sample. It is therefore not amenable to interpretation (Timmer, ed. 2012) We exclude the RoW-region from our calculations throughout.

covered by the sample. The source data for constructing our international textile trade networks are two multiregional I/O-tables for 1995 and 2009. Concerning this, WIOD particularly fits the purpose of this work: On the basis of its multiregional I/O-tables, in contrast to conventional bilateral trade data, it is possible to draw an accurate picture of the international as well as the inter-industry structure of textile trade. To accentuate industry-specific characteristics of Italy's and Portugal's textile industries, their national manufacturing sectors are used as a benchmark in the empirical part of this paper. This gives rise to a better understanding of the restructuring process in the textile industry, without at the same time giving up the inter-industry context. Another convincing reason for using WIOD-data is that it covers price indicators for various variables such that we are able to deflate all the data used in this paper and to concentrate on the restructuring process adjusted for price changes. Furthermore, the database allows us to distinguish between trade flows in terms of intermediate demand and final demand, which proves to be important to answer our research question.

The value added and the labour data for the country sample on an industry level are taken from the 2012-version of the socio-economic accounts (Erumban et al., 2012). Specifically, we use hours worked, since this is a good measure for the amount of labour embodied in real trade volumes. The deflation procedure was accomplished row-wise, using multiple price indices.[10] A consequence of omitting RoW from our empirical analysis is that we create an upward bias in the technology structure underlying the multiregional I/O-table. After the deflation procedure, we therefore make the following corrections to mitigate this bias: The value added vectors and the labour vectors, referring initially to the whole country sample including RoW, are down-scaled by the share of the reduced real gross output vector (excluding then intermediate and final demand deliveries of the 40 countries to RoW) in total real gross output (including RoW).[11] Since the real gross output is no longer equal to the sum of intermediate and final demand deliveries after row-wise deflation, this sum was used in the following as a corrected version of the real gross output vector for analysis.

In order to concentrate our analysis on Italy and Portugal and to get a well-arranged overview of the most important economic variables for these two countries, the other countries are clustered into country groupings (i.e. regional blocks). In line with other studies, the most appropriate classification for our research context is the grouping of countries according to trade costs (Baldwin, 2006b and Chortareas and Pelagidis, 2004). Furthermore, the recent debate on the "distance puzzle" proves a classification according to mere distance measures inferior to a grouping according to trade costs (Bosquet and Boulhol, 2015). Chaney (2013) moreover presents evidence on the firm-level that it is easier for

[10] Intermediate demand levels were deflated using the intermediate demand industry-level price index. The industry gross output (value added) vectors were expressed in real prices using the corresponding gross output (value added) price indices. Since there are no price indices for final demand components (except for gross fixed capital formation), final demand was deflated using the corresponding intermediate delivery industry-level price index.

[11] Down-scaling implies that in 1995 just 87.3 (85.7) per cent of actual international trade in textile (manufacturing) goods were covered. Similarly, calculated based on nominal figures, 82.8 (83.3) per cent of international trade in textile (manufacturing) goods are included in 2009.

countries to enter markets where their trading partners are already located, implying a network characteristic where cultural and spatial proximity could be of an advantage. Factors influencing the costs of transportation are trade imbalances, the absolute volume of trade, infrastructure, as well as fuel prices (that can be very volatile). One database that tries to capture this variety of factors is the ESCAP World Bank[12] database on International Trade Costs (ESCAP, 2013). This is the most suitable database for our purpose as it provides bilateral trade costs for all countries in our sample but Taiwan (for which the trade costs of China are taken as a proxy) and data is available on an annual basis between 1995 and 2009.[13] However, since data is not available at the industry level, we use data for the manufacturing sector, which gives information on symmetric bilateral trade costs. For our sample, the coefficients of variation in trade costs could be minimized by clustering countries in the following way (For details see Appendix A1.):

1. Central Europe (CE): Austria, Belgium, France, Germany, Italy, Netherlands, Slovenia, Spain and United Kingdom.

2. Periphery West and North Europe (PWNE): Denmark, Finland, Greece, Ireland, Luxembourg, Malta, Portugal and Sweden.

3. Periphery East Europe (PEE): Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia.

4. Baltic and Eurasian Countries (BEC): Cyprus, Estonia, Latvia, Lithuania, Russia and Turkey.

5. Americas (A): Brazil, Canada, Mexico and the United States.

6. East Asia and Pacific Region (EAPR): Australia, Indonesia, Japan, Korea and Taiwan.

7. China and India (CI) are treated as one region.

5. Empirical Results

This section reports empirical results. As a starting point, a detailed descriptive analysis of the global distribution of the textile industry and changes therein from 1995 to 2009 is provided. Then, a detailed discussion about the restructuring process from the perspective of Italy and Portugal follows.

[12] International trade costs in this setting captures all additional costs involved in trading goods bilaterally relative to those involved in trading goods domestically. These additional costs are shipping and logistic costs, both tariff and non-tariff costs (such as costs with trade procedures and regulations) as well as costs from differences in language, culture and currencies.

[13] The drawbacks of other databases are the following: The CEPII provide bilateral trade costs, yet they are held constant over time as the primary focus is on accounting for the costs of distance that are treated as constant (see Mayer and Zignano, 2011) . The OECD database on Maritime Transport Costs provides annual data at the industry level, yet data is not available for country pairs, i.e. EU-15 is treated as an entity for imports. Data is not available for non-OECD countries, above all the Eastern European Countries. Imports are not reported for Canada.

5.1. Descriptive Analysis

Global employment and gross output increased from 1995 to 2009, whereas value added declined, as illustrated in Table 2. This contrary development of gross output and value added could be a first hint that both vertical specialisation and vertical trade increased and that it is advisable to look at trade in value added rather than trade in gross output in further analysis. The observed development was not evenly distributed across the regional blocks, however. Overall, all regions except for China and India decreased their gross output, value added, and employment substantially and therefore growth occurred only in the latter region leading to vast relocation processes in the textile industry in the time span of 15 years. There are remarkable differences with regard to the distribution of value added (and gross output) on the one hand and employment on the other hand, giving further motivation to study the development of both variables. Whereas less than 15 per cent of global value added occurred in China and India in 1995, almost two third of global working hours already were concentrated in these two countries, implying that workers and machines were far less productive than in other areas in the world. By 2009, 4 out of 5 working hours in the world were carried out in these two countries and even more noteworthy is that value added more than tripled in 15 years, implying a major increase in productivity over time. Back in 1995, the three regional blocks Central Europe, East Asia and the Pacific Region as well as Americas each still accounted for about 25 per cent of value added and gross output respectively, yet only 25 per cent of global employment. By 2009, less than 15 per cent of global employment and less than 50 per cent of global value added occurred in these three regions. This implies that more capital-intensive production also came under international pressure during the observation period. The drop in significance of both, the Americas and the East Asia and Pacific Region, was even larger than for Central Europe with regard to gross output and value added. These two regions were successful in retaining relatively more employment than Central Europe, however.

	Gross Output		Value Added		Employment	
	1995	2009	1995	2009	1995	2009
World	815,640	1,087,007	256,242	234,849	85,576	111,562
Percentage of World Textile						
Central Europe	24.44	14.76	26.13	21.68	3.73	1.40
Periphery West and North Europe	2.88	1.43	3.09	2.44	.99	.45
Periphery East Europe	1.80	1.03	2.03	1.57	3.39	1.48
East Asia and	24.73	7.24	23.11	10.10	8.92	4.33

Pacific Region						
Baltic and Eurasian Countries	3.83	.61	4.17	.70	5.18	2.74
Americas	24.68	6.80	26.85	14.54	12.23	8.41
China and India	17.65	68.14	14.63	48.97	65.55	81.20
cwHHI	.094	.509	.090	.299	.252	.423
HHI	.092	.396	.096	.207	.233	.335

Table 2: Descriptive Analysis of the Textile Industry. Note that nominal values are in Mio. constant US-$ and 1995 = 100. Employment is expressed in million hours worked.

Analysing overall concentration, the values could theoretically range from .025 (even distribution of both the manufacturing sector and the textile industry across all 40 countries) to 1 (with the manufacturing sector and textile industry being located in a single country only). As can be seen from Table **2**, the level of concentration was very low for both gross output and value added in 1995 – irrespective of whether we take manufacturing weights into account. Concentration increased for all variables under study from 1995 to 2009, indicating that institutional changes and the reduction of transportation costs facilitated concentration. Interestingly, the development of manufacturing-weighted concentration was more accentuated than the unweighted HHI. This is due to the fact that China's value added share in world manufacturing was only .19 whereas its share in textiles was .41 in 2009 (compared to shares of .10 in textiles and .05 in manufacturing in 1995). Concentration of employment already took place in the 1990s with the development being more modest compared to value added and gross output. This suggests that low-wage, low-skill employment was concentrated even before institutional changes occurred but the capital needed to acquire high proportions of value added and gross output, respectively, was transferred after 1995. Remarkably, the increase in concentration was highest with respect to gross output.

5.2. Trade Network Results

Internationally Traded Value Added and Labour: Table 3 reports real trade volumes for 1995 and 2009, which give a first idea of the structure of the ITTNs and the changes thereof from the perspectives of Italy and Portugal.

	1995		2009	
	In-Strength	Out-Strength	In-Strength	Out-Strength
Value Added				
Italy	2,881 (47,844)	7,364 (54,231)	3,738 (64,373)	5,871 (59,053)
Portugal	776 (7,801)	1,398 (5,244)	873 (12,030)	949 (7,386)
Employment				

Italy	887 (3,382)	380 (2,168)	958 (3,533)	224 (2,026)
Portugal	68 (347)	229 (550)	90 (438)	128 (511)

Table 3: Strength Centrality for Italy and Portugal in terms of value added and labour for 1995 and 2009.
Value added is expressed in millions of constant US-$, where 1995 = 100. Employment is expressed in million hours worked.
Figures in brackets correspond to values for the whole manufacturing sector.

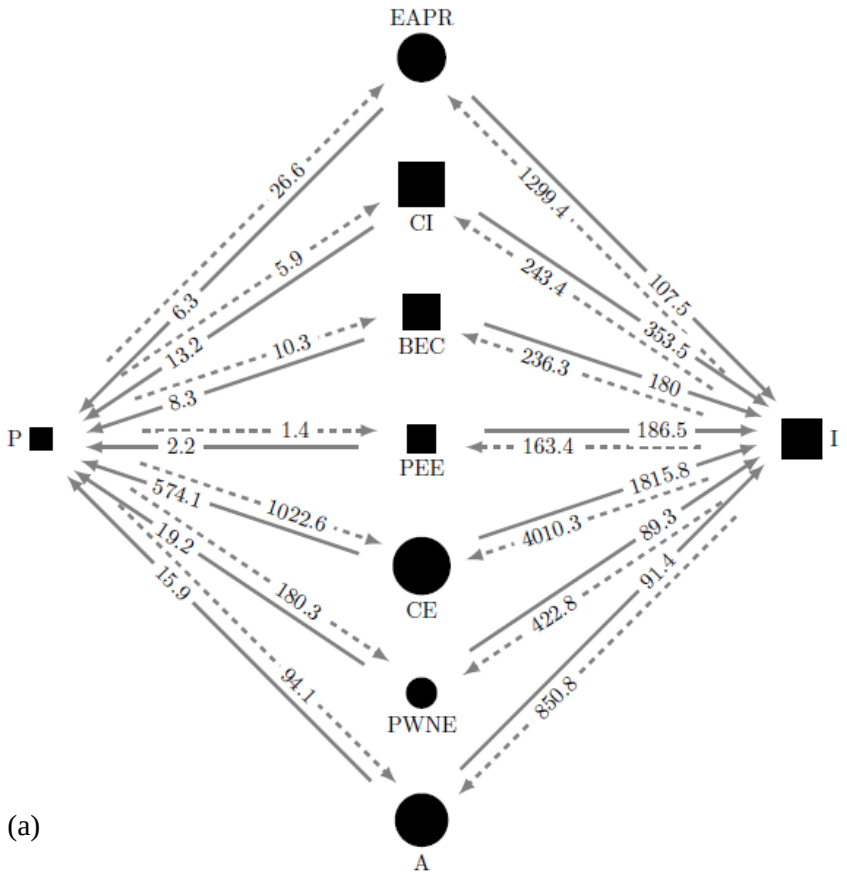
Both Italy and Portugal experienced deep changes from 1995 to 2009 regarding their volumes of value added and labour embodied in traded textiles. More in detail, Italy observed a significant drop by one fifth of exported value added, while imports increased by 29.74 per cent. Changes in volume of value added embodied in traded textiles are not reflected in changes in exports of Italy's national manufacturing sector, where overall exports increased by 8.89 per cent. However, similar to the textile industry value added embodied in Italy's manufacturing imports rose by 34.55 per cent. Regarding our second variable, labour, we find a massive decrease of 41.01 per cent in labour exports embodied in Italian traded textiles over the observation period. Labour imports in textiles, on the contrary, grew by 8 per cent. Hence, contrary to value-added, employment was not sustained during the observation period in Italy's textile industry. Changes in employment in the manufacturing sector as a whole took place at a level far below the textile industry: exports of labour dropped by only 6.56 per cent, and imports increased by 4.48 per cent.

For Portugal, the slump in value added embodied in textile exports was above the level observed for Italy, with a decrease of 32.13 per cent from 1995 to 2009. However, imports of value added increased by only 12.45 per cent. Similar to Italy, manufacturing trade volumes of value added evolved differently during the observation period: Exports of value added went up by 40.84 per cent; while value added embodied in manufacturing imports grew by 54.21 per cent. As regards traded labour in the textile industry, changes in Portugal were even more pronounced than in Italy. Labour exports in the textile industry slumped by 44.39 per cent, while imports rose by 31.76 per cent. Thus, contrary to Italy, Portugal increased its labour imports far more than its value added imports, indicating a continuous labour outsourcing process in the textile industry. This is confirmed by results of our benchmark sector, where labour embodied in manufacturing exports dropped by –7.05 per cent, while labour imports embodied in traded manufacturing goods increased by 26.2 per cent from 1995 to 2009.

Net-trade Position: Focusing next on the net-trade position in the ITTNs, as calculated by the centrality coefficient in (7), Italy was a net exporter of value added in both years, while it was a net importer of labour over the observation period, as illustrated in Figure 1. These results differ slightly from trade positions observed in the manufacturing sector as a whole, where Italy was a net exporter of value added in 1995, and turned into a net importer in 2009. With respect to traded labour within the manufacturing sector, Italy was a net importer in both years. For Portugal different results obtain – it was a net exporter of both value added and labour in 1995 and 2009 in textiles, while in the manufacturing sector as a whole it was a net importer of value added in 1995 and 2009 and vice versa, a net exporter

of labour in both years. In the ITTNs, Portugal's centrality coefficient was rather small (and thus its trade surplus rather large) in terms of embodied labour compared to value added, and Italy's centrality coefficient was relatively small (i.e. its trade surplus was comparatively strong) regarding embodied value added. This gives a first hint that Italy's textile industry was oriented towards value added-intensive production tasks, while in Portugal textile production involved comparatively labour-intensive production tasks, as discussed in more detail below.

Spatial trade patterns within the ITTNs in 1995 and 2009: In order to put the developments of the individual countries into an international context, we illustrate the spatial dimension of trade in value added and labour. Italy's and Portugal's bilateral trade relations with the building blocks are illustrated in Figure 1. In both years, the largest trading partner for Italy in value added trade concerning both imports and exports was Central Europe, i.e. the countries characterized by the lowest level of bilateral trade costs. Trade with Central Europe also accounted for the most intense trade relation in terms of labour embodied exports from Italy in both years. Yet, as concerns the absolute traded volume with Central Europe, exports of value added and labour decreased during the observation period and only Italy's value added imports from Central Europe increased. Turning to the developments of Portugal, some developments are similar to those in Italy. Even though being not a member of this regional block, Central Europe was also the most important trading partner for Portugal in terms of value added exports and imports in both years. Yet, this can be explained by the fact that for Portugal bilateral trade costs were lowest with this region too. Similar to the situation observed in Italy, trade volumes decreased during the observation period – except for value added imports from Central Europe. With respect to traded labour in 1995, bilateral trade between Portugal and Central Europe constituted for the largest part of labour embodied in traded textiles in both directions. However, by 2009 Central Europe was no longer Portugal's most important import source but this was overtaken by China and India. For Italy, already in 1995 Central Europe did not constitute such an important source of labour. In both years the largest volume of labour imports in the textile industry came from China and India. For both countries labour imports from China and India increased during the observation period, going hand in hand with a significant decrease in trade costs.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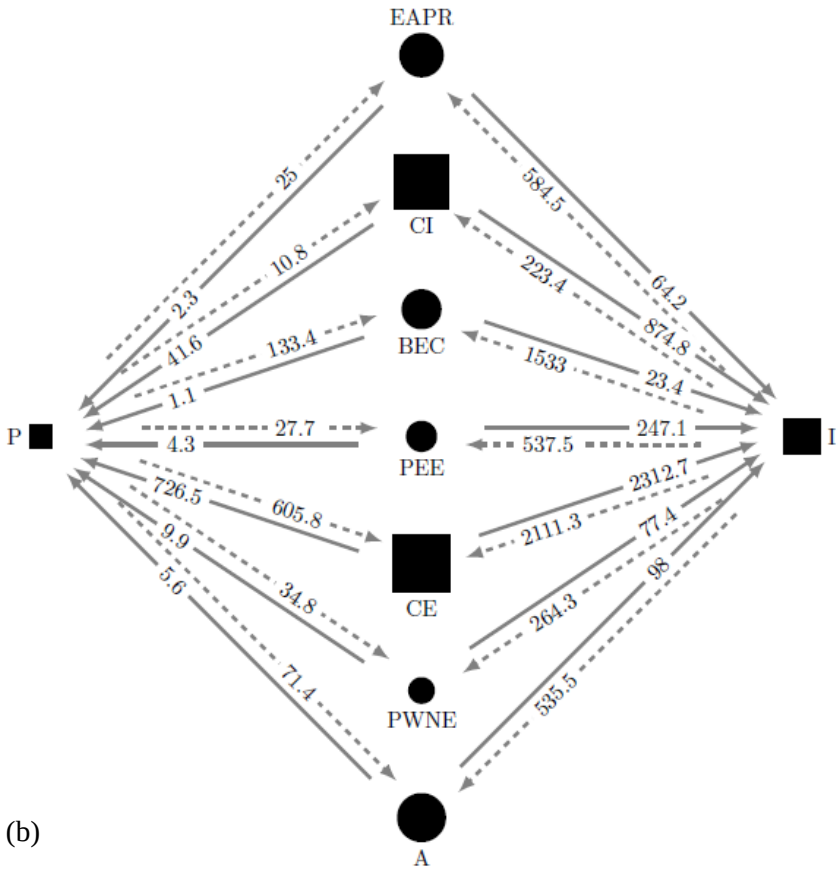
(a)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(b)

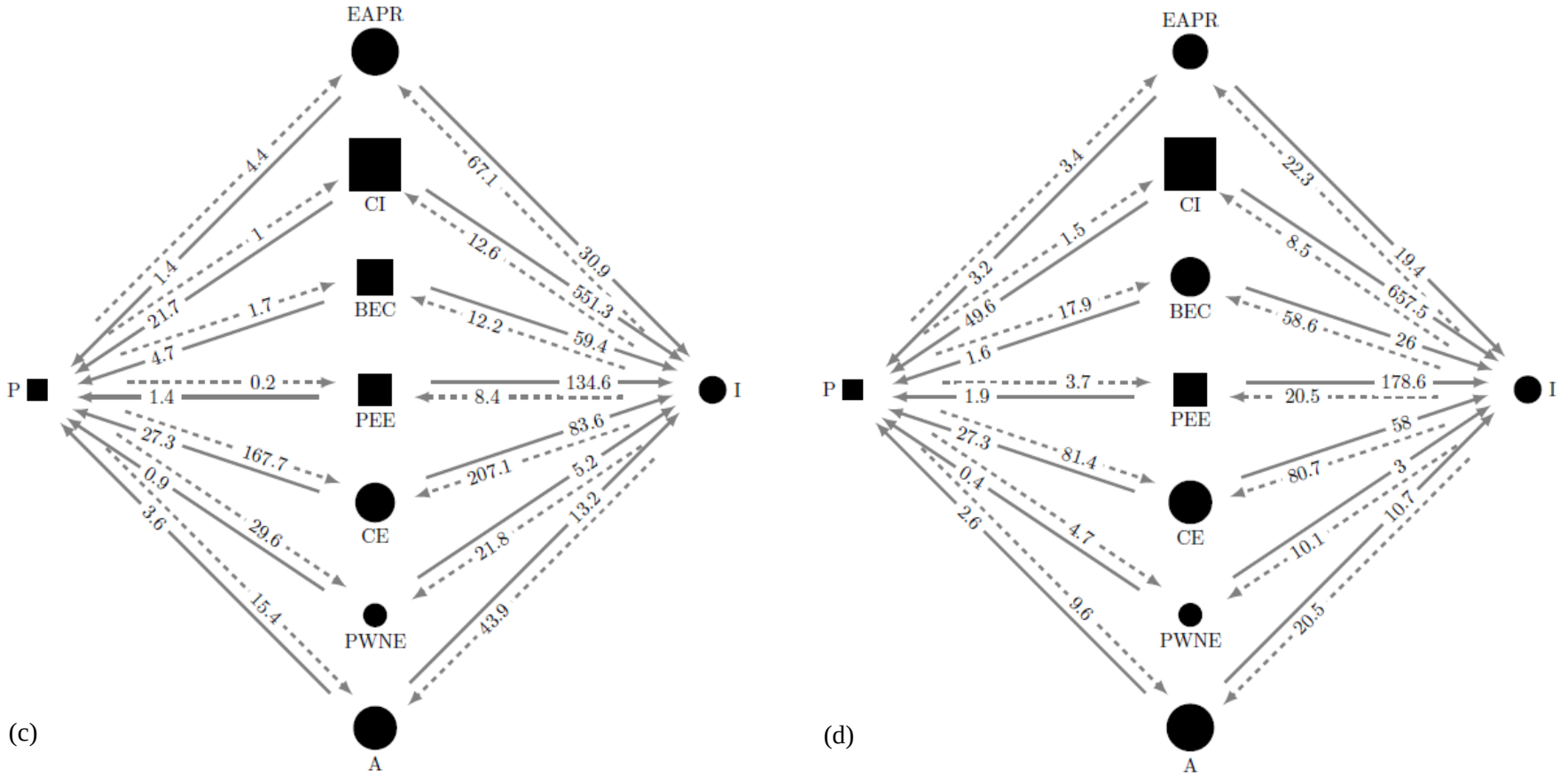

Figure 1: Bilateral textile trade relations from the perspective of Italy (abbreviated as I) and Portugal (abbreviated as P) in terms of value added in 1995 (a) and in 2009 (b), and in terms of hours worked in 1995 (c) and in 2009 (d). The size of the nodes reflects the total strength, or more precisely, the sum of out- and in-strength ranked in descending order. Nodes with circular shape are in-central nodes, while rectangular nodes are out-centrals. Edges which are illustrated as dotted lines are Italy's and Portugal's exports to the regional blocks, while edges illustrated as solid lines are Italy's and Portugal's imports from the regional blocks. Note also that Central Europe excludes Italy and Periphery West and North Europe excludes Portugal.

In general, it can be observed that changes in the intensity of trade linkages to regional building blocks were deeply bound to changes in overall trade costs. Moreover, the increased trade with other regions implies that also restructuring processes with regard to trading partners occurred over the investigation period. With respect to the development of spatial trade patterns to other regional blocks, differences between Italy and Portugal as well as differences between variables are observable only to a small dimension with a few exceptions: For instance, Baltic and Eurasian Countries as well as Periphery East Europe for both countries gained in importance as destinations for their value added exports during the observation period, going hand in hand with a significant drop in bilateral trade costs with these countries. Also for trade in labour – similar to trade in value added – exports from Italy and Portugal to the former two building blocks increased sharply during the observation period. This indicates higher domestic demand for textile goods in these building blocks. For both countries, imports of value added and labour from Baltic and Eurasian Countries and Periphery East Europe slumped, whereas imported value added from Periphery East Europe went up. Even though trade costs to Periphery West and North Europe declined, and especially for Portugal this building block in 1995 constituted for its 2nd most export destination, a sharp decrease in bilateral trade of both value added and labour – more for Portugal than for Italy was observed. Except for an increase in Portugal's imports of labour from East Asia and the Pacific Region and an increase in Italy's imports of value added from Americas, bilateral trade with these two building blocks dropped, despite a decline in trade costs. With respect to East Asia and the Pacific Region, our results are confirmed by Dunford (2006), who points out to an increased competitiveness going alongside with an upgrading process in the textile industry of East Asia and the Pacific Region. Hence, even though trade costs decreased, this region became more independent from international trade in value added.

Comparing trade in value added with trade in labour, inter-temporal changes in the latter variable in general were more pronounced during the observation period. With respect to the spatial dimension, results of value added and labour trade for the textile industry differed partly for the manufacturing sector at the beginning of the transition-phase and also changed partly into another direction until 2009, which is illustrated in more detail in Appendix A.3. To sum up, the level of trade costs seems to be a decisive factor for the shape and even more so for the development of international trade patterns during the transition phase. For Portugal trade costs on average were twice as high as for Italy. Put differently, Italy during the transition phase had more easily access to its trade partners, whereas Portugal faced difficulties to sustain its position in international textile trade of value added and labour due to the easier access of low-wage countries to international distributors of textiles.

Value Added Intensity and Labour Intensity: We next discuss results regarding the qualitative nature of the restructuring process in the textile industry, through comparing strength centralities from the two ITTNs. As illustrated in Table 4, Italy's exports in both years were more value added-intensive relatively to its imports. Its exports from 1995 to 2009 became even more value added-intensive, while

the value added-intensity of its imports increased only slightly. Since the increase of value added intensity in exports is larger than in imports, this signals a growing specialisation in value added-intensive production tasks, which in the textile industry are associated with high-level products. For the manufacturing sector as a whole, Italy's exports were more value added-intensive compared to its imports in both 1995 and 2009. Furthermore, Italy's imports became more value added-intensive from 1995 to 2009, which is also true for its exports.

Compared to Italy, production patterns in Portugal were different in 1995 and 2009 but evolved in a similar direction. For both years, its exports were more labour-intensive compared to its imports. Even though exports became more value added-intensive over time, compared to imports they remained relatively labour-intensive. Portugal thus was involved in lower quality production tasks in the textile industry than Italy. Yet, the decrease in value added intensity of imports is larger than the increase in value added intensity of exports, which implies that also Portugal slightly specialised towards value added-intensive production tasks during the observation period. In the manufacturing sector as a whole, exports were more labour-intensive than imports in both years. Yet, contrary to the textile industry imports became more value added intensive, showing again that the outsoucing of labour was rather industry-specific in Portugal. As regards exports in manufacturing goods, the value added-intensity rose, just as was the case for the textile industry.

	1995		2009	
	q_i^{IN}	q_i^{OUT}	q_i^{IN}	q_i^{OUT}
Italy	3.2480 (14.1467)	19.3789 (25.0143)	3.9019 (18.2205)	26.2098 (29.1476)
Portugal	11.4118 (22.4813)	6.1048 (9.5345)	9.700 (27.4658)	7.4141 (14.4540)

Table 4: Value added/Labour intensity of textile imports and exports for Italy and Portugal in 1995 and 2009. Figures in brackets are values for the whole manufacturing sector.

Keeping in mind the specialisation patterns of Italy's and Portugal's textile industries, we next concentrate on the positions of Italy and Portugal in the international textile production chain as well as patterns of vertical specialisation. As discussed in the following, this supports previous results.

Upstreamness and Downstreamness: In terms of value added, Italy was an upstream producer in both 1995 and 2009, while it consistently ranked as a downstream producer in terms of labour. Italy's upstream position in the textile industry in terms of value added was not reflected in production patterns of the manufacturing sector as a whole. There, it was a mid-upstream producer in 1995, and turned into a downstream producer. In terms of labour it was a down-stream producer in both years. Portugal on the contrary did not change position in the international textile production chain from 1995 to 2009. Concerning value added and labour, it stayed a middle-upstream producer. The results for Portugal's manufacturing sector differ from those observed in the textile industry and are also different for the

two variables: In terms of value added, Portugal was a down-stream producer, and in terms of labour, an up-stream producer in both years. Neither Italy nor Portugal experienced a change in their positions in the international textile production chain. This however does not rule out that they nonetheless shifted slightly up- or downstream. Taking a closer look at the development of their net-trade positions over the observation period lets us conclude that both countries moved downstream. Empirically, this is confirmed by decreases of the trade surpluses in terms of trade value added for Italy (-52.41 per cent) and for Portugal (-87.8 per cent). Regarding labour, Italy's trade deficit even rose by 44.75 per cent from 1995 to 2009, while Portugal exhibited a drop in its trade surplus of 76.52 per cent. Put differently, both countries specialised more on downstream activities in the textile industry, which are associated with value-added intensive but labour-saving production tasks.

Vertical Specialisation: To back results gained hitherto, in a last step, we take a closer look at whether Italy and Portugal have increased their vertical specialisation and have thus outsourced production activities within the textile industry or whether the textile industries of the two countries have become less fragmented during the observation period. As shown in Table 5, Italy increased its value added import content of intermediate textile exports from 1995 to 2009. Contrary to this general increase in outsourcing activities in the production of intermediate textile goods, Italy's vertical specialisation with respect to the value added import content of final demand textile goods decreased. Together with the results regarding the country's movement along the global textile production chain, this again indicates continuous fragmentation of value added during the observation period, going hand in hand with a down-stream movement and an increasing specialisation towards value-added intensive production tasks. As can be seen from the 3rd column of Table 5, Italy decreased its overall degree of vertical specialisation in terms of value added, signalling that only a few highly specialised production tasks remain within the country. The results for the manufacturing sector as a whole differ from those in Italy's textile industry. All vertical specialisation indicators in terms of value added rose, suggesting that Italy's manufacturing sector as a whole became more dependent on international production linkages in terms of value added creation. This furthermore indicates that the country had a comparative advantage in terms of value added-intensive production within the textile industry both in 1995 and in 2009, even though it seems that this decreased over the observation period.

Regarding the situation for Portugal, vertical specialisation coefficients in terms of value added developed rather differently compared to Italy. Both the value added import content of intermediate and final demand textile exports dropped from 1995 to 2009, indicating a decreased fragmentation in Portugal's textile industry. The decrease of the value added import content of intermediate demand textile exports exceeds that for final demand textile exports. Together with Portugal's initial mid-upstream position in terms of value added in 1995, this supports the picture of a move into downstream direction. Overall and similar to Italy, for Portugal a growing vertical integration was observed between the two years. For Portugal, the development of vertical specialisation in the manufacturing sector was

partly the same than that of the textile industry regarding value added. The value added import content of exports in intermediate textile goods decreased, whereas there was an increase in vertical specialisation in terms of value added final demand exports. Altogether, Portugal's manufacturing value added exports (both to the intermediate and the final demand sector) became more dependent on foreign producers.

	c_{Z,Z_i}		c_{Z,F_i}		$c_{Z,Z+F_i}$	
	1995	2009	1995	2009	1995	2009
Value added						
Italy	0.5574	0.6171	0.3852	0.2395	0.2278	0.1725
	(1.0600)	(1.115)	(0.9828)	(1.0103)	(0.5100)	(0.5300)
Portugal	2.5714	2.0323	0.4239	0.3437	0.3639	0.2939
	(1.9197)	(1.329)	(1.3474)	(1.6171)	(0.7917)	(0.7295)
Hours Worked						
Italy	2.4683	4.391	1.7057	1.7043	1.0087	1.2278
	(1.8748)	(1.6661)	(1.7381)	(1.5095)	(0.9019)	(0.7920)
Portugal	1.3701	2.3443	0.2259	0.3964	0.1939	0.3391
	(0.8322)	(0.7503)	(0.5841)	(0.913)	(0.3432)	(0.4118)

Table 5: Measures of Vertical Specialisation for Italy and Portugal in 1995 and 2009 in terms of value added and hours worked. Figures in brackets correspond to values for the whole manufacturing sector.

As regards our second variable, particularly in the intermediate sector fragmentation in terms of labour in Portugal's textile industry increased. Labour imports embodied in final demand textile exports increased to a lesser degree, and overall, vertical specialisation increased from 1995 to 2009, as shown in the 3rd column of Table 5. Hence, despite the fact that the country remained a mid-upstream producer in terms of labour over the observation period, increased outsourcing of labour went hand in hand with a downstream movement along the international textile production chain. Furthermore, Portugal continuously substituted imported labour embodied in textile exports for domestic labour, showing again the massive fragmentation experienced in terms of employment in the textile industry. In Portugal's manufacturing sector, it was particularly the development of the degree of vertical specialisation of intermediate goods production which differed from the results for the textile industry: While in the textile industry there was a growing dependence on imported labour, the manufacturing sector as a whole became more vertically integrated and labour was less outsourced. However, the overall degree of vertical specialisation in Portugal's manufacturing sector, and the labour import content of final demand exports – like in the textile industry – increased.

In Italy, except for imported labour embodied in final demand exports, fragmentation accelerated. Thus, Italy's specialisation towards more value added-intensive downstream production went hand in

hand with increased vertical integration only in final demand exports. Conversely, the labour required for intermediate production activities was gradually outsourced over the course of the observation period. Overall, Italy's textile industry became more vertically specialised in terms of labour. In terms of labour, results for Italy's manufacturing sector are rather different to the textile industry, since vertical specialisation decreased for all three indicators. This shows again, that even though Italy's textile industry is specialised more on value-added intensive production tasks, changes in employment are still industry-specific. Comparing the changes in our measures of vertical specialisation for both countries over time, we again find support for the observation that value added-intensive textile production became more important relative to labour-intensive production in both countries. This is because value added-intensive production tasks became either more vertically integrated in both countries, or were at least outsourced to a lesser degree than labour-intensive production tasks.

6. Conclusions

The aim of this paper was to contribute to a better understanding of the restructuring process in international textile production from the perspective of Italy and Portugal. From a methodological and analytical point of view, using the measures we brought together for answering the research question helped us to investigate changes in structure as a multifaceted process and to figure out both quantitative and qualitative aspects related to this. The empirical results gained by means of the analytical framework are significant also with respect to the different benchmarks chosen. Taking on the one hand the national manufacturing sectors of our two case study countries as a benchmark, and focusing on the other hand on an international context, allowed us to highlight industry- and country-specific aspects of the experienced restructuring process. By including three different variables, namely gross output, value added and labour into our research, we were further able to reconcile empirical results and to study international textile production and changes therein from different angles. To the best of our knowledge such a comprehensive industry-level study on textile production within an international context, addressing a variety of different quantitative and qualitative aspects of the restructuring process has not existed hitherto.

As discussed at the beginning, institutional changes related to trade liberalisation, together with technological change in the textile industry, exposed particularly developed countries to problems which manifested in a tremendous restructuring process. However, we show that the textile industry in developed countries does not necessarily have to suffer *exclusively* from the observed institutional and technological changes. Given that developed countries perceive of distinct path dependencies regarding structural properties of textile production, which beyond doubt is the case for such an 'old' industry, proves decisive in determining whether they suffer more or less from these changes. In an international context, we find that the textile industry in 1995 already exhibited a high level of concentration in terms of labour, which even increased until 2009. A similar picture emerges for gross output and

value added from 1995 to 2009. Concerning results of spatial trade patterns of value added and labour, building regional blocks is also in line with other empirical papers such as Johnson and Noguera (2012) who found evidence that fragmentation occurs along regional blocks as both proximity and regional trade agreements are important drivers of location processes. As regards our two case study countries, we show that the textile industry lost in importance for both of them. Quantitatively, this crystallised into a decreased gross output and strong declines in value added generation and employment. However, from a more qualitative point of view, Italy partly counteracted these slumps through adapting production and strengthening specialisation in value added-intensive production tasks. This probably also led to an extension of its comparative advantage in high-level products. On the contrary, Portugal's textile industry in 1995 was heavily oriented towards labour-intensive production. Despite slight efforts existed to specialise more in value added-intensive textile production, the dominance of labour-intensive textile production caused its textile industry to suffer a lot from changes in the institutional and technological environment, going hand in hand with massive outsourcing processes. Based on this evidence we conclude that textile producing firms in both countries can only stabilize their own situation if they are productive, innovative and able to modernize their production. This was also confirmed by some reports of the European Commission, such as Dachs et al. (2011) or Scheffer (2012). While Italy seemed to proceed in the right direction, Portugal's textile industry constitutes a textbook example of the negative effects of restructuring processes. We suggest that stabilising the situation in either country's textile industry, however, requires taking country-specific action. We consider identifying structural characteristics of the textile industry in an international context as well as changes in economic structure specific to Italy and Portugal, to be a first step towards the formulation of effective policy measures.

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Appendix

A.1 Trade Costs for Italy and Portugal with Country Clubs

	Trade Costs Italy		Trade Costs Portugal	
	1995	2009	1995	2009
World	102,01	87,36	208,46	183,03
	(.30)	(.34)	(.33)	.28)
Central Europe	64,63	56,44	97,50	82,36
	(.10)	(.27)	(.22)	(.35)
Periphery West and North Europe	87,06	86,42	130,29	107,93
	(.20)	(.09)	(.23)	(.41)
Periphery East Europe	98,46	62,82	210,20	118,68
	(.08)	(.20)	(.08)	(.29)
East Asia and Pacific Region	126,83	122,89	232,56	194,56
	(.04)	(.14)	(.21)	(.17)
Baltic and Eurasian Countries	144,38	101,53	230,91	167,79
	(.17)	(.22)	(.27)	(.18)
Americas	120,71	119,62	235,58	196,01
	(.18)	(.13)	(.20)	(.10)
China and India	126,32	108,71	256,67	206,10
	(.04)	(.07)	(.15)	(.21)

Trade Costs. Data from ESCAP database on International Trade Costs. The coefficients of variation for the respective clubs are reported in brackets. Missing data for 1995 were estimated by using data from 1996 and 1997.
Data for Taiwan are not available; therefore data for China were taken as a proxy.

A.2 Strength Centrality: Single Country Values and Totals for Regions.

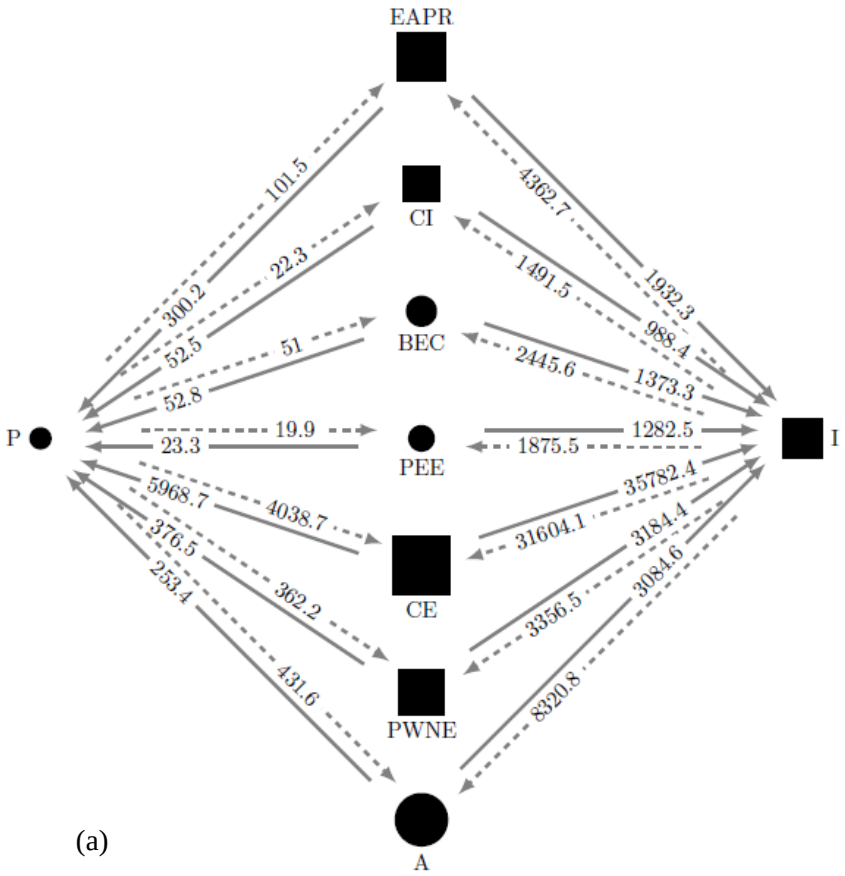
	Value Added				Employment			
	In-Strength		Out-Strength		In-Strength		Out-Strength	
	1995	2009	1995	2009	1995	2009	1995	2009
East Asia and Pacific Region								
Australia	779 (12,634)	1,114 (26,742)	436 (6,149)	199 (7,812)	526 (1,438)	515 (2,335)	30 (268)	15 (258)
Indonesia	633 (10,847)	910 (12,980)	2 (12)	1 (3)	177 (902)	328 (1,607)	513 (3,111)	855 (2,318)
Japan	5,989 (55,822)	4,232 (61,533)	1,873 (102,955)	1,613 (144,797)	3,986 (11,286)	1,672 (7,067)	109 (2,338)	99 (1,890)
South Korea	1,639 (28,975)	1,133 (49,429)	4,127 (23,378)	1,321 (74,190)	821 (2,696)	408 (3,711)	851 (2,279)	145 (3,241)
Taiwan	701 (24,269)	360 (32,875)	2,506 (23,004)	1,042 (34,262)	198 (1,919)	102 (2,039)	359 (1,957)	181 (2,690)
Total 17t18 (Total Manufacturing)	9,741 (132,547)	7,749 (183,559)	8,944 (155,498)	4,176 (261,064)	5,708 (18,241)	3,025 (16,759)	1,862 (9,953)	1,295 (10,397)
Central Europe								
Austria	1,255 (16,622)	1,224 (25,111)	895 (15,108)	1,132 (31,073)	189 (826)	157 (984)	32 (411)	25 (520)
Belgium	1,957 (33,988)	1,587 (40,580)	2,432 (37,071)	2,674 (42,896)	296 (1,685)	270 (1,937)	76 (767)	35 (610)
France	3,771 (67,559)	4,097 (99,942)	3,306 (58,253)	4,538 (84,626)	868 (3,730)	1,187 (5,132)	182 (1,792)	88 (1,450)
Germany	9,788 (108,857)	5,805 (163,635)	5,536 (149,776)	7,559 (248,126)	2,955 (8,968)	1,925 (10,573)	207 (3,768)	185 (4,542)
Italy	2,881 (47,844)	3,738 (64,373)	7,364 (54,231)	5,871 (59,053)	887 (3,382)	958 (3,533)	380 (2,168)	224 (2,026)
Netherlands	1,781 (35,547)	1,517 (43,168)	1,431 (40,484)	1,221 (58,112)	398 (2,162)	264 (2,020)	47 (1,000)	28 (963)
Slovenia	169 (2,384)	172 (3,933)	331 (2,003)	89 (2,983)	17 (135)	35 (190)	53 (220)	11 (225)
Spain	1,336 (27,409)	2,714 (50,689)	968 (20,775)	2,299 (31,469)	278 (1,605)	789 (2,674)	65 (829)	113 (1,074)
United Kingdom	3,725 (63,159)	4,308 (90,267)	3,342 (66,431)	3,245 (80,611)	1,281 (4,428)	1,438 (5,149)	122 (2,168)	82 (1,715)
Total 17t18 (Total Manufacturing)	26,663 (403,369)	25,162 (581,698)	25,605 (444,132)	28,628 (638,949)	7,169 (26,921)	7,023 (32,192)	1,164 (13,123)	791 (13,125)
Periphery West and North Europe								
Denmark	865 (12,572)	413 (18,212)	774 (13,844)	431 (17,375)	258 (737)	98 (645)	27 (377)	11 (323)
Finland	359 (6,935)	448 (11,422)	233 (10,493)	216 (21,976)	87 (487)	96 (616)	10 (244)	7 (244)

Greece	766 (6,456)	946 (11,947)	482 (1,243)	256 (1,657)	82 (414)	117 (631)	47 (97)	19 (99)
Ireland	476 (7,860)	621 (14,824)	377 (12,507)	145 (25,109)	49 (385)	85 (531)	28 (346)	5 (241)
Luxembourg	102 (2,350)	128 (3,214)	203 (2,230)	167 (2,549)	5 (68)	4 (73)	2 (50)	3 (53)
Malta	56 (720)	39 (916)	40 (320)	14 (421)	6 (38)	2 (35)	3 (25)	1 (24)
Portugal	776 (7,801)	873 (12,030)	1,398 (5,244)	949 (7,386)	68 (347)	90 (438)	229 (550)	128 (511)
Sweden	896 (16,299)	699 (22,729)	291 (20,070)	371 (46,209)	257 (850)	149 (887)	13 (548)	16 (502)
Total 17t18 (Total Manufacturing)	4,296 (60,993)	4,167 (95,294)	3,798 (65,951)	2,549 (122,682)	812 (3,326)	641 (3,856)	359 (2,237)	190 (1,997)
Periphery East Europe								
Bulgaria	15 (878)	78 (3,311)	57 (690)	12 (42)	2 (134)	9 (238)	53 (349)	104 (285)
Czech Republic	428 (6,241)	771 (20,668)	391 (4,023)	640 (18,294)	57 (448)	122 (1,184)	146 (912)	91 (1,371)
Hungary	175 (3,637)	492 (15,104)	168 (2,026)	100 (9,040)	19 (284)	37 (797)	74 (446)	70 (1,215)
Poland	264 (6,197)	1,304 (27,938)	1,149 (6,486)	1,735 (23,433)	25 (397)	314 (1,456)	479 (1,438)	293 (2,163)
Romania	347 (2,212)	1,044 (9,340)	401 (1,694)	46 (206)	23 (164)	80 (613)	424 (801)	426 (821)
Slovakia	82 (1,877)	340 (8,337)	137 (1,968)	335 (11,052)	24 (222)	71 (487)	56 (418)	57 (549)
Total 17t18 (Total Manufacturing)	1,311 (21,042)	4,029 (84,698)	2,303 (16,887)	2,868 (62,067)	150 (1,649)	633 (4,775)	1,232 (4,364)	1,041 (6,404)
Americas								
Brazil	503 (11,218)	437 (22,133)	360 (7,969)	99 (5,141)	145 (735)	229 (1,668)	136 (1,400)	93 (1,673)
Canada	1,899 (44,027)	2,505 (78,714)	1,142 (49,998)	1,211 (65,882)	716 (2,915)	844 (4,002)	83 (1,863)	34 (1,177)
Mexico	1,253 (19,857)	1,662 (59,516)	1,024 (15,329)	547 (13,113)	123 (922)	244 (2,900)	502 (3,200)	800 (5,456)
United States	9,290 (174,062)	8,098 (232,842)	3,655 (119,113)	4,382 (255,827)	5,627 (21,945)	5,607 (30,614)	231 (4,132)	218 (4,286)
Total 17t18 (Total Manufacturing)	12,945 (249,164	12,702 (393,205)	6,181 (192,409)	6,239 (339,963	6,611 (26,517	6,924 (39,184	952 (10,595	1,145 (12,592)
Baltic and Eurasian Countries								
Cyprus	77 (778)	135 (1,257)	123 (235)	63 (267)	21 (69)	9 (58)	18 (20)	3 (17)

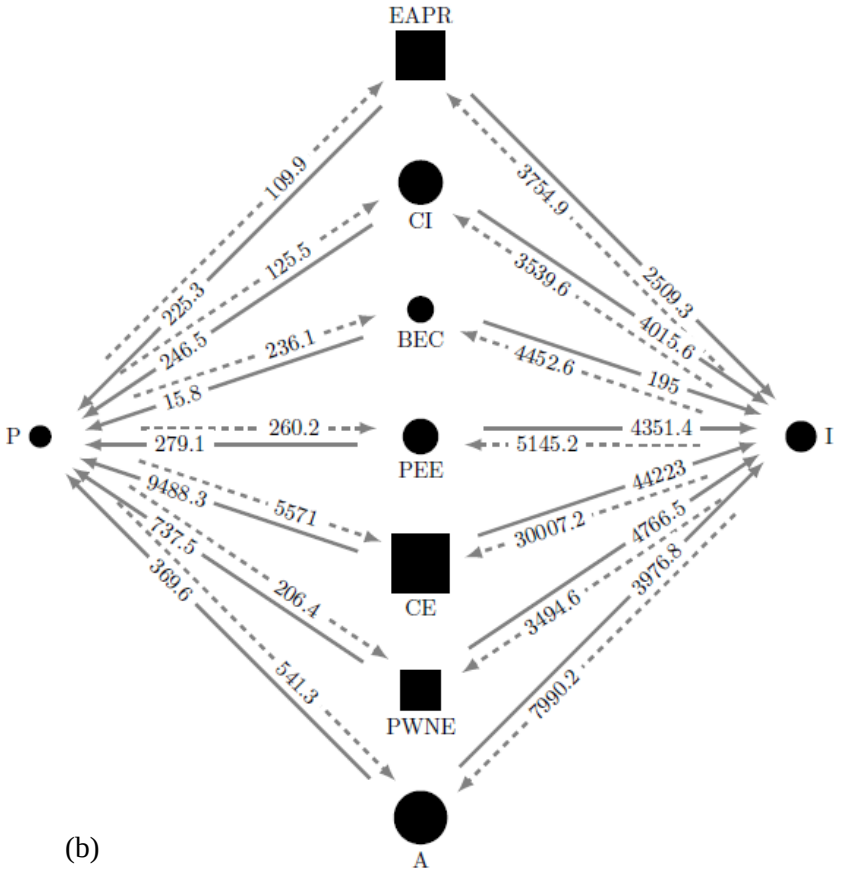
Estonia	74 (640)	84 (1,601)	57 (357)	88 (973)	12 (71)	18 (85)	33 (153)	21 (133)
Latvia	44 (444)	109 (1,545)	46 (319)	31 (503)	6 (73)	11 (98)	23 (112)	10 (80)
Lithuania	65 (742)	211 (2,141)	118 (468)	215 (1,853)	13 (124)	21 (131)	70 (209)	51 (191)
Russia	1,731 (12,871)	5,189 (33,581)	123 (7,808)	2 (693)	346 (1,363)	1,742 (2,748)	183 (3,970)	12 (1,282)
Turkey	490 (8,170)	4,752 (16,619)	3,303 (8,287)	195 (751)	219 (724)	2,169 (2,012)	638 (841)	364 (1,397)
Total 17t18 (Total Manufacturing)	2,481 (23,645)	10,480 (56,744)	3,770 (17,474)	594 (5,040)	617 (2,424)	3,970 (5,132)	965 (5,305)	461 (3,100)
China & India								
China	3,482 (31,131)	3,188 (180,798)	8,276 (30,349)	19,696 (157,789)	489 (2,007)	448 (7,102)	10,408 (27,745)	9,504 (44,718)
India	220 (6,533)	481 (26,972)	2,265 (5,727)	3,210 (15,415)	87 (750)	149 (2,923)	4,706 (8,510)	8,386 (19,590)
Total 17t18 (Total Manufacturing)	3,702 (37,664)	3,669 (207,770)	10,541 (36,076)	22,906 (173,204)	576 (2,757)	597 (10,025)	15,114 (36,255)	17,890 (64,308)

Note that figures in brackets correspond to values for the whole manufacturing sector.
Value added is expressed in constant millions of US-$, where 1995 = 100. Employment is expressed in million hours worked.

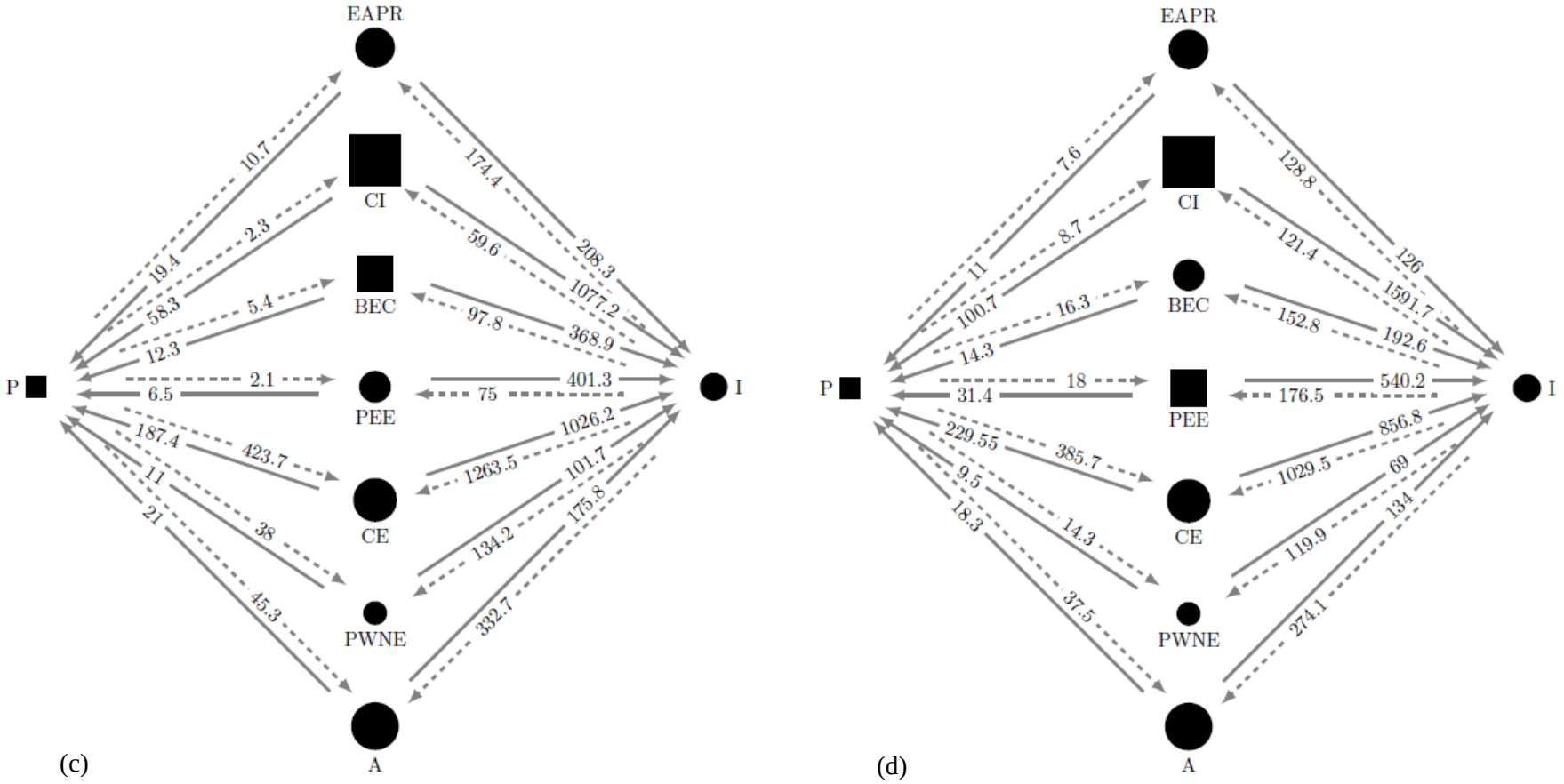
A.3 Bilateral manufacturing trade relations from the perspective of Italy and Portugal



(a)



(b)



Bilateral manufacturing trade relations from the perspective of Italy (abbreviated as I) and Portugal (abbreviated as P) in terms of value added in 1995 (a) and in 2009 (b), and in terms of hours worked in 1995 (c) and in 2009 (d). The size of the nodes reflects the total strength, or more precisely, the sum of out- and in-strength ranked in descending order. Nodes with circular shape are in-central nodes, while rectangular nodes are out-centrals. Edges which are illustrated as dotted lines are Italy's and Portugal's exports to the regional blocks, while edges illustrated as solid lines are Italy's and Portugal's imports from the regional blocks. Note also that Central Europe excludes Italy and Periphery West and North Europe excludes Portugal.