Growing Inequality:
a Novel Integration of
transformations research

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# D4.1. Quantifying the impact of international fragmentation of production on gender inequality

## WP4 Globalisation: Impact on skills and inequality


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## Document Summary

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## Summary

This report provides analyses of the consequences of the rapidly increasing globalisation in the first fifteen years of the 21st century for employment by gender. It first presents an overview of the literature of trade-related economic mechanisms that might affect employment of males and females differently. Next, it argues that the period considered was not only characterized by an increasing trade intensity, but that also the nature of trade changed. With the diffusion of global value chains (GVCs) as a dominant way of organizing production processes (permitted by the internet revolution and strong trade liberalisation policies), countries did no longer only specialise in industries, but also in performing specific activities within industries. This phenomenon is called functional specialisation. The analyses in this report study the implications of changing trade patterns for male and female workers from the perspective of functional specialisation.

Using the 2016-release of the World Input-Output Database and data from population censuses and labour force surveys, we sketch trends in the relative employment levels of male and female workers by business function (fabrication, R&D, marketing and management). As expected, clear differences between the 'old' EU member states and the Eastern European countries that became members in or after 2004 emerge. With the exception of management, the shares of female employment in total employment were consistently higher in Eastern Europe. This also showed up in an analysis of export specialisation in products that contain relatively much female labour, in particular when one focuses on employment in the fabrication function. Over the period considered, the differences between the two sets of European countries decreased.

The final part of the analysis focuses on isolating the effects of changes in international trade from other types of changes, such as changes in technology and changes in the relative numbers of male and female workers required to produce a unit of a final product (which is the output of a GVC). For employment in fabrication, we find very negative trade effects for both female and male employment in Western European countries, and positive effects for most Eastern European countries. The negative effects in Western Europe tend to be slightly smaller for female workers than for male workers. For other business functions, both the differences in the effects between Western and Eastern Europe and those between male and female workers are much less marked.

# Contents

## Abstract

In many countries in the European Union, female employment has grown faster than male employment. In the literature, several potential causes of this trend have been put forward. Besides supply-side factors related to waves of emancipation, technological progress (mainly machines reducing demand for workers performing physically demanding jobs) and trade have been put forward as explanations. In this report, we focus on quantifying the effects that are due to changes in international trade patterns. The period considered is 2000-2014, which roughly corresponds with the period in which global trade grew at a much faster pace than the global economy.

The analysis does not just look at consequences of changes in industry specialisation. In the period studied, production processes became increasingly organised as global value chains (GVCs). The GVC revolution was not only characterised by increased industry specialisation, but also implied 'functional specialisation': whereas industry A in Country 1 is mainly taking care of the headquarter functions (e.g. R&D, marketing, etc.), industry A in Country 2 mainly performs fabrication activities. Like industry specialisation, this type of specialisation is also driven by comparative advantages. Given our objective to quantify the effects of trade on the relatively rapid growth of female employment and the fact that the differences between male and female workers tend to be larger for some business functions than for others, we consider this question using data on employment by function. We present results based on an input-output based accounting approach that considers technological change within GVCs rather than within industries, and that considers changes in trade patterns as relocations of economic activity by function within GVCs.

The data used are the 2016 release of the World Input-Output Database, complemented with new data on employment at industry level split by function and gender. In constructing the data, the functional split was based on the occupations of workers, using population censuses and national labour force surveys. The business functions we consider are fabrication, management, R&D and marketing.



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# 1. Introduction

According to the vast majority of theories, international trade increases welfare of all countries involved. Several waves of trade liberalisation after World War II seem to have had positive implications indeed (see, e.g. Felbermayr et al., 2022, about the positive welfare effects of several aspects of EU integration). At the same time, several theories also explain why the gains of increased international trade are generally not evenly distributed within countries. Many groups gain from trade, but there are be groups that lose. They might lose their jobs, or experience wage reductions. Domestic policies should be designed to ensure that the gains from trade are enjoyed by everyone. Such policies could relate to income redistribution and training/education, for example. According to many, the past few years have shown that such policies have been too weak or at least have been perceived as such. Often, the downsides of international trade for particular groups got much more attention than the economy-wide gains. The strong anti-trade stance of the Trump administration and the increasing anti-EU sentiments in many European countries are a case in point.

In order to design domestic policies that yield a more even distribution of the gains from trade, it is essential to have insights into the various inequalities that trade might cause. Unlike other papers, which for example focus on the differential impacts of trade on workers with different educational attainment levels (e.g. Wood, 1995), this paper particularly focuses on *gender* inequalities. The literature on the differences in labour market outcomes for men and women is growing, but still relatively modest (and often focused on employment and wages in emerging and least developed countries, and less on effects in richer countries). In this paper, we will address the question: "To which extent has trade affected female employment around the world, between 2000 and 2014?" In doing so, we will not adopt a conventional view of trade as if only final goods are traded (like in the well-known textbook models of trade induced by comparative advantages, by Ricardo and Heckscher-Ohlin). Instead, we will adopt a perspective that considers the emergence of global value chains ('GVCs'), in which the activities required to produce final products from scratch tend to be dispersed over countries (often on multiple continents). The fact that production processes have become increasingly organised in GVCs over the period of interest implies that trade in activities (or trade in tasks/functions; see Grossman and Rossi-Hansberg, 2008, and Timmer et al., 2019) has become an important phenomenon. Given that male and female workers tend to have comparative advantages in different business functions, a GVC perspective is indispensable when assessing the effects of trade on their employment.

To implement our approach empirically, we use two types of data. First, we use input-output tables from the World Input-Output Database (2016 release, see Timmer et al., 2015; 2016). Such input-output tables provide a quantitative description of the global production structure, in terms of the values of all

transactions among industries over the world in a given year, and the links between this production structure and users of final products in the countries considered. Second, we use internationally harmonised data on the occupational mix of workers in industries all over the world to derive information about the functions in which these industries specialised. These functions are fabrication, management, marketing and research and development (R&D). These data are an update of the data introduced by Timmer et al. (2019), and have been extended by providing detail about the gender of the workers performing these functions, again by country and industry. We apply by now well-established methods from the input-output toolkit to analyse the impacts of changes in trade patterns on female employment.

The structure of the remainder of this paper is as follows. In Section 2, we will provide an overview of the most important literature that discusses the reasons behind differential impacts of trade on the labour market outcomes for male and female workers. Section 3 then shows empirically why a function-specific focus is needed in a world in which GVCs play a prominent role, by discussing how reductions in costs of coordination of geographically dispersed production activities have caused the functional compositions of many industries to vary strongly over countries. Section 4 is devoted to a discussion of the data, and how these data can be used to analyse GVCs and international trade. We quantify the main trends in the share of female employment in total employment in EU countries in the period 2000-2014 in Section 5, at aggregate level and by business function. Next, Section 6, presents results with respect to differences between countries regarding the extent to which they export female labour (embodied in the exported products) and changes therein over the period 2000-2014. Next, Section 7 quantifies the consequences for male and female employment of changing trade patterns in a world that can be seen as a network of GVCs and thereby answers our central research question. Our conclusions are presented in Section 8.

## 2. Trade and the Gender Gap in Employment: A Brief Review

In large parts of the world, the labour participation rate is considerably lower for women than for men (ILO, 2018). In several regions, the differences have slowly become smaller since 1990 (Pieters, 2018). Latin America was the region in which this tendency could be observed most clearly. In 1990, the female labour participation rate in this region was about half of the male labour participation rate, defined in terms of persons of 15 years old and above. In 2012, the gap decreased to less than 35%. For Europe, the gap in was already much smaller in 1990 (at around 30%) and decreased a bit further, but at a very slow pace (to about 25% in 2012). As this trend was observed in a period in which international trade grew much faster than the world economy, several economists have done research into potential links between the two

phenomena. To which extent does international trade contribute to more equality between male and female workers? One could study such inequality effects in terms of prices, i.e. relative wage rates of men and women (see, e.g. Oostendorp, 2009; Sauré and Zoabi, 2014; Nikulin and Wolszczak-Derlacz, 2022). In this report, however, we will focus on effects on the relative numbers of employed people, that is, on quantity effects of trade. These are not only interesting from the perspective of inequality concerns, but also because increasing labour participation of women can help in sustaining long-run growth. In this section, we will briefly discuss some of the economic mechanisms that have been put forward as potential explanations for a positive relationship between trade intensification and relatively rapid employment growth of female workers.

In her concise overview of the literature, Pieters (2018) argues that the proposed explanations can be split into two types, (i) those focusing on mechanism related to discrimination, and (ii) those focusing on differences in the aptitudes of male and female workers for employment in specific sectors.

Black and Brainerd (2004) is most probably the most well-known study into the role that discrimination could play. They build their line of argumentation on the so-called pro-competitive gains of trade. Trade liberalisation implies that the degree of competition on product markets increases, since it becomes easier for foreign firms to enter markets that could only be served by domestic firms before. This increased competition exerts a downward pressure on prices. This makes it more difficult to discriminate, in the context of this report against women. Assume that a discriminating firm, hires a low-productivity man at a given wage rate, instead of a higher-productivity female worker. If such a firm faces competition from firms that do not discriminate and profit margins are low due to fierce international competition, it will be driven from the market and more female workers will be hired. Black and Brainerd (2004) provided empirical evidence for the US in the period 1977-1994 supporting this theory, but more recent studies for other countries have been less conclusive.

Men tend to have more physical strength than women and work in some sectors requires more physical strength than work in other sectors. Hence, female workers are generally better represented in services than in e.g. manufacturing. In large parts of the services sector, productivity is determined much more by cognitive skills, regarding which differences between male and female workers are non-existent (although e.g. differences in access to education give women a disadvantage in some countries). But within a broad sector like manufacturing, the differences can also be sizable. As Pieters (2018) states, female workers are (relative to men) much more numerous in textiles and clothing manufacturing, and much less so in transportation equipment manufacturing. These sectoral differences can have an effect on the relative employment of men and women if reductions in the costs of trading lead to changes in specialisation patterns. Roughly speaking, female employment will grow at a slower pace in a country that specialises in car manufacturing than in a country that specialises in providing insurance services. Empirical evidence for

this type of 'reallocation' mechanism was provided by Do et al. (2016), while Gaddis and Pieters (2017) and Kis-Katos et al. (2018) find similar effects when studying the effects of sector-specific trade liberalisations, such as the removal of import tariffs on limited ranges of products.

Bøler et al. (2018) did not focus on gender differences related to physical strength, but with respect to flexibility. They argue that trade requires availability and activity outside regular office hours, due to business travel obligations and time zone differences between suppliers and users of traded products. Given that women tend to take care of a larger part of household responsibilities, they are generally less flexible in this respect than men. The authors find evidence for increases in the gender gap in firms that increase that start exporting, for the Norwegian manufacturing sector between 1996 and 2010.

Finally, trade is considered to affect the employment of women through technological upgrading, mainly in emerging countries. Juhn et al. (2014) show that the North American Free Trade Agreement induced Mexican firms to export, but that competing on the US and Canadian markets required capital intensification. Increased competition on domestic markets also led to the adoption of more capital-intensive production techniques. If machines substitute for physically demanding work, the productivity differences between male and female workers decrease, which reduces the gender gap in labour market outcomes.

In her review of the literature, Pieters (2018, p.9) states that "Trade policy is not generally considered among the alternatives for promoting gender equality. Yet empirical evidence suggests that trade liberalisation can have significant effects on gender inequality in wages and employment". This state of affairs asks for more research. In this paper, we will mainly focus on observed reallocation (or specialisation) effects. In the next section, we will argue that the conventional focus on industry specialisation might well hide substantial trade-induced changes in the employment of women relative to men, because this focus neglects a second type of specialisation. Nowadays, functional specialisation takes place *within* industries. This is important, because it is likely that differences between male and female workers are more relevant for the type of job they have than for the industry they are employed in.

## 3. Global Value Chains: Functional Specialisation within Industries

As e.g. Baldwin (2016) argued, the first wave of international trade was caused by falling transportation costs and substantial trade liberalisation, causing major reductions in costs associated with tariffs and other trade barriers. This led to industry specialisation, following the logic of comparative

advantage. Countries saw industries that had relatively large cost advantages over foreign counterparts grow rapidly, at the expense of other industries. This tendency towards specialisation remained mainly limited to trade in raw materials and manufactured final products, since services remained expensive (or even impossible to transport) and had not been subject to tariffs and quota from the beginning. The reallocation of male and female workers across sectors and industries caused by this type of trade has been studied before, as we discussed in the previous section.

The second wave of international trade started in the mid-1990s, with the technological revolution related to information and communication technology. Internet-based technologies allowed firms to slice their production processes up into various parts, which often did not have to be co-located anymore. A third type of trade costs (besides transportation costs and costs associated with trade barriers) that had always been insurmountably high appeared to be conducive to considerable reductions: coordination costs dropped dramatically, due to web-based communication technologies and real-time inventory management systems. The activities that together make up the production process could be relocated to places where costs were relatively low, while still allowing for 'just-in-time' approaches. Consequently, comparative advantage was not that relevant for the production of final products from scratch by an industry anymore, but for each of the activities within such a production process. GVCs emerged.

Two strands of literature have been focusing on causes and consequences of the rapid proliferation of GVCs. The oldest of the two mainly uses case studies to study differences in the governance of GVCs and the effects these differences have on the distribution of the rents associated with the emergence of GVCs. These studies are mostly not confined to a static viewpoint, but consider longer-run opportunities for upgrading and development of weaker actors as well. Prominent scholars in this strand include Gary Gereffi, Timothy Sturgeon, Raphael Kaplinsky and Roberta Rabellotti. The second strand is more recent and emerged in the early 2010s, when global input-output tables were constructed and were in many cases made publicly available. This type of data allowed for a macro-economic approach. Studies adopting this approach cannot go as deeply into matters as case studies, but complement these by allowing for findings that cover tendencies across large numbers of GVCs. The present paper contributes to this strand of research, which was mainly popularised by authors like Robert Johnson, Zhi Wang, Marcel Timmer, Gaaitzen de Vries, Robert Stehrer and Sebastièn Miroudot.

Over time, by complementing global input-output tables with internationally harmonised data at an identical degree of industry detail, the gap between the two strands of literature has narrowed somewhat. One of these type of data relate to the functional mix of workers in industries across the world. As was emphasised by Dedrick et al. (2010) in a case study on value creation in the production and distribution processes of some of Apple's high-end consumer electronics products, the electronics industries of various countries contributed to this GVC, but performing very different functions. In the US, Apple itself managed

the R&D and design activities and organised the logistics and marketing. Japanese and South-Korean firms manufactured components of various degrees of technological complexity (hard disks and memory units, respectively), while China was chosen as the location of low value-added assembly work.

The data introduced by Timmer et al. (2019), which was updated for the present paper, allows for comparable approaches at a macro level. As Los and Ye (2022) highlight (on the basis of the data by Timmer et al., 2019), the share in labour income in the transport equipment industry earned by fabrication workers varied from about 40% in countries like the US, France, South Korea and the UK, to close to 70% in Mexico and China. In the next section, we will pay more attention to the data underlying findings like these, but we hope to show convincingly that trade should no longer be seen as causing specialisation into homogenous industries, but that the changes in its nature require analyses at the level of business functions or activities. This is the level at which specialisation takes place.

Given the context of this paper, it is important to consider the potential implications of trade-induced functional specialisation rather than industry specialisation. As the literature review in the previous section showed, male and female workers have different comparative advantages. In our view, these are much more relevant for the functions that workers perform than the industry they work in. The 'fit' of male and female workers to jobs in the functions R&D, marketing and management is much more similar than to jobs in the fabrication function, in which physical strength is sometimes an important determinant of the productivity of workers. Hence, one might expect that the employment outcomes of female workers due to changing trade patterns are more positive in countries that specialised in functions other than fabrication, while the opposite could be predicted for countries specializing in fabrication activities.

# 4. Data

## 4.1 Representation of GVC in input-output tables

In view of the fact that the second wave of international trade as described in the previous section was caused by increased opportunities for firms producing final products to disperse their production processes over various countries and continents, we cannot rely on data for a single country to separate impacts of changes in trade patterns from changes in production technology. Production technologies can only be studied if they are defined as GVC technologies. As is more or less common by now in the macro-economic approach to GVCs, we define global value chain as "all activities required to produce a product for

final use, from scratch". Due to lack of macro-economic data on ownership or governance of GVCs, this literature generally identifies GVCs by the industry and the country in which the final stage of production takes. Timmer et al. (2015, Table 1), for example, considered the GVC for "German cars". This concept includes all cars that left factories in Germany (also if e.g. Toyota would have had a factory in Germany), but does not include Chinese car factories partly owned by Volkswagen (a German company).

A global input-output (IO) tables provides a quantitative description of the world production structure, and the links between this structure and final users, such as households, governments and companies that purchase capital goods. The typical organisation of a global IO table is presented in Figure 1.

**Figure 1: Schematic outline of a global input-output table.**

| | | | Use by country-industries | | | | | | | Final use by countries | | | Total use |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Country 1 | | | … | Country M | | | Country 1 | … | Country M | |
| | | | Industry 1 | … | Industry N | … | Industry 1 | … | Industry N | | … | | |
| Supply from country-industries | Country 1 | Industry 1 | | | | | | | | | | | |
| | | … | | | | | | | | | | | |
| | | Industry N | | | | | | | | | | | |
| | …… | | | | | | | | | | | | |
| | Country M | Industry 1 | | | | | | | | | | | |
| | | … | | | | | | | | | | | |
| | | Industry N | | | | | | | | | | | |
| Value added by labour and capital | | | | | | | | | | | | | |
| Gross output | | | | | | | | | | | | | |

*Source:* Timmer et al. (2015).

A row in the table relates to one of the NM industries considered (M denotes the number of countries in the table, N stands for the number of industries per country), and provides information about the sales pattern of this industry in the year for which the IO table was constructed. The cells present the values of sales to each of the industries in each of the countries as well as to final users in each of the countries, in the columns. All values are in monetary terms, expressed in a common currency. Global IO tables can also be viewed from a 'column-perspective'. This offers quantifications of the use of each of the intermediate inputs from each of the industries in each of the countries. Value added represents the compensation for the primary production factors, such as labour and capital. This row thus includes wages and salaries, interest payments and profits. Many databases containing global IO tables also provide 'satellite accounts', e.g. with information about the use of labour (measured in numbers of jobs, or in hours worked) or environmental indicators (such as quantities of greenhouse gases emitted, or use of water). As we will explain below, we will use recently constructed additional information about male and female employment (categorised by business function) by industry to address our research question.

If the cells in a column are divided by gross output, information about cost shares is obtained. This type of information allows for the analysis of GVCs in a macro-economic context. Take, as an example, the GVC for German cars. In which industries did activities take place to produce such a car? If we look at the column for the German car manufacturing industry, we not only find how much value per unit of gross output was added in this industry itself, but also how much metal products were bought domestically and imported from Hungary, and the value of the inputs delivered by the German banking industry, etc. etc. to produce one unit of German car manufacturing output. Next, we turn to the columns corresponding to the metal products industries of Germany and Hungary, and the German banking industry, to see how much value was added there and from where these industries sourced intermediate inputs to produce the output levels required for one unit of German car manufacturing final product. This process can be repeated in a backward direction, including the most 'upstream' industries in the value chain. As is explained in e.g. the input-output textbook by Miller and Blair (2009), Nobel Prize winner Wassily Leontief already showed that this process will converge to output levels of all industries in the world, required to produce one unit of final product of the German car industry. Hence, all activities are covered and we have a characterisation of this particular GVC. This type of analysis can, of course, be done for each and every GVC.

Since the first half of the 2010s, several global IO databases have become available. As Tukker and Dietzenbacher (2013) wrote in their overview of early initiatives, these databases have their specific features. They do not only differ with respect to the country coverage, the degree of industry aggregation, the period for which the data are available and the availability of satellite data, but also with respect to their construction methods. Despite the progress that has been made since Tukker and Dietzenbacher (2013), which led to Eurostat's Figaro global IO database and the OECD-ICIO database, only the World Input-Output Database (WIOD; Timmer et al., 2015, 2016) can be used for the present paper. The reason is that it is the only database for which data on employment by function split into male and female workers is available for each of the industries discerned.

We use the 2016-release of WIOD. It covers 43 countries, and the remaining countries are included in one 'country' labelled "Rest of the World" (RoW). In the set of 43 countries, advanced and emerging countries are overrepresented, mainly because many developing countries could not provide data of the quality required for the construction philosophy underlying WIOD. Consequently, Africa, for example, is included in RoW. Slightly more than 85% of world GDP is covered by the 43 fully specified countries. The economies are split into 56 industries, with relatively much detail in services industries.

## 4.2 Employment by function and gender

The process of gathering data on employment by function is a continuation of the work done by Reijnders and de Vries (2018) and Timmer et al. (2019). Labour force surveys and population censuses are used to collect information on the occupation and industry-of-employment of workers. To ensure standardisation, the statistics are internationally harmonised to the International Standard Classification of Occupations (ISCO) 2008. In a final step, the occupations are mapped onto the four business functions: R&D, fabrication, management, and marketing.

For this report, we closely follow the approach by Timmer et al. (2019). The EU labour force surveys provide information on the gender of workers. This allows us to create the business function shares by gender (males and females) for European countries. For non-EU countries, we combine the ILO model-based estimates of gender by occupation with the business function shares by Timmer et al. (2019) to estimates business function shares by gender.

# 5. Trends in Male and Female Employment

To get an idea about the type of empirical phenomena that might or might not be affected by changes in trade patterns, it might be helpful to depict some trends that can be derived from the data discussed in the previous section. Table 1 provides information about the gender compositions of the employed labour forces of countries in 2014, and how these had changed over the period 2000-2014.

**Table 1: Share of female employment (total economies, all functions, in %), 2000-2014**

| | 2000 | 2007 | 2014 | Δ00-07 | Δ07-14 | Δ00-14 | | 2000 | 2007 | 2014 | Δ00-07 | Δ07-14 | Δ00-14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LVA | 50.5 | 53.6 | 54.6 | 3.1 | 1.0 | 4.1 | HRV | 46.8 | 46.6 | 48.5 | -0.2 | 1.9 | 1.7 |
| LTU | 51.1 | 50.9 | 54.2 | -0.2 | 3.2 | 3.0 | BGR | 47.8 | 47.5 | 48.3 | -0.3 | 0.9 | 0.5 |
| EST | 52.6 | 51.9 | 51.6 | -0.7 | -0.3 | -0.9 | HUN | 46.8 | 47.0 | 48.0 | 0.2 | 1.1 | 1.3 |
| CYP | 44.0 | 47.0 | 51.3 | 3.0 | 4.3 | 7.3 | SVK | 48.6 | 47.0 | 47.9 | -1.6 | 0.8 | -0.8 |
| SVN | 46.3 | 46.9 | 50.0 | 0.7 | 3.1 | 3.8 | IRL | 42.0 | 44.9 | 47.8 | 2.9 | 2.9 | 5.8 |
| FRA | 48.0 | 48.6 | 49.9 | 0.6 | 1.4 | 2.0 | POL | 47.2 | 47.4 | 47.7 | 0.2 | 0.4 | 0.5 |
| DNK | 52.3 | 50.9 | 49.6 | -1.4 | -1.3 | -2.7 | NLD | 44.6 | 47.4 | 47.7 | 2.8 | 0.3 | 3.1 |
| DEU | 47.7 | 49.2 | 49.6 | 1.6 | 0.4 | 1.9 | ESP | 39.3 | 42.9 | 47.5 | 3.6 | 4.5 | 8.2 |
| FIN | 48.5 | 48.8 | 49.5 | 0.3 | 0.7 | 1.0 | CZE | 46.1 | 45.7 | 46.1 | -0.4 | 0.4 | 0.0 |
| AUT | 46.8 | 48.3 | 49.5 | 1.5 | 1.2 | 2.7 | ITA | 41.8 | 44.2 | 46.0 | 2.5 | 1.7 | 4.2 |
| GBR | 48.2 | 49.1 | 49.1 | 0.9 | 0.0 | 0.9 | ROU | 50.5 | 46.4 | 45.1 | -4.1 | -1.3 | -5.4 |
| PRT | 45.7 | 47.5 | 48.9 | 1.9 | 1.4 | 3.2 | LUX | 38.3 | 41.2 | 43.1 | 2.9 | 1.9 | 4.8 |
| BEL | 44.8 | 47.1 | 48.8 | 2.3 | 1.6 | 4.0 | GRC | 38.8 | 41.4 | 42.9 | 2.6 | 1.6 | 4.1 |
| SWE | 48.5 | 49.3 | 48.7 | 0.9 | -0.7 | 0.2 | MLT | 37.0 | 38.5 | 41.2 | 1.4 | 2.8 | 4.2 |

*Note*: Countries ordered by female share in 2014. For country codes, see the Appendix.

*Source*: WIOD 2016 release and update/extension of data from Reijnders and de Vries (2018).

The table reveals that the share of female employment in 2014 varied considerably across countries in the EU. The Baltic countries stand out, with shares exceeding 50 per cent. Among the large countries, France and Germany had the highest shares of female employment. On the other side of the spectrum, Malta and Greece had shares of female employment in total employment only just above 40 per cent. Spain and Italy were the large EU economies with the lowest shares of female employment.

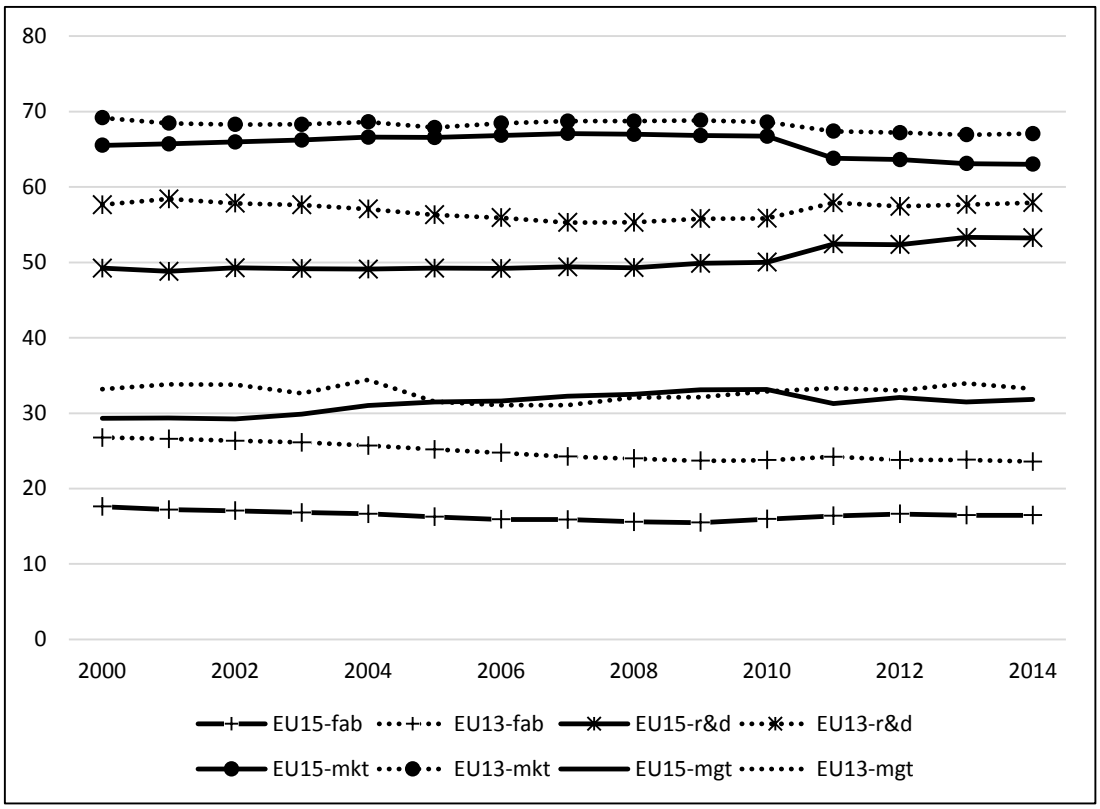
For 23 out of 28 countries, we find that the share of female employment increased over time. The growth was strongest for Spain (from 39.3% to 47.5%), Cyprus (44.0% to 51.3%) and Ireland (42.0% to 47.8%). The declines were most prominent in Denmark and Romania. We have also included information for 2000 and for 2007, to shed light on developments before and after the global financial crisis. This might be interesting in itself, but especially in the context of this report, because the second wave of globalisation was considerably stronger before the crisis than afterwards (although Timmer et al., 2021, show that many GVCs continued to become more internationally fragmented after the crisis). The table does not reveal a very clear pattern. In 11 countries, the percentage point differences were higher (or less negative) in the period 2000-2007 than in 2007-2014. For the remaining countries, it was the other way around. At first sight, countries that became EU-members after 2004 do not show results that are fundamentally different from what we observe for the 'old' EU countries.

The differences across countries and changes over time as reported in Table 1 could hide some important heterogeneities, due to the differences in the employment composition of countries, or changes therein over time. To get more insights into these, we present information about the female share in employment for each of the four business functions, in Figure 2. We decided to focus on two groups of countries within the EU. First, EU15 consists of the 15 countries that were already members before 2004. This includes the UK that was still part of the EU in the period considered. EU13 consists of the countries that became member in 2004 (when many countries in the Eastern part joined the EU) or later. Croatia, which became a member in 2013, is also included.

First of all Figure 2 shows that the shares of female workers within functions have not changed dramatically over the time period studied, neither in the 'old' EU15, nor in the 'new' EU13. Non-negligible changes can be observed between 2010 and 2011, with a reduction in the female share for employment in marketing and an opposite change of about the same magnitude for R&D. This changes are observed for both groups of countries and are most probably caused by a structural break in 2011 regarding the occupational classification on which the assignment of workers to functions was based. The two long-run tendencies are the decline in the female share of employment in fabrication in the EU13 and the increase of women's share in management employment in the EU15.

The other major finding is that the gender gap in terms of employment varies considerably across business functions, in both country groups. In marketing and R&D, the female employment shares were always higher than 50 per cent (up to close to 70 per cent in marketing in the 'new' EU13). In management, the share vary between 30 and 35 per cent. The shares are clearly lowest for fabrication. For the EU13, it was around 25 per cent, but in the EU15, women accounted for only 16-17 per cent of employment in fabrication.

**Figure 2: Share of female employment by function (aggregate economies, in %), 2000-2014**




*Note*: Unweighted averages over countries. EU15 includes Austria, Belgium, Germany, Denmark, Spain, Finland, France, UK, Greece, Ireland, Italy, the Netherlands, Portugal and Sweden; Luxemburg was excluded because of suspicious results, most probably due to small sample problems. EU13 consists of Bulgaria, Cyprus, Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Malta, Poland, Romania, Slovakia and Slovenia. fab: fabrication; r&d: R&D; mkt: marketing; mgt: management.

*Source*: WIOD 2016 release and update/extension of data from Reijnders and de Vries (2018).

An implication of the large and rather stable differences in the share of female employment in total employment across business functions could have implications for the extent to which changes in international trade affect the employment of female workers. Industries always employ workers in all four functions (albeit to degrees that differ from industry to industry). Hence, industry specialisation alone might have limited impacts. Given that the second wave of globalisation implied functional specialisation (as discussed in Section 3), the effects of trade might have increased the magnitude of the effects of trade. Firms can now locate much of the fabrication activities in one country (which will, everything else equal, experience a drop in the female share of total employment), while locating 'headquarter functions' (the other three business functions in another country (which will then, ceteris paribus, experience an increase in the relative employment of women). These are issues we will address systematically in the next two sections.

## 6. Trade: Male and Female Employment in Exports

In the previous section, we sketched a broad picture of the employment of male and female workers, pointing at differences across countries and changes over time. We also considered the differences across business functions. So far, we did not look at issues specifically related to trade. In this section, we will focus on the specialisation of countries into products that require relatively much work done by female workers. As we explained in Section 3, the increased globalisation reflected in the prominence of GVCs means that it might well be useful to consider the business functions in which a country has specialised rather than its industry specialisation. Before turning to issues like these, we should first explain how we determine the labour content (by gender, by function, or by both) in exports of a country. The method is a straightforward extension of the approach proposed by Los et al. (2016). We give an intuitive explanation here, the formal mathematical exposition is contained in Appendix A.

Given that the existence of GVCs implies that part of the value of exported output consists of the value of imported intermediate inputs (e.g., raw materials, parts and components, business services), a focus on the value of gross exports is misplaced. Instead, we should consider the domestic activities that contribute to a country's exports. Los et al. (2016) showed that these activities can be measured by comparing the actual situation with a hypothetical situation. If we would be interested in female employment due to the exports of Country A in year *t*, we first look at observed female employment for that year. It is well-known among input-output scholars that this observed value could also be derived by multiplying the vector of

female employment to gross output ratios (for all N industries in Country A, and zero for all other countries) with the global "Leontief inverse" and the vector of worldwide final demand levels for output of each of the MN industries. The global Leontief inverse is directly derived from the matrix with cost shares of intermediate inputs discussed in Section 4. The hypothetical value is computed using the same type of multiplication, but using a slightly different global Leontief inverse and final demand vector. In both, it is assumed that foreign countries do not import anything from Country A. As Los et al. (2016) explained, subtracting the hypothetical value from the actual value yields Country A's female employment associated with its exports. This is not just the female employment in the industries that export, but also includes domestic employment of women in upstream industries (i.e., industries that deliver directly or indirectly to the exporting industries.

## 6.1 Specialisation patterns regarding exporting female employment (all functions)

Which countries were most specialised in exporting female employment, embodied in its products? Figure 3 presents evidence for this, for the levels in 2000 and for the changes in the period 2000-2014. The indicator is a variant of the well-known Revealed Comparative Advantage (RCA) indicator introduced by Balassa (1965). His RCAs related to whether a product is underrepresented or overrepresented in the export bundle of the country of interest, as compared to the world (or a different reference set). Our variant does the same, but focuses on whether female labour is overrepresented in this country's exports, relative to all countries in the WIOD data. For Country A, our indicator is

$$RCA\_FE^A = \frac{FE\_X^A / E\_X^A}{\sum_j FE\_X^j / \sum_j E\_X^j} \quad . \qquad (1)$$

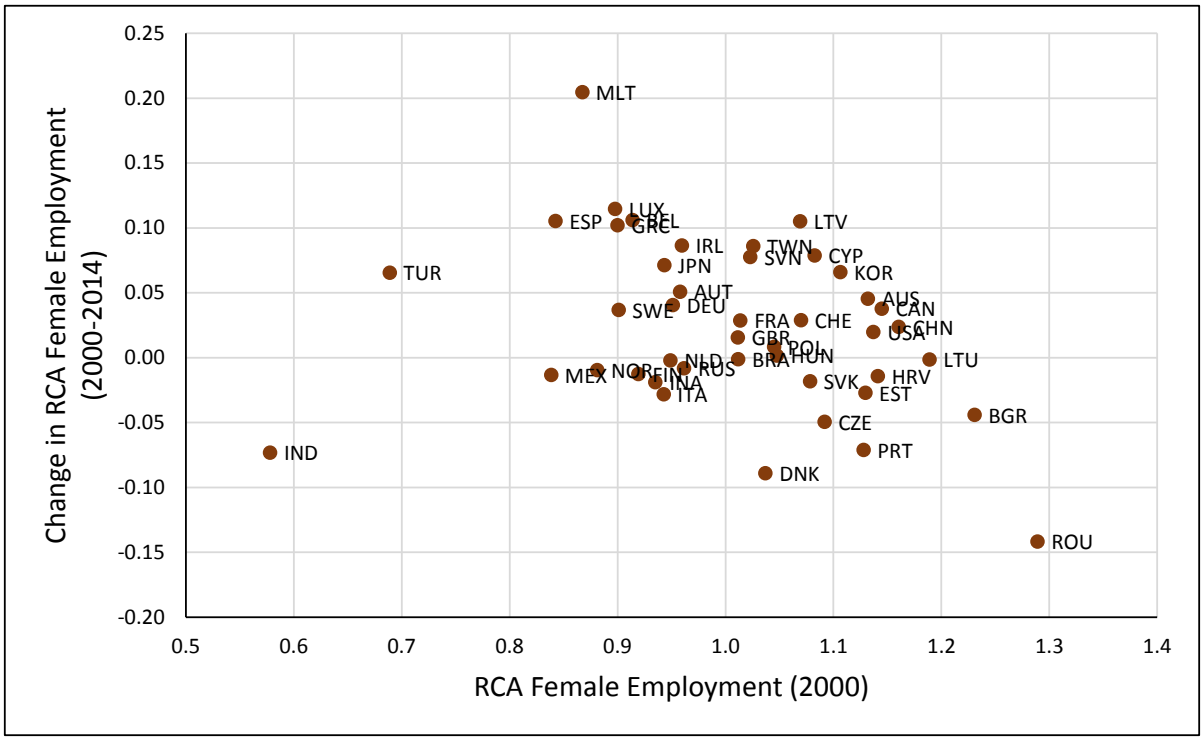
In this equation *FE_X* stands for female labour contained in the exports of a country and *E_X* for all labour in those exports (i.e., the sum of exported male and female labour). The numerator gives information on the importance of female labour in exporting, while the denominator does the same for the aggregate of all countries considered. If *RCA_FE* for country A is larger than one, the country can be viewed as having specialised in exporting female labour.

Figure 3 presents information on these *RCA_Fe*s. The horizontal axis represents the values of this indicator in 2000. Countries to the right of the vertical line at 1.0 were specialised in exporting female

labour, countries to the left exported relatively much male labour (embodied in the products they exported). Along the vertical axis, the changes in the *RCA_FE* of countries between 2000 and 2014 are depicted. A position above the horizontal line at 0.0 indicates that the country became more specialised in exporting female employment in this period.

The figure shows that in 2000, Eastern European countries were generally specialised in exporting female employment, with countries like Romania, Bulgaria and Lithuania having *RCA_FE*s higher than 1.15. For most Western-European countries, we find results that point towards rather neutral specialisation patterns. Countries like Denmark, Switzerland, France and the UK had revealed comparative advantage scores just above 1, while Italy, The Netherlands, Austria and Germany, among others scored just below this value. Belgium, Greece, Sweden and especially Spain had relatively low *RCA_FE*s among the group of Western European countries. These results are in line with the findings in Figure 2 about the female shares in all employment (not specifically in exports), which tended to be higher in the group of EU countries that became members in 2004 or afterwards than in the 'older' member states. If we compare the specialisation patterns of European countries to those of the non-European countries in the sample, we find that several of these (Australia, Canada, China, USA) were about as specialised in exporting female labour as many Eastern European countries. Indonesia, Russia, Brazil and Japan are found to have had specialisation patterns close to those of the majority of Western European countries. Mexico was comparable to Spain in this respect. The two countries that had extremely low *RCA_FE*s in 2000 are Turkey and India.

**Figure 3: Revealed Comparative Advantages in exporting female labour**




*Note:* Revealed Comparative Advantages computed using Eq. (1). The vertical axis depicts absolute changes (the *RCA_FE* in 2014 minus the *RCA_FE* in 2000). For country codes, see the Appendix.

*Source*: WIOD 2016 release and update/extension of data from Reijnders and de Vries (2018).

Between 2000 and 2014, we find that the specialisation in exporting female employment became less prominent in most Eastern European countries. Latvia, Lithuania and Slovenia were the exceptions to this rule. In the majority of Western European countries, however, the changes in revealed comparative advantage scores hint at shifts towards exporting relatively much female labour. Italy, Portugal and Denmark were the most prominent outliers in this respect. Thus, for Europe, the overall tendency apparent from Figure 3 is one of convergence. We do not find something similar for other countries. Those non-European countries that were already specialised in exporting female labour in 2000 generally specialised further. South Korea and Australia are the clearest examples. Between 2000 and 2014, Mexico and particularly India became even less specialised in exporting female labour than they were in 2000 already, while Turkey's specialisation pattern became slightly less outspoken.

## 6.2 Specialisation patterns regarding exporting female employment (by function)

The differences in specialisation patterns regarding the female employment embodied in the products exported by a country as depicted in Figure 3 could reflect two types of differences. First, a country with a strong specialisation in exporting female labour could have a relatively strong representation of women in the industries that contribute (directly or indirectly) to the production of exported products, across business functions involved. In such cases, functional specialisation in GVCs is not a driving force of the relatively high share of female labour due to exports. Secondly, a country with a strong specialisation in exporting female labour could have specialised in functions in which female workers tend to be more represented than in other functions. As discussed in the previous section (see Figure 2), the share of female workers in total employment is generally much higher in the functions marketing and R&D than in management and especially fabrication. Does functional specialisation matter in this respect, or not?

Table 2 provides evidence in this respect, focusing specifically on the fabrication function. We focus on this function because of its relatively low representation of female workers and because Timmer et al. (2019), argue that mainly fabrication activities were relocated in the period considered. We obtain the RCA-values documented in the table in a way very similar to Equation (1), the only difference being that the variables in the numerators and denominators relate to female employment in fabrication and total employment. The results in the first and third column relate to these computations. Furthermore, we present results for RCAs regarding male employment in fabrication, in the second and fourth column. The results are presented for countries that were member states of the EU in (part of) the period 2000-2014, and for a selected group on countries outside Europe.

We find that Romania, Portugal and Lithuania were the only EU countries in 2000 with an RCA for female fabrication employment (*RCA_FE-f*) higher than one. At the other end of the spectrum, we find countries like The Netherlands, the United Kingdom, Cyprus and Belgium with values below 0.3. Most EU countries were clearly de-specialised in exporting embodied female fabrication labour. China, on the other hand was strongly specialised in this, with an *RCA_FE-f* exceeding 1.4.

Romania, Portugal, Lithuania and Bulgaria are the only countries for which the RCA scores for male fabrication employment (*RCA_ME-f)* were lower than *RCA_FE-f* in 2000. We also observe this for China. For Spain we find that it was (weakly) specialized in male fabrication employment, while it was strongly de-specialised in female fabrication employment. Many other countries (especially those with low *RCA_FE-fs*, like Belgium, the United Kingdom and The Netherlands) had *RCA_FE-f*s that were much lower than *RCA_ME-fs.* This clearly suggests that functional specialization alone does not nearly account for the sizable

differences in specialization in female labour exports in 2000, as depicted along the horizontal axis of Figure 3: *within* the fabrication function, we observe large differences in the relative importance of female and male workers.

**Table 2: Revealed Comparative Advantages in exporting female and male labour in fabrication (2000-2014)**

| | 2000 | | Δ00-14 | |
|---|---|---|---|---|
| | Female | Male | Female | Male |
| ROU | 1.44 | 0.98 | -0.19 | 0.02 |
| PRT | 1.23 | 0.93 | -0.32 | -0.02 |
| LTU | 1.19 | 0.96 | -0.13 | 0.00 |
| BGR | 0.99 | 0.79 | 0.12 | 0.11 |
| HUN | 0.94 | 1.03 | -0.11 | -0.07 |
| SVK | 0.87 | 0.97 | -0.15 | -0.08 |
| POL | 0.87 | 1.01 | -0.05 | -0.02 |
| SVN | 0.86 | 0.95 | -0.09 | -0.13 |
| EST | 0.86 | 0.95 | -0.05 | -0.03 |
| CZE | 0.85 | 0.89 | -0.06 | 0.04 |
| LVA | 0.74 | 0.95 | 0.02 | -0.03 |
| HRV | 0.65 | 0.78 | -0.01 | 0.01 |
| GRC | 0.60 | 0.82 | -0.13 | -0.17 |
| DNK | 0.59 | 0.79 | -0.24 | -0.03 |
| ITA | 0.56 | 0.81 | -0.07 | 0.10 |
| AUT | 0.55 | 0.93 | -0.05 | -0.11 |
| FIN | 0.51 | 0.86 | -0.13 | -0.01 |
| ESP | 0.47 | 1.03 | -0.04 | -0.12 |
| FRA | 0.45 | 0.79 | -0.07 | -0.14 |
| DEU | 0.42 | 0.86 | -0.02 | -0.10 |
| MLT | 0.38 | 0.86 | -0.15 | -0.30 |
| IRL | 0.38 | 0.61 | -0.09 | 0.15 |
| SWE | 0.31 | 0.77 | -0.01 | -0.07 |
| BEL | 0.30 | 0.77 | -0.07 | -0.14 |
| CYP | 0.28 | 0.59 | -0.07 | -0.05 |
| GBR | 0.27 | 0.62 | -0.06 | -0.07 |
| NLD | 0.24 | 0.61 | 0.01 | 0.00 |
| | | | | |
| CHN | 1.41 | 0.93 | -0.08 | -0.05 |
| IND | 1.02 | 1.37 | -0.19 | -0.07 |
| TUR | 0.98 | 1.19 | 0.13 | 0.04 |
| USA | 0.36 | 0.73 | 0.00 | -0.05 |

*Note*: The first two columns give the RCA scores in 2000, for female and male fabrication employment, respectively. The third and fourth column presents the changes in these scores between 2000 and 2014. European countries are ordered according to their specialization in female fabrication employment in 2000. Luxemburg omitted, due to data issues. For country codes, see the Appendix.

*Source*: WIOD 2016 release and update/extension of data from Reijnders and de Vries (2018).

Next, we turn our attention to changes over the period considered. If changes in functional specialisation alone would have caused the different locations of countries along the vertical axis of Figure 3, the values regarding the changes in *RCA_FE-f* and *RCA_ME-f* (presented in the third and fourth column of Table 2, respectively) should have the same sign and be of comparable magnitude. For most EU-countries (19), we find that the sign is negative for both variables. This implies that functional specialisation in fabrication decreased (Bulgaria is the main exception, with sizable increases in the RCA scores for both female and male fabrication labour). The sizes of the reductions in *RCA_FE-f* and *RCA_ME-f* are not too different for many countries, but there is a tendency for larger decreases in the RCA related to female fabrication employment than for male fabrication employment (the unweighted average change over the 27 EU-countries for *RCA_FE-f* is -0.08, and -0.05 for *RCA_ME-f*). We find similar results for China and India, while Turkey became more specialised in fabrication, regarding the employment of both men and women.

The results presented so far strongly suggest that the link between exports and female employment has not just changed because of changes in the functions a country performs to produce its exports bundle. Still, the vast majority of European countries became more de-specialized in fabrication, which is the function with the lowest share of females in total employment. This begs the question to what extent changes in trade can be held responsible for changes in female employment. This is the main question addressed in the next section.

# 7. The Contribution of Trade to Changes in Male and Female Employment

Since the early 2000s, many studies have asked the question whether changes in trade patterns (e.g. offshoring; see Levy and Murnane, 2004) or technological change (e.g. automation and robotisation; see Autor et al., 2003) have been the main culprit of the decline in the demand for employment in specific activities. Most studies found that employment in routine jobs is affected negatively by both drivers of change, relative to non-routine employment (see, e.g., Goos et al., 2014). Routine jobs are more present in the business function fabrication, relative to in other functions In the context of this paper, it is likely that this finding would imply negative effects of both changes in trade and technology for employment in the fabrication function, in which female workers are less present than in other functions (Figure 2). Below, we will argue that the changed nature of international trade (due to the rise of production processes organized in GVCs) has implications for the way in which the effects of trade on employment should be measured.

If all activities required to produce products for final use would take place in a single country, this type of question could be addressed by considering data for a single country. Changes in the domestic mix of production factors (possibly complemented with prices for these, such as wages for capital and specific types of labour) and changes in domestic total factor productivity allow for the quantification of the contributions to changes in labour demand of technological change. Changes in the country's imports and exports of these products also cause changes in labour demand. As Reijnders and de Vries (2018) argue, the increasing pervasiveness of GVCs and the associated opportunities for functional specialisation imply that the two effects cannot be separated anymore based on data for the country considered only.

If, for example, fabrication labour requirements per unit of product in Country A would have decreased over time, this could be due to technological change, but also because fabrication activities were offshored (or, in other words, relocated) to Country B. The two effects are observationally equivalent if only data for Country A are used. The only way to determine how important changes in technology have been is by adopting the viewpoint that technology should be defined for GVCs (defined in Section 4 as "all activities required to produce a product for final use, from scratch") rather than for industries. This implies that we look at all production factors that are needed to produce a unit of final product, irrespective of where in the world these production factors are deployed. The 2016-release of WIOD can be used to quantify these, in the same way as Reijnders and de Vries (2018) used the 2013-release of WIOD. Given that there is ample evidence that economic activities are done more efficiently in some countries than in others, we use country-level total factor productivity (TFP) measures from the Penn World Tables to convert workers into "efficiency units of labour". Since such measures are not available at the level of functions or specifically for women or men, we have to assume that the efficiency differences across countries are the same for all types of workers. If the number of efficiency labour units for a function required to produce a dollar (in real terms) of output of a GVC changes, we consider this as technological change. This implies that we basically assume a Leontief production function within GVCs, in which substitution between labour in one function cannot substitute for labour in a different function.

Following Reijnders and de Vries (2018), we can then identify the effects of trade within a GVC (i.e., offshoring) by analysing changes in the location of the production factors deployed in a GVC. This can be done for employment by function, allowing for functional specialisation. As we have seen, women are not equally well-represented across business functions, so these effects might be different for men and women. Employment in a country can also be affected by changes in the output of a GVC relative to other GVCs. As an example, worldwide demand for cars assembled in Germany might grow faster than for cars assembled in Japan, for example. Since the labour contributions of a given country is likely to differ between these GVCs, such changes in demand can have employment implications. These can vary across functions, and therefore also between male and female workers. As Los et al. (2014) showed, changes in the relative

outputs of GVCs due to changes in the composition of consumption and fixed capital formation (e.g. due to consumers purchasing less food and more services) are minor in comparison to such changes caused by changes in preferences for the same type of final products but from a different country (e.g. due to consumers purchasing more German cars instead of Japanese cars).

**Table 3: Effects of trade on female and male employment growth by function (2000-2014, in % of employment by function in 2000)**

| | Fabrication | | | | R&D | | | | Marketing | | | | Management | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Trade | | Other | | Trade | | Other | | Trade | | Other | | Trade | | Other | |
| | Female | Male | Female | Male | Female | Male | Female | Male | Female | Male | Female | Male | Female | Male | Female | Male |
| AUT | -19.9 | -21.5 | 9.2 | 15.7 | -9.3 | -2.6 | 39.5 | 36.6 | -15.5 | -16.0 | 44.3 | 49.2 | -18.5 | -26.6 | -19.1 | -8.4 |
| BEL | -32.4 | -27.1 | 22.6 | 19.5 | -22.7 | -28.0 | 43.4 | 20.0 | -19.1 | -16.7 | 46.8 | 46.4 | -22.1 | -21.0 | 8.1 | 6.3 |
| BGR | 4.3 | 8.0 | -9.7 | -3.2 | -7.2 | 6.0 | -6.2 | -27.9 | 17.8 | 10.2 | 10.1 | 19.4 | 27.3 | 29.9 | 0.1 | -25.8 |
| CYP | -24.8 | -27.5 | -15.1 | 13.2 | -5.0 | -12.7 | 26.5 | 35.0 | -5.5 | -9.0 | 51.8 | 9.4 | 22.1 | 1.8 | 75.1 | 54.1 |
| CZE | 9.9 | -1.2 | -28.5 | 0.2 | -10.5 | -5.8 | 16.3 | -1.2 | -5.0 | -9.0 | 18.4 | 48.0 | -6.2 | -1.4 | 14.8 | -11.3 |
| DEU | -19.8 | -23.9 | 13.6 | 12.1 | -16.9 | -17.0 | 55.6 | 22.1 | -20.2 | -22.0 | 29.1 | 54.7 | -25.7 | -24.8 | 9.1 | 2.9 |
| DNK | -29.4 | -34.3 | -5.3 | 26.0 | -12.9 | -16.7 | 18.2 | 16.0 | -19.0 | -25.4 | 21.3 | 94.8 | -51.9 | -61.0 | -24.8 | -18.5 |
| ESP | -33.5 | -37.8 | 13.2 | 10.3 | -6.5 | -9.8 | 72.0 | 30.8 | -17.3 | -14.9 | 56.4 | 45.6 | -10.9 | -21.1 | -25.3 | -9.2 |
| EST | 8.0 | 6.7 | -17.3 | -13.5 | -1.5 | 7.2 | 3.6 | 3.2 | 9.4 | 15.6 | 3.7 | 61.0 | 4.4 | 7.4 | -35.0 | -15.9 |
| FIN | -26.2 | -34.4 | -6.3 | 33.1 | -19.3 | -27.0 | 9.2 | 27.6 | -19.7 | -21.2 | 55.5 | 107.2 | -46.6 | -48.2 | -15.6 | -22.8 |
| FRA | -31.9 | -32.2 | 18.7 | 12.8 | -15.0 | -12.5 | 33.1 | 22.7 | -17.0 | -20.6 | 31.0 | 56.0 | -17.5 | -16.9 | 10.4 | 15.5 |
| GBR | -16.0 | -17.3 | 22.7 | 13.9 | -0.8 | -13.4 | 10.2 | 8.2 | -0.1 | -3.0 | 21.0 | 57.2 | -10.5 | -16.5 | -6.8 | -4.5 |
| GRC | -42.9 | -56.2 | 10.4 | 25.6 | -47.1 | -49.9 | 71.1 | 57.4 | -51.3 | -45.5 | 69.1 | 69.7 | -44.6 | -42.4 | -4.0 | -9.4 |
| HRV | -28.8 | -26.1 | -6.6 | 10.2 | -19.4 | -25.8 | 40.0 | 24.6 | -15.9 | -18.3 | 28.4 | 30.1 | -3.8 | -7.4 | 23.3 | 24.1 |
| HUN | -5.4 | -11.7 | -12.7 | -3.1 | -10.4 | -6.7 | 0.0 | 12.9 | -5.7 | -4.4 | 22.1 | 48.2 | -16.9 | -16.9 | -0.5 | -19.2 |
| IRL | -22.8 | -35.0 | -1.9 | 36.9 | -9.8 | -7.4 | 55.4 | 12.9 | -9.6 | -7.4 | 50.5 | 50.0 | -39.2 | -36.4 | 7.4 | -14.6 |
| ITA | -42.3 | -49.1 | 16.5 | 50.4 | -32.9 | -34.9 | 44.5 | 36.0 | -37.4 | -32.9 | 62.7 | 28.5 | -55.6 | -36.4 | 137.0 | 23.6 |
| LTU | 8.9 | 22.5 | -40.0 | -43.0 | -6.5 | 16.4 | -1.4 | -28.4 | 6.6 | 14.2 | 15.9 | 0.3 | 11.1 | 16.0 | -19.2 | -17.5 |
| LVA | -3.1 | 8.9 | -25.9 | -24.6 | -10.7 | 2.1 | -3.9 | -12.7 | 12.4 | 13.0 | 11.3 | -0.8 | 16.8 | 15.1 | -1.3 | -35.7 |
| MLT | -22.8 | -18.8 | 5.8 | 11.4 | 18.4 | 13.8 | 16.9 | 20.9 | 30.8 | 21.5 | 23.8 | 25.6 | 45.5 | 21.9 | 38.3 | 9.6 |
| NLD | -34.7 | -38.6 | 41.8 | 31.1 | -6.6 | -24.4 | 20.1 | 5.3 | -15.5 | -22.0 | 36.0 | 64.4 | -29.1 | -33.6 | -14.6 | -9.7 |
| POL | -1.2 | 5.1 | -26.1 | -10.4 | 11.9 | 14.2 | 9.0 | 3.1 | 10.7 | 7.7 | 10.7 | 20.6 | 11.0 | 14.6 | -2.7 | -10.6 |
| PRT | -30.2 | -42.8 | -3.9 | 14.8 | -32.2 | -28.2 | 62.3 | 34.9 | -33.1 | -31.3 | 38.5 | 39.0 | -33.8 | -37.0 | 41.7 | 25.0 |
| ROU | 11.8 | 16.0 | -56.4 | -38.9 | 5.0 | 7.8 | -20.5 | -18.4 | 16.1 | 6.3 | -5.0 | 126.2 | 21.3 | 16.2 | -77.2 | 36.5 |
| SVK | 23.8 | 12.4 | -43.1 | -15.6 | 0.8 | 15.4 | -12.0 | -9.4 | 14.9 | 12.5 | 12.8 | 61.7 | 7.4 | 7.4 | -37.2 | -33.7 |
| SVN | -23.0 | -22.8 | 0.9 | 4.5 | -19.3 | -12.0 | 55.3 | 29.0 | -12.8 | -13.7 | 34.3 | 38.6 | -9.1 | -6.8 | 28.0 | -0.6 |
| SWE | -15.4 | -13.2 | 6.9 | 9.8 | -18.5 | -16.9 | 20.8 | 3.8 | -12.1 | -8.0 | 26.2 | 48.4 | 6.2 | 13.0 | 46.2 | 17.0 |
| CHN | 60.3 | 60.9 | -74.3 | -68.7 | 96.3 | 96.1 | -28.0 | -30.7 | 130.7 | 130.1 | -38.0 | -42.9 | 95.7 | 93.8 | -59.1 | -72.0 |
| IND | 40.2 | 41.8 | -18.4 | 9.0 | 102.7 | 99.1 | 72.3 | 39.1 | 79.6 | 76.6 | 17.4 | -7.4 | 158.6 | 157.2 | 168.8 | 154.6 |
| TUR | 11.5 | 10.6 | 8.6 | 5.7 | 44.2 | 42.6 | 57.3 | 40.8 | 29.3 | 27.7 | 109.3 | 64.8 | 18.0 | 16.8 | 13.1 | -12.4 |
| USA | -24.0 | -24.0 | 10.4 | 10.8 | -7.3 | -7.4 | 31.4 | 33.2 | -13.9 | -14.3 | 14.2 | 22.3 | -13.6 | -13.5 | 32.0 | 30.5 |

*Note*: Decomposition of employment changes using methods developed by Reijnders and de Vries (2018). Luxemburg omitted due to data quality problems.

*Source*: WIOD 2016 release and update/extension of data from Reijnders and de Vries (2018).

Table 3 shows the impacts of trade on the one hand and all other determinants (e.g., technology, global final demand growth) on changes in employment of female and male workers in EU countries and a selection of non-European countries. We present the results for each business function. All cells represent percentage growth rates over the period 2000-2014, with employment in the function in 2000 as the base.

If we consider fabrication first, we see that trade changes alone would have reduced employment considerably in Western European countries, both for female and male workers. In Austria, for example,

female and male fabrication employment would have decreased by about 20%, if only trade patterns would have changed. The other factors taken separately would have led to increases in Austrian fabrication employment for both genders (9% and 16%, respectively), but taken together fabrication employment decreased in this country. Similar patterns can be observed for countries like Germany, Denmark, Spain, France and most other Western European countries. For the United States, we find a similar pattern.

For many Eastern European countries (but not all), we find that changes in trade patterns caused growth of fabrication employment. Slovakia, Estonia, Romania and Lithuania are good examples. Despite the decreases in the RCAs for fabrication employment documented in Table 2 above, these countries remained much more specialized in fabrication activities than Western European countries. The results in Table 3 are a reflection of this. For several of the Eastern European countries, the aggregate of other changes caused the opposite effect. In the Strong productivity increases in these countries (and even more so in China, see the bottom panel) led to situations in which demand growth was not fast enough to keep up with the rate of technological progress.

From the perspective of this report, differences between the employment effects of increased globalisation for male and female workers are the most interesting. For the majority of Western European countries, we find that the reductions in fabrication employment due to trade changes are slightly smaller for female workers than for male workers. In many cases, however, the differences do not exceed five percentage points. Still, globalisation appears to have hit male fabrication workers in Western Europe harder than female fabrication workers in this region. For Eastern European countries, we do not find clear patterns. In Slovakia, for example, the effects on female fabrication employment were about twice as strong as those for male employment in that function. For Bulgaria, on the other hand, the opposite is observed.

For R&D, marketing and management, we also find negative trade effects for employment of both male and female workers in most Western European countries, and positive effects for Eastern European countries. The differences between these two groups of countries is much smaller, however, and the smaller negative effects in Western Europe are compensated by larger effects of the other drivers of employment changes. No clear patterns regarding the relative magnitudes of the effects on male and female employment can be detected. In most cases, these magnitudes are in the same range, although there are interesting exceptions, such as R&D in The Netherlands (in which changes in trade led to much smaller reductions in female employment than in male employment).

# 8. Conclusions

This report provides analyses of the consequences of the rapidly increasing globalisation in the first fifteen years of the 21st century for employment by gender. After having presented an overview of the literature of trade-related economic mechanisms that might affect employment of males and females differently, we argued that this period was not only characterized by an increasing trade intensity, but that also the nature of trade had changed. With the diffusion of global value chains (GVCs) as a dominant way of organizing production processes (permitted by the internet revolution and strong trade liberalisation policies), countries did no longer only specialise in industries, but also in performing specific activities within industries. This phenomenon is called functional specialisation. The analyses in this report study the implications of changing trade patterns for male and female workers from the perspective of functional specialisation, arguing that female workers might have comparative disadvantages at performing the fabrication function, which sometimes requires physical strength. In other functions (R&D, marketing and management), cognitive abilities are much more important and female workers should be able to perform as well as men.

Using the 2016-release of the World Input-Output Database and data from population censuses and labour force surveys, we sketch trends in the relative employment levels of male and female workers by function. As expected, clear differences between the 'old' EU member states and the Eastern European countries that became members in or after 2004 emerge. With the exception of the management business function, the shares of female employment in total employment were consistently higher in Eastern Europe. This also showed up in an analysis of export specialisation in products that contain relatively much female labour, in particular when one focuses on employment in the fabrication function. Over the period considered, the differences between the two sets of European countries decreased.

In the final part of the analysis, we focused on isolating the effects of changes in international trade from other types of changes, such as changes in technology and changes in the relative numbers of male and female workers required to produce a unit of final product (the output of a GVC). For employment in fabrication, we find very negative trade effects for both female and male employment in Western European countries, and positive effects for most Eastern European countries. The negative effects in Western Europe tend to be slightly smaller for female workers than for male workers. For other business functions, both the differences in the effects between Western and Eastern Europe and those between male and female workers are much less marked.

The analyses presented in this report have some limitations, of course. The most important of these, we think, relates to the fact that we assume that substitution of male labour by female labour (or vice versa) within a function within a GVC is not affected by trade. Some of the mechanisms that were discussed in the

overview of the literature clearly suggest that this is not in line with reality. Using micro-data for firms and employees, the magnitude of such effects could be analysed empirically. With data currently available, the importance of trade in determining global differences between the impacts of trade on male and female employment cannot be estimated taking such mechanisms into account.

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# Appendices

## Country codes

| | | | |
|---|---|---|---|
| AUS | Australia | IRL | Ireland |
| AUT | Austria | ITA | Italy |
| BEL | Belgium | JPN | Japan |
| BGR | Bulgaria | KOR | South Korea |
| BRA | Brazil | LTU | Lithuania |
| CAN | Canada | LUX | Luxembourg |
| CHE | Switzerland | LVA | Latvia |
| CHN | China | MEX | Mexico |
| CYP | Cyprus | MLT | Malta |
| CZE | Czech Republic | NLD | Netherlands |
| DEU | Germany | NOR | Norway |
| DNK | Denmark | POL | Poland |
| ESP | Spain | PRT | Portugal |
| EST | Estonia | ROU | Romania |
| FIN | Finland | RUS | Russia |
| FRA | France | SVK | Slovakia |
| GBR | United Kingdom | SVN | Slovenia |
| GRC | Greece | SWE | Sweden |
| HRV | Croatia | TUR | Turkey |
| HUN | Hungary | TWN | Taiwan |
| INA | Indonesia | USA | United States |
| IND | India | | |

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Centre for European Policy Studies (Belgium)
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