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The Reduction of the Gender Gap through Global Value Chains: Political Commitment or Perpetuation of Gender Roles?

La reducción de la brecha de género en clave de Cadenas Globales de Valor: ¿apuesta política o perpetuación de los roles de género?

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Abstract

The relationship between international trade and the gender gap is complex. On one hand, foreign insertion can generate economic opportunities for women in the export sector. On the other hand, it can also result in heightened competition and the relocation of jobs, especially in the context of global value chains (GVCs). The study on the gender gap through GVCs examines the mechanisms within production networks that contribute to enhance women's economic empowerment and gender equality. The paper analyzes the relationship between the gender gap, GVCs, technological intensity of exports, and female empowerment in the EU-27, investigating whether GVCs could reduce or worsen gender disparities. The aim of this paper is to expand the gender gap studies incorporating the effects of trade in value added in the European Union. The study used a panel of data from various sources, including Eurostat, Trade in Employment (TiM), and the World Bank. The results suggest that an increase in exports, regardless of the level of technological intensity, tends to exacerbate the gender gap in export sectors by increasing the proportion of male workers relative to female workers. However, a higher female participation rate in medium-low technology sectors could reduce the gender gap in export sectors. The study identified obstacles to female insertion in export markets, including the need to improve education and training for women in high-demand areas, promote STEM (science, technology, engineering and mathematics) education and labor participation for women. This paper makes significant contributions to the literature by incorporating global value GVCs and considering the European context. Additionally, it provides an in-depth analysis of socioeconomic factors that are crucial for designing policies aimed at addressing gender inequality.

Keywords: gender gap, global value chain, employment, gender roles, technology intensity, EU-27.

Resumen

La relación entre el comercio internacional y la brecha de género es compleja. Por un lado, la inserción extranjera puede generar oportunidades económicas para las mujeres en el sector exportador. Por otro lado, también puede dar lugar a una mayor competencia y a la deslocalización de puestos de trabajo, especialmente en el contexto de las cadenas globales de valor (CGV). El estudio sobre la brecha de género a través de las CGV examina los mecanismos dentro de las redes de producción que contribuyen a mejorar el empoderamiento económico de las mujeres y la igualdad de género. El trabajo analiza la relación entre la brecha de género, las CGV, la intensidad tecnológica de las exportaciones y el empoderamiento femenino en la UE-27, investigando si las CGV pudieran reducir o empeorar las disparidades de género. El objetivo de este trabajo es ampliar los estudios sobre la brecha de género incorporando los efectos del comercio en el valor añadido en la Unión Europea. El estudio está basado en un panel de datos elaborado a partir de diversas fuentes, entre ellas Eurostat, Trade in Employment (TiM) y el Banco Mundial. Los resultados sugieren que un aumento en las exportaciones, independientemente del nivel de intensidad tecnológica, tiende a exacerbar la brecha de género en los sectores exportadores al aumentar la proporción de trabajadores masculinos en relación con las trabajadoras. Sin embargo, una mayor tasa de participación femenina en los sectores de tecnología media-baja podría reducir la brecha de género en los sectores de exportación. El estudio identificó obstáculos para la inserción femenina en los mercados de exportación, incluida la necesidad de mejorar la educación y la capacitación de las mujeres en áreas de alta demanda, promover la educación STEM (ciencia, tecnología, ingeniería y matemáticas) y la participación laboral de las mujeres. Este documento hace contribuciones significativas a la literatura al incorporar CGV de valor global y considerar el contexto europeo. Además, proporciona un análisis en profundidad de los factores socioeconómicos que son cruciales para diseñar políticas destinadas a abordar la desigualdad de género.

Palabras clave: brecha de género, cadena global de valor, empleo, roles de género, intensidad tecnológica, UE-27.

Clasificación JEL / JEL Clasification: F14, J16, J21, J78.

1. Introduction

Reducing the gender gap can lead to greater economic growth. In turn, economic growth contributes to the reduction of the gender gap through increased labor participation, productivity, and human capital. In addition, international trade, and integration into global value chains (GVCs) can be articulated as an engine of economic growth through innovation, the emergence of new business opportunities and improved labor conditions for the companies that participate in them.

The relationship between international trade and the gender gap is complex. On the one hand, a greater degree of foreign insertion can create new economic opportunities for women, especially in the export sector. This can lead to an increase in their income, a reduction in poverty and an improvement in their overall economic situation. On the other hand, international trade can also lead to increased competition and offshoring of jobs, which can affect women in insecure and less skilled jobs to a greater extent. This is particularly relevant in a trade context defined to a large extent by GVCs, insofar as they imply a profound fragmentation of production chains.

The aim of this paper is to analyze the relationship of the gender gap with global value chains, the technological intensity of exports and female empowerment in the EU-27. Specifically, it analyzes how integration in GVCs affect gender disparities. This paper contributes to the literature on the effects of international trade on the gender gap. In addition, it brings novelty by approximating foreign trade from GVCs in relation to the gender gap.

To meet the objective, a panel of data has been designed from Eurostat, Trade in Employment (TiM, OECD) and the World Bank including export variables in domestic value added, other economic variables and variables of a social nature, such as the number of women in management positions, among others.

The results reveal some of the factors affecting the gender gap in employment in export sectors embedded in GVCs. The female activity rate, the number of women in executive positions and the gap between men and women in the degree of success in tertiary studies (which points to a higher attainment rate among women) reveal a significant effect and reduce the gender gap. However, an increase in the fertility rate would lead to an increase in the gap. This effect may be due to traditional care-giving gender roles.

This paper introduces several contributions. Firstly, it expands the existing literature on the relationship between GVCs and the gender gap in the European context, which has received reduced attention in previous studies. In this sense, it should be noted that addressing the effect of GVCs represents a contribution itself. Secondly, it examines a range of economic and social variables that provide valuable insights to design public policy measures. Thirdly, it delves deeper into the gender patterns in the domestic and foreign labor markets, shedding light on their differences.

The structure of this article starts with this introduction and continues with the second section which deals with the literature review on gender gap and the effect of trade and global value chains. Thirdly, the methodology and data sources used are explained in detail. Fourthly, descriptive variables and the results of the econometric model are presented. Finally, a discussion section is carried out, detailing the results and conclusions of the study. This structured approach has enabled a clear and well-organized presentation of the research conducted on the gender gap and the impact of trade and global value chains, allowing for a rigorous evaluation of the topic and providing meaningful insights for further investigation.

2. Literature review

The gender gap in the labor market is a critical global issue that has been extensively studied by scholars. International trade has been recognized as one of the factors influencing this gap, but its impact on gender disparities is multifaceted and not yet fully understood. On the one hand, greater trade openness can enhance the working conditions of workers, including women (Gilles, 2018). On the other hand, participation in international trade may affect the gender gap in terms of the sexual division of labor and access to productive assets, leading to significant differences in wages, employment opportunities, and career advancement.

The interest in reducing the gender gap is not only justified on social but also on economic grounds. Morais (2017) argues that improving gender equality would have a positive effect on economic growth and women's employment. The positive impacts are due to an increase in productivity and an improvement in the potential productive capacity of the European economy. While traditionally viewed as a national issue, globalization and economic integration have made gender disparities a global concern (Ghosh et al., 2022), underscoring the need for a comprehensive approach to address these inequalities.

The issue is considered in the classic models that deal with international trade. However, this methodology is insufficient to explain gender disparity factors (Papyrakis et al., 2012). For example, the Heckscher-Ohlin (HO) model does not consider the social factors that influence women's role in the labor market. Instead, it focuses on determining wages as a function of external demand and the mobility of factors of production. In the same way, the work of Manning (2003) points to two characteristics of women in the labor market

that may accentuate the wage gap. Firstly, because they are willing to accept a lower reservation wage and, secondly, because of their lower labor elasticity, in both cases due to various socio-cultural factors. Therefore, a broader and more inclusive approach that considers gender inequalities and other relevant social variables is necessary for a more complete understanding of international trade relations.

Black and Brainerd (2004) work builds upon Becker's (1957) traditional model, which posits that increased market competition can lead to a reduction in discrimination against women and minority groups over time. To address this issue, the authors develop a model that identifies changes in market competitiveness through imports and firm concentration at the sectoral level. Their findings suggest that wage differentials narrowed more in sectors that experienced increased competition through foreign trade at the beginning of the period, compared to firms that were already operating in a competitive environment. Sauré and Zoabi (2014) challenge the common assumption that trade expansion in female-intensive sectors (FIS) leads to an increase in female labor force participation (FLFP). Instead, the paper argues that FLFP may decrease if trade expands FIS in capital-abundant economies, resulting in a widening gender wage gap. This highlights again the importance of considering the broader economic context when examining the effects of competition on reducing discrimination.

While greater trade openness generally implies better working conditions for employees in companies with some degree of external insertion, it does not necessarily lead to a narrowing of the wage gap. Initially, greater external insertion could lead to greater facilities for the incorporation of women into working life (Bussmann, 2009). However, several studies have found that the wage gap increases in sectors with a higher relative participation in foreign trade (Chowdhury et al., 2021; Li et al., 2020; Orkoh et al., 2022). Furuta et al. (2018) and Menon and Rodgers (2009) found that trade openness in India resulted in an increase in the gender gap, although this effect varied depending on whether labor-intensive or capital-intensive sectors were considered, with the gap increasing in the former. Some studies have pointed to fundamental causes differences in gender pay, such as the productivity differential between men and women. However, not all studies reach this same conclusion. For example, Almasifard (2018) and Sepehrivand (2017) indicate that greater external integration may not only increase the income level of competitive sectors but also decrease the gender gap. This suggests that the effects of trade openness on employment and the gender gap may be contingent upon national policies and the type of external integration (Dluhosch, 2021).

Other studies have explored how the origin of capital can impact the gender pay gap. Vahter and Masso (2019) analyzed gender pay gaps in foreign and domestic firms, with a focus on multinational acquisitions. They utilized propensity score matching to compare the differences between the two groups and found a larger wage gap in firms owned by multinationals. This difference may be attributed to greater demands for employee commitment from these

companies, consistent with Manning's (2003) discussion of factors contributing to wage differentials. Fernández (2020) analyzes the effect of foreign ownership on female employment. Results show that foreign ownership increases the proportion of female workers within the company. Foreign acquisition increases the proportion of skilled women only when the acquired company was not an exporter before its acquisition, supporting Becker's (1957) theory of taste-based discrimination.

Regarding foreign direct investment (FDI), Kodama et al. (2018) shows how, in the case of Japan, foreign-owned firms have a higher participation of women in leadership and management positions. According to the authors, this contrast between domestic versus foreign-owned domestic firms has to do with the culture and social norms imported through FDI. It is worth noting that family reconciliation is easier in foreign-owned companies, facilitating the attraction of talent not only among the male audience. In addition, Lee and Shin (2020) notes that women see FDI as an opportunity insofar as it can entail not only new jobs for women, but also better working conditions and, ultimately, greater equality. In this sense, the analysis conducted by Pantelopoulos (2022) for a set of OECD countries points out that women's access to the labor market is a factor of attraction for FDI. Bui et al.(2018) research shows that promoting gender equality is a crucial factor in attracting foreign direct investment (FDI) to developing nations.

However, Helble and Takeda's (2020) research on the manufacturing sector in Cambodia did not provide clear evidence that FDI influences the gender gap. Nonetheless, they acknowledged that FDI can lead to wage improvements and increased formal employment opportunities. Thus, while competition can play a role in reducing discrimination, it is not a silver bullet, and policymakers and researchers must consider a wide range of factors when striving to achieve greater equality. In contrast, other studies have found that the free trade and capital flows may not always lead to an increase in gender disparities.

Some literature considers the export orientation to explain the gender gap (Bonfiglioli & De Pace, 2021; Busse & Spielmann, 2006; Ozler, 2000). In the exporting sectors, the sexual division of labor often involves women being concentrated in lower-paying and lower-status jobs, such as sewing and assembly work in the clothing and textile industries. This division is a result of gender-based discrimination and a lack of equal opportunities for women in these industries. Women are also underrepresented in leadership and management positions in exporting sectors. The study by Granitoff and Hong Tiing Tai (2022) highlights the differences that exist between exporting and domestically traded firms. The results find that exporting firms have a positive impact on wages, while being a woman reduces wages.

To address this issue, it is important to promote gender equality and increase women's participation in STEM education and careers. This can include initiatives aimed at breaking down gender-based stereotypes and increasing girls' access to educational resources and opportunities in these fields. Encouraging women to pursue careers in STEM and promoting a supportive

and inclusive work environment is also critical in reducing the sexual division of labor according to technological level.

Related to exports is technological intensity. In this sense, it is worth noting the interpretative framework implied by the sexual division of labor. The gender gap is influenced by several factors, including care work and entry into the labor market under more precarious working conditions, such as part-time contracts. According to Morais (2017) the reasons that can reduce the gender gap are: active participation in the labor market, matching their male counterparts; reduction of wage gaps; and larger presence in STEM jobs.

The sexual division of labor according to technological level refers to the way in which tasks and responsibilities within different industries are divided based on the level of technology used. In many cases, higher-skilled and higher-paying jobs that utilize advanced technology are dominated by men, while women are concentrated in lower-skilled and lower-paying positions that involve manual labor or routine tasks. This division is often a result of gender-based biases and a lack of equal opportunities for women in STEM fields (Donmez, 2020). It should be noted that access to certain sectors may be determined by access to productive assets by virtue of social stereotypes. This can be seen when analyzing access to credit by gender (Andrés Alonso et al., 2019; Wang et al., 2022; Morais, 2017).

Although there has been extensive literature on the influence of exports, trade openness, and even FDI flows on the gender gap, the role of GVCs in this regard remains relatively unexplored. McCarthy et al. (2021) argue that despite the potential for analysis of governance patterns, the role of gender roles in GVCs has been largely overlooked. Given the dominance of men in decision-making positions within GVCs, the authors propose a shift in methodologies and a more profound analysis of the social relations and gender roles surrounding these chains.

A handful of studies have delved into the relationship between GVCs and gender equality. For example, Szymczak and Wolszczak-Derlacz (2022) examine the impact of GVCs on wages and employment levels, finding a negative correlation between these variables. The study suggests that the increasing competition resulting from external integration under these international networks puts downward pressure on wages, especially in backward linkages. Deb (2022) also explores this issue focusing on the gender wage gap. Her findings indicate that increased participation in GVCs has led to a reduction in women's wages relative to men's in India. The findings of Gagliardi et al. (2019) and Nikulin and Wolszczak-Derlacz (2022) also suggest that GVCs contribute to greater gender inequalities.

Despite the negative results found by some studies regarding GVC participation and gender inequality, not all studies show negative effects of GVC participation. For instance, Said-Allsopp and Tallontire (2015) approached the issue of female employment in GVCs from a different perspective than that of employment level and wage gender gaps. Based on a case study conducted in Kenya, the study concludes that increased female employment in GVCs

can empower women in three ways: by enabling them to adopt different ways of being, different ways of doing things, and by sharing experiences. These changes can alter the way women fit into society and their roles within the family, leading to positive societal transformations.

To summarize, the gender gap is a complex and multifaceted phenomenon that can be examined from various angles. Although the literature has primarily focused on wage and employment disparities, there are many other dimensions to consider (Jehn et al., 2021; Ma et al., 2021; Wolszczak-Derlacz, 2013). Women's participation in certain sectors, participation in positions of greater economic relevance and representation or changes in social roles. For instance, the gender gap can be analyzed in terms of differences in labor market participation or access to education and healthcare (Yamamura, 2016).

To address this issue, policies and initiatives aimed at promoting gender equality and empowering women in the workplace are necessary. This includes equal pay for equal work, access to education and training, and opportunities for career advancement. Challenging gender-based stereotypes and promoting diversity and inclusion in the workplace are also important steps in breaking down the sexual division of labor in the exporting sectors.

3. Data and Methodology

This section describes the methodology of the study. To achieve the objective established in the Introduction, data was collected on employment levels by gender and technological intensity of manufacturing sectors, exports by technological intensity, GVC, educational level, fertility, and social status of women. Table A1 in Appendix A defines the selected variables along with their sources. The data collected covers the period 2008-2018 and includes all EU27 countries. Next, some of these indicators are discussed in more detail.

Starting with the employment dimension, the employment gap is defined as female to male employees ratio. This research differentiates between total, export, and domestic employment by gender. The first two indicators are obtained from Trade in Employment (*TiM* OECD, 2021 edition), while the third can be obtained by difference between the two previous ones. The input-output methodology for the calculation of the employment variables related to foreign trade is detailed below. The complete methodology can be consulted at (Horvát et al., 2020).

For a set of c countries and s sectors, the following basic input-output entities are defined: T_{csxcs} is the intermediate transactions matrix, Y_{csxc} is the final demand vector and X_{csx1} is the total output vector obtained as the row-wise sum of T and Y. From these entities, the technical coefficients matrix A_{csxcs} can be defined, where each $a_{ij} = t_{ij}/x_j$ represents the fraction of value incorporated in the production of sector j from sector i (being possible i = j). Then, the Leontief inverse matrix, $L_{csxcs} = (I-A)^{-1}$, can be obtained, where I is the identity matrix. Each element l_{ij} of the Leontief inverse represents the total requirements (both direct and indirect) for a given sector, indicating how much

the production of that sector will grow with an increase in final demand by one monetary unit.

In order to obtain the number of employees resulting from foreign trade, it is necessary to calculate the employment intensity. E_{1xcs} is defined as a vector that collects, for each sector, the number of employees. The employment intensity, e_{1xcs}, is defined as follows:

$$e=E\hat{X}^{-1} \quad (1)$$

Where $\hat{X}$ is a square matrix that diagonalizes the total output vector. To differentiate between the total employment and the employment linked to a country's exports, adjustments need to be made to the Leontief inverse matrix. The diagonal submatrices of the matrix, with size $s^x s$, represent the domestic market, whereas the remaining elements depict foreign relations. To determine the impacts on the domestic employment market, only the diagonal submatrices' elements are needed, with all other values null. The resulting Leontief inverse matrix is called $L_{cs^x cs}$.

Also, gross exports, $EXPb_{cs^x 1}$, can be obtained by making similar modifications to T and Y matrices, i.e., making the domestic market elements null. Thus, the domestic employment resulting from foreign trade, E^t_{1xcs}, can be obtained as follows:

$$E^t=eL^*\widehat{EXPb} \quad (2)$$

After obtaining E and E^t, the level of domestic employment, E^d, can be derived by determining the difference between the two elements. This value represents the employment generated by domestic transactions. Additionally, by distinguishing between employment by gender, the intensity and employment variables defined in expressions (1) and (2) can be recalculated for each gender. For instance, the number of employed men and women is represented by E_m and E_f respectively, while their employment intensities are e_m and e_f ($e = e_m + e_f$). Finally, E^t_m and E^t_f are used to denote the employment associated with foreign trade by gender and E^d_m and E^d_f to denote the employment associated with domestic transactions.

Moving on to foreign trade indicators, the participation and position indexes within GVCs require special attention. These indicators are conceptually defined in Table A1. To calculate these indices, one should start by determining the forward and backward participation ratios in the GVC, known as and respectively. The forward participation is calculated as the ratio of domestic value-added exports re-exported by third countries over gross exports, while the backward participation is determined as the ratio of foreign value-added exports over gross exports. From these ratios, the participation and position indexes are usually obtained as follows:

$$GVC\ participation = ln(FPI+1) + ln(BPI+1) \quad (3)$$

$$GVC\ position = ln(FPI+1) - ln(BPI+1) \quad (4)$$

In order to meet the established objective, an econometric model was developed using some of the variables outlined in Table A1. Due to the nature of the data, a panel data estimation was chosen. Based on Hausman test, a fixed effects versus random effects estimation is deemed more appropriate. The employment gap, defined as E_f^t / E_m^t, is the dependent variable. Values below unity indicate a higher proportion of male presence in export sectors. The specification of the model is shown below, for countries in years:

$$GAP_{it} = \alpha_0 + \alpha_1 GDP_{it} + \alpha_2 PI_{it} + \alpha_3 ACT_{it} + \alpha_4 FER_{it} + \alpha_5 FPAR_{it} + \alpha_6 FMNG + \alpha_7 EDU_{it} + \alpha_8 FHT_{it} + \\ + \alpha_9 FMHT_{it} + \alpha_{10} FMLT_{it} + \alpha_{11} FLT_{it} + \alpha_{12} XH_{it} + \alpha_{13} XMH_{it} + \alpha_{14} XML + \alpha_{15} XL + \varepsilon_{it} \quad (5)$$

The objective of this model is to study the impact of export specialization in manufacturing and the type of participation in GVCs on the gender gap in employment in export sectors. In addition to the variables related to technology intensity, trade, and GVCs, various control variables are included, such as the female activity rate, fertility rate, women's participation in management positions and national parliaments, and disparities in tertiary education attainment between men and women. It also incorporates female participation rates in different sectors of activity grouped by technological intensity. For example, high-tech sectors may require specific skills and knowledge that may not be available to women due to barriers in access to education and training. Additionally, in some cases, the work culture and social norms may discourage women from working in certain sectors. Finally, Table 1 shows the main descriptive statistics of the variables used in the model.

Table 1. Descriptive statistics. N. of observations: 297

Variable	*Mean*	*Std. Dev.*	*Min*	*Max*
GAP	0.66	0.10	0.44	0.92
GDP	33308.29	22664.48	6853	123678.7
PI	-0.12	0.10	-0.41	0.02
ACT	65.96	7.11	40.4	81
FER	1.56	0.20	1.21	2.06
FPAR	25.76	10.08	8.7	46.99
FMNG	29.63	8.93	0	46.3
EDU	1.38	0.25	0.84	1.86
FHT	0.4	0.14	0	0.96
FMHT	0.22	0.11	0	0.47
FMLT	0.15	0.07	0	0.28
FLT	0.39	0.11	0	0.63
XH	7.29	5.61	0.68	28.39
XMH	19.57	9.9	3.09	45.19

Variable	*Mean*	*Std. Dev.*	*Min*	*Max*
XML	13.01	4.7	2.73	30.96
XL	18.62	8.54	5.86	50.32

Source: Authors.

4. Results

This section presents the key findings of the research and their implications in two parts. The first subsection provides descriptive statistics on some of the most relevant indicators outlined in section 3. Following this analysis, the second subsection presents the results of the econometric analysis developed using a panel data model relating the relationship between the employment gap in foreign trade and various factors, such as the technological intensity of exports, female empowerment, and comparative education outcomes, among others.

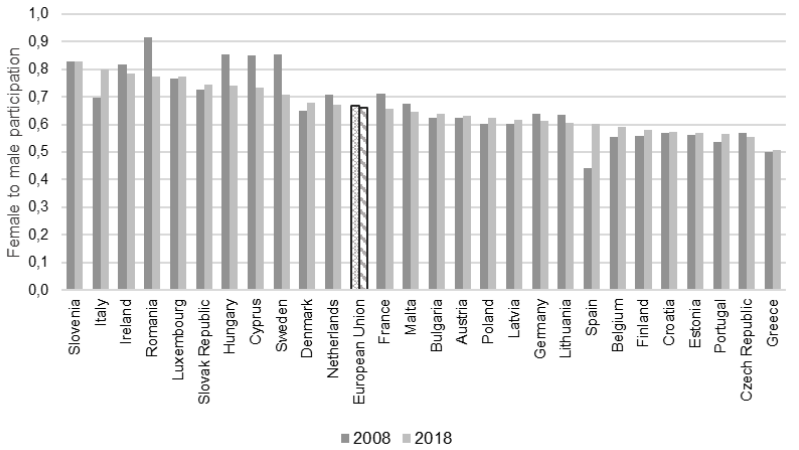
4.1. Descriptive analysis

The term *gender gap* refers to the differences between men and women in the labor market, including disparities in salaries and employment rates (Morais, 2017). Despite progress in protecting women's rights and promoting work-life balance, there is still much to be done to achieve gender equality. As mentioned in the literature review, trade liberalization has been found to increase the number of women employed and to change the gender composition of certain sectors in foreign trade. However, this does not always lead to a decrease in the disparity between genders. Figure 1 shows the ratio of female to male employment in export sectors across EU27 countries. A value below unity indicates a greater male presence. This is used as the dependent variable in the econometric model described in the following subsection.

On average across the EU, the results show that for every 10 men employed in export sectors, there are only 7 women. In other words, approximately 40% of the foreign trade workforce involves women. It is worth noting that none of the countries in the sample have a value above unity. In 2018, the highest female labor force participation rates in export sectors were observed in Slovenia, Italy, Ireland, Romania, and Luxembourg, with rates close to 45% of the total. In contrast, Greece, the Czech Republic, Portugal, Estonia, and others had rates below 35%. Regarding changes between 2008 and 2018, it can be observed that female participation remained relatively stable, with a few exceptions. Romania, Hungary, Cyprus, and Sweden experienced a decrease in female participation after the financial crisis, while Spain's female participation increased.

Although a gender gap in employment exists in foreign trade sectors, the situation in the domestic market is often different for many European countries. When referring to the domestic market, only the level of domestic employment is considered, excluding from the total the number of employees in export sectors for each gender. Even in cases where there is still a disparity

Figure 1. Gender gap in foreign trade employment, EU27 countries, 2008 and 2018



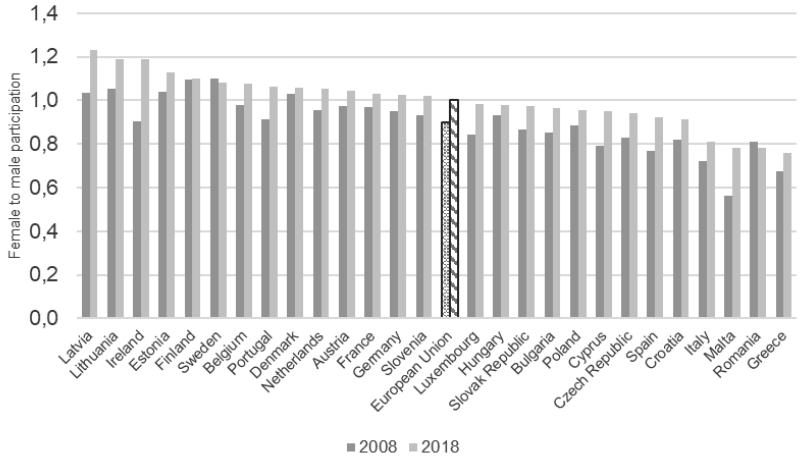
Source: Authors based on TiM (OECD, 2021 edition).

in employment between genders, the difference is typically smaller than in export sectors. Figure 2 displays the ratio of female to male employment for the domestic markets of the EU27 countries.

In 2018, the European average was at gender parity in 2018, improving since 2008. Regarding the member countries, 14 out of the 27 had a higher level of female participation than male employment volume, while a gender gap continued to exist in the remaining 13. It is worth noting that gender gaps in the domestic market are generally smaller compared to the foreign market, except for Italy, Malta, Romania, and Greece, where the differences in female participation are around 45% or less (still smaller than those revealed by Figure 1 for these countries). Looking at the evolution of the indicator over time, it's worth noting that female participation in domestic employment has increased in most European countries.

The literature review also examined the impact of technological intensity on the gender gap. Descriptive analysis of the EU context shows that regardless of the technological level of each sector, male participation is higher in industry and manufacturing (see Figure 3). These differences are particularly pronounced in medium-high and medium-low technology intensity sectors, where women's participation is less than 25% and 20%, respectively. However, these differences are less significant in high and low technology sectors, which traditionally have had a greater female presence, such as the pharmaceutical, textile, and certain food industries (Blickenstaff, 2005; Wang & Degol, 2017). On this occasion, no significant differences were found in female participation between the two periods considered. Note that Figure 3 measures female participation as a percentage of the total number of employees, not as a percentage of male employees.

Figure 2. Female share over total employment by technology intensity, EU27, 2008 and 2018



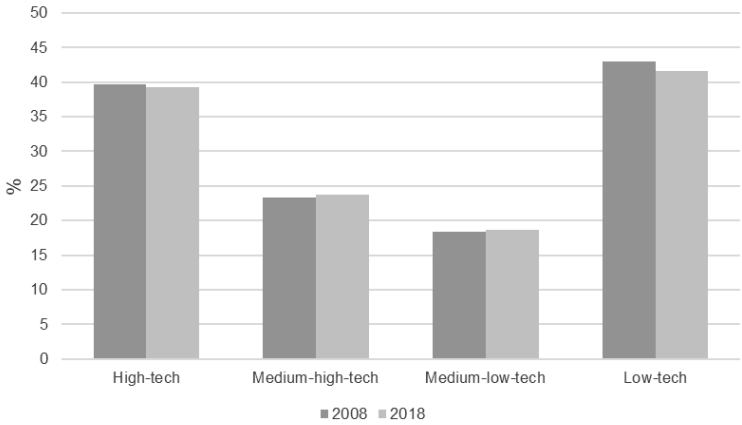
Source: Authors based on TiM (OECD, 2021 edition).

Table A2 in Appendix A presents the percentage of domestic value-added exports by technological intensity over total manufacturing exports. The results show that, on average, 47.5% of total European manufacturing exports (both intra- and extra-zone) are concentrated in sectors of medium-high technology intensity, which have a low female participation in employment. In contrast, high-tech exports, which have higher female representation, account for only 12.5% of domestic value-added manufacturing exports. Furthermore, most female manufacturing jobs are concentrated in low technology-intensive sectors, representing, on average, 53% in the EU (see Table A3 in Appendix A).

Finally, Figure 4 illustrates the GVC position index as defined in Expression (4). This index reflects the kind of participation of each country in this type of foreign trade, where a positive value indicates a greater progressive or forward participation –higher share of domestic value-added reexported by third countries–, while a negative value indicates a greater regressive or backward participation in GVCs –higher share of foreign value-added exported–. The position index is a complex indicator to interpret in terms of a country's competitiveness. Various factors must be taken into account, such as the stage of development and the role of each country in the supply chain, or more specifically, each sector of activity in each territory. All member countries show some degree of backward participation, although there are significant differences among them. Notably, Luxembourg and Malta stand out due to their singular production structures.

If a country specializes in activities more closely linked to the final stages of the value chain (such as marketing, sales, and after-sales), the position index tends towards negative values. Conversely, countries that specialize in the exploitation

Figure 3. Female share over total employment by technology intensity, EU27, 2008 and 2018



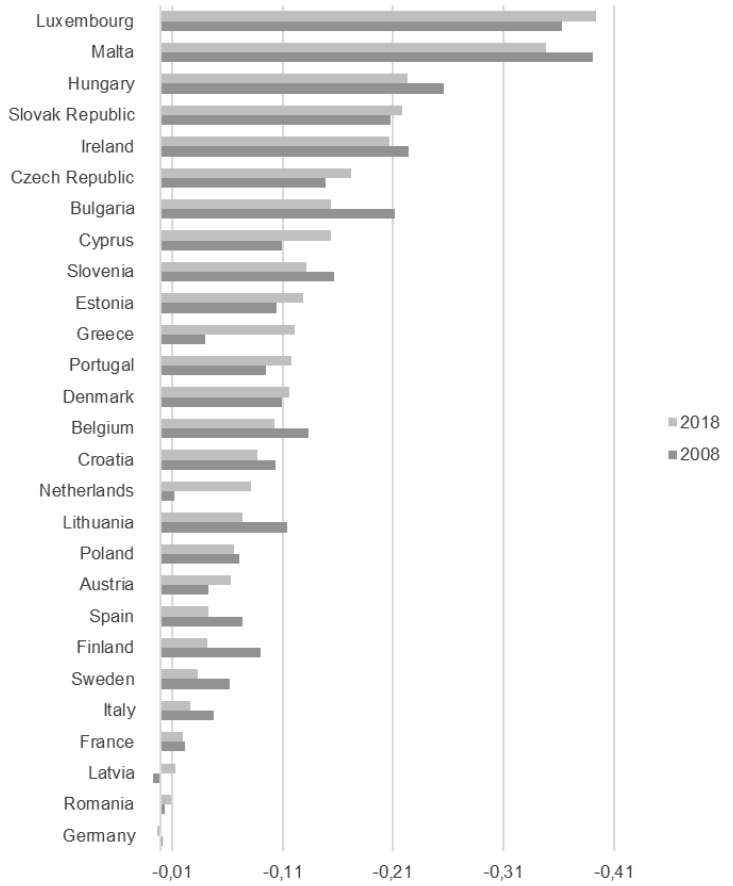
Source: Authors based on Eurostat (dataset: LFSA_EGAN22D).

of natural resources and manufacturing, as well as R&D and design, tend to show positive values (Rodil-Marzábal, 2017). In developed economies, industries tend to specialize in R&D, design, and the final stages of the production chain, leading low positive or negative values, close to 0. Note that most European economies show values above -0.1, with a few exceptions. When interpreting the results for Europe, it is important to consider the region's strong dependence on external resources. The GVC participation index (see Table A4 in Appendix A) is a complementary indicator that measures the chains' contribution to total foreign trade. European countries have a high participation rate, averaging over 50% For example, Italy, France, and Spain stand out, with a share of over 60%. The country with the lowest share is the Slovak Republic, with 37%.

To understand its impact on gender participation in employment, it's crucial to consider the relevance of the productive sector. The productive structure is conditioned by the sexual division of labor and the type of activities performed by both genders. If women have lower participation in R&D or manufacturing activities, their involvement in GVCs may lead to further disadvantages. This concern is compounded by the low presence of women in manufacturing, as shown in Figure 3. Furthermore, among European countries, medium-high technology value-added exports are prominent (see Table A1), precisely one of the sectors with the lowest female representation in employment.

Several factors influence the gender gap in employment, including the technological intensity of different sectors and the importance of considering a country's position in GVCs. The GVC position index is mentioned as a complex indicator reflecting a country's position in foreign trade and competitiveness. Furthermore, the low participation of women in higher value-added activities, combined with Europe's dependence on external resources, could limit women's empowerment in GVCs.

Figure 4. Position Index in GVCs, EU27 countries, 2008 and 2018



Source: Authors based on TiVA (OCDE, 2021 edition).

To provide a more comprehensive understanding of the gender gap between socio-economic factors in the economies of the EU27 and their impact on participation in foreign trade, a detailed examination is proposed in the following section. This analysis will delve into various aspects of the relationship between gender, socio-economic factors, and foreign trade, including but not limited to the role of education. By examining these factors in depth, we aim to provide a more nuanced perspective on the complex interplay between gender and foreign trade participation in the EU27, and to identify potential avenues for addressing the gender gap in this context.

4.2. Econometric results

This subsection describes the main results obtained from the estimation of Expression (5) using a panel data and fixed effects model with the variables described in Section 3 and Table A1 (see Table 2). The findings indicate that an increase in exports, regardless of the level of technological intensity, tends to worsen the gender gap in export sectors by increasing the proportion of male workers relative to female workers. This effect is particularly pronounced in the medium-high technology sectors, which not only have the highest export levels within the manufacturing industry but also exhibit lower female participation rates.

These findings are consistent with the research conducted by Chowdhury et al. (2021) and Granitoff and Hong Tiing Tai (2022), who suggest that an increase in exports and trade openness contributes to an increase in gender disparities. Similarly, Li et al. (2020) also supports this claim, albeit with more nuanced results. Considering first that Li's research focuses on Asian countries, it suggests that initial increases in trade openness and foreign competition may lead to higher female labor market participation. However, beyond a certain threshold of trade openness, the gender gap may widen once again in favor of men. Additionally, depending on the import substitution effect, these inequalities could further increase.

The model produces varied results when it comes to the variables that measure the proportion of female employment in manufacturing sectors by technological intensity. Only participation in high and medium-low intensity sectors shows significant results with opposite signs. Greater female participation in high-tech intensity sectors would not help reduce the gender gap, while greater participation in medium-low technology sectors would reduce the gender gap in export sectors. These results can be explained by the findings depicted in Figure 3, where women's participation in high-tech sectors is relatively high (around 40%) compared to medium-low intensity sectors, where there is still a significant gender gap (less than 20% female representation).

Regarding the position index in GVCs, the results point out in the opposite direction than technology intensive exports. Interpreting the effects of this index is complex and requires relying on the results shown in Figure 4. Changes in this index that result in increased forward participation appear to indicate a reduction in the gender gap, while the opposite –greater backward participation– would tend to increase the gap. An increase in forward participation would imply greater involvement in global markets in the initial and intermediate stages of the production chain, which could boost activity in sectors with higher female participation (such as certain manufacturing and high-tech industries).

However, an intensification of the regressive position could lead to the replacement of certain productive tasks by imports. If this substitution occurs in sectors with a relatively higher female presence, it could lead to an increase in the number of female workers. Conversely, if it occurs in sectors with a relatively lower female presence, it could result in greater job losses among the female population. In this regard, Dluhosch (2021) study suggests that an increase in

import penetration would result in a wider gender gap, consistent with Li et al. (2020) findings. Regarding its link with the position index, a greater quantity of imports would correspond to a more regressive position within GVCs. Gagliardi et al. (2019) also points out that a higher progressive position in GVCs would lead to better salaries, although the distribution between men and women depends to a large extent on gender parity in each case. This insightful finding highlights the necessity of further exploring the impacts of GVCs on gender disparities.

Table 2. Estimation results. Dependent variable: Women to men working in exporting sectors
Source: Authors from TiM

Variable	*Coefficient*	*Standard error*	*t*
GDP	-1.31E-06	4.31E-07	-3.04*
PI	0.5189563	0.1202727	4.31*
ACT	0.0003655	0.000623	0.59
FER	-0.0584337	1.79E-02	-3.270*
FPAR	-0.000897	0.0004	-2.140**
FMNG	0.0024537	0.0006	4.370*
EDU	-0.0334915	0.0261	-1.280
FHT	-0.0392383	0.0131	-2.990*
FMHT	-0.0141325	0.0203	-0.700
FMLT	0.1361949	0.0425	3.200*
FLT	0.0373118	0.0376	0.990
XH	-0.0030893	0.0010	-3.050*
XMH	-0.0055916	0.0012	-4.580*
XML	-0.0025853	0.0012731	-2.03**
XL	-0.0018247	0.0011046	-1.65***
cons	1.008535	0.0882868	11.42
Rho	0.97	R^2 within	0.27
F-prob	0	R^2 between	0.06

Source: Authors based on TiM (OECD, 2021 edition), TiVA (OECD, 2021 edition), World Bank and Eurostat.

As for the GDP per capita, the econometric results indicate its statistical significance with a negative coefficient, implying that an increase in income level would exacerbate the gender gap within the export sectors. Nonetheless, to make a conclusive statement based solely on the evolution of GDP per capita would be oversimplifying. However, one can infer that further economic growth in European countries cannot be considered a sufficient factor in reducing the gender gap. However, multiple studies have agreed that policies targeted at diminishing gender gaps can foster higher levels of economic growth (Agénor et al., 2021; Agénor & Canuto, 2015; Dheer et al., 2019).

Regarding the control variables, the analysis indicates that the female activity rate is not a significant factor, while the proportion of women in parliament has yielded counterintuitive results. Therefore, it is possible that this variable is inadequate in explaining the employment gap in export sectors. Meanwhile, the

fertility rate and the proportion of women in management positions were both significant at the 1% level, with negative and positive signs, respectively.

The finding that a higher fertility rate leads to a larger gender gap may be attributed to established gender roles in society. Despite advances in work-life balance policies (Goldin & Mitchell, 2017), in addition to the time women have to devote to pregnancy, they tend to take more time off work or assume the primary responsibility for caregiving and household duties (Cortés & Pan, 2020). When examining individual countries, it is important to take into account the effectiveness of work-life balance policies, as they can facilitate the simultaneous increase of fertility rates and women's participation in the labor market (Vitali & Billari, 2017). The proportion of women in management positions serves as a proxy variable for the gender gap's evolution and the situation with respect to the so-called glass ceiling effect (Bear et al., 2017; Haveman & Beresford, 2012; Said-Allsopp & Tallontire, 2015). A better value for this variable reflects greater gender parity in society.

Finally, the rho indicator measures the proportion of variance attributable to individual effects in the panel data model, indicating the extent to which unobserved heterogeneity factors across countries explain the variance of the dependent variable. A higher value suggests the existence of substantial differences among the analyzed countries. This finding emphasizes the importance of considering not only the variables included in the model but also the specific circumstances of each economy. Additionally, the index underscores the relevance of employing a panel data and fixed effects model to examine this matter in the European context. Moreover, this could provide an explanation for the results obtained from certain variables, such as the lack of significance of the education variable, which may be heavily influenced by the specific demand for human capital in each country, as well as the non-significant impact of the female activity rate. The differences between the R^2 within (which explains how the model fits for each country) and the R^2 between (which explains how the model fits to understand the differences between the different countries) are consistent with the rho index obtained, since these variables do not capture the differences between the results of each country.

5. Conclusions

The gender gap represents a significant impediment to the development of nations, affecting not only developing economies but also persisting within more developed ones. Therefore, it is crucial to examine the impact of international relations, particularly participation in GVCs on gender inequality. On the one hand, increased participation in foreign markets can create new economic opportunities for women, particularly in the export sector. This can result in higher incomes, reduced poverty, and overall economic improvement. However, international trade can also lead to intensified competition and the relocation of jobs, affecting women in precarious and low-skilled positions disproportionately. This is especially pertinent in the current trade landscape,

heavily defined by GVCs, which entail a significant fragmentation of production processes. Thus, the aim of this paper is to delve into the relationship between the gender gap, global value chains, technological intensity of exports and female empowerment in the EU-27. Specifically, it analyzes how integration in GVCs affects gender inequalities.

This paper uncovers several significant findings. Firstly, the results indicate that an increase in exports, regardless of the level of technological intensity, tends to worsen the gender gap in export sectors by amplifying the proportion of male workers compared to female workers. This effect is particularly noticeable in medium-high technology sectors, which not only exhibit the highest export levels within manufacturing but also display lower female participation rates. Secondly, we demonstrate the intricate and nuanced nature of the effects GVCs on gender inequalities. Depending on the type of participation (forward or backward), the impact on inequalities may vary. Thirdly, a priori, increasing manufacturing exports contributes to widening the gender gap. This finding aligns with the observation of disparities between internal and external labor markets.

The study revealed various obstacles to women's integration into export-driven markets, which justify the development and implementation of policies. Firstly, enhancing women's education and training is crucial to improve their skills and knowledge in high-demand areas of the labor market, which are vital for future economic growth. Additionally, promoting women's education in STEM fields and ensuring their access to technology training and education are essential. Secondly, ensuring social protection for women in vulnerable and precarious sectors, particularly in low-tech export-intensive sectors, is imperative. This may entail implementing social security policies, combating workplace discrimination and harassment, and implementing measures to support work-life balance. Lastly, it is recommended that institutions facilitate women's entry into traditionally male-dominated industries by promoting their representation in decision-making bodies associated with international trade, such as ministries of commerce, chambers of commerce, and business organizations.

This work arises future lines of research. Firstly, it is crucial to delve deeper into the effects of global value chains (GVCs) by differentiating between types of participation and examining their potential impact on gender inequalities. Secondly, considering the indication of variations among European countries, it becomes necessary to analyze these variables within groups of countries sharing similar characteristics.

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Annex A

Table A1. Description of variables included in the research

Dimension	*Indicator*	*Description*	*Source*
Employment	Employment embodied in trade Gap in employment embodied in trade (GAP) Gap in domestic employment	Number of employees linked to export sectors. Includes direct and indirect jobs (see Expression (2)) Ratio between the number of women and men working in export sectors. If the ratio is less than 1, it indicates a greater representation of men in exporting workforce Ratio between the number of women and men working in non-export sectors. If the ratio is less than 1, it indicates a greater representation of men in domestic workforce	*TiM* (OECD, 2021 edition)
Women empowerment/ female social status	Women in management (FMNG) Women in national parliaments (FPAR) Fertility rate (FER) Female activity rate (ACT)	Proportion of females in total employment in senior and middle management Proportion of parliamentary seats in a single or lower chamber held by women Number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with age-specific fertility rates of the specified year Percentage of active women in relation to the total comparable population between 15 and 64 years of age	World Bank Eurostat
Technology intensity	High-technology VAD exports (XH) Medium-high-technology VAD exports (XMH) Medium-low-technology VAD exports (XML) Low-technology VAD exports (XL)	Domestic value-added exports of high technological intensity. Only includes the value generated in the domestic country Domestic value-added exports of medium-high technological intensity. Only includes the value generated in the domestic country Domestic value-added exports of medium-low technological intensity. Only includes the value generated in the domestic country Domestic value-added exports of low technological intensity. Only includes the value generated in the domestic country	*TiVA* (OECD, 2021 edition)
Female employment by technological level	High-technology (FHT) Medium-high-technology (FMHT) Medium-low-technology (FMLT) Low-technology (FLT)	Ratio of women to total employment in high-technology sectors Ratio of women to total employment in medium-high-technology sectors Ratio of women to total employment in medium-low-technology sectors Ratio of women to total employment in low-technology sectors	Eurostat
Other	Gap in tertiary education (EDU) GDP per capita (GDP) Participation Index Position Index (PI)	Ratio between males and females in the success rate in tertiary education (ISCED 5-8) GDP share over population The participation index in GVCs reflects the degree to which a country performs in this category of foreign trade with respect to its total exports. It is measured as the sum of the backward and forward participation indexes (see Expression (3)) Measure of a country's position in GVCs. A score above 0 indicates a higher relative volume of domestic value-added exported by third countries while a lower score indicates a higher relative volume of foreign value-added exports (see Expression (4))	World Bank *TiVA* (OECD, 2021 edition)

Source: Authors.
Note 1: Eurostat sectoral classification has been used to determine the degree of technological intensity.
Note 2: The column "indicator" specifies the abbreviations of the variables employed in the econometric model.

Table A2. Share of domestic value-added exports by technology intensity over total manufacturing, EU27 countries, 2018

	High-tech	*Medium-high-tech*	*Medium-low-tech*	*Low-tech*
Austria	8.72	41.08	24.97	25.23
Belgium	20.14	32.75	24.89	22.22
Bulgaria	6.47	28.43	32.65	32.45
Croatia	8.49	19.52	28.59	43.41
Cyprus	22.01	12.93	10.82	54.23
Czech Republic	9.48	52.14	21.90	16.49
Denmark	31.68	29.36	11.24	27.72
Estonia	8.10	22.00	18.04	51.86
Finland	10.90	34.40	21.90	32.80
France	12.63	51.05	15.09	21.23
Germany	11.19	61.38	14.73	12.69
Greece	6.48	15.73	43.41	34.38
Hungary	16.39	47.48	19.29	16.84
Ireland	47.64	15.49	12.98	23.90
Italy	6.22	45.02	20.45	28.31
Latvia	6.55	15.36	13.29	64.80
Lithuania	3.54	21.18	19.10	56.18
Luxembourg	2.36	15.57	64.09	17.98
Malta	39.89	9.17	7.72	43.22
Netherlands	11.78	41.26	16.23	30.74
Poland	5.65	35.65	24.63	34.07
Portugal	5.91	27.84	23.31	42.94
Romania	6.98	54.19	13.51	25.32
Slovak Republic	5.44	51.47	27.79	15.30
Slovenia	14.29	37.84	28.44	19.43
Spain	6.28	43.07	22.82	27.82
Sweden	8.99	49.73	19.24	22.04

Source: Authors based on TiVA (OECD, 2021 edition).

Table A3. Female employment by technology intensity over total female manufacturing employment (%), EU27 countries, 2018

	High-tech	*Medium-high-tech*	*Medium-low-tech*	*Low-tech*
Austria	11.00	24.24	24.30	40.46
Belgium	13.91	21.52	15.09	49.48
Bulgaria	4.23	13.96	14.25	67.57
Croatia	6.68	11.59	8.46	73.28
Cyprus	19.30	-	15.79	64.91
Czechia	7.82	33.83	23.78	34.57
Denmark	26.96	24.04	11.69	37.32
Estonia	8.60	10.93	9.30	71.16
Finland	11.61	23.80	15.58	49.01
France	10.30	20.76	19.90	49.04

Germany	11.51	31.81	17.18	39.50
Greece	7.59	5.77	10.26	76.39
Hungary	15.37	30.29	12.97	41.37
Ireland	40.00	-	-	60.00
Italy	6.93	22.98	19.24	50.85
Latvia	-	-	-	-
Lithuania	2.14	10.18	11.36	76.31
Luxembourg	-	-	-	-
Malta	26.79	10.71	8.93	53.57
Netherlands	6.16	17.90	16.08	59.86
Poland	5.95	22.94	18.94	52.16
Portugal	3.80	14.75	13.43	68.03
Romania	3.04	24.39	9.45	63.12
Slovakia	8.86	38.72	20.39	32.02
Slovenia	10.93	33.54	23.60	31.93
Spain	7.87	22.98	16.18	52.97
Sweden	8.99	36.47	19.15	35.39

Source: Authors based on Eurostat (dataset: LFSA_EGAN22D).

Table A4. GVC participation index, EU27 countries, 2018

	Participation Index in GVC		
Austria	53.97	*Italy*	78.59
Belgium	59	*Latvia*	55.49
Bulgaria	61.81	*Lithuania*	53.65
Croatia	48.94	*Luxembourg*	46.73
Cyprus	54.38	*Malta*	67.02
Czech Republic	52.19	*Netherlands*	56.74
Denmark	46.3	*Poland*	42.45
Estonia	46.25	*Portugal*	47.68
Finland	46.47	*Romania*	54.06
France	63.31	*Slovak Republic*	37
Germany	53.57	*Slovenia*	48.92
Greece	43.01	*Spain*	63.01
Hungary	45.54	*Sweden*	47.67
Ireland	52.23		

Source: Authors based on TiVA (OECD, 2021 edition).

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