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Global Value Chains Participation and Social Upgrading: Evidence from Developing Countries

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Abstract

This paper explores the effect of Global Value Chain (GVC) participation on social upgrading, which is captured by skill upgrading and working condition measures. Based on comprehensive firm-level data from the World Bank Enterprise Survey (WBES), this study provides a dataset of 84,191 firms in 117 developing countries. Using a propensity score matching a difference-in-differences approach and controlling for fixed effects, the results suggest an overall positive significant effect of GVC integration on social upgrading, i.e., skill upgrading and working conditions. However, according to the sectoral evidence, this effect is very heterogeneous amongst sectors, with a strong negative impact in the textile and garment sector, where GVC participation is strongly associated with skill downgrading and poor working conditions. The paper provides evidence that the positive effect of Global Value Chains (GVCs) depends on specific industries and is mainly driven by capital intensive sectors. Furthermore, the results are consistently gender neutral, except for highly skilled firms and for the garment and textile sector, which appear to exert a negative effect on the share of female skilled labour. Finally, the effect of GVCs is more evident for initially highly skilled firms.

Keywords: Global Value Chains, Social Upgrading, Skill Upgrading, Working Conditions, Firm-Level Data.

JEL Classification : F13, F14, F16, J24

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1 Introduction

Recent decades have witnessed a dramatic change in trade. Production patterns and international trade are structured around so-called Global Value Chains (GVCs), where the stages of production are dispersed internationally. In this context of vertical fragmented production processes, different stages of the same production have been internationally dispersed, leading to the concept of "unbundling" of production. Based on the definition of Gereffi and Fernandez-Stark (2011) GVC refers to "*the full range of activities that firms and workers perform to bring a specific product from its conception to its end use and beyond*". GVCs, which now account for more than two-thirds of world trade, have profoundly changed the way goods and services are produced and exchanged (World Trade Organisation (WTO), 2019). These changes are likely to have a significant effect on socio-economic aspects and labour standards, especially in less developed countries (Baldwin and Yan, 2014).

The literature indicates the strategies used by firms to maintain or strengthen their positions in the global economy, which are known as "Upgrading". It describes "a process of improving the ability of a firm or an economy to move to a more profitable and/or technologically sophisticated capital and skill-intensive economic niche" (Gereffi and Lee, 2016; Gereffi and Fernandez-Stark, 2011). Upgrading via GVCs is fundamental for firms and economies to stay competitive. Firstly, it enables firms to capture a larger share of the value generated during production. By moving into higher value-added activities, such as research and development, design, branding and marketing, firms can boost their profits and generate higher returns. Secondly, upgrading enables firms to differentiate themselves from competitors. Whilst low-cost production can offer a competitive advantage initially, this is rarely sustainable in the long term. By moving up the value chain, firms can develop more unique products and technologies that differentiate them in the market and attract new customers. Thirdly, it enhances technological capabilities and fosters innovation. Engaging in activities, such as research and development, requires firms to develop advanced technological capabilities. This not only improves their products but also allows them to constantly innovate and respond to varying customer demands (Gereffi, Humphrey & Sturgeon, 2005).

There are several strategies that firms can adopt to upgrade within fragmented production processes. Primarily, they can invest in research and development to develop new technologies, products or processes. This requires allocating resources towards innovation and continuous learning and improvement within the organisation. Furthermore, firms can invest in human capital development by providing training and education for their employees. By upgrading the skills and knowledge of their workers,

firms can enhance their capacity to engage in higher value-added activities. Lastly, firms can form strategic partnerships and collaborations with other firms along the value chain. This can involve joint research and development projects, sharing of knowledge and expertise to access new markets or technologies, which can facilitate their upgrading process (World Trade Organisation, 2019).

Therefore, participation in GVCs can be considered as a key element for social upgrading - a concept that is framed by the International Labour Organisation (ILO, 1999) decent work framework, which refers to "The process of improvements in the rights and entitlements of workers as social actors, which enhances the quality of their employment". In his study, Sen (2000) defined it as the process of enhancing workers' rights and improving the quality of their employment, through access to better work that may result from economic upgrading and the improvement of working conditions, protection and rights. According to Barrientos, Gereffi and Rossi (2011), social upgrading encompasses both quantifiable aspects of worker well-being, such as employment, wages, skill upgrading and labour conditions, as well as qualitative factors like freedom of association, human dignity, non-discrimination and harassment.

It is worth mentioning that measures of social upgrading in the context of GVCs go beyond just skilled worker outcomes. There are several dimensions of social upgrading that are often considered: Working conditions, which include factors such as wages, working hours, training provided, safe and healthy working environments, and job security; Labour rights, which refers to the protection and promotion of workers' rights, involving freedom of association, collective bargaining, and protection against discrimination and child labour; Gender equality, an important dimension of social upgrading, which entails addressing gender-based discrimination, promoting equal opportunities and addressing gender pay gaps. By addressing these various dimensions of social upgrading, global value chains have the potential to contribute to more inclusive and sustainable development, ensuring wider and equitable benefits (Bernhardt and Pollak, 2016; International Labour Organisation (ILO), 2015).

Whilst most of the available literature has focused on GVCs and their relationship with firm performance, less attention has been paid to analysing the effects on social upgrading. This paper relies on two main strands of the empirical literature. The first one focuses on the effect of GVCs on skill upgrading and the second one is related to the effects of GVC participation on working conditions. Theoretical and empirical evidence reveals how GVCs can promote the demand for skilled labour and increase their relative wage, compared to unskilled labour (Feenstra and Hanson, 1996; Acemoglu, 2003). Feenstra and Hanson (2003) explained that GVC integration promotes the demand for highly

skilled workers, not only in developed countries but also in developing countries, thanks to technological change. They point out that since developing countries are trapped in lower end production stages, they need to introduce more advanced foreign technology to upgrade and, accordingly, this will increase the demand for better management and boost the demand for highly skilled workers.

Additionally, several empirical studies find evidence consistent with this model. Chen et al. (2007), Ma et al. (2019), Ehab and Zaki (2021), and Shen and Zheng (2020) explain a positive effect of GVCs on the relative demand of skilled workers. Chen et al. (2017), using firm-level data in China, argue that trade liberalisation increases the skill premium, with a higher share of skilled workers due to "skill complementarity". Similarly, Ma et al. (2019) explain that a rise in the GVC position in developed countries will have a positive and direct effect on highly skilled labour, which induces a great demand for highly skilled workers in developing countries. In the same vein, Ehab and Zaki (2021) by examining the effect of GVCs and service liberalisation on skill upgrading, using firm-level data from the World Bank, found that GVC integration is positively associated with skill-upgrading, which is more pronounced when trade in services is liberalised. Moreover, Shen and Zheng (2020) by focusing on the largest countries integrated at the lower end of value chains, such as China, discovered that low-end integration has a negative impact on skill-based technological change due to low skilled technology, low skilled activities and a lack of skilled workers for highly skilled industries.

Furthermore, evidence shows that women represent a large share of labour-intensive value chains. In sectors most intensively traded in GVCs, female workers account for the largest share of employment. Over 70 percent of labour forces in the Kenyan and Ugandan firms involved in GVCs are women. In Bangladesh, women made up around 80% of the garment industry workforce (Kumar, 2017). However, involvement in GVCs does not guarantee gender equality. Gender disparities in GVCs can take many different forms and have many different causes. In fact, gender segregation exists both between and within sectors. In their paper, Barrientos, Gereffi and Rossi (2011) address the issue of gender and discover that it plays a prominent role in global value chains. Gender determines specific roles within value chains; particular positions, jobs and fields of work differ between men and women. Compared to men, women are more likely to work in the most disadvantaged networks and in the lower value-added parts of value chains, receiving lower wages and experiencing unfavourable working conditions (Bamber and Staritz 2016). The disadvantages that women frequently face, in terms of education, experience and social capital, make it challenging for them to get better jobs that come with joining GVCs. This seemed to be the case in Egyptian call centres, where women found it difficult

to take advantage of the increased demand for higher technical skills, due to their limited access to education, training, promotion and networks (Ahmed 2013).

On the other hand, theoretical and empirical studies on the effect of GVCs on working conditions are not abundant. This notion, promoted by the ILO as the concept of "decent work" includes both measurable labour standards, such as wages and non-measurable factors. It is important to note that wages are an insufficient indicator of working conditions in the broader sense (Bernhardt & Pollak, 2016). Positive factors, like labour rights, receiving training and empowerment must be taken into account. Several authors have adopted this broader perspective, including Lee, Gereffi & Lee (2016), Bair & Gereffi (2003), and Rossi (2013). These authors focus on quantifiable labour standards such as wages, work environment, enabling rights, social security, safety conditions, exploitation of workers and compliance with local labour laws.

Even whilst empirical data is still in its early stages and the effect of GVCs on working conditions remains anecdotal, evidence is beginning to emerge. On one side, GVCs have the ability to generate new employment opportunities for a marginalised workforce, enables the inclusion of discriminated groups, like women, and may increase wages via the productivity channel. On the other side, the globalisation of production might create some pressure to reduce labour costs, which usually entails worse working conditions and less respect for labour standards and regulations, depending on the country's comparative advantage (Plank, Rossi & Staritz, 2012). Therefore, the literature suggests a mechanism by which participation in GVCs affects working conditions in a country or an industry. It is linked to participation in Preferential Trade Arrangements (PTAs), leading to the introduction of specific labour standards, primarily in developing countries. In their analysis of how NAFTA has affected firms and workers for the garment industry in the United States, Mexico and the Caribbean, Bair & Gereffi (2003) discovered that the agreement has contributed to creating opportunities for upgrading in some Mexican firms, as well as improving working conditions at the firm level.

Some empirical findings have confirmed a positive relationship. For instance, Bair and Gereffi (2003) reveal an enhancement in labour conditions in Torreon in Mexico. In their study of the Vietnamese garment and textile industry, Nadvi et al. (2004) discover that inclusion in GVCs has a positive impact on productivity and wages in textile firms. However, another set of studies concludes that economic upgrading (benefiting firms in terms of productivity) does not always translate into social upgrading for workers, which is consistent with the ILO Decent Work Agenda, in the sense that economic upgrading within GVCs may even be accompanied by a deterioration in working conditions, as the

relocation of production in labour-intensive sectors may be driven by low wages and worse employment conditions (Barrientos, Gereffi & Rossi, 2011; Plank, Rossi & Staritz, 2012; Nikulin et al., 2019).

Therefore, this study aims to explore the nexus between the GVC participation of firms and its implications on social upgrading in developing countries, which is mostly seen through the effects of involvement in GVCs on skill upgrading and working conditions of employment. The objective of this paper is to propose a better understanding of the relationship between social upgrading and global value chain participation in developing countries. In order to study this relationship, a micro, firm level analysis will be performed based on a recent panel of firm level-data from the World Bank, by analysing a panel of 84,191 firms that are active in 117 developing countries.

This paper contributes to the literature in several ways. First, the paper will try to reduce the gaps in the available literature, since there is little direct empirical work on the socio-economic effects of GVCs. Hence, it will provide a micro, firm level analysis on GVCs in developing countries. Second, this study addresses the shortcomings in the literature, by focusing on different outcomes and providing different measures of social upgrading. The latter is captured not only by skill upgrading but also by working conditions indicators. These measures matter from a GVC perspective. Conceptually and economically, it is important to focus on developing countries that might deteriorate labour conditions, in the sense that they exploit cheap labour, do not seek higher skilled labour, or might rely on female workers who are paid less and are more likely to be located in lower value-added components of value chains. Therefore, the paper is attempting to study industry specifications, by examining whether GVCs exert a differential effect in specific sectors.

Furthermore, this research attempts to deal with selection bias and causality issues, by performing Propensity Score Matching and difference-in-differences techniques. By combining the two methodologies, it is then possible to allow for self-selection owing to some unobservable characteristics, under the assumption that these are constant over time. To this aim, the available World Bank Enterprise (WBES) panel surveys will be used. The main findings suggest that GVC participation is associated with skill upgrading and better working conditions. Moreover, this positive effect is more pronounced when GVCs are involved in capital intensive sectors. At the same time, this effect is negative in the garment and textile sectors. The paper also shows gender neutral results, except for the garment and textile sector and for highly skilled firms, which appear to exert a negative effect on the share of female skilled labour. Finally, the effect of GVCs is more evident for initially highly skilled firms.

The paper is organised as follows. Section 2 describes the data sets used in the analysis and presents some stylised facts and preliminary evidence. Section 3 presents the empirical framework and investigates econometrically the relationship between GVC participation, skill upgrading and working conditions. Section 4 discusses the main results. Robustness checks are provided in section 5. Finally, section 6 provides the conclusion.

2 Data and Stylised Facts

2.1 Data

This micro, firm level analysis will be performed, based on a recent panel of firm-level data from the World Bank Enterprise Surveys (WBES), by analysing a panel of 84,191 manufacturing and service firms active in 117 developing countries, covering the period 2006-2020. The sample of countries is presented in Appendix, Table 8. It is composed of East Asian & Pacific countries (which account for 12.8% of the firm sample), European & Central Asian countries (25.1%) , Latin American countries (20.5%), Middle East & North African countries (10.5%), South Asian countries (14.7%) and Sub-Saharan African countries (16.4%).

Moreover, in order to account for firm fixed effects, these surveys are harmonised to construct a panel dataset that comprises 15,334 firms from 70 developing countries, between 2006 and 2020. The surveys provide information on the characteristics of firms across various dimensions, including sales, value added, output, size, trading status, workforce, ownership, performance, etc. Moreover, it covers the manufacturing and service sectors, such as garments, textiles, food, wood and paper, rubber and plastics, metals and mechanical, transport, chemicals, electronic industries and leather, retail, construction, transport, hotel and restaurants, and IT services (World Bank, 2020).

Given that the WBES includes information on exporting and importing firms, firms that are foreign owned and have international quality certification, this allows us to construct different measures of GVCs. The evidence suggests that internationalised firms are likely to be involved in complex fragmented activities. Firms in developing countries are likely to receive a certification when they have to meet particular reliability and quality requirements. Accordingly, firms involved in GVC activities can be identified as international traders who received an internationally recognised quality certification, in

line with Nadvi (2008), Beghin et al. (2015), Del Prete et al., (2018) and Dovis and Zaki, (2020).

This paper investigates the effect of GVC participation on social upgrading, which is captured by different measures. First, skill upgrading is measured as the proportion of skilled workers (the share of non-production full-time workers over the total number of full-time workers, as well as the share of non-production full-time workers over production full-time workers, where the number of non-production workers is used as a proxy for the number of skilled workers). In addition, it is measured as the relative demand for women skilled labour (the share of non-production full-time female workers over the total number of full-time workers and the ratio of non-production, full-time workers that are female and non-production, and full-time workers that are male). Finally, given data availability, two variables are used to capture working conditions: Total labour cost per worker (which includes wages, salaries, bonuses, etc.) and firms offering formal training programmes for permanent, full-time workers.

Concerning GVC measures, the Dovis and Zaki (2020) definition is adopted, suggesting that GVC firms are exporters, importers, receive internationally recognised certification and have a share of foreign capital. Furthermore, size is measured as the number of workers; age is calculated by taking the logarithm of the difference between the date of the most recent available survey (2020) and the year when the establishment started operations. Industries are classified as two-digit ISIC rev 3.1 activities. Human capital is the ratio of skilled workers to total number of workers.

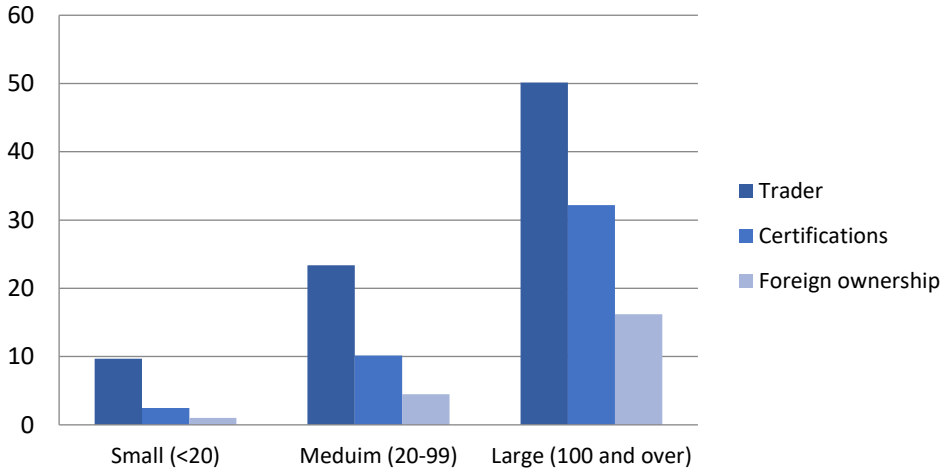
The main summary statistics for the firm-level variables employed in the empirical analysis are reported in Appendix, Table 9. Two-way traders account for 25% of the sample. Firms that receive an international certification represent 12.5% of the sample. Moreover, foreign-owned firms account for 6% of the sample, where foreign owned firms are defined as firms that are more than 10% controlled by a foreign company or organisation. Finally, 3.5% are engaged in two-way trade, have a share of foreign ownership and receive an international certification.

Stylised Facts

This part provides some stylised facts on the relationship between Global Value Chains (GVC) participation, skill upgrading and working conditions. According to the World Bank report (2020), around 60% of the international trade is performed through GVCs, which have immensely increased during recent years, particularly for developing countries that are increasingly engaged in international production networks. At the firm-

level, the share of traders tends to increase with the size of firms, as shown in Figure 1. This finding is in line with the heterogeneous firm literature, where large, international firms perform comparatively better because they tend to access more productive markets. Figure 1 also illustrates that, unsurprisingly, larger firms are more likely to be both foreign-owned and internationally quality certified. Hence, quality certifications ensure that a firm can meet the international quality standards necessary for vertically fragmented production processes (Beghin et al., 2015). Larger companies in the sample are also more likely to have foreign capital, receive international certification and engage in two-way trade. Furthermore, larger firms in the sample have a greater probability of having a foreign capital, receiving an international certification and having two-way trade activity.

Fig.1 Shares of traders, certified firms and foreign owned firms by size



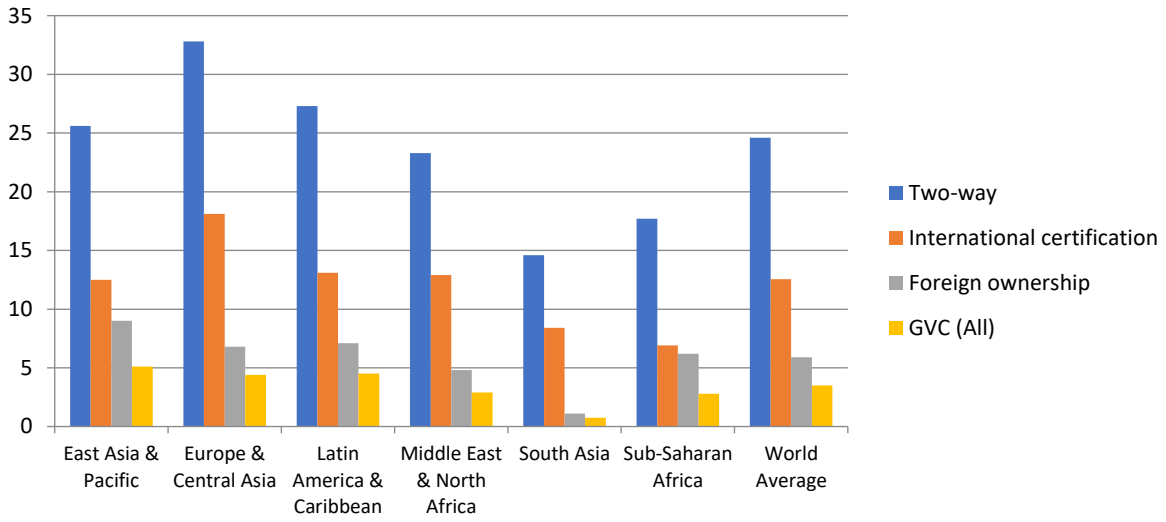
***Source**: Author's elaboration based on WB Enterprise Surveys.*

On the other hand, Figure 2 provides statistics on the different dimensions of GVCs. As shown, on average, 3.5 percent of firms at the world-level are two-way trading firms with a foreign ownership and an international certification, which indicates that some barriers exist that keep firms from taking part in GVCs in the majority of regions. In other words, they could prevent firms from obtaining international certification or foreign capital or even both. A closer examination reveals that only 12.54% of firms in the world are two-way traders that have an internationally recognised certification. This share is highest in Europe and Central Asia (18.1%) compared to the world average, with the Latin

America and MENA regions (13.1% and 12.9%, respectively). Moreover, according to Figure 2, the share of firms having foreign capital is 5.9% at world level. In East Asia & the Pacific, the share of firms that have foreign capital (9%) is above the world average and the highest amongst all regions. For Latin America, Europe & Central Asia and Sub-Saharan Africa, this share is slightly above the world average (7.1%, 6.8% and 6.2%, respectively). It is worth noting that South Asia presents the lowest share of two-way traders that have internationally recognised certification (8.4%), as well as firms having foreign capital (1.98%), which could be an indication that there are obstacles preventing foreign capital accessing the region.

Furthermore, it is important to disentangle the sectoral dimensions of GVC participation. Figure 3 shows the contribution to GVCs within the first seven sectors, according to their export volumes. In particular, in all regions, Food, Garment & Textile, and Machinery & Equipment are the most GVC integrated sectors. The Latin America and MENA regions demonstrate a high level of participation in the Food sector (16% and 19%, respectively), whilst East Asia & Pacific, as well as Europe & Central Asia are relatively more involved in the Machinery and Equipment sector (21% and 14%, respectively). However, the Garment and Textile sector highlights greater GVC involvement in the South Asia and MENA regions (with around a 17% and 18% share).

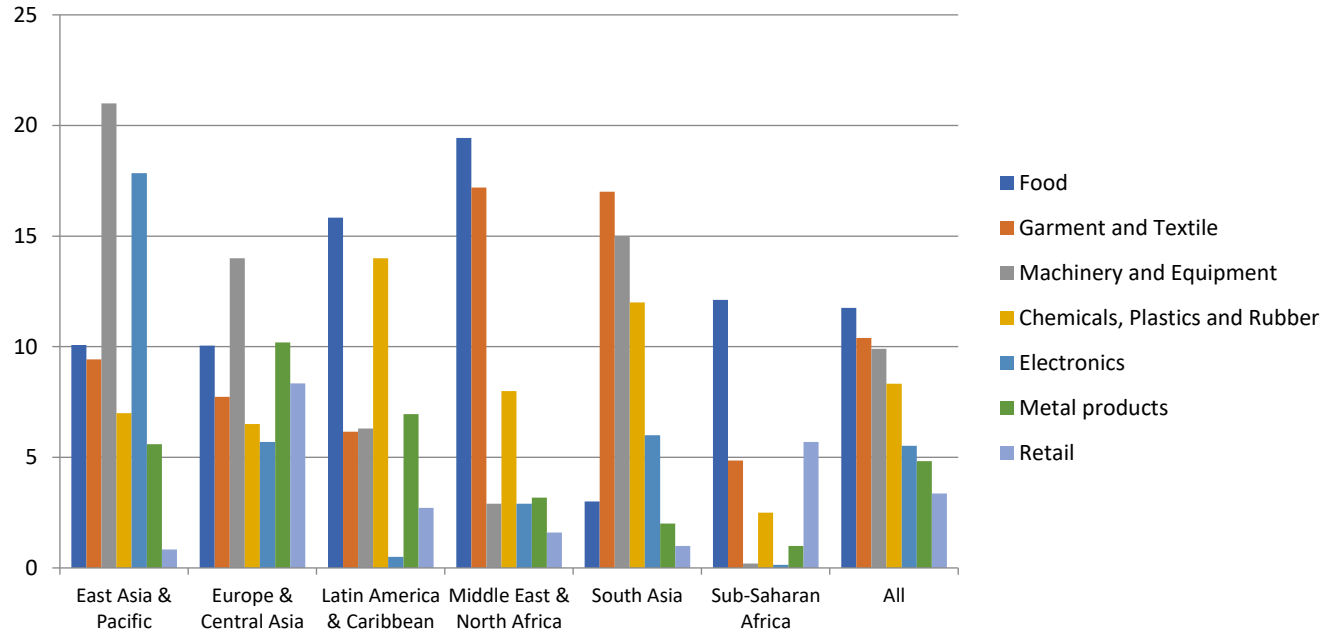
Fig.2 GVC characteristics (Different definitions by region)



***Source**: Author's elaboration based on WB Enterprise Surveys.*

Note: Firms integrated in GVCs are those who export, import, receive an internationally recognised certification and are foreign owned.

Fig.3 Sectoral GVC participation (by region)



***Source**: Author's elaboration based on WB Enterprise Surveys.*

Focusing on the idea behind the empirical strategy, the share of skilled labour is positively associated with the integration in GVCs, as shown in Table 1. Across the sample, GVC firms show higher shares of skilled workers compared to domestic firms, which indicate a positive association between the fragmentation of production and skill upgrading. This is explained by the fact that participation in GVCs allows countries to have access to new technologies and advanced production techniques, resulting in a spillover effect on the demand for skilled labour (Ma et al., 2019). Furthermore, descriptive statistics show that domestic firms exhibit lower shares of female skilled labour. Finally, any examination of the social upgrading of GVC participation must take into account the working conditions, which are captured in this study by the total labour cost per worker and the formal training programmes offered by the firm. Table 1 describes the positive association between GVC participation, receiving formal training programmes and total labour cost per worker. In fact, firms that export, import, have foreign capital and international certifications are more likely to offer formal training programmes to their workers. On average, the probability of receiving a firm training programme doubled when

the firm is a part of a GVC (it increases from 34.6% to 72.6%). Similarly, total labour cost per worker (covering wages, salaries and bonuses etc. per employee) is higher amongst firms that participate in GVCs, compared to domestic firms.

Table 1 social upgrading measures by GVC participation

	Share of skilled labour	Share of skilled labour/Unskilled	Share of skilled female labour	Share of skilled female/male	Total labour cost	Receiving formal training programmes
Domestic firms	25.7	49.2	8.9	35.5	11.5	34.6
Firms in GVCs	27.5	60.5	10.3	41.3	12.0	72.6

***Source**: Author's elaboration based on WB Enterprise Surveys.*

Note: The share of skilled labour is measured as the ratio of non-production full-time workers and the total number of full-time workers. Non-production worker is used as a proxy for skilled workers. Firms in GVCs are firms that export, import, have an international quality certification and foreign capital.

3 Methodology

To directly assess the effect of GVC participation on skill upgrading and working conditions, first, we look at the results when the OLS estimator is used by including country, industry and year dummies; second, a Propensity Score Matching (PSM) and a difference-in-differences method are used. The participation of firms in the international fragmentation of production is likely to be driven by a series of ex-ante characteristics (such as employment and capital). Therefore, the main identification problem in assessing the effect of GVC participation is selection bias, caused by the fact that participation is non-random - GVC firms may be different from other firms, in terms of characteristics that influence participation decisions.

In order to address this selection bias problem, a set of observable comparable covariates is required to compare similar participants and non-participants. Consequently, the Propensity Score Matching (PSM) estimator will be the first step of the empirical methodology (Rosenbaum and Rubin, 1983). The PSM method is implemented

by defining a control group using information from the observable characteristics, which refers to domestic firms with similar characteristics to GVC firms. However, it is worth mentioning that some unobservable characteristics are likely to play a role in the selection of GVCs. Hence, a difference-in-differences method is performed to control for this bias associated with unobservable time-invariant characteristics. This approach basically relies on a less restrictive assumption, which indicates that unobserved differences between the treated and the non-treated groups are time invariant. The analysis is performed by combining the two methodologies. First, apply PSM to find firms that were identical before GVC participation i.e., non-treated firms, similar to the treated ones before the treatment. Second, perform the difference-in-differences method to estimate a counterfactual for the change in outcomes in each group of matched firms (Caliendo and Kopeinig, 2008; Del Prete et al., 2018).

A PSM[2] technique should include a set of firm-level control variables Z_{it},, and take into account the sector of the firm. Z_{it}, and include firm age and size to control for the ex-ante characteristics of the firm. It is noted that firms are matched based on their Z_{it} characteristics observed in first year, whilst the propensity scores are estimated by a probit model. Based on the literature on GVCs, the research aims to access the effect of GVC participation on skill upgrading and working conditions, as follows:

$$Y_{i,j,s,t} = \beta_0 + \beta_1 \mathrm{GVC}_{\mathrm{i,j,s,t}} + \beta_2 X_{\mathrm{i,j,s,t}} + \delta_{\mathrm{j}} + \delta_{\mathrm{s}} + \delta_{\mathrm{t}} + \varepsilon_{\mathrm{i,j,s,t}} \quad (1)$$

With i, j, s and t respectively, the firm, the country, the industry and the year. Where $Y_{i,j,s,t}$ is the dependent variable covering the proportion of skilled workers, relative demand for women skilled workers and working conditions of firm i ; $\mathrm{GVC}_{\mathrm{i,j,s}}$:1 for treated group firms, i.e., the firm is a trader, has an internationally-recognised quality certification and has a share of foreign owned capital, which is our proxy for GVC involvement; $X_{\mathrm{i,j,s,t}}$ is the firm age and size[3], a variable that is expected to influence the dependent variable; δ_j and δ_s terms represent the country and industry fixed effect respectively, in order to take into account time invariant country-specific and industry-specific characteristics. Moreover, year dummies (δ_t) are included to allow for common shocks within the

[2]Specifically, a Kernel PSM-DiD estimation is performed. The Kernel matching identifies the counterfactual, using weighted averages of all control units within the common support, with the major advantage that all the available information is exploited.

[3] Firm size is captured by three dummy variables: small firms (less than 20 employees), medium firms (between 21 and 99 employees) and large firms (more than 100 employees).

firms. $\varepsilon_{i,j,s,t}$ is the error term and β_1 is the coefficient of interest. It is worth mentioning that all the empirical equations are also estimated using firm fixed effects, allowing us to control for firm-level time invariant heterogeneity.

In addition, the effect of GVC participation may depend on a specific sector or a particular firm's activity. An additional dummy variable is included, which is S_i: a sector specific variable:

$$Y_{i,j,s,t} = \beta_0 + \beta_1 \mathrm{GVC}_{i,j,s,t} + \beta_2 \mathrm{GVC}_{i,j,s,t} \times S_i + \beta_3 X_{i,j,s,t} + \delta_j + \delta_s + \delta_t + \varepsilon_{i,j,s,t} \quad (2)$$

Based on the same notation as in equation (1), the coefficients $\beta_1 + \beta_2$ represent the coefficients of interest.

Finally, in order to examine empirically whether this specification is robust to sample composition effects based on initial human capital levels[4], an additional dur (3) variable is included in the model, W_i:

$$Y_{i,j,s,t} = \beta_0 + \beta_1 \mathrm{GVC}_{i,j,s,t} + \beta_2 \mathrm{GVC}_{i,j,s,t} \times W_i + \beta_3 W_i + \beta_4 X_{i,j,s,t} + \delta_j + \delta_s + \delta_t + \varepsilon_{i,j,s,t}$$

The variable W_i is a dummy equal to 1 if firms' human capital level is above the pre-treatment median, in order to capture firms that initially have higher human capital levels. In other words, in order to study the heterogeneous effect of GVCs, the sample is divided into two sub-groups, according to the median value of the share of skilled workers. Hence, W_i captures high human capital firms (a dummy equal to 1 if the firm's share of skilled labour is equal or greater than the median share of skilled labour, and 0 otherwise).

4 Results

4.1 Empirical results – Whole sample

According to the empirical specification, a PSM is applied to find non-treated firms that are similar to the treated ones before the firm entered into a GVC, based on a set of observable covariates Z_{it}. Results for the common support condition are reported in Figure

[4] Human capital is the ratio of skilled workers to total number of workers.

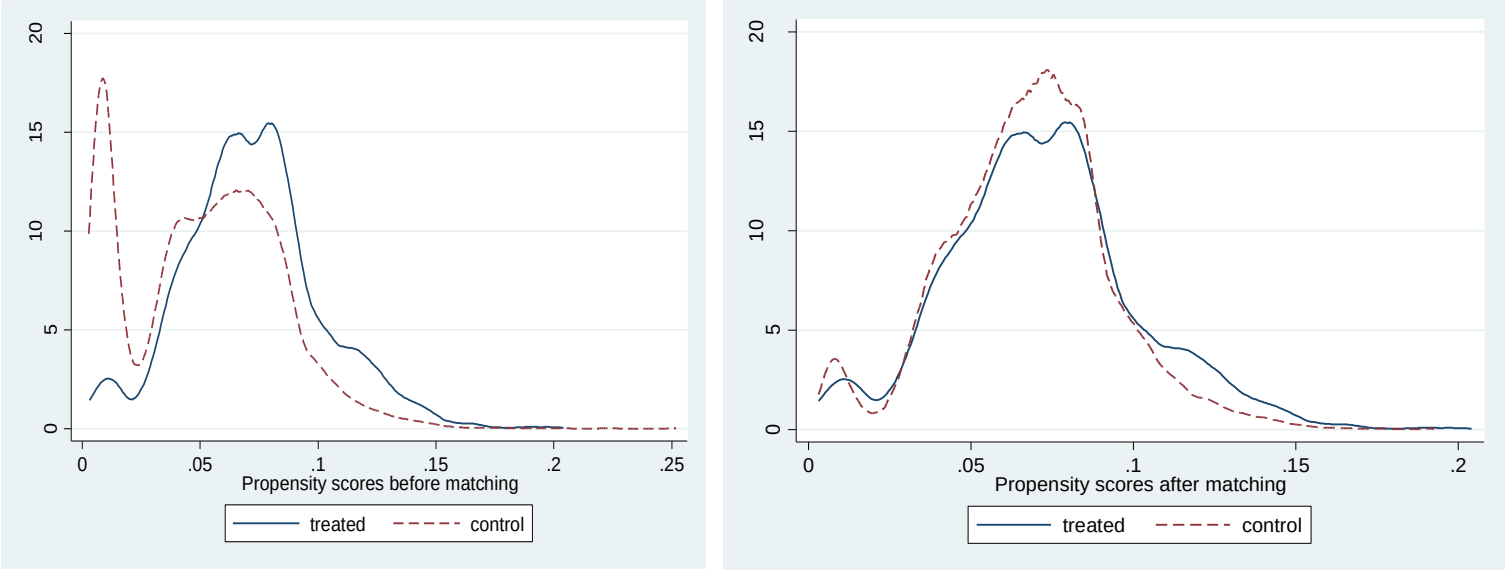
4 and Figure 5 in Appendix. Figure 5, which illustrates the propensity scores distribution between treated and control groups, shows that the two groups are well balanced with respect to the propensity score. Prior to matching, some non-overlapping areas are observed, however, after matching, a reasonable overlap is created in the propensity score distribution, as Fig. 4 displays.

This section presents the results of the effect of GVC integration on skill upgrading and working conditions. Table 2 confirms the prediction that becoming a two-way trader, having foreign capital and an international quality certification has a positive impact on skill upgrading. The results of columns 1 to 4 show that GVC integration is associated with skill upgrading. Along the different models, we find that the effect of GVC participation is positive; the coefficient of interest is positive and significant at the 1% significant level. The coefficient of the share of skilled labour is 0.061 with country, sector and year dummies, and 0.085 with firm and year fixed effects. The results support the baseline findings when skill upgrading is measured as the relative demand of non-production and production workers (columns 3 and 4). Moreover, the empirical results for the panel sample are robust and in line with the results when the OLS estimator is used by including country, industry and year dummies.

In term of magnitude, on average, compared to domestic firms, GVC participation is associated with a 6.1% increase in the share of skilled workers in the whole sample. For the panel sample, columns 2 and 4, presenting the results of the PSM and diff-in-diff estimation[5], confirm that being part of a GVC has a significant positive effect on skill upgrading. The results indicate that GVC firms are 8.5% more likely to increase their share of skilled labour compared to domestic firms. In other words, by joining a GVC, firms have a higher probability of increasing their share of skilled labour. This is in line with Shepherd and Stone (2012), who find a positive significant relationship between the number of skilled workers and firms with international linkages (that are two-way traders and foreign owned).

[5] Errors are clustered by country, year and sector in order to correct for the potential correlation between unobserved components within clusters.

Fig.4 Propensity Score Matching Common Support



***Source**: Author's elaboration based on STATA output.*

Note: Balance plot which reports the kernel density estimates of the propensity scores before and after matching of treated (Firms in GVCs) and untreated (Domestic firms).

The findings are in line with firm-level studies which demonstrate that participation in GVCs fosters skill upgrading through three main channels: The first channel is through productivity, where GVC integration increases a firm's access to a wider variety and more efficient intermediate inputs that are necessary in the production process. The development of foreign technology provides a second avenue for skill upgrading. Due to the complementarity of skills, technology transfer in imported inputs raises the demand for skilled workers. In other words, firms may share know-how and technology with suppliers because such sharing boosts their sales and productivity. Finally, GVC participation enables firms to expand their markets, which raises the demand for better management and improves a firm's productivity. Participating in GVCs will, therefore, raise firm performance by generating positive spillovers from technological advancement, quality improvement and economies of scale (Acemoglu, 2003; Del Prete et al. 2018; and Rigo 2020).

Furthermore, it is important to shed light on the share of female skilled workers and to examine whether GVCs are associated with a rise or a decline in the ratio between

female and male skilled labour. On one hand, column 5 shows that GVCs may be associated with an increase in the overall number of female skilled labour, the coefficient is positive, yet statistically significant only in the case of the whole sample. On the other hand, by including the share of skilled females to skilled males, columns 7 and 8 show no gender effect. The results show that regardless of the measure of the gender variable, the coefficients are statistically insignificant (with country, year and sector dummies or with firm fixed effects).

As explained, social upgrading is a complex concept, with interrelated dimensions which are not limited to skill upgrading measures. Therefore, we are looking into whether GVC participation may affect the working conditions of workers. Two main measures are calculated to capture the working conditions in the sample; first, total labour cost per worker and second, formal training programmes offered by the firm. Columns 9 to 12 reveal that GVC integration is associated with better working conditions in general. In columns 9 and 10, the coefficients of interest are positive and significant (0.39 and 0.35, with 1% significance level). On average, compared to domestic firms, GVC participation is associated with a 39% increase in total labour cost per worker, across the whole sample. Taking into account firm fixed effects, firms that participate in GVCs are 35% more likely to increase the total labour cost per worker. In other words, the fact of being involved in the GVC positively affects total labour cost per worker. Moreover, results show that workers in firms involved in GVCs are more likely to obtain formal training programmes, which could be seen as a positive sign of labour standards (Columns 11 and 12). The coefficients of interest are equal to 0.18 and 0.14, indicating that firms, after joining the GVC, have a higher probability of receiving formal training programmes; this effect is statistically significant at 1% level.

These findings are in line with the theoretical and empirical evidence. According to the literature, two main arguments serve to explain the results. One is linked to participation in Preferential Trade Arrangements that require the introduction of certain labour standards, mainly in developing countries (Plank, Rossi & Staritz, 2012; Kamata 2014; Bair & Gereffi 2003). The second mechanism operates via the productivity, where social upgrading and economic upgrading should go hand in hand. Economic upgrading consists of an increase in productivity; accordingly this increase in marginal labour productivity will be associated with higher wages and, hence, better living standards for workers (Better Work, 2015; Nadvi et al., 2004).

Moreover, the control variables have the expected signs. The firm's age is positively associated with the share of skilled workers. According to the theoretical predictions on the "capital skill complementarity" mechanism, which produce evidence that capital is

relatively more complementary to skilled labour than to unskilled labour, older firms are more capital intensive than newly founded firms; and as a result, they need a higher share of skilled labour (Damanpour, 2010). Regarding the effect of the firm's size, medium and large firms appear to have a lower share of skilled workers; this can be explained by the fact that smaller firms tend to be more innovative and flexible. Yet, compared to smaller firms, larger ones would have more stringent bureaucratic and less flexible organisational structures, limiting their ability to innovate and be more adaptable. This is consistent with the findings of Dean et al. (1998) and Ehab and Zaki (2021).

Table 2 Baseline equation

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable:	**Skill/Emp.**	**Skill/Emp.**	**Skill/Unskill**	**Skill/Unskill**	**Female skill**	**Female skill**
GVC	0.0606***	0.0853**	0.0892***	0.0997**	0.0529***	0.0502
	(0.0157)	(0.0354)	(0.0224)	(0.0504)	(0.0200)	(0.0484)
Medium	-0.195***	-0.265***	-0.235***	-0.346***	-0.519***	-0.468***
	(0.00704)	(0.0361)	(0.00978)	(0.0532)	(0.0101)	(0.0353)
Large	-0.373***	-0.427***	-0.444***	-0.525***	-0.918***	-0.819***
	(0.0127)	(0.0461)	(0.0165)	(0.0683)	(0.0172)	(0.0489)
Age (ln)	0.0487***	0.0392**	0.0663***	0.0609**	0.0436***	0.0149
	(0.00678)	(0.0167)	(0.00919)	(0.0254)	(0.00854)	(0.0273)
Constant	-1.479***	-1.294***	-1.154***	-0.905***	-1.966***	-1.890***
	(0.0213)	(0.0723)	(0.0294)	(0.114)	(0.0273)	(0.0999)
Country & sector dummies	Yes	No	Yes	No	Yes	No
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	No	Yes	No	Yes	No	Yes
Observations	75,531	14,042	75,155	13,956	49,957	9,410
R-squared	0.153	0.531	0.145	0.540	0.283	0.631

	(7)	(8)	(9)	(10)	(11)	(12)
Dep. Variable:	Female/Male Skill	Female/Male skill	Total labour cost/Emp.	Total labour cost/Emp.	Training programmes	Training programmes
GVC	-0.0117	-0.0285	0.393***	0.350***	0.176***	0.143***
	(0.0161)	(0.0452)	(0.0321)	(0.0862)	(0.00948)	(0.0248)
Medium	-0.275***	-0.206***	0.142***	-0.0723	0.145***	0.105***
	(0.00882)	(0.0299)	(0.0182)	(0.110)	(0.00489)	(0.0253)
Large	-0.468***	-0.406***	0.218***	-0.0930	0.331***	0.269***
	(0.0161)	(0.0415)	(0.0278)	(0.146)	(0.00735)	(0.0314)
Age (ln)	-0.0134*	-0.0421*	0.0689***	-0.0251	0.0231***	0.0247**
	(0.00689)	(0.0229)	(0.0165)	(0.0489)	(0.00408)	(0.0121)
Constant	-0.571***	-0.560***	11.25***	11.57***	0.148***	0.215***
	(0.0218)	(0.0825)	(0.0572)	(0.246)	(0.0131)	(0.0531)
Country & sector dummies	Yes	No	Yes	No	Yes	No
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	No	Yes	No	Yes	No	Yes
Observations	49,873	9,395	70,012	12,268	78,721	14,473
R-squared	0.180	0.541	0.779	0.841	0.215	0.530

***Source**: Author's elaboration based on STATA output.*

Notes: (i) GVC is a dummy that takes the value of 1, if the firm is part of a GVC and zero otherwise. Firms integrated in GVCs are firms that export, import, have international quality certification and foreign capital. (ii) Robust standard errors in parentheses. (iii) *** p<0.01, ** p<0.05, * p<0.1 (iv) OLS Regressions include country, year & sector dummies (Columns (1), (3), (5), (7), (9) and (11)). (v) Standard errors are clustered by country, year and sector. (vi) Columns (2), (4), (6), (8), (10) and (12) display the results using a PSM and diff-in-diff technique, when firm fixed effects are accounted for, with robust standard errors clustered by country, year and sector.

4.2 Empirical results by sector

It is worth mentioning that the effect of GVCs on social upgrading may depend on firms' involvement in a specific industry. Hence, to examine if the GVC effect depends on a certain sector, the study will focus on the three sectors that are more integrated into GVCs: garment & textile, food, and machinery & equipment. After creating an interaction variable, the results on social upgrading suggest that the effect of GVCs differs by sector.

In the garment and textile sector, the results reveal a strongly negative significant effect of GVC participation on the share of skilled workers, with an overall effect of -0.189 and -0.239 significant at 1% level (columns 1 and 2, in Table 3). More precisely, GVC participation for two-way traders, having international quality certification and being foreign owned, is associated with a 19% decrease in the share of skilled workers. Columns (2) and (4), which display the results when firm fixed effects are accounted for, imply that firms joining GVCs have a 24% and 30% greater probability of reducing their share of skilled labour, respectively. Looking at the total labour cost per worker, the coefficients of the interaction term in the garment and textile sector are negative and significant. The effect of GVCs on training programmes is found to be insignificant. As for the machinery and equipment sector, the effect of GVCs on social upgrading measures is positive and statistically significant. Results show that being part of this sector will amplify the effect of GVC integration. Meanwhile, the effects of GVCs in the food sector are statistically insignificant, which indicate the absence of any additional effect (Tables 10 and 11 in Appendix).

Interestingly, according to this sectoral evidence, GVC participation in the textile and garment sector is strongly correlated with a social downgrading, skill downgrading and poor working conditions. This issue is particularly associated with labour intensive and more traditional sectors, where outsourcing to developing countries is frequently driven by lower labour costs. These results are in line with the literature and consistent with the definition of a GVC, where strategic specialisation plays a key role. Accordingly, sectors are engaged in different stages of a GVC. It is worth remarking that the variations in the effect of GVCs on social upgrading may be explained by the position of the firm in a certain industry. The stringent standards and quality certification requirements that are common in GVC integration enforce compliance costs which are more challenging for smaller firms to bear. Thus, firms may find themselves locked out of this production fragmentation or at the bottom of the value chains, which is associated with the production of raw materials and basic inputs.

With regards to the gender dimension, coefficients of the share of skilled females over skilled male workers are statistically insignificant. In contrast to previous findings, the effect of GVC integration on the share of female skilled workers seems to be negative and significant for the textile and garment sector. Columns 5 and 6 in Table 3 reveal negative and statistically significant effects - equal to -0.16 with country, year and sector dummies and -0.22 with firm fixed effects. This shows that GVCs are associated with female skill downgrading in this sector. These quite remarkable results concur with other studies, which have shown that the gender effects of global value chains (GVC) are complex and multifaceted. On the one hand, GVCs can provide women with employment opportunities. For example, in the garment and textile sector, women constitute the majority of the workforce. On the other hand, GVCs can sometimes lead to the exploitation of female workers and the perpetuation of gender inequality. This is particularly true in the garment and textile sector, where the workforce is predominantly female. Female workers in these industries are often concentrated in low-skilled and low-paying jobs, which can limit their access to higher-skilled roles and opportunities for advancement within the value chain (Barrientos, 2019; ILO, 2015; Posthuma and Rossi, 2017; and Staritz and Reis, 2013). In other words, the gender gap is particularly pronounced in the garment and textile sector, which relies on a gendered division of labour. Even though women make up more than half of the workforce in this sector, only a few of them are skilled workers. In this industry, women typically hold lower-skilled jobs and contribute mainly to primary production, compared to their male counterparts who work in higher value chains (World Bank, 2020).

As the integration into GVCs may affect the indicators of social upgrading in different ways, sectors are aggregated into two main categories: labour intensive and capital-intensive sectors[6], in order to examine if a GVC exerts a differential impact on them. The results suggest that capital intensive sectors have a statistically significant positive effect. Table 4 shows that being part of a capital-intensive sector will amplify the positive effect of GVC participation on skill upgrading, with coefficients equal to 0.10 and 0.12 (Table 4, columns 1 and 2), as well as the share of female skilled labour (column 5) and training programmes (columns 11 and 12). On the other hand, labour intensive sector results illustrate negative significant coefficients. In summary, results suggest that GVC

[6] Labour intensive and capital intensive sectors' definitions are based on the paper of Gordon H.Hanson (2020), "Who will fill China's shoes? The Global Evolution of Labour-Intensive Manufacturing".

participation has a positive effect on social upgrading, which is more pronounced when firms are part of a capital-intensive sector.

Consistent with this finding, the World Bank Report (2020) suggested that costs of capital are relatively low for GVC firms, since they have easier financial access and foreign equipment and machinery. Therefore, GVC firms in developing countries typically implement more capital-intensive techniques, in order to increase productivity and achieve a higher level of scale, by providing high quality output and the precision required in the production processes. Through the positive productivity and scale effects, firms involved in capital-intensive sectors of the value chains tend to demand more skilled labour. Moreover, capital-intensive sectors contribute to an increase in the relative demand for skilled labour; due to "capital skill complementarity" they require a significant amount of investment in fixed assets, especially capital equipment, which is less substitutable with skilled labour than with unskilled labour (Griliches, 1969).

Table 3 Testing sector-specific effect of Garment and Textile sector

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable:	**Skill/Emp.**	**Skill/Emp.**	**Skill/Unskill**	**Skill/Unskill**	**Female skill**	**Female skill**
GVC	0.0826***	0.121***	0.118***	0.144***	0.0725***	0.0813*
	(0.0162)	(0.0356)	(0.0234)	(0.0517)	(0.0202)	(0.0493)
GVC x S	-0.272***	-0.359***	-0.360***	-0.440***	-0.232***	-0.298*
	(0.0566)	(0.129)	(0.0713)	(0.160)	(0.0788)	(0.175)
Medium	-0.195***	-0.266***	-0.235***	-0.347***	-0.519***	-0.469***
	(0.00704)	(0.0360)	(0.00978)	(0.0531)	(0.0101)	(0.0353)
Large	-0.373***	-0.426***	-0.444***	-0.524***	-0.918***	-0.819***
	(0.0127)	(0.0462)	(0.0165)	(0.0683)	(0.0172)	(0.0488)
Age (ln)	0.0484***	0.0386**	0.0660***	0.0602**	0.0433***	0.0144
	(0.00677)	(0.0166)	(0.00918)	(0.0254)	(0.00853)	(0.0273)
Constant	-1.479***	-1.292***	-1.153***	-0.902***	-1.965***	-1.888***
	(0.0213)	(0.0720)	(0.0294)	(0.114)	(0.0273)	(0.1000)
Country & sector dummies	Yes	No	Yes	No	Yes	No
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	No	Yes	No	Yes	No	Yes
Observations	75,531	14,042	75,155	13,956	49,957	9,410
R-squared	0.154	0.532	0.145	0.540	0.283	0.631

Table 3 (continued) Testing sector-specific effect of Garment and Textile sector

	(7)	(8)	(9)	(10)	(11)	(12)
Dep. Variable:	Female/Male skill	Female/Male skill	Total labour cost/Emp.	Total labour cost/Emp.	Training programmes	Training programmes
GVC	-0.0130	-0.0366	0.412***	0.368***	0.181***	0.145***
	(0.0169)	(0.0492)	(0.0345)	(0.0934)	(0.00985)	(0.0259)
GVC x S	0.0155	0.0774	-0.226**	-0.190	-0.0583	-0.0197
	(0.0533)	(0.112)	(0.0938)	(0.257)	(0.0374)	(0.0895)
Medium	-0.275***	-0.206***	0.142***	-0.0727	0.145***	0.105***
	(0.00882)	(0.0299)	(0.0182)	(0.110)	(0.00489)	(0.0253)
Large	-0.468***	-0.406***	0.219***	-0.0925	0.331***	0.269***
	(0.0161)	(0.0415)	(0.0278)	(0.146)	(0.00734)	(0.0314)
Age (ln)	-0.0134*	-0.0419*	0.0687***	-0.0252	0.0231***	0.0247**
	(0.00690)	(0.0228)	(0.0165)	(0.0490)	(0.00408)	(0.0121)
Constant	-0.571***	-0.560***	11.25***	11.57***	0.148***	0.215***
	(0.0218)	(0.0823)	(0.0572)	(0.246)	(0.0131)	(0.0531)
Country & sector dummies	Yes	No	Yes	No	Yes	No
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	No	Yes	No	Yes	No	Yes
Observations	49,873	9,395	70,012	12,268	78,721	14,473
R-squared	0.180	0.541	0.779	0.841	0.215	0.530

***Source**: Author's elaboration based on STATA output.*

Notes: (i) GVC is a dummy that takes the value of 1, if the firm is part of a GVC and zero otherwise and S is a sector specific variable equal to 1 for garment and textile sector and zero otherwise. (ii) Robust standard errors in parentheses. (iii) *** p<0.01, ** p<0.05, * p<0.1 (iv) Standard errors that are clustered by country, sector and year. (v) Columns (1), (3), (5), (7), (9) and (11) are estimated using the OLS estimator, with country, sector and year dummies. (vi) Columns (2), (4), (6), (8), (10) and (12) display the results using a PSM and diff-in-diff technique, when firm fixed effects are accounted for, with robust standard errors clustered by country, year and sector.

Table 4 Testing capital intensive sectors-specific effect

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable:	**Skill/Emp.**	**Skill/Emp.**	**Skill/Unskill**	**Skill/Unskill**	**Female skill**	**Female skill**
GVC	0.0308	0.0422	0.0466	0.0384	0.0309	0.0585
	(0.0234)	(0.0418)	(0.0329)	(0.0590)	(0.0278)	(0.0656)
GVC x S	0.103***	0.115*	0.145***	0.164*	0.0694*	-0.0219
	(0.0325)	(0.0661)	(0.0473)	(0.0925)	(0.0407)	(0.0906)
Dummy S	0.0304*		0.0303		-0.0789***	
	(0.0156)		(0.0217)		(0.0152)	
Medium	-0.192***	-0.265***	-0.230***	-0.346***	-0.521***	-0.468***
	(0.00719)	(0.0360)	(0.0100)	(0.0531)	(0.0101)	(0.0353)
Large	-0.371***	-0.427***	-0.439***	-0.525***	-0.920***	-0.819***
	(0.0133)	(0.0460)	(0.0173)	(0.0681)	(0.0174)	(0.0489)
Age (ln)	0.0577***	0.0390**	0.0789***	0.0607**	0.0492***	0.0149
	(0.00718)	(0.0166)	(0.00969)	(0.0253)	(0.00871)	(0.0273)
Constant	-1.524***	-1.293***	-1.212***	-0.904***	-1.951***	-1.890***
	(0.0236)	(0.0722)	(0.0324)	(0.114)	(0.0290)	(0.0999)
Country & sector dummies	Yes	No	Yes	No	Yes	No
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	No	Yes	No	Yes	No	Yes
Observations	75,532	14,042	75,156	13,956	49,957	9,410
R-squared	0.125	0.531	0.115	0.540	0.273	0.631

Table 4 (Continued) Testing capital intensive sectors-specific effect

	(7)	(8)	(9)	(10)	(11)	(12)
Dep. Variable:	Female/Male skill	Female/Male skill	Total labour cost/Emp.	Total labour cost/Emp.	Training programmes	Training programmes
GVC	-0.00504	0.0409	0.386***	0.426***	0.162***	0.128***
	(0.0225)	(0.0542)	(0.0469)	(0.0987)	(0.0137)	(0.0317)
GVC x S	-0.0324	-0.183*	0.0637	0.200	0.0523***	0.0385
	(0.0320)	(0.0932)	(0.0670)	(0.192)	(0.0195)	(0.0499)
Dummy S	-0.118***		0.0967*		0.0310***	
	(0.0125)		(0.0516)		(0.00880)	
Medium	-0.277***	-0.206***	0.150***	-0.0719	0.148***	0.105***
	(0.00894)	(0.0299)	(0.0183)	(0.110)	(0.00498)	(0.0253)
Large	-0.469***	-0.407***	0.225***	-0.0922	0.335***	0.269***
	(0.0164)	(0.0414)	(0.0283)	(0.146)	(0.00742)	(0.0314)
Age (ln)	-0.0208***	-0.0422*	0.0779***	-0.0246	0.0260***	0.0247**
	(0.00705)	(0.0227)	(0.0165)	(0.0489)	(0.00422)	(0.0120)
Constant	-0.497***	-0.559***	11.17***	11.56***	0.123***	0.215***
	(0.0233)	(0.0819)	(0.0635)	(0.246)	(0.0149)	(0.0531)
Country & sector dummies	Yes	No	Yes	No	Yes	No
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	No	Yes	No	Yes	No	Yes
Observations	49,873	9,395	70,013	12,268	78,722	14,473
R-squared	0.168	0.542	0.776	0.841	0.208	0.530

***Source**: Author's elaboration based on STATA output.*

Notes: (i) S is a dummy that captures capital-intensive sectors in order to examine if a GVC exerts a differential impact on them. (ii) Robust standard errors in parentheses are clustered by country, sector and year. (iii) *** p<0.01, ** p<0.05, * p<0.1 (iv) Columns (1), (3), (5), (7), (9) and (11) are estimated using the OLS estimator, with country, sector and year dummies. (v) Columns (2), (4), (6), (8), (10) and (12) display the results using a PSM and diff-in-diff technique, when firm fixed effects are accounted for.

4.3 Results based on initial human capital level

Finally, by examining the sample composition effect based on initial human capital[7], GVC participation is found to have a greater positive effect if the firm has a high level of skilled labour. As shown in Table 5, highly skilled firms are associated with social upgrading (a greater increase in skill upgrading and working conditions indicators), whilst for GVC firms with lower initial human capital, the change in social upgrading measures is not remarkable or distinguishable from that of the control group. These results are in line with the empirical evidence (Del Prete et al., 2018), since highly skilled firms are already relatively more efficient than their counterparts because they have access to a broader variety of inputs; accordingly, results are more pronounced for these firms. From a gender perspective, this may lead to increased demand for female skilled labour (columns 5 and 6). However, when we look at the share of female skilled over male skilled workers, we found that females are more negatively affected than males (column 8). As explained earlier, in developing countries, females found it challenging to take advantage of the growing demand for skilled labour, due to the lack of networks, limited access to education, training opportunities, as well as social norms and gender biased regulations (Bamber & Staritz, 2016; Ahmed, 2013).

[7] Firms are considered highly skilled if their share of skilled workers is equal or above the median (more robust than the mean). The median of the share of skilled workers is 0.214 in the whole sample, and 0.25 in the panel sample. Highly skilled firms are those who have a share equal to or above 21.4% and 25%, respectively.

Table 5 Empirical results by high initial human capital level

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable:	**Skill/Emp.**	**Skill/Emp.**	**Skill/Unskill**	**Skill/Unskill**	**Female skill**	**Female skill**
GVC	0.0108	0.132***	0.0195	0.167***	0.00782	0.0649
	(0.0176)	(0.0361)	(0.0241)	(0.0514)	(0.0234)	(0.0498)
GVC x W	0.129***	0.599***	0.185***	0.860***	0.132***	0.185*
	(0.0250)	(0.0548)	(0.0422)	(0.0940)	(0.0382)	(0.107)
Dummy W	0.881***		1.183***		0.526***	
	(0.0125)		(0.0177)		(0.0192)	
Medium	-0.160***	-0.268***	-0.189***	-0.351***	-0.488***	-0.469***
	(0.00672)	(0.0360)	(0.00924)	(0.0531)	(0.00986)	(0.0353)
Large	-0.307***	-0.443***	-0.356***	-0.549***	-0.863***	-0.824***
	(0.0124)	(0.0457)	(0.0161)	(0.0675)	(0.0177)	(0.0487)
Age (ln)	0.0390***	0.0383**	0.0522***	0.0595**	0.0352***	0.0145
	(0.00609)	(0.0165)	(0.00822)	(0.0250)	(0.00822)	(0.0271)
Constant	-1.690***	-1.290***	-1.432***	-0.899***	-2.100***	-1.890***
	(0.0185)	(0.0715)	(0.0258)	(0.113)	(0.0269)	(0.0989)
Country & sector dummies	Yes	No	Yes	No	Yes	No
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	No	Yes	No	Yes	No	Yes
Observations	75,531	14,044	75,155	13,958	49,957	9,412
R-squared	0.361	0.535	0.338	0.544	0.324	0.631

Table 5 (continued) Empirical results by high initial human capital level

	(7)	(8)	(9)	(10)	(11)	(12)
Dep. Variable:	Female/Male skill	Female/Male skill	Total labour cost/Emp.	Total labour cost/Emp.	Training programmes	Training programmes
GVC	-0.00218	-0.0556	0.337***	0.384***	0.167***	0.155***
	(0.0179)	(0.0455)	(0.0347)	(0.0865)	(0.0109)	(0.0253)
GVC x W	0.000127	-0.340***	0.229***	0.497***	0.0377**	0.160***
	(0.0354)	(0.110)	(0.0773)	(0.166)	(0.0184)	(0.0598)
Dummy W	-0.345***		0.169***		0.0415***	
	(0.0167)		(0.0262)		(0.00576)	
Medium	-0.296***	-0.205***	0.145***	-0.0742	0.146***	0.104***
	(0.00901)	(0.0299)	(0.0182)	(0.110)	(0.00491)	(0.0253)
Large	-0.504***	-0.396***	0.228***	-0.107	0.334***	0.264***
	(0.0171)	(0.0414)	(0.0278)	(0.145)	(0.00738)	(0.0314)
Age (ln)	-0.00796	-0.0413*	0.0670***	-0.0251	0.0226***	0.0244**
	(0.00691)	(0.0231)	(0.0164)	(0.0490)	(0.00410)	(0.0119)
Constant	-0.483***	-0.561***	11.21***	11.57***	0.139***	0.216***
	(0.0217)	(0.0837)	(0.0583)	(0.246)	(0.0132)	(0.0527)
Country & sector dummies	Yes	No	Yes	No	Yes	No
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	No	Yes	No	Yes	No	Yes
Observations	49,873	9,397	70,012	12,268	78,721	14,475
R-squared	0.206	0.542	0.779	0.841	0.216	0.530

***Source**: Author's elaboration based on STATA output.*

Notes: (i) GVC is a dummy that takes the value of 1, if the firm is part of a GVC and zero otherwise and W captures highly skilled firms based on their initial human capital level. (ii) Robust standard errors in parentheses are clustered by country, sector and year. (iii) *** p<0.01, ** p<0.05, * p<0.1 (iv) Columns (1), (3), (5), (7), (9) and (11) are estimated using the OLS estimator, with country, sector and year dummies. (v) Columns (2), (4), (6), (8), (10) and (12) display the results using a PSM and diff-in-diff technique, when firm fixed effects are accounted for.

Robustness checks

Robustness checks were provided. Based on the baseline model, different treatments are examined. By employing different GVC proxies we wanted to check whether the findings are reliable and not driven by the adopted variables combination. In particular, four treatments are used, ranging from a narrower to a broader treatment. The former identifies the GVC proxy used - certified two-way traders and foreign owned firms - whereas the latter presents firms in the treated group whether certificated - those acquiring an international recognised certification - two-way traders or foreign owned. In comparison to all other firms, the effect on social upgrading measures is expected to be higher for GVC proxy. since it is more likely to have profound and deeper global production linkages. These predictions are fully confirmed, as shown in Table 6, which reflects statistically significant and higher effects for the GVC treatment in columns 1 to 6, whilst there are no or less statistically significant effects for the certification, two-way traders and foreign ownership treatments. Moreover, the broader measure reveals that the results are not exclusively due to a specific variable.

To investigate the impact of GVC participation on social upgrading, we extended the analysis by taking into consideration the regional heterogeneity. Table 12 in Appendix displays the results when the baseline estimations are run for six regions: East Asia & the Pacific, Europe & Central Asia, Latin America, MENA region, South Asia and Sub-Saharan Africa. The findings show a positive and significant effect of GVCs on the demand for skilled workers in Europe & Central Asia and Sub-Saharan Africa. It is worth noting that Europe & Central Asian and Sub-Saharan African firms present higher levels of skill upgrading with respect to the remaining regions. The former appears to have particularly benefitted from GVC participation in the period examined, possibly due to their large manufacturing sectors, skilled labour force and investment friendly policies. Europe & Central Asian countries attract foreign direct investment (FDI) and have built strong industrial clusters, allowing them to participate extensively in GVCs; similarly Sub-Saharan Africa, with its well-developed manufacturing sector, has actively participated in GVCs, particularly in the food, garment and textile industries, due to its low labour costs.

According to the literature, the impact of GVCs can differ across regions due to various factors, such as the economic structure, policies, infrastructure and institutional capacity. First, the economic structure plays a significant role as certain industries, such as manufacturing, electronics and textiles, are more integrated into global production networks. Regions with strong manufacturing sectors with highly educated and trained workforces can engage in complex, higher value-added activities and are more likely to

benefit from GVCs. Second, policies implemented that encourage foreign direct investment (FDI), trade liberalisation, innovation and skill development attract investors and ease integration into GVCs. Third, efficient infrastructure, including transportation networks and reliable logistics, is essential for effective participation in GVCs. Lastly, advanced and effective institutions, including legal systems and enforcement mechanisms, can create a conducive environment for GVC activities (Ignatenko et al., 2019; United Nations Conference on Trade and Development (UNCTAD), 2020; World Bank, 2020).

At the gender level, for the Latin America and MENA regions, GVCs appear to exert a negative significant effect on the share of female skilled workers compared to their male counterparts, reflecting a gender-based discrimination. In these regions, women in GVCs are concentrated in lower-skilled and lower-paid positions. In addition, women may face barriers in accessing training and skill development opportunities, which can limit their access to higher-skilled roles and hinder their opportunities for advancement within the value chain. This could be a result of multiple factors, including gender norms, biases and limited support for women's career advancement. Looking at the effect on working conditions, the results highlight that GVC firms have a positive effect on total labour cost per worker and formal training programmes for nearly all regions. GVC coefficients for total labour cost turn out to be higher for Sub-Saharan Africa and statistically insignificant for South Asia. Despite the strong growth in trade flows, South Asia still trades below its potential. This can be explained by the fact that different countries are integrated in different ways; as yet, some countries have not been able to enter significantly into global production networks, with a risk of being locked into a low value-added environment.

Finally, reverse causality concerns are largely generated by the fact that GVC participation could be the result of social upgrading. Consequently, a suitable instrumental variable should be chosen in order to address this issue. By definition, an instrumental variable needs to have a strong correlation with the endogenous variable, as well as needing to be uncorrelated with the error term or not directly correlated with it. Hence, two main instrumental variables are used: first, technology licensed from foreign companies[8], which boosts the capacity of the firm to innovate and is positively associated with their trade productivity (Grossman et al., 1991); and second, obstacles to accessing finance[9], which prevent firms from being more efficient and innovate. Thus, limited access

[8] Foreign-owned technology is a dummy equal to one if the firm adopted a foreign technology and zero otherwise.

[9] Obstacles to accessing finance is a categorical variable, indicating that obstacles could be absent, minor, moderate, major or very severe. Thus, a dummy is created, equals to one if obstacles to accessing finance are major or very severe and zero otherwise.

to finance should be negatively correlated with the firm performance and its capacity to integrate into GVCs (Dovis and Zaki, 2020, and Ehab and Zaki, 2021).

Furthermore, technology licensed from foreign companies and obstacles to accessing finance are suitable instruments for GVCs, for several reasons. On one hand, the first stage regression and summary statistics show that they have a strong correlation with the endogenous variable, reported in Tables 13 and 14 in the Appendix. The first stage is significant at 1%; the F-statistic was higher than the critical value, which means that the instruments are strong, increasing the likelihood of firms participating in GVCs, which is in line with the literature. On the other hand, the instruments appear to be uncorrelated with the error term in the second stage regression; hence, they are regarded as valid. Additionally, both instruments are exogenous variables, which are unlikely to be affected by skill upgrading or working conditions. As shown in Table 7, the findings of the second stage regression using the two GVC instruments - technology licensed from foreign companies and obstacles to accessing finance - are robust. The GVC coefficients are positive, significant and larger than the coefficients in the baseline results, indicating that the baseline results are reliable and robust.

Table 6 Robustness checks on different treatment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Treatment:	**GVC proxy**	**GVC proxy**	**GVC proxy**	**GVC proxy**	**GVC proxy**	**GVC proxy**	**Two-way**	**Two-way**	**Two-way**	**Two-way**	**Two-way**	**Two-way**
Dep. Variable:	**Skill/Emp.**	**Skill/Unskill**	**Female Skill**	**Female/Male Skill**	**Total labour cost/Emp.**	**Training Programs**	**Skill/Emp.**	**Skill/Unskill**	**Female Skill**	**Female/Male Skill**	**Total labour cost/Emp.**	**Training Programmes**
Treatment	0.0606***	0.0892***	0.0529***	-0.0117	0.393***	0.176***	-0.0141	-0.0216	-0.0492***	-0.0234***	0.186***	0.118***
	(0.0157)	(0.0224)	(0.0200)	(0.0161)	(0.0321)	(0.00948)	(0.00896)	(0.0121)	(0.0100)	(0.00849)	(0.0176)	(0.00521)
Medium	-0.195***	-0.235***	-0.519***	-0.275***	0.142***	0.145***	-0.192***	-0.231***	-0.511***	-0.272***	0.124***	0.133***
	(0.00704)	(0.00978)	(0.0101)	(0.00882)	(0.0182)	(0.00489)	(0.00692)	(0.00962)	(0.0100)	(0.00891)	(0.0181)	(0.00480)
Large	-0.373***	-0.444***	-0.918***	-0.468***	0.218***	0.331***	-0.362***	-0.426***	-0.892***	-0.460***	0.188***	0.305***
	(0.0127)	(0.0165)	(0.0172)	(0.0161)	(0.0278)	(0.00735)	(0.0119)	(0.0156)	(0.0169)	(0.0156)	(0.0276)	(0.00708)
Age (ln)	0.0487***	0.0663***	0.0436***	-0.0134*	0.0689***	0.0231***	0.0492***	0.0670***	0.0450***	-0.0127*	0.0642***	0.0198***
	(0.00678)	(0.00919)	(0.00854)	(0.00689)	(0.0165)	(0.00408)	(0.00684)	(0.00927)	(0.00858)	(0.00694)	(0.0165)	(0.00408)
Constant	-1.479***	-1.154***	-1.966***	-0.571***	11.25***	0.148***	-1.479***	-1.154***	-1.964***	-0.570***	11.25***	0.146***
	(0.0213)	(0.0294)	(0.0273)	(0.0218)	(0.0572)	(0.0131)	(0.0213)	(0.0295)	(0.0274)	(0.0218)	(0.0574)	(0.0131)
Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	75,531	75,155	49,957	49,873	70,012	78,721	75,531	75,155	49,957	49,873	70,012	78,721
R-squared	0.153	0.145	0.283	0.180	0.779	0.215	0.153	0.145	0.283	0.180	0.779	0.219

Table 6 (Continued) Robustness checks on different treatment

	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Treatment:	**Certif.**	**Certif.**	**Certif.**	**Certif.**	**Certif.**	**Certif.**	**Foreign ownership**	**Foreign ownership**	**Foreign ownership**	**Foreign ownership**	**Foreign ownership**	**Foreign ownership**
Dep. Variable:	**Skill/Emp.**	**Skill/Unskill**	**Female Skill**	**Female/Male Skill**	**Total labour cost/Emp.**	**Training Programmes**	**Skill/Emp.**	**Skill/Unskill**	**Female Skill**	**Female/Male Skill**	**Total labour cost/Emp.**	**Training Programmes**
Treatment	0.0553***	0.0675***	0.00711	-0.0382***	0.269***	0.197***	-0.0266	-0.0165	-0.0322*	-0.0172	0.310***	0.110***
	(0.0101)	(0.0139)	(0.0125)	(0.0103)	(0.0201)	(0.00656)	(0.0157)	(0.0215)	(0.0173)	(0.0137)	(0.0308)	(0.00791)
Medium	-0.198***	-0.238***	-0.519***	-0.272***	0.132***	0.135***	-0.193***	-0.233***	-0.517***	-0.274***	0.137***	0.144***
	(0.00703)	(0.00975)	(0.0101)	(0.00882)	(0.0183)	(0.00480)	(0.00699)	(0.00973)	(0.0100)	(0.00885)	(0.0181)	(0.00488)
Large	-0.382***	-0.454***	-0.914***	-0.458***	0.186***	0.295***	-0.363***	-0.432***	-0.906***	-0.466***	0.211***	0.333***
	(0.0128)	(0.0167)	(0.0173)	(0.0156)	(0.0283)	(0.00711)	(0.0121)	(0.0159)	(0.0171)	(0.0163)	(0.0275)	(0.00736)
Age (ln)	0.0465***	0.0637***	0.0432***	-0.0116*	0.0588***	0.0155***	0.0484***	0.0662***	0.0429***	-0.0137**	0.0737***	0.0247***
	(0.00680)	(0.00921)	(0.00854)	(0.00696)	(0.0164)	(0.00403)	(0.00674)	(0.00916)	(0.00854)	(0.00692)	(0.0166)	(0.00411)
Constant	-1.474***	-1.148***	-1.965***	-0.575***	11.27***	0.165***	-1.478***	-1.154***	-1.964***	-0.570***	11.23***	0.142***
	(0.0213)	(0.0294)	(0.0273)	(0.0219)	(0.0571)	(0.0129)	(0.0213)	(0.0294)	(0.0274)	(0.0218)	(0.0574)	(0.0132)
Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	75,531	75,155	49,957	49,873	70,012	78,721	75,531	75,155	49,957	49,873	70,012	78,721
R-squared	0.154	0.145	0.282	0.180	0.779	0.226	0.153	0.144	0.282	0.180	0.779	0.213

***Source**: Author's elaboration based on STATA output.* Notes: (i) Robust standard errors in parentheses. (ii) *** p<0.01, ** p<0.05, * p<0.1 (iii) All columns are estimated using country, sector and year dummies. (iv) Standard errors are clustered by country, sector and year.

Table 7 Robustness Checks – Instrumental variable approach

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable:	**Skill/Emp.**	**Skill/Emp.**	**Skill/Unskill**	**Skill/Unskill**	**Female skill**	**Female skill**
GVC	0.953***	0.679***	1.388***	0.795***	0.463***	0.645***
	(0.131)	(0.191)	(0.178)	(0.272)	(0.158)	(0.248)
Medium	-0.210***	-0.259***	-0.257***	-0.337***	-0.529***	-0.470***
	(0.00741)	(0.0287)	(0.0103)	(0.0437)	(0.0105)	(0.0322)
Large	-0.466***	-0.450***	-0.580***	-0.551***	-0.967***	-0.852***
	(0.0187)	(0.0406)	(0.0248)	(0.0600)	(0.0257)	(0.0479)
Age (ln)	0.0461***	0.0402**	0.0635***	0.0644***	0.0445***	0.0113
	(0.00716)	(0.0169)	(0.00966)	(0.0244)	(0.00873)	(0.0272)
Constant	-1.381***	-1.325***	-0.928***	-0.951***	-2.219***	-1.908***
	(0.149)	(0.0674)	(0.247)	(0.101)	(0.160)	(0.0934)
Country, sector & year dummies	Yes	No	Yes	No	Yes	No
Firm fixed effects	No	Yes	No	Yes	No	Yes
Observations	73,690	14,164	73,327	14,105	48,871	10,303

Table 7 (Continued) Robustness Checks – Instrumental variable approach

	(7)	(8)	(9)	(10)	(11)	(12)
Dep. Variable:	**Female/Male skill**	**Female/Male skill**	**Total labour cost/Emp.**	**Total labour cost/Emp.**	**Training programmes**	**Training programmes**
GVC	-0.216*	-0.114	2.992***	2.586***	1.759***	0.926***
	(0.129)	(0.223)	(0.314)	(0.645)	(0.135)	(0.172)
Medium	-0.271***	-0.203***	0.0982***	-0.160**	0.117***	0.0987***
	(0.00927)	(0.0274)	(0.0179)	(0.0815)	(0.00581)	(0.0224)
Large	-0.443***	-0.412***	-0.0517	-0.296***	0.163***	0.220***
	(0.0233)	(0.0407)	(0.0399)	(0.113)	(0.0185)	(0.0311)
Age (ln)	-0.0126*	-0.0428*	0.0624***	-0.0395	0.0217***	0.0225*
	(0.00693)	(0.0223)	(0.0169)	(0.0432)	(0.00471)	(0.0124)
Constant	-0.983***	-0.571***	10.76***	11.60***	0.188***	0.201***
	(0.128)	(0.0770)	(0.271)	(0.171)	(0.0670)	(0.0497)
Country, sector & year dummies	Yes	No	Yes	No	Yes	No
Firm fixed effects	No	Yes	No	Yes	No	Yes
Observations	48,793	10,287	68,483	12,818	76,777	14,660

***Source**: Author's elaboration based on STATA output.*

Notes: (i) Robust standard errors in parentheses. (ii) *** p<0.01, ** p<0.05, * p<0.1 (iii) The instruments for GVCs are foreign-owned technology and obstacles to accessing finance. (iv) Standard errors are clustered by country, sector and year. (v) Columns (1), (3), (5), (7), (9) and (11) are estimated using the OLS estimator, with country, sector and year dummies. (vi) Columns (2), (4), (6), (8), (10) and (12) display the results using a PSM and diff-in-diff technique, when firm fixed effects are accounted for, with robust standard errors clustered by country, year and sector.

5 Conclusion

This paper proposes a comprehensive framework to examine the effect of GVC integration on skill upgrading and working conditions, based on a detailed panel data from the World Bank Enterprise Survey (WBES) in several developing countries, during the period 2006-2020. Using both OLS estimation with country, sector and year fixed effects, and propensity score matching difference-in-differences method, the paper finds that a firm's involvement in GVCs has a positive significant effect on skill upgrading and working conditions. Additionally, these results are more pronounced for initially highly skilled firms. Three main channels could actually be used to explain these findings: First, involvement in GVCs fosters firm productivity and efficiency, by providing and giving access to a wider range of more efficient goods and services that can be used as intermediate inputs. Second, due to skill complementarity, technological progress and transfer in imported inputs this could raise the demand for skilled labour. Third, GVC participation enables firms to grow their markets, which enhance their demand for better management, thanks to the economy of scale (Acemoglu, 2003, Del Prete et al. 2018, Ehab and Zaki, 2021, and Rigo 2020).

It is worth mentioning that the results show some evidence of gender bias across different sectors. On one hand, in the garment and textile sector, the effect of GVC participation on the share of female skilled workers is strongly negative. One argument that could be put forward to explain this gender gap is that although firms in GVCs tend to employ more women than other firms, women are generally in lower value-added segments of the value chain, mostly in labour intensive production jobs, which require lesser skills (Kumar, 2017). On the other hand, for capital-intensive sectors and highly skilled firms, results were similar, with an overall increase in the share of female skilled labour. However, findings highlight a decline in the ratio of female skilled workers versus male skilled workers for initially highly skilled firms, showing a lack of gender equality due to the women having limited access to education, training, networks and social norms in developing countries, where men usually dominate jobs in higher value segments (Bamber & Staritz, 2016, and World Bank, 2020).

As to the impact of production fragmentation on working conditions, the total labour cost per worker proves to be positively related to GVC participation. Hence, workers in sectors involved in GVCs have higher and more stable earnings; in addition, they are also more likely to have formal training programmes, which one may see as a sign of improved labour standards. According to the literature, the globalisation of production could increase the firm's productivity and, hence, wages which often entails better working conditions (Barrientos, Gereffi & Rossi, 2011).

The findings show also that this effect of GVCs depends on specific sectors. In the garment and textile sector, the results reveal a strongly negative significant effect of GVC

participation on the share of skilled workers. Moreover, the results on skill upgrading and working conditions suggest that the coefficients of interest in the three more integrated sectors differ. The coefficients vary in sign and significance. This can be explained by the fact that some of the industries, which are involved in the production of raw materials and basic inputs, are more towards the bottom of the value chain. In other words, different sectors are integrated in different ways. Some have not yet been able to fully integrate into GVCs, with the risk of becoming trapped in a low value-added environment. Thus, to get involved in international production networks, firms need to comply with international standards bringing with it better quality and lower costs. Taking into account sector specifications, sectors are aggregated into two categories - labour intensive and capital-intensive sectors. The results imply that the positive effect of GVCs is driven by the capital-intensive sectors, since these sectors correspond with dynamic production processes that need a significant amount of investment in fixed assets. Hence, they can benefit from the transfer of technological advancements, economy of scale, adoption of new technology and the attraction of FDI and their spillover effects.

Based on these empirical findings, four main policy recommendations can be drawn. Policymakers could strengthen the positive effect on social upgrading, by enforcing and implementing measures that encourage domestic firms to join GVCs, as well as motivate firms already integrated into GVCs to expand further. Moreover, policies designed to support entry into the GVCs are considered as a powerful driver for enhancing a firm's knowledge transfer and learning opportunities, through the introduction of new foreign technologies. Thus, research and development should be encouraged and implemented to meet the needs of GVCs, as high skill levels are required for participation in high value-added stages of the value chain. To address gender inequalities, it is important to adopt policies and practices that promote the empowerment of female skilled labour within value chains, including creating more inclusive and equitable opportunities, and tackling gender-based discrimination. Finally, it is important to improve working conditions by considering different aspects of labour regulations - not only wages, because it is clear that the effect of production fragmentation on workers' socio-economic conditions is not one dimensional.

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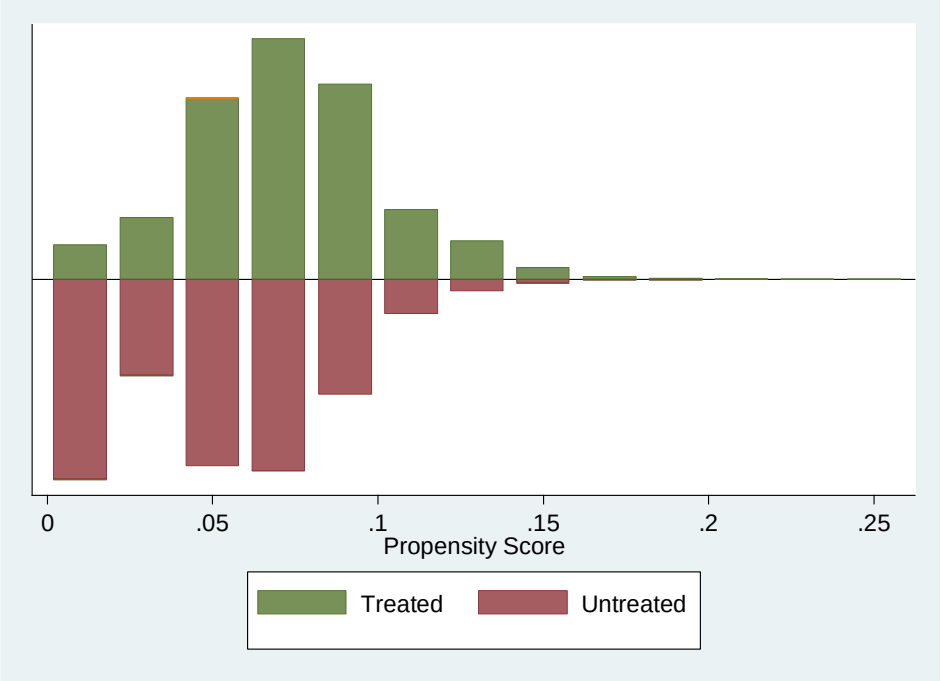
7 Appendix

Fig.5 Propensity Scores distribution between GVC participants (Treated) and non-participants (Untreated)



***Source**: Author's elaboration based on STATA output.*

Table 8 List of countries

Country	Survey	Freq.	Percent	Cum.
Afghanistan	2008 and 2014	244	0.29	0.29
Albania	2007, 2013 and 2019	334	0.4	0.69
Angola	2006 and 2010	356	0.42	1.11
Argentina	2006, 2010 and 2017	2,067	2.46	3.56
Armenia	2009, 2013 and 2020	495	0.59	4.15
Azerbaijan	2009, 2013 and 2019	286	0.34	4.49
Bangladesh	2007 and 2013	2,381	2.83	7.32
Belarus	2008, 2013 and 2018	526	0.62	7.95

Benin	2009 and 2016	69	0.08	8.03
Bhutan	2009 and 2015	78	0.09	8.12
Bolivia	2006, 2010 and 2017	591	0.7	8.82
Bosnia and Herzegovina	2009, 2013 and 2019	363	0.43	9.25
Botswana	2006 and 2010	200	0.24	9.49
Brazil	2009	1,315	1.56	11.05
Bulgaria	2007, 2009, 2013 and 2019	1,158	1.38	12.43
Burkina Faso	2009	94	0.11	12.54
Burundi	2006 and 2014	162	0.19	12.73
Cambodia	2013 and 2016	596	0.71	13.44
Cameroon	2009 and 2016	200	0.24	13.68
Chad	2009 and 2018	66	0.08	13.76
Chile	2006 and 2010	1,409	1.67	15.43
China	2012	1,690	2.01	17.44
Colombia	2006, 2010 and 2017	1,850	2.2	19.63
Congo, Dem. Rep.	2006, 2010 and 2013	512	0.61	20.24
Costa Rica	2010	322	0.38	20.62
Croatia	2007, 2013 and 2019	605	0.72	21.34
Czech Republic	2009, 2013 and 2019	482	0.57	21.92
Côte d'Ivoire	2009 and 2016	264	0.31	22.23
Djibouti	2013	50	0.06	22.29
Dominican Republic	2010 and 2016	225	0.27	22.56
Ecuador	2006, 2010 and 2017	583	0.69	23.25
Egypt, Arab Rep.	2013, 2016 and 2020	5,052	6	29.25
El Salvador	2006, 2010 and 2016	963	1.14	30.39
Estonia	2009, 2013 and 2019	307	0.36	30.76
Eswatini	2006 and 2016	142	0.17	30.93
Ethiopia	2011 and 2015	630	0.75	31.67

Gambia, The	2006 and 2018	91	0.11	31.78
Georgia	2008, 2013 and 2019	424	0.5	32.29
Ghana	2007 and 2013	658	0.78	33.07
Guatemala	2006, 2010 and 2017	808	0.96	34.03
Guinea	2006 and 2016	156	0.19	34.21
Guinea-Bissau	2006	50	0.06	34.27
Honduras	2006, 2010 and 2016	493	0.59	34.86
Hungary	2009, 2013 and 2019	674	0.8	35.66
India	2014	7,160	8.5	44.16
Indonesia	2009 and 2015	2,249	2.67	46.83
Iraq	2011	479	0.57	47.4
Israel	2013	224	0.27	47.67
Jamaica	2010	110	0.13	47.8
Jordan	2013 and 2019	595	0.71	48.51
Kazakhstan	2009, 2013 and 2019	1,222	1.45	49.96
Kenya	2007, 2013 and 2018	1,244	1.48	51.44
Kosovo	2009, 2013 and 2019	288	0.34	51.78
Kyrgyz Republic	2009, 2013 and 2019	337	0.4	52.18
Lao PDR	2012, 2016 and 2018	347	0.41	52.59
Latvia	2009, 2013 and 2019	325	0.39	52.98
Lebanon	2013 and 2019	504	0.6	53.57
Lesotho	2009 and 2016	74	0.09	53.66
Liberia	2009 and 2017	74	0.09	53.75
Lithuania	2009, 2013 and 2019	312	0.37	54.12
Madagascar	2009	203	0.24	54.36
Malawi	2014	151	0.18	54.54
Malaysia	2015	570	0.68	55.22
Mali	2007, 2010 and 2016	520	0.62	55.84
Mauritania	2006 and 2014	128	0.15	55.99

Mauritius	2009	150	0.18	56.17
Mexico	2006 and 2010	2,274	2.7	58.87
Moldova	2009, 2013 and 2019	352	0.42	59.29
Mongolia	2009, 2013 and 2019	369	0.44	59.72
Montenegro	2009, 2013 and 2019	145	0.17	59.9
Morocco	2013 and 2019	578	0.69	60.58
Mozambique	2007 and 2018	625	0.74	61.32
Myanmar	2014 and 2016	719	0.85	62.18
Namibia	2006 and 2014	257	0.31	62.48
Nepal	2009 and 2013	378	0.45	62.93
Nicaragua	2006, 2010 and 2016	583	0.69	63.63
Niger	2017	38	0.05	63.67
Nigeria	2007 and 2014	1,902	2.26	65.93
North Macedonia	2009, 2013 and 2019	354	0.42	66.35
Pakistan	2007 and 2013	1,810	2.15	68.5
Panama	2006 and 2010	351	0.42	68.92
Paraguay	2006, 2010 and 2017	604	0.72	69.63
Peru	2006, 2010 and 2017	1,667	1.98	71.61
Philippines	2009 and 2015	1,957	2.32	73.94
Poland	2009, 2013 and 2019	1,136	1.35	75.29
Romania	2009, 2013 and 2019	864	1.03	76.31
Russian Federation	2009, 2012 and 2019	2,680	3.18	79.5
Rwanda	2006, 2011 and 2019	179	0.21	79.71
Senegal	2007 and 2014	499	0.59	80.3
Serbia	2009, 2013 and 2019	364	0.43	80.74
Sierra Leone	2009 and 2017	76	0.09	80.83
Slovak Republic	2009, 2013 and 2019	366	0.43	81.26
Slovenia	2009, 2013 and 2019	344	0.41	81.67
Solomon Islands	2015	40	0.05	81.72

South Africa	2007 and 2020	1,015	1.21	82.92
South Sudan	2014	85	0.1	83.02
Sri Lanka	2011	361	0.43	83.45
Sudan	2014	93	0.11	83.56
Suriname	2018	61	0.07	83.63
Tajikistan	2008, 2013 and 2019	351	0.42	84.05
Tanzania	2006 and 2013	644	0.76	84.82
Thailand	2016	719	0.85	85.67
Timor-Leste	2009 and 2015	60	0.07	85.74
Togo	2009 and 2016	44	0.05	85.79
Trinidad and Tobago	2010	118	0.14	85.93
Tunisia	2013 and 2020	687	0.82	86.75
Turkey	2008, 2013 and 2019	2,934	3.48	90.24
Uganda	2006 and 2013	668	0.79	91.03
Ukraine	2008, 2013 and 2019	2,075	2.46	93.49
Uruguay	2006, 2010 and 2017	804	0.95	94.45
Uzbekistan	2008, 2013 and 2019	1,047	1.24	95.69
Venezuela, RB	2006 and 2010	83	0.1	95.79
Vietnam	2009 and 2015	1,437	1.71	97.5
West Bank and Gaza	2013 and 2019	281	0.33	97.83
Yemen, Rep.	2010 and 2013	362	0.43	98.26
Zambia	2007, 2013 and 2019	817	0.97	99.23
Zimbabwe	2011 and 2016	647	0.77	100
Total		84,191	100	

Source: Author's elaboration based on WB Enterprise Surveys.

Table 9 Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Skill/Emp.	84,191	0.257	0.18	0.00	1.00
Skill/Unskill	83,582	0.496	1.25	0.00	165.00
Female skill	78,209	0.090	0.11	0.00	1.00
Skill/Emp. (ln)	79,086	-1.500	0.68	-6.48	0.00
Skill/Unskill (ln)	78,485	-1.159	0.93	-6.48	5.11
Female skill (ln)	51,703	-2.340	0.90	-8.39	0.00
Total Labour Cost	72,889	11.537	2.63	0.00	23.90
Training Programmes	81,158	0.360	0.48	0.00	1.00
Treatment (GVC)	84,191	0.035	0.18	0.00	1.00
Two-way	84,191	0.246	0.43	0.00	1.00
Certification	84,191	0.125	0.33	0.00	1.00
Foreign ownership	84,191	0.060	0.24	0.00	1.00
Size (ln)	84,191	3.523	1.42	0.00	10.31
Age (ln)	83,293	3.162	0.57	0.00	5.86

***Source**: Author's elaboration based on WB Enterprise Surveys.*

Table 10 Testing sector-specific effect of Machinery and Equipment sector

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable:	**Skill/Emp.**	**Skill/Emp.**	**Skill/Unskill**	**Skill/Unskill**	**Female skill**	**Female skill**
GVC	0.0506***	0.0794**	0.0754***	0.0919*	0.0450**	0.0485
	(0.0164)	(0.0371)	(0.0234)	(0.0528)	(0.0209)	(0.0504)
GVC x S	0.151***	0.0801	0.209***	0.105	0.107	0.0275
	(0.0490)	(0.0829)	(0.0754)	(0.121)	(0.0705)	(0.156)
Medium	-0.195***	-0.265***	-0.235***	-0.346***	-0.519***	-0.468***
	(0.00704)	(0.0360)	(0.00978)	(0.0531)	(0.0101)	(0.0353)
Large	-0.373***	-0.427***	-0.444***	-0.526***	-0.918***	-0.819***
	(0.0127)	(0.0461)	(0.0165)	(0.0683)	(0.0172)	(0.0489)
Age (ln)	0.0487***	0.0392**	0.0663***	0.0609**	0.0436***	0.0149
	(0.00678)	(0.0167)	(0.00919)	(0.0254)	(0.00853)	(0.0273)
Constant	-1.479***	-1.294***	-1.155***	-0.904***	-1.966***	-1.890***
	(0.0213)	(0.0723)	(0.0294)	(0.114)	(0.0273)	(0.0999)
Country & sector dummies	Yes	No	Yes	No	Yes	No
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	No	Yes	No	Yes	No	Yes
Observations	75,531	14,042	75,155	13,956	49,957	9,410
R-squared	0.153	0.531	0.145	0.540	0.283	0.631

Dep. Variable:	(7) Female/Male skill	(8) Female/Male skill	(9) Total labour cost/Emp.	(10) Total labour cost/Emp.	(11) Training programmes	(12) Training programmes
GVC	-0.00902	-0.0216	0.376***	0.367***	0.174***	0.129***
	(0.0169)	(0.0472)	(0.0339)	(0.0859)	(0.00993)	(0.0253)
GVC x S	-0.0365	-0.116	0.253**	0.254	0.0301	0.180**
	(0.0463)	(0.119)	(0.118)	(0.432)	(0.0322)	(0.0751)
Medium	-0.275***	-0.206***	0.142***	-0.0723	0.145***	0.105***
	(0.00882)	(0.0299)	(0.0182)	(0.110)	(0.00489)	(0.0253)
Large	-0.468***	-0.406***	0.218***	-0.0917	0.331***	0.268***
	(0.0161)	(0.0415)	(0.0278)	(0.146)	(0.00735)	(0.0313)
Age (ln)	-0.0134*	-0.0421*	0.0689***	-0.0251	0.0231***	0.0247**
	(0.00690)	(0.0229)	(0.0165)	(0.0489)	(0.00408)	(0.0121)
Constant	-0.571***	-0.560***	11.25***	11.57***	0.148***	0.215***
	(0.0218)	(0.0825)	(0.0572)	(0.246)	(0.0131)	(0.0531)
Country & sector dummies	Yes	No	Yes	No	Yes	No
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	No	Yes	No	Yes	No	Yes
Observations	49,873	9,395	70,012	12,268	78,721	14,473
R-squared	0.180	0.541	0.779	0.841	0.215	0.530

***Source**: Author's elaboration based on STATA output.*

Notes: (i) S is a sector specific variable equal to 1 for machinery, equipment and electronics sector and zero otherwise. (ii) Robust standard errors in parentheses. (iii) *** p<0.01, ** p<0.05, * p<0.1 (iv) Standard errors that are clustered by country, sector and year. (v) Columns (1), (3), (5), (7), (9) and (11) are estimated using the OLS estimator, with country, sector and year dummies. (vi) Columns (2), (4), (6), (8), (10) and (12) display the results using a PSM and diff-in-diff technique, when firm fixed effects are accounted for.

Table 11 Testing sector-specific effect of food sector

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable:	**Skill/Emp.**	**Skill/Emp.**	**Skill/Unskill**	**Skill/Unskill**	**Female skill**	**Female skill**
GVC	0.0627***	0.0745*	0.0928***	0.0836	0.0668***	0.00831
	(0.0174)	(0.0412)	(0.0248)	(0.0573)	(0.0211)	(0.0521)
GVC x S	-0.0144	0.0554	-0.0246	0.0821	-0.0945	0.222
	(0.0385)	(0.0733)	(0.0558)	(0.110)	(0.0597)	(0.131)
Medium	-0.195***	-0.265***	-0.235***	-0.346***	-0.519***	-0.468***
	(0.00704)	(0.0361)	(0.00978)	(0.0532)	(0.0101)	(0.0353)
Large	-0.373***	-0.427***	-0.444***	-0.525***	-0.918***	-0.820***
	(0.0127)	(0.0461)	(0.0165)	(0.0683)	(0.0172)	(0.0489)
Age (ln)	0.0487***	0.0392**	0.0663***	0.0608**	0.0437***	0.0144
	(0.00678)	(0.0167)	(0.00919)	(0.0254)	(0.00855)	(0.0273)
Constant	-1.479***	-1.294***	-1.155***	-0.905***	-1.967***	-1.889***
	(0.0213)	(0.0723)	(0.0294)	(0.114)	(0.0273)	(0.0999)
Country, sector & year dummies	Yes	No	Yes	No	Yes	No
Firm fixed effects	No	Yes	No	Yes	No	Yes
Observations	75,531	14,042	75,155	13,956	49,957	9,410
R-squared	0.153	0.531	0.145	0.540	0.283	0.631

Dep. Variable:	(7) Female/Male skill	(8) Female/Male skill	(9) Total labour cost/Emp.	(10) Total labour cost/Emp.	(11) Training programmes	(12) Training programmes
GVC	-0.00393	-0.0531	0.383***	0.357***	0.173***	0.146***
	(0.0173)	(0.0504)	(0.0338)	(0.0954)	(0.0103)	(0.0285)
GVC x S	-0.0527	0.130	0.0702	-0.0355	0.0240	-0.0153
	(0.0462)	(0.114)	(0.109)	(0.252)	(0.0274)	(0.0515)
Medium	-0.275***	-0.206***	0.142***	-0.0724	0.145***	0.105***
	(0.00882)	(0.0300)	(0.0182)	(0.110)	(0.00489)	(0.0254)
Large	-0.468***	-0.406***	0.218***	-0.0931	0.331***	0.269***
	(0.0161)	(0.0415)	(0.0278)	(0.146)	(0.00734)	(0.0314)
Age (ln)	-0.0133*	-0.0424*	0.0688***	-0.0251	0.0231***	0.0247**
	(0.00689)	(0.0229)	(0.0165)	(0.0489)	(0.00408)	(0.0121)
Constant	-0.571***	-0.559***	11.25***	11.57***	0.148***	0.215***
	(0.0218)	(0.0825)	(0.0572)	(0.246)	(0.0131)	(0.0531)
Country, sector & year dummies	Yes	No	Yes	No	Yes	No
Firm fixed effects	No	Yes	No	Yes	No	Yes
Observations	49,873	9,395	70,012	12,268	78,721	14,473
R-squared	0.180	0.541	0.779	0.841	0.215	0.530

***Source**: Author's elaboration based on STATA output.*

Notes: (i) GVC is a dummy that takes the value of 1, if the firm is part of a GVC and zero otherwise and S is a sector specific variable equal to 1 for food sector and zero otherwise. (ii) Robust standard errors in parentheses. (iii) *** p<0.01, ** p<0.05, * p<0.1 (iv) Standard errors that are clustered by country, sector and year. (v) Columns (1), (3), (5), (7), (9) and (11) are estimated using the OLS estimator, with country, sector and year dummies. (vi) Columns (2), (4), (6), (8), (10) and (12) display the results using a PSM and diff-in-diff technique.

Table 12 Effect of GVC on social upgrading (by region)

	(1)	(2)	(3)	(4)	(5)	(6)
Region	**AFR**	**AFR**	**AFR**	**AFR**	**AFR**	**AFR**
Dep. Variable:	**Skill/Emp.**	**Skill/Unskill**	**Female skill**	**Female/Male skill**	**Total labour cost/Emp.**	**Training programmes**
GVC	0.0965**	0.142**	-0.00602	-0.0920	0.628***	0.215***
	(0.0463)	(0.0670)	(0.0649)	(0.0588)	(0.118)	(0.0241)
Medium	-0.163***	-0.183***	-0.555***	-0.335***	0.314***	0.114***
	(0.0166)	(0.0232)	(0.0215)	(0.0193)	(0.0602)	(0.0122)
Large	-0.360***	-0.381***	-1.045***	-0.613***	0.364***	0.267***
	(0.0335)	(0.0449)	(0.0439)	(0.0331)	(0.0896)	(0.0172)
Age (ln)	0.0479***	0.0552**	0.0306	-0.0429**	0.297***	0.0492***
	(0.0149)	(0.0223)	(0.0194)	(0.0174)	(0.0493)	(0.0104)
Constant	-1.483***	-1.129***	-1.963***	-0.493***	10.80***	0.0506
	(0.0462)	(0.0679)	(0.0603)	(0.0548)	(0.171)	(0.0312)
Country & sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,873	10,786	6,741	6,716	11,826	11,825
R-squared	0.127	0.104	0.257	0.192	0.593	0.116

	(1)	(2)	(3)	(4)	(5)	(6)
Region	**EAP**	**EAP**	**EAP**	**EAP**	**EAP**	**EAP**
Dep. Variable:	**Skill/Emp.**	**Skill/Unskill**	**Female skill**	**Female/Male skill**	**Total labour cost/Emp.**	**Training programmes**
GVC	0.0345	0.0465	0.0194	0.00621	0.250***	0.203***
	(0.0346)	(0.0498)	(0.0481)	(0.0362)	(0.0716)	(0.0249)
Medium	-0.224***	-0.270***	-0.484***	-0.235***	0.0827**	0.129***
	(0.0197)	(0.0261)	(0.0371)	(0.0321)	(0.0400)	(0.0121)
Large	-0.457***	-0.563***	-0.811***	-0.307***	0.0743	0.304***
	(0.0363)	(0.0421)	(0.0545)	(0.0371)	(0.0651)	(0.0186)
Age (ln)	0.0544**	0.0706**	-0.000713	-0.0562***	0.0636*	0.0204
	(0.0211)	(0.0276)	(0.0258)	(0.0202)	(0.0337)	(0.0139)
Constant	-1.533***	-1.210***	-1.884***	-0.441***	13.19***	0.178***
	(0.0584)	(0.0799)	(0.0807)	(0.0673)	(0.108)	(0.0433)
Country & sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,464	9,456	5,556	5,532	9,389	10,065
R-squared	0.155	0.152	0.220	0.124	0.871	0.353

	(1)	(2)	(3)	(4)	(5)	(6)
Region	ECA	ECA	ECA	ECA	ECA	ECA
Dep. Variable:	Skill/Emp.	Skill/Unskill	Female skill	Female/Male skill	Total labour cost/Emp.	Training programmes
GVC	0.113***	0.149***	0.139***	0.0190	0.297***	0.159***
	(0.0277)	(0.0371)	(0.0271)	(0.0215)	(0.0539)	(0.0179)
Medium	-0.266***	-0.326***	-0.528***	-0.228***	0.0618***	0.132***
	(0.0130)	(0.0176)	(0.0163)	(0.0133)	(0.0212)	(0.00833)
Large	-0.490***	-0.606***	-0.880***	-0.329***	0.0527	0.301***
	(0.0211)	(0.0265)	(0.0251)	(0.0198)	(0.0364)	(0.0114)
Age (ln)	0.0491***	0.0602***	0.0491***	0.00539	-0.0143	0.0188***
	(0.0105)	(0.0140)	(0.0130)	(0.00896)	(0.0191)	(0.00718)
Constant	-1.454***	-1.110***	-1.943***	-0.573***	10.97***	0.148***
	(0.0304)	(0.0412)	(0.0387)	(0.0286)	(0.0592)	(0.0220)
Country & sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	20,096	20,034	16,465	16,451	16,735	20,786
R-squared	0.151	0.136	0.258	0.137	0.793	0.129

	(1)	(2)	(3)	(4)	(5)	(6)
Region	**LAC**	**LAC**	**LAC**	**LAC**	**LAC**	**LAC**
Dep. Variable:	**Skill/Emp.**	**Skill/Unskill**	**Female skill**	**Female/Male skill**	**Total labour cost/Emp.**	**Training programmes**
GVC	0.0244	0.0513	-0.0254	-0.0568**	0.482***	0.151***
	(0.0311)	(0.0471)	(0.0376)	(0.0261)	(0.0424)	(0.0142)
Medium	-0.162***	-0.201***	-0.495***	-0.290***	0.229***	0.239***
	(0.0132)	(0.0199)	(0.0182)	(0.0153)	(0.0243)	(0.00941)
Large	-0.294***	-0.353***	-0.791***	-0.434***	0.432***	0.450***
	(0.0220)	(0.0326)	(0.0301)	(0.0232)	(0.0333)	(0.0143)
Age (ln)	0.0819***	0.112***	0.0674***	-0.0262**	0.153***	0.0149**
	(0.0126)	(0.0195)	(0.0166)	(0.0114)	(0.0195)	(0.00741)
Constant	-1.452***	-1.086***	-1.942***	-0.519***	10.76***	0.270***
	(0.0439)	(0.0681)	(0.0584)	(0.0393)	(0.0693)	(0.0268)
Country & sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16,646	16,571	14,268	14,259	14,519	17,110
R-squared	0.125	0.119	0.212	0.140	0.870	0.212

Region	(1) MNA	(2) MNA	(3) MNA	(4) MNA	(5) MNA	(6) MNA
Dep. Variable:	Skill/Emp.	Skill/Unskill	Female skill	Female/Male skill	Total labour cost/Emp.	Training programmes
GVC	0.0187	0.0485	-0.0942	-0.107*	0.387***	0.143***
	(0.0419)	(0.0564)	(0.0816)	(0.0631)	(0.0838)	(0.0344)
Medium	-0.153***	-0.175***	-0.610***	-0.368***	0.0615*	0.0748***
	(0.0202)	(0.0278)	(0.0441)	(0.0395)	(0.0350)	(0.00995)
Large	-0.286***	-0.318***	-1.121***	-0.701***	0.0288	0.253***
	(0.0305)	(0.0402)	(0.0679)	(0.0551)	(0.0489)	(0.0176)
Age (ln)	0.0498***	0.0801***	0.0130	-0.0338	0.0476	0.00862
	(0.0125)	(0.0177)	(0.0254)	(0.0228)	(0.0297)	(0.00608)
Constant	-1.518***	-1.281***	-1.959***	-0.630***	10.23***	0.0277
	(0.0401)	(0.0578)	(0.0779)	(0.0706)	(0.0891)	(0.0199)
Country & sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,461	8,328	3,792	3,789	8,132	8,690
R-squared	0.128	0.118	0.320	0.232	0.803	0.154

Region	(1) SA	(2) SA	(3) SA	(4) SA	(5) SA	(6) SA
Dep. Variable:	Skill/Emp.	Skill/Unskill	Female skill	Female/Male skill	Total labour cost/Emp.	Training programmes
GVC	0.0887	0.143	0.0244	0.00347	0.164	0.224***
	(0.103)	(0.143)	(0.157)	(0.157)	(0.246)	(0.0445)
Medium	-0.168***	-0.202***	-0.606***	-0.449***	0.0812*	0.138***
	(0.0212)	(0.0289)	(0.0603)	(0.0607)	(0.0469)	(0.0122)
Large	-0.282***	-0.320***	-1.370***	-1.069***	0.334***	0.351***
	(0.0360)	(0.0433)	(0.0582)	(0.0616)	(0.0699)	(0.0200)
Age (ln)	-0.00983	-0.00528	0.00726	0.0568	-0.0919***	0.0380**
	(0.0276)	(0.0347)	(0.0538)	(0.0414)	(0.0250)	(0.0176)
Constant	-1.497***	-1.214***	-2.108***	-0.757***	11.72***	0.0983*
	(0.0979)	(0.124)	(0.163)	(0.140)	(0.0888)	(0.0563)
Country & sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,985	9,974	3,129	3,120	9,407	10,239
R-squared	0.100	0.097	0.256	0.188	0.079	0.127

***Source**: Author's elaboration based on STATA output.*

Notes: (i) GVC is a dummy that takes the value of 1, if the firm is part of a GVC and zero otherwise. Firms integrated in GVC are firms that export, import, have international quality certification and foreign capital. (ii) Robust standard errors in parentheses. (iii) *** p<0.01, ** p<0.05, * p<0.1 (iv) OLS Regressions include country, year & sector dummies. (v) Standard errors are clustered by country, year and sector. (vi) AFR: Sub-Saharan Africa; EAP: East Asia & the Pacific; ECA: Europe & Central Asia; LAC: Latin America; MNA: MENA region; SA: South Asia.

Table 13 First stage regression

Dep. variable:	(1) GVC	(2) Two-way	(3) Certification	(4) Foreign ownership
Medium	0.0128***	0.126***	0.0600***	0.0316***
	(0.00122)	(0.00515)	(0.00340)	(0.00207)
Large	0.0913***	0.363***	0.258***	0.139***
	(0.00468)	(0.00958)	(0.00754)	(0.00647)
Age (ln)	0.00150	0.0303***	0.0400***	-0.0122***
	(0.00174)	(0.00409)	(0.00318)	(0.00257)
Foreign-owned technology	0.0654***	0.103***	0.104***	0.0780***
	(0.00362)	(0.00583)	(0.00519)	(0.00422)
Obstacles to accessing finance	-0.0125***	-0.0186***	-0.0137***	-0.0180***
	(0.00167)	(0.00383)	(0.00301)	(0.00208)
Constant	-0.0189**	-0.186***	-0.152***	-0.0131
	(0.00909)	(0.0297)	(0.0184)	(0.0178)
Observations	78,470	78,470	78,470	78,470
R-squared	0.095	0.229	0.200	0.115

***Source**: Author's elaboration based on STATA output.*

Notes: (i) Robust standard errors in parentheses. (ii) *** p<0.01, ** p<0.05, * p<0.1

(iii) All regressions include country, year and sector dummies. (iv) Standard errors are clustered by country, year and sector.

Table 14 First stage summary statistics and Endogeneity tests

First stage summary statistics

IV	Adjusted R-sq	Partial R-sq	R-sq	F stat.	P-value
	0.0936	0.0918	0.0181	628.394	0.0000

Tests of endogeneity, Ho: variables are exogenous

Durbin (score) chi2(1) = 181.67 (p = 0.0000)

Wu-Hausman F(1, 68347) = 181.791 (p = 0.0000)

Minimum eigenvalue statistic = 628.394 (p = 0.0000)

Tests of overidentifying restrictions

Sargan (score) chi2(1) = 1.22293 (p = 0.2688)

Basmann chi2(1) = 1.22052 (p = 0.2693)

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