

DISCUSSION PAPER SERIES

IZA DP No. 16510

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**Piotr Lewandowski**

*Institute for Structural Research (IBS), IZA and RWI*

**Karol Madoń**

*Institute for Structural Research (IBS) and SGH Warsaw School of Economics*

**Deborah Winkler**

*World Bank Group*

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**IZA – Institute of Labor Economics**

Schaumburg-Lippe-Straße 5–9  
53113 Bonn, Germany

Phone: +49-228-3894-0  
Email: [publications@iza.org](mailto:publications@iza.org)

[www.iza.org](http://www.iza.org)

## ABSTRACT

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# The Role of Global Value Chains for Worker Tasks and Wage Inequality\*

This paper studies the relationship between global value chain (GVC) participation, worker-level routine task intensity, and wage inequality within countries. Using unique survey data from 38 countries, we find that higher GVC participation is associated with more routine-intensive work, especially among workers in offshorable occupations. This relationship is particularly strong in industry and in countries at lower development levels. As higher routine task intensity links with to wages, this indirectly widens within-country wage inequality. However, GVC participation directly contributes to reduced wage inequality, except in the richest countries. Overall, GVC participation is negatively associated with wage inequality in most low- and middle-income countries that receive offshored jobs, and positively in high-income countries that offshore jobs.

**JEL Classification:** J21, J24, J31, F66

**Keywords:** routine task intensity, global value chains, globalisation, cross-country division of work, wage inequality

**Corresponding author:**

Piotr Lewandowski  
Institute for Structural Research (IBS)  
Wiśniowa 40B/8  
02-520 Warsaw  
Poland  
E-mail: [piotr.lewandowski@ibs.org.pl](mailto:piotr.lewandowski@ibs.org.pl)

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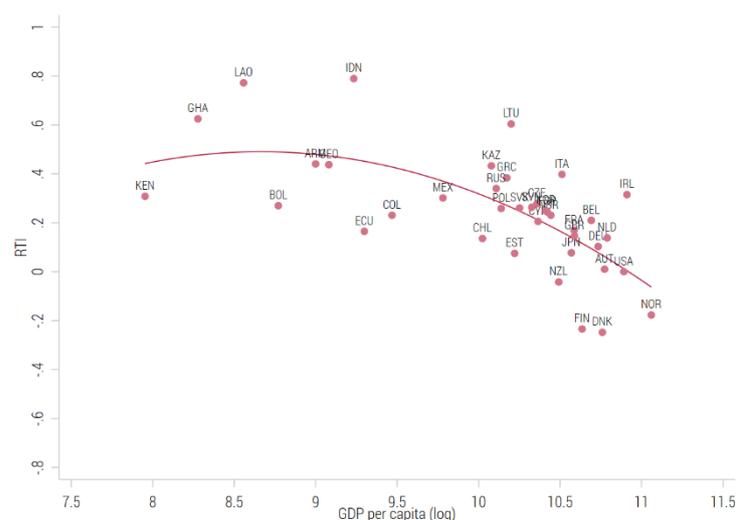
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# 1. Introduction

Traditional trade theory predicted that countries' specialisation in trade affects the international division of labour. Wealthier countries, which tend to be relatively more endowed with skilled labour and technology, have had a comparative advantage in the exports of skill- and technology-intensive goods and services. In contrast, developing nations have been relatively more abundant in low-wage labour and natural resources, thus specialising in labour- and resource-intensive goods exports. Both types of countries exported the goods and services that use their relatively abundant factors more intensively. Recently, however, countries specialise in the exports of tasks they have a comparative advantage in (Grossman and Rossi-Hansberg, 2008) rather than final goods and services. Technological change and trade liberalisation have fostered the possibility of trading tasks, offering opportunities to developing countries to participate and upgrade in global value chains (GVCs) (Taglioni and Winkler, 2016). The "second unbundling" of corporate tasks has intensified this division of labour (Baldwin, 2014), as routine tasks are easier to offshore (Blinder and Krueger, 2013), especially in manufacturing (Rodrik, 2013). The decline in routine jobs in the United States, the European Union, and some emerging countries since the late 1980s contributed to the polarisation of job opportunities within countries (Autor and Dorn, 2013; Cortes et al., 2017; Goos et al., 2014; Jensen and Kletzer, 2010; Michaels et al., 2014; Reijnders and de Vries, 2018; Spitz-Oener, 2006).

A GVC consists of a series of value-adding tasks, from inception to selling a product or service for final consumption (World Bank, 2020). Richer countries perform more non-routine tasks that require creativity, data analytics, or guiding people. In contrast, poorer countries specialise in routine-intensive tasks that are often repetitive, well-structured, and require being exact and accurate rather than creative (Figure 1). However, some jobs are easier to offshore while others cannot readily move between borders. An important question is, what is the GVCs' contribution to between- and within-country differences in job tasks, and as higher routine task intensity is strongly associated with lower earnings (Autor and Handel, 2013; de la Rica et al., 2020), to wage inequality? Do various forms of GVC participation differ in this regard?

**Figure 1. The average routine task intensity (RTI), by countries' development level (GDP per capita), accounts for cross-country occupational task differences.**



Note: for each task content, the 0 is set at the United States average value, and 1 corresponds to one standard deviation of RTI in the United States. GDP per capita in PPP, current international \$, country averages for 2011–2016.

Source: Lewandowski et al. (2022).

We evaluate how GVCs contribute to within-country wage inequality (measured by the Gini coefficient) through its impact on the task structures in the domestic labour markets. We distinguish between the direct channel – through wages – and a novel, indirect channel – through routine task intensity – of GVCs' contribution to wage inequality. Drawing on a unique survey dataset, this study examines the existence and nature of linkages between GVC participation, routine task intensity (RTI) of workers, and wage inequality in 38 countries at all developmental stages. Specifically, we systematically assess how the nature of GVCs mediates this relationship, accounting for differences across sectors and types of occupations, particularly offshorable and non-offshorable occupations.

The relationship between GVC participation and RTI depends on a country's factor endowments, which determine its type of task specialisation in GVCs. In developing countries such as Indonesia, a higher backward GVC participation, i.e., the share of imported inputs used in export production, may be associated with a higher worker-level RTI. Such countries tend to have abundant low-wage labour and specialise in the production tasks of basic manufacturing GVCs, typically in the final assembly stage. Thus, they rely strongly on imported inputs they process for their semi-final or final exports. However, high backward GVC integration also characterises countries specialising in more advanced manufacturing and services GVCs. Such countries are endowed with skilled labour and perform some routine tasks (e.g. customer service or accounting) and some non-routine tasks (e.g., IT support) (World Bank, 2020). Examples include Central Eastern European countries (Czech Republic, Hungary, Poland).<sup>1</sup>

The type of GVC participation in East Asian and Central Eastern European countries contrasts sharply with that of many Sub-Saharan African or Latin American countries specialising in commodities – agriculture and mining (Hanson, 2017). These countries show low backward GVC participation as they predominantly export upstream GVC tasks with low reliance on imported inputs and fewer opportunities to innovate and upgrade (Fernandez-Stark et al., 2011; Taglioni and Winkler, 2016; World Bank, 2020). They typically exhibit high forward GVC participation, namely a high share of domestic value added embodied in their direct partner countries' exports (Borin and Mancini, 2019, 2015). As a result, higher forward GVC participation in commodity-exporting countries may be associated with a higher RTI, as upstream tasks in agricultural or small-scale mining GVCs are more likely to be routine-intensive.<sup>2</sup> A high level of forward GVC participation also characterises countries specialised in innovative GVC tasks (World Bank, 2020), but its expected relationship with RTI contrasts that of commodity exporters. In innovative countries, high value-added upstream tasks, such as research and design services, make up a larger portion of their domestic value added that is re-exported by their bilateral trading partners. These tasks tend to be non-routine. These country examples illustrate that the relationship between GVC participation and RTI may vary across sectors and countries with different development levels and models. It may also differ between backward and forward GVC participation.

We make three key contributions. First, we assess the relationship between GVC participation and wage inequality, measured with the Gini coefficient of hourly wages, in countries across the development spectrum. Globalisation may shape the allocation of job tasks across occupations and thus contribute to earnings inequality, as workers

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<sup>1</sup> For instance, some East Asian countries that initially specialised in blue-collar jobs managed to increase their workforce's skill supply, upgraded in GVCs, and shifted towards more upstream and downstream activities (de Vries et al., 2019). Similarly, some Central Eastern European countries (Czech Republic, Hungary, Poland, Slovenia) have been upgrading from an assembly-line specialisation towards more advanced activities (Kordalska and Olczyk, 2022; Timmer et al., 2019).

<sup>2</sup> In agribusiness, for instance, routine tasks include seed sowing and harvesting. More downstream tasks, such as washing, chopping, packing, and applying bar codes on fruits and vegetables, are also routine. Assigning one specialised task to each worker, rather than having one worker perform a series of consecutive tasks, increases the RTI.

performing less routine-intensive tasks tend to earn more (Autor and Handel, 2013; de la Rica et al., 2020). Our study confirms the negative association between RTI and wages. Consequently, GVC participation can contribute to wage inequality through two channels: (i) indirectly through its relationship with RTI, (ii) and directly through its relationship with wages that can differ between different types of workers, especially offshorable and non-offshorable occupations.

Second, we quantify the indirect channel of GVCs' contribution to wage inequality through worker tasks, which remains under-researched (Marcolin et al., 2016). We account for two key factors: the offshorability of occupations (Blinder and Krueger, 2013) and sectoral differences, specifically between manufacturing, tradable and non-tradable services (Hanson, 2017).<sup>3</sup> The relationship between GVC participation and RTI may be particularly strong among workers performing offshorable tasks in tradable sectors. Less developed countries have a comparative advantage in performing routine tasks as they usually exhibit a lower skill supply than more developed countries (Grossman and Rossi-Hansberg, 2008). Indeed, Lewandowski et al. (2022) found that the relationship between backward GVC participation and worker-level RTI is the strongest among workers in low-skilled occupations.

We reveal important heterogeneity between occupation types, sectors, and countries in the role of GVCs for worker tasks. Higher GVC participation corresponds to a larger RTI gap between offshorable and non-offshorable occupations, especially in less developed countries. Backward GVC participation is associated with higher RTI in offshorable occupations in industry and tradable services but not in non-offshorable occupations. Similarly, forward GVC participation relates to higher RTI, but this relationship is stronger among workers in offshorable occupations.

Moreover, higher GVC participation is associated with a larger distance between low- and middle-income (LMIC) and high-income countries (HIC) regarding workers' RTI, especially in offshorable occupations. While we find strong and positive associations between GVC participation and workers' RTI in LMICs, they are zero or negligible in HICs. This disequalising pattern is the most pronounced in sectors with the highest employment share of offshorable occupations, namely industry and tradable services.

Third, we quantify labour market channels of globalisation's contribution to within-country wage inequality in a cross-country setting that covers both developed and developing countries and accounts for occupations' offshorability. Importantly, we focus on GVC participation instead of relying on multifactor globalisation indices. The direct contribution – driven by GVCs' associations with wages of different types of workers – reduces wage inequality in most countries except for those most developed, while the indirect contribution – through linkages with RTI – increases it in countries at all development stages. The relative strengths of these contributions differ between countries at different development levels. We show that in LMIC countries that primarily receive offshored jobs, GVC participation reduces wage inequality despite widening the gap in RTI between offshorable and non-offshorable occupations. However, in rich countries that mostly offshore jobs, it widens wage inequality as GVC participation mainly benefits workers in non-offshorable services occupations.

Our study enhances the understanding of relationships between globalization and jobs by using more detailed GVC participation and RTI measures than in past literature. The PIAAC and STEP survey data cover 38 countries across

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<sup>3</sup> Studying labour market effects of GVC participation in services is important – in the 21<sup>st</sup> century, the export share of services grew much faster than the share of manufacturing, and services become more globally tradable than manufacturing (Bohn et al., 2018). For instance, services offshoring increased sectoral labour productivity but decreased employment in manufacturing in Germany (Winkler, 2010).

all development levels and types of integration into GVCs. We measure RTI at a worker level, applying the method proposed by Lewandowski et al. (2022) to account for cross-country task differences in comparable occupations. This is vital as theory suggests that offshoring polarises tasks within occupations in different countries (Grossman and Rossi-Hansberg, 2008), and occupational task demands indeed differ between countries (Caunedo et al., 2023; de la Rica et al., 2020; Lewandowski et al., 2022; Lo Bello et al., 2019).<sup>4</sup> We also control for worker-level skills (reading proficiency), which allows us to capture differences in education quality. Lacking direct export measures at the task level,<sup>5</sup> we link sectoral measures of GVC participation to workers' RTI in a given sector, drawing on the methodology of Borin and Mancini (2019) based on the EORA data. We also control for technology use with a country-sector share of workers who use computers at work. Such country-sector level globalisation and technology measures are plausibly exogenous to the decisions of individual firms and workers.<sup>6</sup>

Extensive literature studied the effects of offshoring on the relative demand for different occupations at the sectoral level, usually finding demand shifts with implications for inequality. It primarily differentiated between production and non-production workers, and captured relative demand for particular worker types with their share in the sector's wage bill. It initially focused on goods offshoring in manufacturing – see the seminal studies on the United States by Feenstra and Hanson (1999, 1996), and the broader literature review in Crinò (2009) – generally finding an increase in the relative demand for non-production workers. Focusing on services offshoring, some studies found it increased the relative demand for skills in the United States and Western Europe (Crinò, 2012, 2010), or lowered the relative demand for non-production workers in German manufacturing (Winkler, 2013). At the same time, globalisation is associated with a higher demand for low-educated workers in low-income countries (Reijnders et al., 2021). Several studies focused on worker-level adjustments to trade and offshoring found a downward pressure on wages in low-skilled occupations and upward pressure on wages in high-skilled occupations in the United Kingdom and Germany (Geishecker and Görg, 2013; Koerner, 2022). Ebenstein et al. (2014) showed that offshoring negatively affects individuals' wages in the United States due to relocating workers from higher-wage manufacturing jobs to other sectors and occupations. Existing cross-country studies (Wolszczak-Derlacz and Parteka, 2018) find minor adverse effects of offshoring on the wages of low- and middle-skilled workers, but they focus on high-income countries. In the meta-analysis of within-country studies, Cardoso et al. (2021) showed that offshoring benefits high-skilled workers and harms low-skilled workers, especially in the origin countries.

A related strand of literature focused on globalisation's distributional effects. Gonzalez et al. (2015) found that GVC participation has a relatively small impact on wage distributions and can reduce wage inequality among low-skilled

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<sup>4</sup> Other strands of literature relating globalisation to the demand for workers in routine jobs study the effects of global trade (Autor et al., 2015), the China trade shock on local labour markets (Aghelmaleki et al., 2022; Autor et al., 2016, 2013), as well as offshoring (Autor et al., 2016; Baumgarten et al., 2013; Ebenstein et al., 2014; Goos et al., 2014; Hanson, 2017).

<sup>5</sup> To understand how GVCs shape the division of tasks across countries, research would ideally relate measures of task exports to data on tasks' routine intensity. GVC participation measures to date are only available at the sector or firm level for a given country. However, recent work has introduced new measures of income and job activities in exports where an activity is defined as a sector-occupation pair (Kruse et al., 2023).

<sup>6</sup> The closest study to ours is Lewandowski et al. (2022), but we use much more disaggregated measures of GVC participation (especially in manufacturing) and assess the relative role of forward and backward linkages. Reijnders and de Vries (2018) also studied the role of offshoring and technological change in GVCs in explaining the demand increase for non-routine occupations in a sample of 37 advanced and emerging countries. They decomposed changes in occupational labour demand along the value chain, but their methodology did not allow differentiation between intensities of GVC participation. They assumed that occupations are identical worldwide and measured occupational task contents with American data (the Occupation Information Network – O\*NET), while we account for cross-country differences in job tasks in comparable occupations.

segments of the labour force. Duarte et al. (2022) showed that countries with medium levels of GVC participation tend to record higher income inequality than those with low or high levels of GVC participation. Heimberger's (2020) meta-analysis pointed out that financial globalisation has a more sizeable and inequality-increasing impact than trade globalisation.

This paper is structured as follows. Section two introduces the data, measurements, and descriptive analysis. Section three describes the methodology. Section four presents our econometric results. Section five concludes and outlines policy implications.

## 2. Data and descriptive evidence

### 2.1. Data and measurement

Our worker-level dataset covers 38 countries at different development levels (Table A4 in Appendix A). Most of the country's coverage comes from the OECD's Programme for the International Assessment of Adult Competencies – PIAAC (2019). During three rounds of the study (2011-2012, 2014-2015, and 2017-2018), data, including wage data, were collected in 31 countries. The sample sizes amount to a few thousand 16-65 years old individuals. We complement PIAAC with the Skills Towards Employment and Productivity – STEP (World Bank, 2017) survey data from seven low- and middle-income countries. STEP data were collected in 2012-2014 among urban residents aged 15-64, covering a few thousand respondents in each country.

Following Lewandowski et al. (2022), we create a worker-level task measure of routine task intensity in the spirit of Acemoglu and Autor (2011). As the STEP surveys are urban surveys, we omit farmers and skilled agricultural workers (ISCO 6 from the sample in all countries) for comparability. For methodological details, see Lewandowski et al. (2022). We calculate the worker-level routine task intensity according to the following formula:

$$RTI = \ln(r_{cog}) - \frac{(nr_{analytical} + nr_{personal})}{2} \quad (1)$$

where,  $r_{cog}$ ,  $nr_{analytical}$ ,  $nr_{personal}$  are routine cognitive, non-routine cognitive analytical, and non-routine cognitive personal task levels. Table A1 in Appendix A enlists survey items used to construct these task measures. Particular task measures and RTI are standardised using their mean and standard deviation in the United States.

We use hourly wages in US dollars, adjusted for purchasing power parity, with a 99% winsorisation.

The country-sector level measures of GVC participation are based on the EORA database (Lenzen et al., 2013, 2012) and computed with the method of (Borin and Mancini, 2019, 2015). We use backward and forward GVC participation measures. Both quantify value-added flows that cross at least two country borders. Backward GVC participation measures the share of imported inputs used in export production (% of total exports). Forward GVC participation captures the share of domestic value added embodied in a country's bilateral partners' exports (% of total exports).<sup>7</sup>

We follow Blinder and Krueger (2013), dividing occupations into offshorable and non-offshorable. Depending on data availability, we assign occupations to groups starting at the 4-digit ISCO-08 level. Most countries in PIAAC and STEP report occupations using 3- and 4-digit ISCO-08 codes. Table A3 in Appendix A enlists occupations with assigned offshorability groups (at the 2-digit ISCO level).

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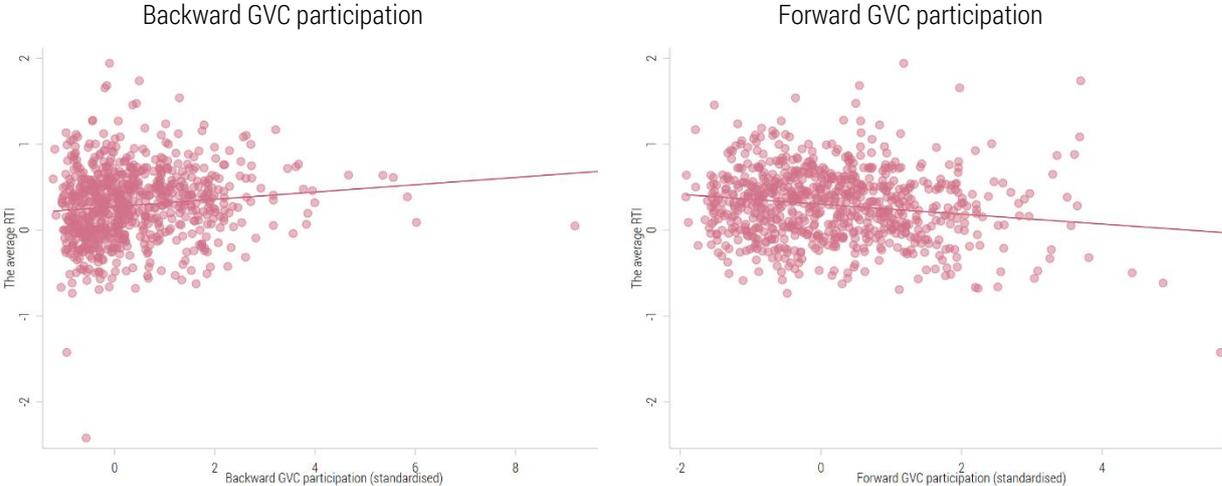
<sup>7</sup> This measure avoids a double-counting problem prevalent in alternative measures of forward GVC participation.

Finally, we distinguish between three broad sectors: industry, tradable services, and non-tradable services, drawing on World Bank’s method (Nayyar et al., 2021). Table A2 in Appendix A shows the assignment of specific NACE / ISIC sectors to these three broad sectors.

### 2.2. Descriptive analysis

We begin with visually exploring the relationship between GVC participation and RTI at the country-sector level. There is a weak correlation between the average RTI and backward GVC participation (11%, left panel of Figure 2), and a weak, negative correlation with forward GVC participation (-16%, right panel of Figure 2). The definition of GVC participation does not specify the type of value-added crossing borders – ranging from low (e.g., raw materials) to high high-value-added tasks (World Bank, 2020). These weak relationships could thus mask heterogeneity across types of countries, sectors, and occupations.

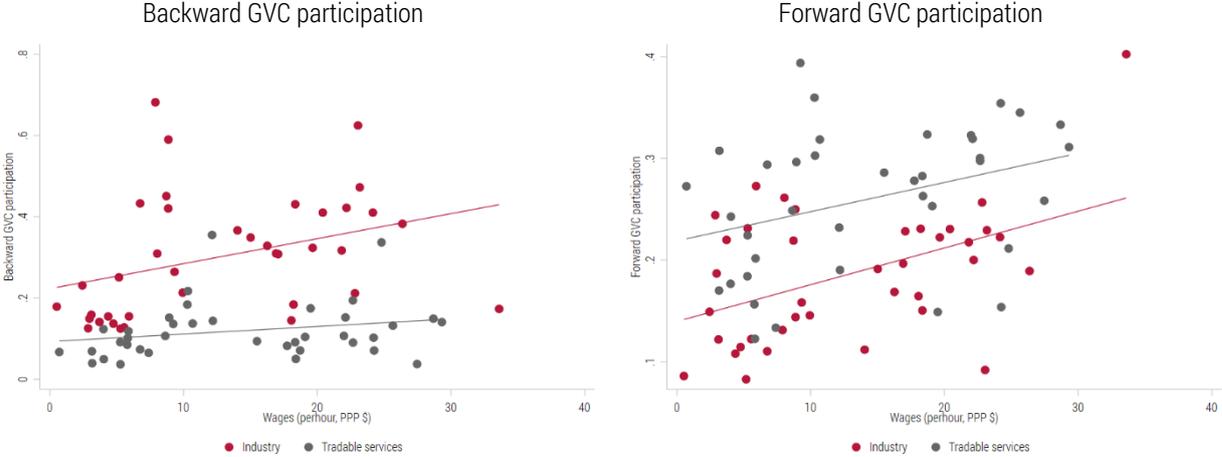
**Figure 2. The correlation between GVC participation and the average routine task intensity (RTI), by country and sector.**



Note: for each task content, the 0 is set at the United States average value and 1 corresponds to one standard deviation of this particular task content value in the United States. GDP per capita in PPP, current international \$, country averages for 2011–2016. For presentation purpose, we removed outlier from left panel.

Source: Authors’ calculations based PIAAC, STEP, World Bank, and EORA data.

**Figure 3. The correlation between GVC participation and hourly wages, by country and broad sector.**



Note: Hourly wages are in PPP US \$, top 1% of earners are excluded. Average wages are weighted with sectors’ output.

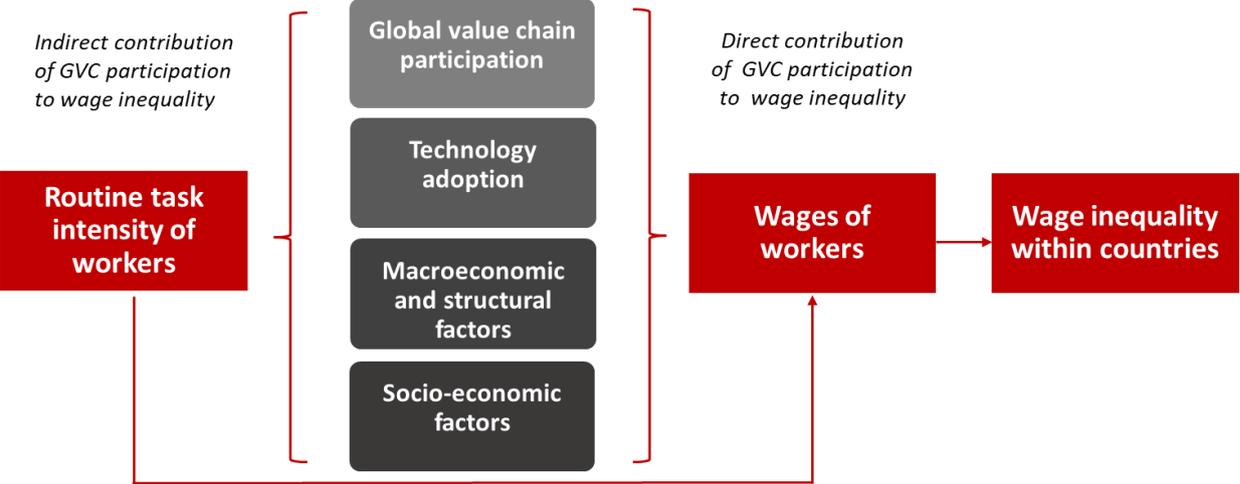
Source: Authors’ calculations based on PIAAC, STEP, and EORA data.

Next, we relate GVC participation to average wages at the country-sector level, differentiating between the industrial and tradable services sectors. Overall, both GVC participation measures positively correlate with average hourly wages at the country-sector level (Figure 3), suggesting positive productivity spillovers from firms participating in GVCs for workers. In the case of backward GVC participation, the correlation with wages in the industrial sector (35%) is stronger relative to the tradable services sector<sup>8</sup> (23%, Figure 3, left panel). It is in line with the intuition that high backward GVC participation in the industrial sector (driven mainly by manufacturing sectors) is associated with assembly tasks of specialised sectors where hourly wages can be expected to be higher (think of, e.g., technicians in the automotive sector). There is, however, high dispersion because high backward GVC participation can characterise low-wage countries specialised in limited manufacturing GVCs, but also richer countries specialised in more sophisticated GVCs. In the case of forward GVC participation, the opposite finding holds. The correlation with average hourly wages in the tradable services sector (46%) is higher than in the industrial sector (35%, Figure 3, right panel). High forward GVC participation in tradable services is associated with high-value-added tasks such as product design or R&D, which earn higher hourly wages. The high dispersion also suggests that high forward GVC participation is associated with lower-wage commodity exporters and innovative countries.

### 3. Methodology

We study the contribution of GVC participation to wage inequality within countries. As a higher RTI is negatively correlated with wages, both at the occupation and worker level (Autor and Handel, 2013; de la Rica et al., 2020), GVC participation may widen wage inequality between workers in offshorable occupations and those in non-offshorable occupations. Hence, we distinguish between two channels: (1) the direct contribution of GVC participation to individual wages, and (2) the indirect contribution of GVC participation through its relationship with workers' RTI. Diagram 1 exemplifies our reasoning. Our analysis can be divided into two parts: first, modelling RTI, second, modelling wages, and third, modelling inequality measured with the Gini coefficient of hourly wages.

**Diagram 1. Concept of wage inequality analysis.**



Source: Own elaboration.

<sup>8</sup> For details, see Table A2 in Appendix A.

### 3.1. Econometric model – routine task intensity (RTI)

Our first regression quantifies the relationship between GVC participation and the average RTI of workers and exploits the variation between countries within sectors (especially within manufacturing). It broadly follows the specification of Lewandowski et al. (2022). Specifically, we estimate pooled OLS regressions of the following form:

$$RTI_{ijsc} = \beta_0 + \beta_1 G_{sc} + \beta_2 G_{sc} * GDP_c^{PC} + \beta_3 Z_{sc} + \beta_4 X_{ijsc} + \lambda_s + \epsilon_{ijsc} \quad (2)$$

where  $RTI_{ijsc}$  is the RTI of individual  $i$  in occupation  $j$  in sector  $s$  in country  $c$ ;  $G_{sc}$  measures GVC participation in sector  $s$  in country  $c$ ;  $Z_{sc}$  captures technology in sector  $s$  in country  $c$ ;  $X_{ijsc}$  are individual skills of worker  $i$  in occupation  $j$  in sector  $s$  in country  $c$ ; and  $\lambda_s$  are sector fixed effects. We interact GVC participation,  $G_{sc}$ , with GDP per capita  $GDP_c^{PC}$  to control for potential differences between countries.

We use measures of backward and forward GVC participation in sector  $s$  and country  $c$ . The measures are standardised within the sample to allow for interpretation regarding their relative economic magnitudes. Importantly, they vary between narrowly defined sub-sectors within manufacturing. Additionally, we control for foreign direct investment (FDI) as a share of GDP to capture globalisation more broadly.

To capture technology, we use the share of workers in sector  $s$  and country  $c$  who use computers at work, calculated with the PIAAC and STEP survey questions about a worker's personal computer use. We aggregate this worker-level information to the sector level to address potential endogeneity concerns, as the performance of particular tasks may require computers. Following Lewandowski et al. (2022), we include a quadratic term, allowing for possible non-linear linkages between computer use and RTI. We also include sector-level fixed effects (18 sectors of 1-digit International Standard Industrial Classification, ISIC rev. 4) and their interactions with a country's GDP per capita (log, demeaned) to control for structural differences between countries.

To control for individual characteristics and skill levels, we include indicator variables for age (10-year age groups), gender, education level (primary, secondary, tertiary), and a test-based measure of literacy skills (four proficiency levels). The literacy test comprehensively quantifies individuals' skills to understand, evaluate, use, and engage with written texts in personal, work-related, societal, and educational contexts (PIAAC Literacy Expert Group, 2009).

We estimate the regression for all workers, and two main subsamples: workers in offshorable and non-offshorable occupations. We apply the allocation proposed by Blinder and Krueger (2013), see Table A3 in Appendix A for details. In all worker-level regressions, standard errors are clustered at the country-sector level.

### 3.2. Econometric model – wages

We divide our sample into six subsamples by broad sector (industry, tradable services and non-tradable services) and occupation (offshorable and non-offshorable), as introduced in section 3. For each subsample, we estimate the following Mincerian wage regression:

$$w_{ijsc} = \beta_0 + \beta_1 G_{sc} + \beta_2 G_{sc} * GDP_{sc}^{PC} + \beta_3 Z_{sc} + \beta_4 X_{ijsc} + \beta_5 RTI_{ijsc} + \lambda_j + \epsilon_{ijsc} \quad (3)$$

where,  $w_{ijsc}$  is the wage of individual  $i$  in occupation  $j$  in sector  $s$  in country  $c$ . In wage models, we interact GVC participation,  $G_{sc}$ , with GDP at sectoral level  $GDP_{sc}^{PC}$  instead of country level, as in model (2). This is required to control for average wage differences between countries and sectors. The rest of the notation follows equation (2). Our key coefficients of interest in the wage regression are  $\beta_5$  pertaining to worker-level RTI, and  $\beta_1$  and  $\beta_2$  which capture the role of GVCs across the development spectrum.

### 3.3. Counterfactual decomposition of wage inequality

Quantifying the direct and indirect – through RTI – contribution of GVC participation to countries' wage inequality involves four steps. Appendix A gives a more detailed description, including formulas for the underlying methodology, which we outline below.

First, based on the model (3) estimated coefficients, we predict workers' wages in each of the six subpopulations. We then calculate the Gini coefficient for each country, our *baseline scenario*.

Second, we calculate the indirect contribution of GVC participation to wage inequality. For each of the six sub-samples, we use the model (2) estimated coefficients to calculate counterfactual worker-level RTI under the scenario of no GVC integration, i.e., assuming GVC participation values equal to zero ( $G_{sc} = 0$ ). We then use the model (3) estimated coefficients to predict wages conditional on these counterfactual RTI values. To isolate the indirect contribution of GVC participation to wages through its relationship with workers' RTI, we use the observed values of GVC participation in this calculation (rather than setting their values to zero). We define *the indirect contribution of GVC participation to wage inequality* as a difference between the Gini coefficient of wages calculated in the baseline scenario and the Gini coefficient of wages obtained in this counterfactual scenario.

Third, we assess the direct contribution of GVC participation to wage inequality. We use the model (3) estimated coefficients for each of the six sub-samples to calculate counterfactual wages assuming GVC participation values equal to zero. We define *the direct contribution of GVC participation to within-country wage inequality* as the difference between the Gini coefficient of wages calculated in the baseline scenario and the Gini coefficient of wages obtained in this counterfactual scenario.

In the fourth step, we calculate the *total* contribution of GVC participation to wage inequality. We use the model (2) estimated coefficients for each of the six sub-samples to calculate counterfactual worker-level RTI, assuming GVC participation values equal to zero (as in the indirect contribution calculation). Then we use the model (3) estimated coefficients to calculate wages conditional on these counterfactual values of RTI and no GVC integration ( $G_{sc} = 0$ ). We define *the total contribution of GVC participation to wage inequality* as the difference between the Gini coefficient of wages in the baseline scenario and the Gini coefficient of wages in this final scenario.

## 4. Results

### 4.1. GVC participation and workers' tasks

We start by regressing worker-level RTI against backward and forward GVC participation at the country-sector level and a set of controls (model 2). We find barely any effects in the pooled sample of all occupations and sectors (Table 1, column 1). However, there is important heterogeneity between sectors, with industry and tradable services being most interesting as sectors highly integrated into GVCs (Table 1, Panel A, columns 2-4). In industry, higher GVC participation is associated with more routine-intensive work and the relationship is mediated by development level. To illustrate this, we show the relationship between GVC participation and RTI in an average low- or middle-income country and an average high-income country in our sample (Figure 4).

Further distinguishing between offshorable and non-offshorable occupations reveals clear correlation patterns between GVC participation type, sector of employment, and occupation type. Overall, GVC participation is associated with higher RTI among offshorable occupations but not among non-offshorable occupations. As

backward and forward GVC participation measures are standardised within the sample, the coefficients' similar size (in absolute terms) suggests that both participation types are equally important for workers' RTI, especially among offshorable occupations.<sup>9</sup>

In industry, both types of GVC participation are associated with higher RTI among workers in offshorable occupations. Hence, workers in industrial sectors and countries specialised in smaller segments of GVC (e.g., assemblers of final products) tend to perform more routine-intensive tasks. However, the relationship between forward GVC participation and RTI is mediated by countries' development level (Table 1, Panel B, column 2) – it is much more prominent in LMICs (0.18 of the US std. dev. in RTI) than in HICs (0.04, Figure 4, top panel).<sup>10</sup> In contrast, among workers in non-offshorable occupations, the relationship between RTI and backward GVC participation is insignificant (Table 1, panel C, column 2), while the relationship with forward GVC participation is only significant in LMICs (0.07, Figure 4, bottom panel).

In tradable services, the relationship between GVC participation and workers' RTI in offshorable occupations differs substantially between LMICs and HICs (Table 1, Panel B, column 3). In LMICs, we find a positive but imprecise association between RTI and backward GVC participation (0.13) and a strong positive association with forward GVC participation (0.19, Figure 4, top panel). In HICs, both are insignificant. Similarly to industry, there is no association between RTI and backward GVC participation among workers in non-offshorable occupations (Table 1, panel C, column 3). Still, we find a small, positive relationship between workers' RTI and forward GVC participation in LMICs (0.09, Figure 4, bottom panel).

In non-tradable services – much less integrated into GVCs than the other two broad sectors<sup>11</sup> – we find a positive association between RTI and backward (0.09-0.15, imprecise) and forward (0.09-0.16, Figure 4, top panel) GVC participation among workers in offshorable occupations (Table 1, panel B, column 4). However, this segment is small – on average, offshorable occupations account for 7% of non-tradable services employment, equivalent to 4% of total employment. In contrast with industry and tradable services, the results are not significantly different between LMICs and HICs (Figure 4, top panel). In the case of non-offshorable occupations, we find a positive association between workers' RTI and backward GVC participation in HICs and a negative one in LMICs (Figure 4, bottom panel). The relationship with forward GVC participation is insignificant (Table 1, panel C, column 4).

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<sup>9</sup> As a robustness check, we run models for backward and forward GVC participation measures separately, rather than combining them in one joint regression, and obtain similar results (Table B1 in Appendix B).

<sup>10</sup> We obtain similar results for manufacturing (ISIC rev. 4 section C) rather than industry – results are available upon request.

<sup>11</sup> On average, backward GVC participation in non-tradable services is 17.4 pp lower than in industry, and forward GVC participation is 3.3 pp lower (estimated as sector indicator variables in regressions on GVC participation, controlling for country dummies).

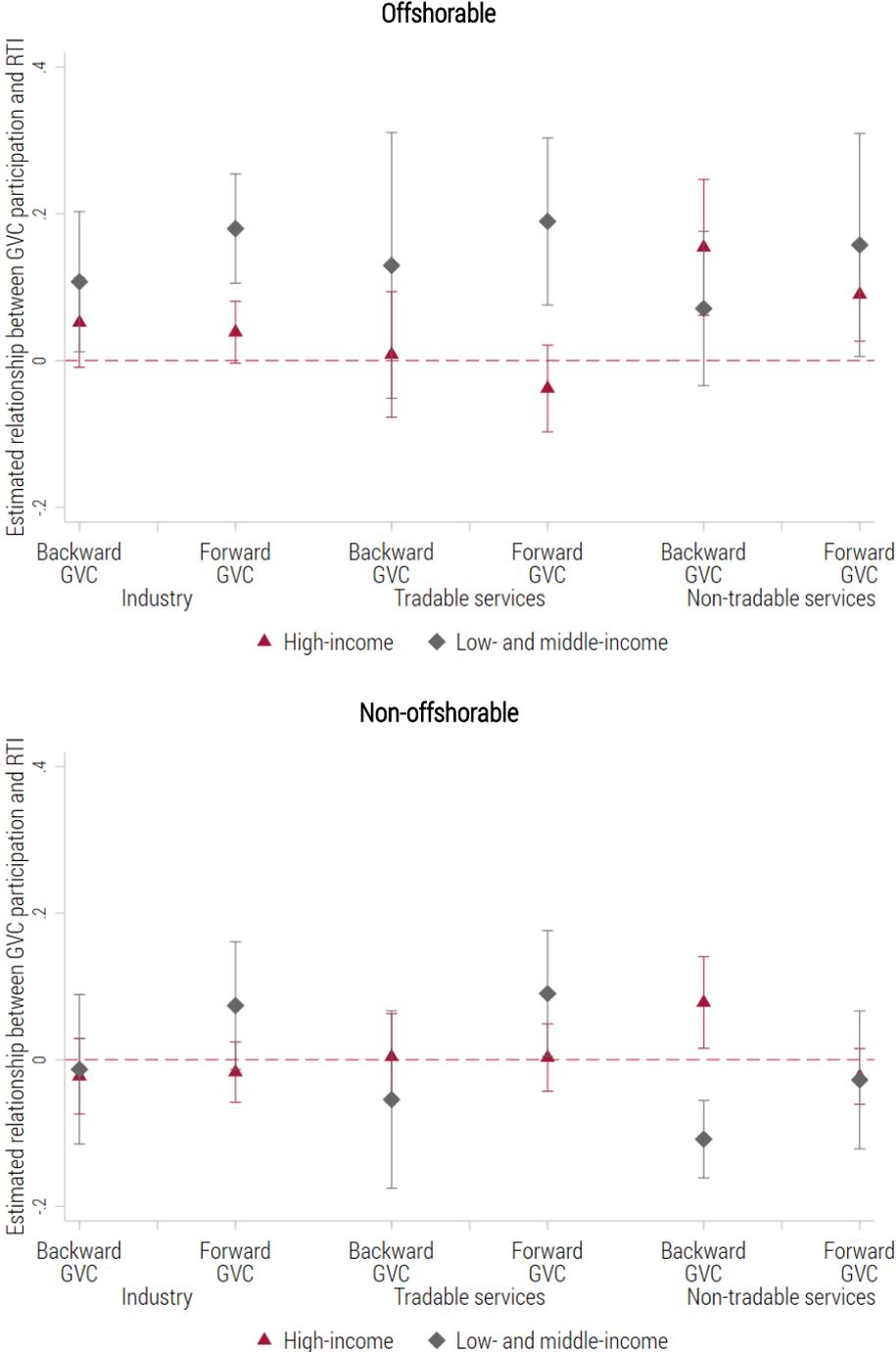
**Table 1. The relationship between GVC participation and RTI, total and by occupation type, standardized**

| Dependent variable: worker level RTI                                     | (1)                  | (2)                  | (3)                  | (4)                 |
|--|----------------------|----------------------|----------------------|---------------------|
|  | Total                | Industry             | Tradable             | Non-tradable        |
|  | economy              |                      | services             | services            |
| <b>Panel A: all workers</b>  |                      |                      |                      |                     |
| Backward Global Value Chain participation (GVCB) share in exports (std.) | 0.003<br>(0.015)     | 0.019<br>(0.019)     | -0.011<br>(0.024)    | 0.020<br>(0.021)    |
| GVCB share (std.) * [Ln(GDP pc) –mean(Ln(GDP pc))]                       | 0.041**<br>(0.021)   | -0.013<br>(0.031)    | 0.014<br>(0.034)     | 0.096***<br>(0.022) |
| Forward Global Value Chain participation (GVCF) share in exports (std.)  | 0.010<br>(0.011)     | 0.046**<br>(0.018)   | 0.032<br>(0.020)     | -0.013<br>(0.024)   |
| GVCF share (std.) * [Ln(GDP pc) –mean(Ln(GDP pc))]                       | -0.045***<br>(0.012) | -0.057***<br>(0.019) | -0.058**<br>(0.025)  | -0.001<br>(0.023)   |
| Ln(GDP per capita) –mean(Ln(GDP per capita))                             | 0.059<br>(0.040)     | 0.346***<br>(0.123)  | 0.022<br>(0.092)     | 0.084**<br>(0.040)  |
| Observations   | 118,182              | 19,123               | 30,410               | 68,649              |
| <b>Panel B: offshorable occupations</b>                                  |                      |                      |                      |                     |
| Backward Global Value Chain participation (GVCB) share in exports (std.) | 0.079***<br>(0.020)  | 0.072***<br>(0.024)  | 0.052<br>(0.049)     | 0.121***<br>(0.033) |
| GVCB share (std.) * [Ln(GDP pc) –mean(Ln(GDP pc))]                       | -0.031<br>(0.023)    | -0.029<br>(0.032)    | -0.065<br>(0.047)    | 0.047<br>(0.041)    |
| Forward Global Value Chain participation (GVCF) share in exports (std.)  | 0.081***<br>(0.014)  | 0.089***<br>(0.020)  | 0.043<br>(0.029)     | 0.111***<br>(0.038) |
| GVCF share (std.) * [Ln(GDP pc) –mean(Ln(GDP pc))]                       | -0.083***<br>(0.016) | -0.075***<br>(0.022) | -0.119***<br>(0.033) | -0.030<br>(0.040)   |
| Ln(GDP per capita) –mean(Ln(GDP per capita))                             | 0.055<br>(0.062)     | 0.270**<br>(0.117)   | 0.079<br>(0.108)     | 0.137**<br>(0.066)  |
| Observations   | 18,268               | 7,348                | 6,128                | 4,792               |
| <b>Panel C: non-offshorable occupations</b>                              |                      |                      |                      |                     |
| Backward Global Value Chain participation (GVCB) share in exports (std.) | -0.016<br>(0.015)    | -0.019<br>(0.021)    | -0.016<br>(0.028)    | 0.013<br>(0.022)    |
| GVCB share (std.) * [Ln(GDP pc) –mean(Ln(GDP pc))]                       | 0.050**<br>(0.020)   | -0.005<br>(0.033)    | 0.030<br>(0.037)     | 0.099***<br>(0.023) |
| Forward Global Value Chain participation (GVCF) share in exports (std.)  | -0.007<br>(0.013)    | 0.016<br>(0.023)     | 0.034<br>(0.022)     | -0.024<br>(0.025)   |
| GVCF share (std.) * [Ln(GDP pc) –mean(Ln(GDP pc))]                       | -0.036***<br>(0.013) | -0.048**<br>(0.023)  | -0.046*<br>(0.026)   | 0.002<br>(0.024)    |
| Ln(GDP per capita) –mean(Ln(GDP per capita))                             | 0.056<br>(0.040)     | 0.658***<br>(0.133)  | 0.027<br>(0.100)     | 0.077*<br>(0.042)   |
| Observations   | 99,914               | 11,775               | 24,282               | 63,857              |

Note: \*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1. Standard errors in parentheses. Standardised weights are used that give each country equal weight. The standard errors are clustered at a sector × country level. Measures for GVCB share and GVCF share are standardised. All regressions include controls for technology (computer use, computer use squared), FDI, skills, education, age, gender, sector FE, and sector FE interacted with GDP per capita.

Source: Authors' calculations based on PIAAC, STEP, World Bank, and EORA data.

Figure 4. The estimated relationship between GVC participation and workers' RTI in high-income and low- and middle-income countries, by employment sectors, occupation, and participation type



Note: Figure presents the marginal effects of GVC participation based on regressions presented in Table 1, for the average GDP per capita of high-income and low- and middle-income countries. High-income country closest to the average is Italy, and low- middle-income country is Macedonia.

Source: Authors' calculations based on PIAAC, STEP, World Bank, and EORA data.

We draw two main conclusions. First, participation in GVC widens the gap in workers' RTI between countries at different development levels. Especially in offshorable occupations, the impacts of GVC participation on workers' RTI tend to be strong and positive in LMICs, while they are zero or negligible in HICs. This divergence of RTI is most pronounced in sectors with the highest share of offshorable occupations – industry and tradable services. Our findings align with the theory: manufacturing low-value-added, basic intermediates that require more routine-intensive work tends to be outsourced to less developed countries (factory economies), while the performance of non-routine tasks remains in countries at higher development levels (Baldwin, 2013).

Second, participation in GVC widens the RTI gap between offshorable and non-offshorable occupations, especially in LMICs. Backward GVC participation correlates positively with workers' RTI in offshorable occupations, such as plant and machine operators, but not in non-offshorable occupations, such as truck drivers (see the list of occupations by offshorability in Table A3). Similarly, a positive correlation between forward GVC participation and workers' RTI is stronger among workers in offshorable occupations. Higher RTI is linked to lower wages, so this divergence of workers' tasks in offshorable and non-offshorable occupations can indirectly contribute to wage inequality. We explore this mechanism in Subsection 4.4

## **4.2. Robustness check: occupations by skill intensity**

As a robustness check for differences between occupational groups, we re-estimate model (2) distinguishing between occupational groups that differ in skill levels rather than between offshorable and non-offshorable occupations. We distinguish between high-skilled (managers, professionals, technicians – ISCO 1-3), medium-skilled (clerical workers, sales and services workers – ISCO 4-5) and low-skilled (craft and related trades workers, plant and machine operators, elementary occupations – ISCO 7-9) occupations. This classification of occupations follows the standard typology of the International Labour Organisation, and was used by Lewandowski et al. (2022). These occupational groups perform tasks with different routine intensities. On average, workers in high-skilled occupations perform relatively non-routine tasks, workers in middle-skilled occupations moderately routine-intensive tasks, and workers in low-skilled occupations more routine-intensive tasks.

Results for high- and middle-skilled occupations somewhat resemble those for non-offshorable occupations, while results for low-skilled occupations resemble those for offshorable occupations (see Table B2 in Appendix B). Importantly, we observe almost identical patterns in correlations between GVC participation and RTI for specific sectors. It confirms that distinguishing between industries is crucial for studying the relationship between GVC participation and labour market outcomes. Our results suggest that the relationship between GVC participation and RTI differs substantially between the industrial and tradable services sectors. In the industrial sector, higher GVC participation is associated with more routine intensive work in offshorable occupations that usually demand low to medium levels of skills. In tradable services, it is associated with less routine intensive work in non-offshorable occupations, which often require higher skills.

### 4.3. GVC participation and wages

Next we study the relationship between GVC participation and workers' wages, using Mincerian wage regressions (model 3) estimated for each of the six subpopulations by broad sector and occupation type (Table 2).<sup>12</sup>

Results consistently show a significant negative association between workers' RTI and hourly wages in all occupation types and sectors; that is, more routine intensive tasks pay less.<sup>13</sup> However, the RTI wage penalty differs between sectors: it is the largest in tradable services and the smallest in non-tradable services (Table 2). In tradable services, it is also larger for workers in offshorable occupations than for workers in non-offshorable occupations. In the other two sectors, there are no differences between occupational groups (Table 2).

**Table 2. The relationship between RTI, GVC participation, and wages, by sector and occupation type, standardised**

| Dependent variable: worker-level wages                    | Industry             |                      | Tradable services    |                      | Non-tradable services |                      |
|---|----------------------|----------------------|----------------------|----------------------|-----------------------|----------------------|
|   | (1)                  | (2)                  | (3)                  | (4)                  | (5)                   | (6)                  |
|   | Offshorable          | Non-offshorable      | Offshorable          | Non-offshorable      | Offshorable           | Non-offshorable      |
| Routine Task Intensity (RTI, std)                         | -1.697***<br>(0.228) | -1.795***<br>(0.196) | -2.306***<br>(0.270) | -1.885***<br>(0.124) | -1.376***<br>(0.172)  | -1.358***<br>(0.077) |
| Backward GVC participation (GVCB) share in exports (std.) | 0.191<br>(0.186)     | 0.399*<br>(0.230)    | -1.324***<br>(0.444) | 0.068<br>(0.334)     | 0.176<br>(0.326)      | 0.689***<br>(0.225)  |
| GVCB share (std.) * [Ln(output) – mean(Ln(output))]       | 0.103<br>(0.084)     | 0.157<br>(0.100)     | -0.241<br>(0.190)    | 0.050<br>(0.134)     | -0.005<br>(0.071)     | 0.124<br>(0.077)     |
| Forward GVC participation (GVCF) share in exports (std.)  | -0.195*<br>(0.101)   | 0.185<br>(0.175)     | -0.759<br>(0.605)    | 0.716<br>(0.477)     | -0.000<br>(0.260)     | 0.371*<br>(0.197)    |
| GVCF share (std.) * [Ln(output) – mean(Ln(output))]       | 0.000<br>(0.046)     | 0.213***<br>(0.075)  | -0.256<br>(0.212)    | 0.352***<br>(0.129)  | -0.209**<br>(0.088)   | -0.124*<br>(0.063)   |
| Ln(output) – mean(Ln(output))                             | 0.636**<br>(0.257)   | 0.431**<br>(0.210)   | 0.557*<br>(0.329)    | -0.150<br>(0.184)    | -0.120<br>(0.162)     | 0.256**<br>(0.111)   |
| Observations  | 6,688                | 10,605               | 5,432                | 21,233               | 4,285                 | 56,991               |

Note: \*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1. Standard errors in parentheses. Standardised weights are used that give each country equal weight. We use sectoral output instead of countries' GDP per capita to control for between-country, between-sector wage differences. However, regressions, including GDP per capita yield similar results. The standard errors are clustered at a sector × country level. Measures for GVCB share and GVCF share are standardised. All regressions include controls for technology (computer use, computer use squared), skills, education, age, gender, sector FE, and country FE.

Source: Authors' calculations based on PIAAC, STEP, World Bank, and EORA data.

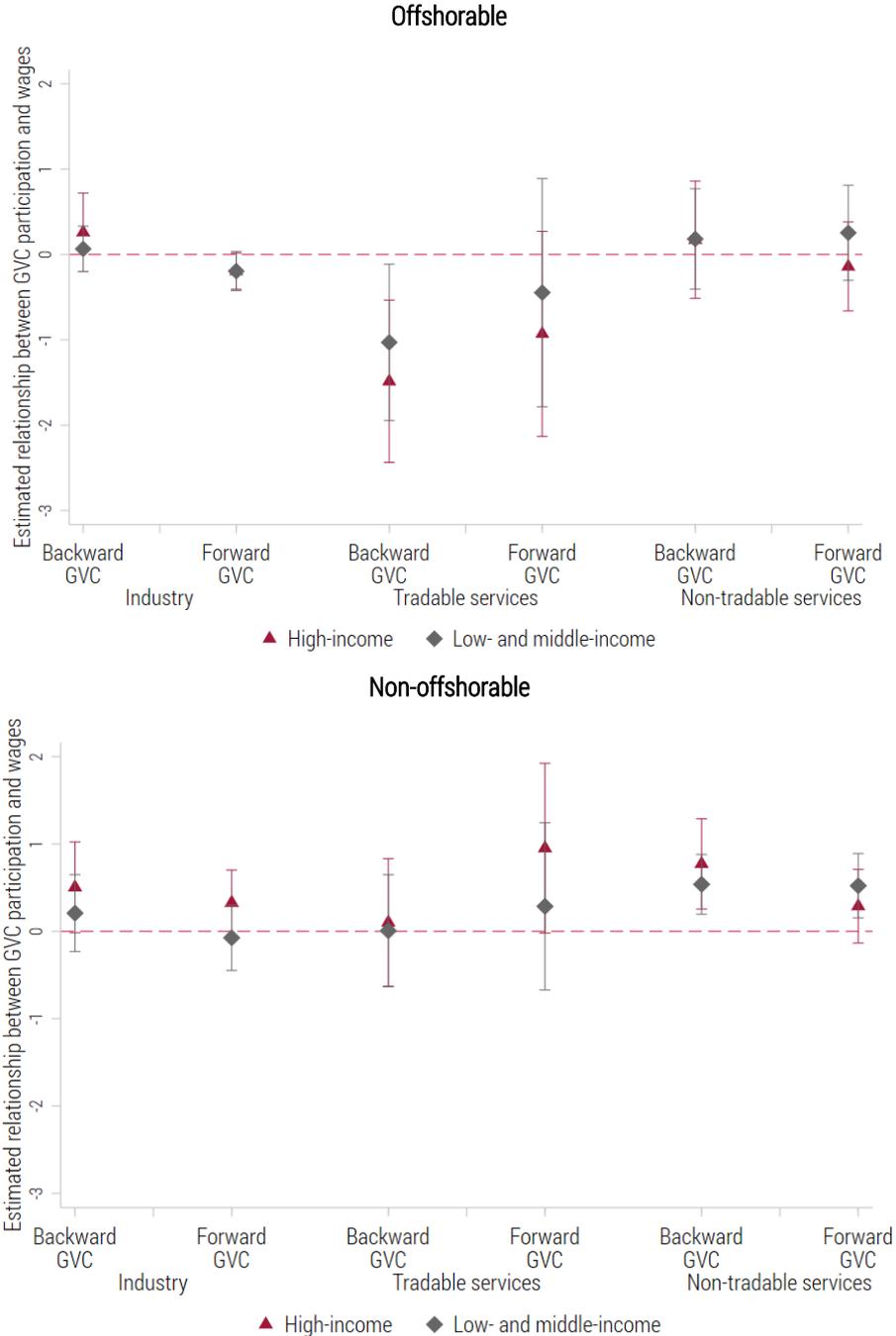
At the same time, higher GVC participation is associated with lower wages among workers in offshorable occupations. In HICs, it also with higher wages among non-offshorable occupations. Specifically, a higher GVC participation is strongly associated with lower wages among workers in offshorable occupations in tradable services (backward GVC, 1.03-1.49 \$ per hour, Figure 5, top panel, and Table 2) and industry (forward GVC, 0.19 \$ per hour, Figure 5, top panel, and Table 2). At the same time, in HICs, higher GVC participation is associated with higher wages among workers in non-offshorable occupations in tradable services (forward GVC, 0.95 \$ per hour),

<sup>12</sup> Some individuals do not report wages, so the sample sizes in wage regressions are slightly smaller than sample sizes in RTI regressions (see Tables 1 and 2).

<sup>13</sup> Robust, negative association between worker-level RTI and wages was also identified by Autor and Handel (2013) in the US and de la Rica et al. (2020) in the group of OECD countries.

non-tradable services (backward GVC, 0.54-0.77 \$ per hour), and industry (backward, 0.50 \$ per hour, Figure 5, bottom panel, and Table 2). In LMICs, we find no direct relationship between GVC participation and workers' wages in non-offshorable occupations (Figure 5, bottom panel). Our results are in line with demand-side explanations, for instance, GVC participation reducing the bargaining power of workers whose jobs can easily be offshored, and increasing premium for performing high-value-added tasks in occupations which cannot easily move out of HICs.

**Figure 5. The estimated relationship between GVC participation and workers' wages in high-income and low- and middle-income countries, by employment sectors, occupation and participation type**



Note: Figure presents the marginal effects of GVC participation based on regressions presented in Table 1, for the average GDP per capita of high-income and low- and middle-income countries. High-income country closest to the average is Italy, and low- middle-income country is Macedonia.  
 Source: Authors' calculations based on PIAAC, STEP, World Bank, and EORA data.

#### 4.4. Direct and indirect contribution of GVC participation to wage inequality

Here, we explore the contribution of GVC participation to within-country wage inequality, distinguishing between its direct and indirect contributions through workers' RTI. Our approach likely provides an upper bound, as we use cross-sectional regression that describes the equilibrium allocation of tasks and wages across workers in different countries. GVC participation may be partly endogenous to comparative advantage in tasks and pre-existing wage-level differences. For this reason, we focus on within-country wage inequality rather than cross-country differences in wage levels. Moreover, only a minor share of cross-country differences in RTI can be attributed to globalisation, as differences in technology use and skill supply play a much larger role (Lewandowski et al., 2022).

We find that the direct contribution of GVC participation to wage inequality is negative in most countries, with a clear U-shaped relationship between GDP per capita and this contribution (Figure 6a). In other words, higher GVC participation is directly linked to reduced wage inequality within countries, to the largest extent in upper-middle-income and bottom-high-income countries. Some notable exceptions include the US and small countries intensively integrated into GVC, such as Norway (high forward GVC participation), and developing economies with high GVC participation only in selected sectors (e.g., Ghana, Kenya). The Mincerian wage regressions suggest that the direct contribution reflects the positive role of backward GVCs for workers' wages in non-offshorable occupations in industry and non-tradable services sectors (Table 2). Furthermore, GVC participation tends to be negatively correlated with workers' wages in offshorable jobs (Figure 5, top panel). Importantly, in most countries, the majority of workers in offshorable jobs earn above the country-specific median (see Figure B2 in Appendix B). Therefore, a negative relationship between GVC participation and wages in offshorable jobs compresses wage distribution.

In sharp contrast, the indirect contribution of GVC participation to wages through its link with workers' RTI generally widens wage inequality (Figure 6b). Contrasting associations between GVC participation and RTI among different groups of workers drive this pattern. The relationship between workers' RTI and individual wages is negative in all sectors and occupation types (Table 2). Higher GVC integration is associated with larger RTI gaps between workers in offshorable and non-offshorable occupations (Figure 4), indirectly widening the within-country wage inequality. In most countries, the indirect contribution is smaller in absolute terms than the direct contribution.

Finally, we assess the total (net) contribution of GVC participation to wage inequality within countries (Figure 6c).<sup>14</sup> We find that GVC participation links with higher wage inequality in the top high-income countries, in most cases driven by the indirect contribution of GVCs through workers' RTI. At the same time, GVC participation is associated with reduced wage inequality in most low- and middle-income countries (e.g., Latin American countries in the sample), as well as the bottom high-income countries (Central Eastern and Southern Europe), where the direct reduction in wage inequality is stronger than the indirect contribution.

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<sup>14</sup> The Gini coefficient is a non-linear measure, so the sum of Gini coefficients calculated with separate shocks (direct and indirect contribution) may not equal the Gini coefficient calculated with the same two shocks jointly (total contribution). The residual, however, is small compared to the total contribution (see Figure B1 in Appendix B). Moreover, after controlling for industry fixed effects, we find no relationship between GVC participation and the share of workers performing offshorable jobs at the sector level (Table B3 in the Appendix B). Thus, we do not consider the structural effect in the decomposition of GVC contribution to Gini (Figure 6).



Our results suggest that in countries that mostly receive offshored jobs, GVC participation reduces wage inequality despite expanding the gap in the RTI of work between offshorable and non-offshorable occupations. However, in rich countries that mostly offshore jobs, GVC participation widens wage inequality as it benefits mainly workers in non-offshorable occupations.<sup>15</sup>

## 5. Conclusions and policy implications

In this paper, we investigated the relationship between GVC participation and the RTI of workers and its contribution to within-country wage inequality. We used a unique dataset combining worker-level, country-specific RTI measures based on a pooled sample of survey data for 38 countries at all development levels, applying the methodology of Lewandowski et al. (2022), with measures of backward and forward GVC participation at the country-sector level based on the method of Borin and Mancini (2019, 2015). We showed that GVC participation contributes to wage inequality within countries directly and indirectly through its relationship with workers' RTI. However, the relationship between GVC participation and the RTI of workers is complex and depends on the nature of GVCs, occupations, and sectors. It also differs between countries at different development levels.

We studied the contribution of GVC participation to within-country wage inequality – directly through GVCs' associations with wages and indirectly through its relationship with the workers' RTI. GVC participation is associated with larger wage inequality in HICs but with reduced wage inequality in most LMICs. Its indirect contribution to wage inequality – widening the gap between the RTI of workers in offshorable and non-offshorable occupations – is a crucial disequalising mechanism. It reflects different patterns between GVC participation and workers' RTI across occupation types, sectors, and countries. In countries and sectors with higher GVC participation, workers in offshorable occupations perform more routine-intensive work, particularly in low- and middle-income countries. This relationship is the strongest in tradable sectors, namely industry and tradable services, in line with theories of trading tasks between more and less developed countries (Grossman and Rossi-Hansberg, 2008). At the same time, GVC participation is barely related to RTI of workers in non-offshorable occupations. Since higher RTI is associated with lower wages, GVC participation indirectly widens wage inequality. However, in most countries in our sample, the direct relationship between GVC and wages works in the opposite direction, as GVC participation is associated with lower wages in tradable occupations in services, a high-paying sector. In most countries, the direct contribution to wage inequality dominates over the indirect one, so GVC participation is associated with lower wage inequality. However, in the most advanced HICs, GVC participation is disequalising, as it benefits workers in non-offshorable occupations in tradable services, so the direct contribution amplifies the indirect contribution.

Understanding the differences in the RTI of workers across the development spectrum and its relationship with fundamental factors – technology adoption, skill supply, and globalisation – has important policy implications. The transition from routine to non-routine work has been a key dimension of structural change in labour markets, increasing worker productivity and earnings. Jobs with a higher non-routine content involve higher levels of

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<sup>15</sup> To test the robustness of our results, we have estimated a seemingly unrelated regression (SUR) system (results available upon request). We find that separate estimation is correct. First, we find no correlation between the residuals from RTI and wage models, suggesting they are unrelated. Error terms have fairly symmetric distributions required for the estimator to be unbiased in small samples. Second, the point estimates are in line with those obtained from separate estimations.

technology, require higher skill levels, and offer higher earnings between and within occupations (Autor and Handel, 2013; de la Rica et al., 2020). Diverging effects of globalisation on the RTI of different types of workers can thus contribute to wage inequality within countries. So far, LMICs have not been catching up with HICs in terms of routine task intensity and providing non-routine work in the global division of labour, and they have not experienced labour market polarization to a comparable extent (Gradin et al., 2023).

We also find that the positive relationship between GVC participation and workers' RTI is much stronger in LMICs than in HICs, widening the RTI gap between these country groups. At the same time, cross-country differences in RTI, especially between high- versus low- and middle-income countries, are larger than implied by mere cross-country differences in skills supply, as they can be mainly attributed to differences in technology use (Lewandowski et al., 2022). Investments in education and skills in developing and emerging economies are frequently cited as necessary conditions to foster shared prosperity (World Bank, 2019). They are also often highlighted to counter the adverse labour market effects of increased technology adoption in developing countries. The mediating role of worker skills becomes even more urgent amidst rapid advances in artificial intelligence, such as recent developments of Chat-GPT and GPT-4. While they are most likely required to achieve these goals, they are unlikely to be sufficient, given that differences in job task content are largely related to differences in technology use and participation in GVCs. Policies to increase technology use and approaches to facilitate upgrading in GVC should complement investments in skills, especially since technological change within GVCs tends to increase the relative demand for non-routine work (Reijnders and de Vries, 2018).

Our study has limitations. First, it does not claim to have determined a causal effect. Since the survey data were collected only once per country, only cross-sectional analysis is possible. The analysis therefore cannot capture *wage changes over time* or cases where GVC participation created new *labour market segments that did not exist before*. In the future, the second round of PIAAC data collection will allow running a quasi-panel study to study the relationship between changes in GVC participation, technology use, and the supply of skills, with the RTI of particular occupations in various countries. Second, the survey data do not distinguish between domestic and foreign-owned firms, so it is unclear if FDI correlates with RTI differences within sectors. Lewandowski et al. (2022) showed that FDI is not a significant factor behind RTI differences between sectors, but there may be a relationship within sectors. Third, adult skill surveys have greatly improved our understanding of skills supply and the quality of education worldwide. It is possible, though, that literacy or numeracy measures are insufficient to fully understand factors behind differences in the nature of work, task content of jobs, and productivity. Differences in managerial and interpersonal skills may also contribute to differences in organising and performing work. These skills are unfortunately not measured in the same survey data that capture worker tasks. Finally, the estimated contribution of technology adoption to worker-level RTI may likely increase in the future. Advances in artificial intelligence may more strongly affect business services tasks, the extent of offshoring, and thus the relationship between GVC participation and RTI.

## References

- Acemoglu, D., Autor, D., 2011. Skills, tasks and technologies: implications for employment and earnings, in: Card, D., Ashenfelter, O. (Eds.), *Handbook of Labor Economics*. Elsevier, pp. 1043–1171. [https://doi.org/10.1016/S0169-7218\(11\)02410-5](https://doi.org/10.1016/S0169-7218(11)02410-5)
- Aghelmaleki, H., Bachmann, R., Stiebale, J., 2022. The China shock, employment protection, and European jobs. *ILR Review* 75, 1269–1293. <https://doi.org/10.1177/00197939211052283>
- Autor, D.H., Dorn, D., 2013. The growth of low-skill service jobs and the polarization of the US labor market. *American Economic Review* 103, 1553–1597. <https://doi.org/10.1257/aer.103.5.1553>
- Autor, D.H., Dorn, D., Hanson, G.H., 2016. The China shock: learning from labor-market adjustment to large changes in trade. *Annu. Rev. Econ.* 8, 205–240. <https://doi.org/10.1146/annurev-economics-080315-015041>
- Autor, D.H., Dorn, D., Hanson, G.H., 2015. Untangling trade and technology: evidence from local labour markets. *The Economic Journal* 125, 621–646. <https://doi.org/10.1111/eoj.12245>
- Autor, D.H., Dorn, D., Hanson, G.H., 2013. The geography of trade and technology shocks in the United States. *American Economic Review* 103, 220–225. <https://doi.org/10.1257/aer.103.3.220>
- Autor, D.H., Handel, M.J., 2013. Putting tasks to the test: human capital, job tasks, and wages. *Journal of Labor Economics* 31, S59–S96. <https://doi.org/10.1086/669332>
- Baldwin, R., 2014. Trade and industrialization after globalization's second unbundling: how building and joining a supply chain are different and why it matters, in: 5. *Trade and Industrialization after Globalization's Second Unbundling: How Building and Joining a Supply Chain Are Different and Why It Matters*. University of Chicago Press, pp. 165–214. <https://doi.org/10.7208/9780226030890-007>
- Baldwin, R., 2013. Global supply chains: Why they emerged, why they matter, and where they are going. *Global Value Chains in a Changing World* 13–59. <https://doi.org/10.30875/3c1b338a-en>
- Baumgarten, D., Geishecker, I., Görg, H., 2013. Offshoring, tasks, and the skill-wage pattern. *European Economic Review* 61, 132–152. <https://doi.org/10.1016/j.euroecorev.2013.03.007>
- Blinder, A.S., Krueger, A.B., 2013. Alternative measures of offshorability: a survey approach. *Journal of Labor Economics* 31, S97–S128. <https://doi.org/10.1086/669061>
- Bohn, T., Brakman, S., Dietzenbacher, E., 2018. The role of services in globalisation. *The World Economy* 41, 2732–2749. <https://doi.org/10.1111/twec.12640>
- Borin, A., Mancini, M., 2019. Measuring what matters in global value chains and value-added trade (Working Paper). World Bank. <https://doi.org/10.1596/1813-9450-8804>
- Borin, A., Mancini, M., 2015. Follow the value added: bilateral gross export accounting. Bank of Italy Temi Di Discussione (Working Paper) No 1026.
- Cardoso, M., Neves, P.C., Afonso, O., Sochirca, E., 2021. The effects of offshoring on wages: a meta-analysis. *Rev World Econ* 157, 149–179. <https://doi.org/10.1007/s10290-020-00385-z>
- Caunedo, J., Keller, E., Shin, Y., 2023. Technology and the Task Content of Jobs across the Development Spectrum. *The World Bank Economic Review* 37, 479–493. <https://doi.org/10.1093/wber/lhad015>
- Cortes, G.M., Jaimovich, N., Siu, H.E., 2017. Disappearing routine jobs: Who, how, and why? *Journal of Monetary Economics*, The Swiss National Bank/Study Center Gerzensee Special Issue: "Modern Macroeconomics: Study Center Gerzensee Conference in Honor of Robert G. King" Sponsored by the Swiss National Bank and the Study Center Gerzensee 91, 69–87. <https://doi.org/10.1016/j.jmoneco.2017.09.006>

- Crinò, R., 2012. Service offshoring and the skill composition of labour demand. *Oxford Bulletin of Economics and Statistics* 74, 20–57. <https://doi.org/10.1111/j.1468-0084.2010.00634.x>
- Crinò, R., 2010. Service offshoring and white-collar employment. *The Review of Economic Studies* 77, 595–632. <https://doi.org/10.1111/j.1467-937X.2009.00586.x>
- Crinò, R., 2009. Offshoring, multinationals and labour market: a review of the empirical literature. *Journal of Economic Surveys* 23, 197–249. <https://doi.org/10.1111/j.1467-6419.2008.00561.x>
- de la Rica, S., Gortazar, L., Lewandowski, P., 2020. Job tasks and wages in developed countries: evidence from PIAAC. *Labour Economics* 65, 101845. <https://doi.org/10.1016/j.labeco.2020.101845>
- de Vries, G., Chen, Q., Hasan, R., Li, Z., 2019. Do Asian countries upgrade in global value chains? A novel approach and empirical evidence. *Asian Economic Journal* 33, 13–37. <https://doi.org/10.1111/asej.12166>
- Duarte, R., Espinosa-Gracia, A., Jiménez, S., Sánchez-Chóliz, J., 2022. New insights on the relationship between the involvement of countries in global value chains, and intra- and inter-country inequalities. *Structural Change and Economic Dynamics* 63, 320–329. <https://doi.org/10.1016/j.strueco.2022.11.001>
- Ebenstein, A., Harrison, A., McMillan, M., Phillips, S., 2014. Estimating the impact of trade and offshoring on american workers using the current population surveys. *The Review of Economics and Statistics* 96, 581–595. [https://doi.org/10.1162/REST\\_a\\_00400](https://doi.org/10.1162/REST_a_00400)
- Feenstra, R.C., Hanson, G.H., 1999. The impact of outsourcing and high-technology capital on wages: estimates for the United States, 1979–1990. *The Quarterly Journal of Economics* 114, 907–940.
- Feenstra, R.C., Hanson, G.H., 1996. Globalization, outsourcing, and wage inequality. *The American Economic Review* 86, 240–245.
- Fernandez-Stark, K., Bamber, P., Gereffi, G., 2011. Workforce development in the fruit and vegetable global value chain. Duke Center on Globalization, Durham.
- Geishecker, I., Görg, H., 2013. Services offshoring and wages: evidence from micro data. *Oxford Economic Papers* 65, 124–146. <https://doi.org/10.1093/oep/gpr055>
- Gonzalez, J.L., Kowalski, P., Achard, P., 2015. Trade, global value chains and wage-income inequality. OECD, Paris. <https://doi.org/10.1787/5js009mzrqd4-en>
- Goos, M., Manning, A., Salomons, A., 2014. Explaining job polarization: routine-biased technological change and offshoring. *The American Economic Review* 104, 2509–2526. <https://doi.org/10.1257/aer.104.8.2509>
- Gradin, C., Lewandowski, P., Schotte, S., Sen, K., 2023. Tasks, Skills, and Institutions. *The Changing Nature of Work and Inequality*. Oxford University Press.
- Grossman, G.M., Rossi-Hansberg, E., 2008. Trading Tasks: A Simple Theory of Offshoring. *American Economic Review* 98, 1978–1997. <https://doi.org/10.1257/aer.98.5.1978>
- Hanson, G.H., 2017. What do we really know about offshoring? Industries and countries in global production sharing. <https://doi.org/10.2139/ssrn.2980947>
- Heimberger, P., 2020. Does economic globalisation affect income inequality? A meta-analysis. *The World Economy* 43, 2960–2982. <https://doi.org/10.1111/twec.13007>
- Jensen, J.B., Kletzer, L.G., 2010. Measuring tradable services and the task content of offshorable services jobs, in: *Labor in the New Economy*. University of Chicago Press, pp. 309–335.
- Koerner, K., 2022. The wage effects of offshoring to the East and West: evidence from the German labor market. *Review of World Economics*. <https://doi.org/10.1007/s10290-022-00471-4>

- Kordalska, A., Olczyk, M., 2022. Upgrading low value-added activities in global value chains: a functional specialisation approach. *Economic Systems Research* 0, 1–27. <https://doi.org/10.1080/09535314.2022.2047011>
- Kruse, H., Timmer, M., de Vries, G., Ye, X., 2023. Structural change in export activities: an exploration using occupations data. Groningen University, mimeo.
- Lenzen, M., Kanemoto, K., Moran, D., Geschke, A., 2012. Mapping the structure of the world economy. *Environ. Sci. Technol.* 46, 8374–8381. <https://doi.org/10.1021/es300171x>
- Lenzen, M., Moran, D., Kanemoto, K., Geschke, A., 2013. Building EORA: a global multi-region input–output database at high country and sector resolution. *Economic Systems Research* 25, 20–49. <https://doi.org/10.1080/09535314.2013.769938>
- Lewandowski, P., Park, A., Hardy, W., Du, Y., Wu, S., 2022. Technology, skills, and globalization: explaining international differences in routine and nonroutine work using survey data. *The World Bank Economic Review* 36, 687–708. <https://doi.org/10.1093/wber/lhac005>
- Lo Bello, S., Sanchez Puerta, M.L., Winkler, H., 2019. From Ghana to America: the skill content of jobs and economic development (Working Paper No. 12259). IZA Discussion Papers.
- Marcolin, L., Miroudot, S., Squicciarini, M., 2016. Routine jobs, employment and technological innovation in global value chains. OECD science, technology and industry working papers no. 2016/01.
- Michaels, G., Natraj, A., Van Reenen, J., 2014. Has ICT Polarized Skill Demand? Evidence from Eleven Countries over Twenty-Five Years. *The Review of Economics and Statistics* 96, 60–77. [https://doi.org/10.1162/REST\\_a\\_00366](https://doi.org/10.1162/REST_a_00366)
- Nayyar, G., Hallward-Driemeier, M., Davies, E., 2021. *At Your Service?: The Promise of Services-Led Development*. World Bank, Washington, DC.
- PIAAC Literacy Expert Group, 2009. *PIAAC Literacy: A Conceptual Framework*. OECD, Paris. <https://doi.org/10.1787/220348414075>
- Reijnders, L.S.M., de Vries, G.J., 2018. Technology, offshoring and the rise of non-routine jobs. *Journal of Development Economics* 135, 412–432. <https://doi.org/10.1016/j.jdeveco.2018.08.009>
- Reijnders, L.S.M., Timmer, M.P., Ye, X., 2021. Labour demand in global value chains: Is there a bias against unskilled work? *The World Economy* 44, 2547–2571. <https://doi.org/10.1111/twec.13092>
- Rodrik, D., 2013. Unconditional Convergence in Manufacturing \*. *The Quarterly Journal of Economics* 128, 165–204. <https://doi.org/10.1093/qje/qjs047>
- Spitz-Oener, A., 2006. Technical Change, Job Tasks, and Rising Educational Demands: Looking outside the Wage Structure. *Journal of Labor Economics* 24, 235–270. <https://doi.org/10.1086/499972>
- Survey of Adult Skills (PIAAC) [WWW Document], 2019. URL <https://www.oecd.org/skills/piaac/> (accessed 10.1.19).
- Taglioni, D., Winkler, D., 2016. *Making global value chains work for development*. World Bank, Washington, DC. <https://doi.org/10.1596/978-1-4648-0157-0>
- Timmer, M.P., Miroudot, S., de Vries, G.J., 2019. Functional specialisation in trade. *Journal of Economic Geography* 19, 1–30. <https://doi.org/10.1093/jeg/lby056>
- Winkler, D., 2013. Services offshoring and the relative demand for white-collar workers in German manufacturing, in: Bardhan, A., Jaffee, D., Kroll, C. (Eds.), *The Oxford Handbook of Offshoring and Global Employment*. Oxford University Press, p. 0. <https://doi.org/10.1093/oxfordhb/9780199765904.013.0004>

- Winkler, D., 2010. Services Offshoring and its Impact on Productivity and Employment: Evidence from Germany, 1995–2006. *The World Economy* 33, 1672–1701. <https://doi.org/10.1111/j.1467-9701.2010.01269.x>
- Wolszczak-Derlacz, J., Parteka, A., 2018. The effects of offshoring to low-wage countries on domestic wages: a worldwide industrial analysis. *Empirica* 45, 129–163. <https://doi.org/10.1007/s10663-016-9352-4>
- World Bank, 2020. *World Development Report 2020: Trading for development in the age of global value chains*.
- World Bank, 2019. *World Development Report 2019: The changing nature of work*.
- World Bank, 2017. *STEP skills measurement surveys : innovative tools for assessing skills (English)*. Social protection and labor discussion paper.

## Appendix A – Methodological details

### a. Measurements and classifications

**Table A1. The task items selected to calculate task content measures with the US PIAAC data**

| Task content                                | Non-routine cognitive analytical  | Non-routine cognitive interpersonal   | Routine cognitive  | Manual            |
|---|---|---|--|-------------------|
| Task items                                  | Solving problems<br>Reading news<br>(at least once a month)<br>Reading professional journals<br>(at least once a month)<br>Programming<br>(any frequency) | Supervising others<br>Making speeches or<br>giving presentations<br>(any frequency) | Changing order of tasks -<br>reversed (not able)<br>Filling out forms (at least<br>once a month)<br>Making speeches or<br>giving presentations -<br>reversed (never) | Physical<br>tasks |
| Correlation with<br>O*NET-based<br>measures | 0.77  | 0.72  | 0.55   | 0.74              |

Note: The cut-offs for the “yes” dummy in brackets. For the full wording of questions and definitions of cutoff see Lewandowski et al. (2022). O\*NET-based measures are based on Acemoglu and Autor (2011).

**Table A2. Wide sectors aggregation, ISIC rev. 4/ NACE rev. 2**

| Nace rev.2/<br>ISIC 4 | Nace rev.1 | Title  | Wide sector  |
|-----------------------|------------|--|--------------|
| 5                     | B          | Mining of coal and lignite   | Industry     |
| 6                     | B          | Extraction of crude petroleum and natural gas  | Industry     |
| 7                     | B          | Mining of metal ores   | Industry     |
| 8                     | B          | Other mining and quarrying   | Industry     |
| 9                     | B          | Mining support service activities  | Industry     |
| 10                    | C          | Manufacture of food products   | Industry     |
| 11                    | C          | Manufacture of beverages   | Industry     |
| 12                    | C          | Manufacture of tobacco products  | Industry     |
| 13                    | C          | Manufacture of textiles  | Industry     |
| 14                    | C          | Manufacture of wearing apparel   | Industry     |
| 15                    | C          | Manufacture of leather and related products  | Industry     |
| 16                    | C          | Manufacture of wood and of products of wood and cork, except furniture;<br>manufacture of articles of straw and plaiting materials | Industry     |
| 17                    | C          | Manufacture of paper and paper products  | Industry     |
| 18                    | C          | Printing and reproduction of recorded media  | Industry     |
| 19                    | C          | Manufacture of coke and refined petroleum products   | Industry     |
| 20                    | C          | Manufacture of chemicals and chemical products   | Industry     |
| 21                    | C          | Manufacture of basic pharmaceutical products and pharmaceutical preparations   | Industry     |
| 22                    | C          | Manufacture of rubber and plastic products   | Industry     |
| 23                    | C          | Manufacture of other non-metallic mineral products   | Industry     |
| 24                    | C          | Manufacture of basic metals  | Industry     |
| 25                    | C          | Manufacture of fabricated metal products, except machinery and equipment   | Industry     |
| 26                    | C          | Manufacture of computer, electronic and optical products   | Industry     |
| 27                    | C          | Manufacture of electrical equipment  | Industry     |
| 28                    | C          | Manufacture of machinery and equipment n.e.c.  | Industry     |
| 29                    | C          | Manufacture of motor vehicles, trailers and semi-trailers  | Industry     |
| 30                    | C          | Manufacture of other transport equipment   | Industry     |
| 31                    | C          | Manufacture of furniture   | Industry     |
| 32                    | C          | Other manufacturing  | Industry     |
| 33                    | C          | Repair and installation of machinery and equipment   | Industry     |
| 35                    | D          | Electricity, gas, steam and air conditioning supply  | non-tradable |
| 36                    | E          | Water collection, treatment and supply   | non-tradable |
| 37                    | E          | Sewerage   | non-tradable |
| 38                    | E          | Waste collection, treatment and disposal activities; materials recovery  | non-tradable |
| 39                    | E          | Remediation activities and other waste management services   | non-tradable |
| 41                    | F          | Construction of buildings  | non-tradable |
| 42                    | F          | Civil engineering  | non-tradable |
| 43                    | F          | Civil engineering  | non-tradable |
| 45                    | G          | Wholesale and retail trade and repair of motor vehicles and motorcycles  | non-tradable |
| 46                    | G          | Wholesale of mining, construction and civil engineering machinery  | tradable     |
| 47                    | G          | Retail trade, except of motor vehicles and motorcycles   | non-tradable |
| 49                    | H          | Land transport and transport via pipelines   | tradable     |
| 50                    | H          | Water transport  | tradable     |
| 51                    | H          | Air transport  | tradable     |
| 52                    | H          | Warehousing and support activities for transportation  | tradable     |
| 53                    | H          | Postal and courier activities  | tradable     |
| 55                    | I          | Accommodation  | tradable     |
| 56                    | I          | Food and beverage service activities   | tradable     |

|    |   |  |              |
|----|---|--|--------------|
| 58 | J | Publishing activities  | tradable     |
| 59 | J | Motion picture, video and television programme production, sound recording and music publishing activities | tradable     |
| 60 | J | Programming and broadcasting activities  | tradable     |
| 61 | J | Telecommunications   | tradable     |
| 62 | J | Computer programming, consultancy and related activities   | tradable     |
| 63 | J | Information service activities   | tradable     |
| 64 | K | Financial service activities, except insurance and pension funding   | tradable     |
| 65 | K | Insurance, reinsurance and pension funding, except compulsory social security                              | tradable     |
| 66 | K | Activities auxiliary to financial services and insurance activities  | tradable     |
| 68 | L | Real estate activities   | non-tradable |
| 69 | M | Legal and accounting activities  | tradable     |
| 70 | M | Activities of head offices; management consultancy activities  | tradable     |
| 71 | M | Architectural and engineering activities; technical testing and analysis                                   | tradable     |
| 72 | M | Scientific research and development  | tradable     |
| 73 | M | Advertising and market research  | tradable     |
| 74 | M | Other professional, scientific and technical activities  | tradable     |
| 75 | M | Veterinary activities  | non-tradable |
| 77 | N | Rental and leasing activities  | non-tradable |
| 78 | N | Employment activities  | non-tradable |
| 79 | N | Travel agency, tour operator reservation service and related activities                                    | non-tradable |
| 80 | N | Security and investigation activities  | non-tradable |
| 81 | N | Services to buildings and landscape activities   | non-tradable |
| 82 | N | Office administrative, office support and other business support activities                                | tradable     |
| 84 | O | Public administration and defence; compulsory social security  | non-tradable |
| 85 | P | Education  | non-tradable |
| 86 | Q | Human health activities  | non-tradable |
| 87 | Q | Residential care activities  | non-tradable |
| 88 | Q | Social work activities without accommodation   | non-tradable |
| 90 | R | Creative, arts and entertainment activities  | non-tradable |
| 91 | R | Libraries, archives, museums and other cultural activities   | non-tradable |
| 92 | R | Gambling and betting activities  | non-tradable |
| 93 | R | Sports activities and amusement and recreation activities  | non-tradable |
| 94 | S | Activities of membership organisations   | non-tradable |
| 95 | S | Repair of computers and personal and household goods   | non-tradable |
| 96 | S | Other personal service activities  | non-tradable |

Source: Authors' elaboration based on Nayyar et al. (2021).

**Table A3. Offshorability and task groups allocation by occupations (ISCO08 2-digit)**

| ISCO 08 code | Offshorability  | Task group | Title  |
|--------------|-----------------|------------|--|
| 11           | not offshorable | NRCP       | Chief Executives, Senior Officials and Legislators                               |
| 12           | not offshorable | NRCP       | Administrative and Commercial Managers   |
| 13           | not offshorable | NRCP       | Production and Specialized Services Managers                                     |
| 14           | not offshorable | NRCP       | Hospitality, Retail and Other Services Managers                                  |
| 21           | not offshorable | NRCA       | Science and Engineering Professionals  |
| 22           | not offshorable | NRCA       | Health Professionals   |
| 23           | not offshorable | NRCP       | Teaching Professionals   |
| 24           | not offshorable | NRCA       | Business and Administration Professionals  |
| 25           | offshorable     | NRCA       | Information and Communications Technology Professionals                          |
| 26           | not offshorable | NRCA       | Legal, Social and Cultural Professionals   |
| 31           | not offshorable | NRCA       | Science and Engineering Associate Professionals                                  |
| 32           | not offshorable | NRCP       | Health Associate Professionals   |
| 33           | not offshorable | RC         | Business and Administration Associate Professionals                              |
| 34           | not offshorable | RC         | Legal, Social, Cultural and Related Associate Professionals                      |
| 35           | not offshorable | NRCA       | Information and Communications Technicians                                       |
| 41           | offshorable     | RC         | General and Keyboard Clerks  |
| 42           | not offshorable | RC         | Customer Services Clerks   |
| 43           | offshorable     | RC         | Numerical and Material Recording Clerks  |
| 44           | not offshorable | RC         | Other Clerical Support Workers   |
| 51           | not offshorable | NRM        | Personal Services Workers  |
| 52           | not offshorable | RC         | Sales Workers  |
| 53           | not offshorable | NRM        | Personal Care Workers  |
| 54           | not offshorable | NRM        | Protective Services Workers  |
| 61           | not offshorable | NRM        | Market-oriented Skilled Agricultural Workers                                     |
| 62           | not offshorable | NRM        | Market-oriented Skilled Forestry, Fishery and Hunting Workers                    |
| 63           | not offshorable | NRM        | Subsistence Farmers, Fishers, Hunters and Gatherers                              |
| 71           | not offshorable | NRM        | Building and Related Trades Workers (excluding Electricians)                     |
| 72           | not offshorable | RM         | Metal, Machinery and Related Trades Workers                                      |
| 73           | offshorable     | RM         | Handicraft and Printing Workers  |
| 74           | not offshorable | NRM        | Electrical and Electronic Trades Workers   |
| 75           | not offshorable | RM         | Food Processing, Woodworking, Garment and Other Craft and Related Trades Workers |
| 81           | offshorable     | RM         | Stationary Plant and Machine Operators   |
| 82           | offshorable     | RM         | Assemblers   |
| 83           | not offshorable | NRM        | Drivers and Mobile Plant Operators   |
| 91           | not offshorable | NRM        | Cleaners and Helpers   |
| 92           | not offshorable | NRM        | Agricultural, Forestry and Fishery Labourers                                     |
| 93           | not offshorable | NRM        | Labourers in Mining, Construction, Manufacturing and Transport                   |
| 94           | not offshorable | RM         | Food Preparation Assistants  |
| 95           | not offshorable | NRM        | Street and Related Sales and Services Workers                                    |
| 96           | not offshorable | NRM        | Refuse Workers and Other Elementary Workers                                      |

Note: NRCA- Non-Routine Cognitive Analytical, NRCP- Non-Routine Cognitive Personal, RC- Routine Cognitive, RM- Routine Manual, NRM- Non-Routine Manual.

Source: own elaboration based on Acemoglu and Autor (2011) and Blinder and Krueger (2013).

**Table A4. List of countries used in the study**

| Country name       | Country ISO3 | Source | Survey year |
|--------------------|--------------|--------|-------------|
| Armenia            | ARM          | STEP   | 2013        |
| Austria            | AUT          | PIAAC  | 2012        |
| Belgium            | BEL          | PIAAC  | 2012        |
| Bolivia            | BOL          | STEP   | 2012        |
| Chile              | CHL          | PIAAC  | 2015        |
| Colombia           | COL          | STEP   | 2012        |
| Cyprus             | CYP          | PIAAC  | 2012        |
| Czech Republic     | CZE          | PIAAC  | 2012        |
| Denmark            | DNK          | PIAAC  | 2012        |
| Ecuador            | ECU          | PIAAC  | 2017        |
| Estonia            | EST          | PIAAC  | 2012        |
| Finland            | FIN          | PIAAC  | 2012        |
| France             | FRA          | PIAAC  | 2012        |
| Georgia            | GEO          | STEP   | 2013        |
| Germany            | DEU          | PIAAC  | 2012        |
| Ghana              | GHA          | STEP   | 2013        |
| Greece             | GRC          | PIAAC  | 2015        |
| Indonesia          | IDN          | PIAAC  | 2015        |
| Ireland            | IRL          | PIAAC  | 2012        |
| Israel             | ISR          | PIAAC  | 2015        |
| Italy              | ITA          | PIAAC  | 2012        |
| Japan              | JPN          | PIAAC  | 2012        |
| Kazakhstan         | KAZ          | PIAAC  | 2017        |
| Kenya              | KEN          | STEP   | 2013        |
| Korea, Rep.        | KOR          | PIAAC  | 2012        |
| Lao PDR            | LAO          | STEP   | 2012        |
| Lithuania          | LTU          | PIAAC  | 2015        |
| Mexico             | MEX          | PIAAC  | 2017        |
| Netherlands        | NLD          | PIAAC  | 2012        |
| New Zealand        | NZL          | PIAAC  | 2015        |
| Norway             | NOR          | PIAAC  | 2012        |
| Poland             | POL          | PIAAC  | 2012        |
| Russian Federation | RUS          | PIAAC  | 2012        |
| Slovak Republic    | SVK          | PIAAC  | 2012        |
| Slovenia           | SVN          | PIAAC  | 2015        |
| Spain              | ESP          | PIAAC  | 2012        |
| United Kingdom     | GBR          | PIAAC  | 2012        |
| United States      | USA          | PIAAC  | 2012        |

Source: own elaboration.

## b. Wage inequality analysis

### Baseline scenario

In a first step, we divide the full sample into six groups by broad sector (industry, business, and other services) and type of occupation (offshorable and non-offshorable) and for each group estimate Mincerian wage regressions of the following form:<sup>16</sup>

$$w_{ijsc} = \beta_0 + \beta_1 RTI_{ijsc} + \beta_2 GVC_{sc}^B + \beta_3 GVC_{sc}^F + \beta_4 GVC_{sc}^B * OUT_{sc} + \beta_5 GVC_{sc}^F * OUT_{sc} + \beta_6 Z_{sc} + \beta_7 X_{ijsc} + \lambda_s + \rho_c + \epsilon_{ijsc} \quad (1)$$

where  $w_{ijsc}$  stands for hourly wages of individual  $i$ , in occupation  $j$ , in sector  $s$ , and in country  $c$ ;  $GVC_{sc}^B$  is backward and  $GVC_{sc}^F$  forward GVC participation in sector  $s$  and in country  $c$ ;  $OUT_{sc}$  is output in sector  $s$  and in country  $c$ ;  $Z_{sc}$  measures technology in sector  $s$  and in country  $c$ ;  $X_{ijsc}$  are individual skills of worker  $i$ , in occupation  $j$ , in sector  $s$  and in country  $c$ ;  $\lambda_s$  and  $\rho_c$  are, respectively, sector and country fixed effects.

Based on the estimated coefficients from equation (1) and actual values for each right-hand side variables, we can predict wages ( $\hat{w}_{ijsc}^{base}$ ) for each individual in the six group. Formally:

$$\hat{w}_{ijsc}^{base} = \beta_0 + \beta_1 RTI_{ijsc} + \beta_2 GVC_{sc}^B + \beta_3 GVC_{sc}^F + \beta_4 GVC_{sc}^B * OUT_{sc} + \beta_5 GVC_{sc}^F * OUT_{sc} + \beta_6 Z_{sc} + \beta_7 X_{ijsc} + \lambda_s + \rho_c \quad (2)$$

For each country, we then calculate the Gini coefficient ( $\rho_c^{base}$ ) of predicted wages:

$$\rho_c^{base} = gini(\hat{w}_{ijsc}^{base}) \quad (3)$$

This is our baseline scenario.

### Scenario of no GVC participation

In the second step, we assess the direct contribution of GVC participation to wage inequality ( $E^{direct}$ ). This is based on the estimated models from equation (1), but based on predicted wages conditional on GVC participation values equal to zero ( $\hat{w}_{ijsc}^{direct}$ ). Formally:

$$\hat{w}_{ijsc}^{direct} = \beta_0 + \beta_1 RTI_{ijsc} + \beta_2 * 0 + \beta_3 * 0 + \beta_4 * 0 * OUT_{sc} + \beta_5 * 0 * OUT_{sc} + \beta_6 Z_{sc} + \beta_7 X_{ijsc} + \lambda_s + \rho_c \quad (4)$$

For each country, we then calculate the Gini coefficient ( $\rho_c^{direct}$ ) under the assumption of no integration into GVCs:

$$\rho_c^{direct} = gini(\hat{w}_{ijsc}^{direct}) \quad (5)$$

We describe the direct contribution of GVC participation to wage inequality ( $E^{direct}$ ) as the difference between the Gini coefficients of wages calculated in the baseline scenario and in the scenario of no GVC participation:

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<sup>16</sup> This model is equivalent to equation (3) in the main body of the paper. However, for simplicity reasons the expression  $GVC_{sc}^B + GVC_{sc}^F + GVC_{sc}^B * OUT_{sc} + GVC_{sc}^F * OUT_{sc}$  is noted as  $G_{sc}$ .

$$E^{direct} = \rho_c^{base} - \rho_c^{direct} \quad (6)$$

### Counterfactual RTI scenario

In a third step, we analyse how GVC participation indirectly contributes to wage inequality through its relationship with workers' RTI ( $E^{indirect}$ ). Specifically, we estimate the model of workers' RTI and then calculate counterfactual worker-level RTI, assuming GVC participation values equal to zero ( $\widehat{RTI}_{ijsc}^{indirect}$ ).<sup>17</sup> Formally:

$$RTI_{ijsc} = \beta_0 + \beta_1 GVC_{sc}^B + \beta_2 GVC_{sc}^F + \beta_3 GVC_{sc}^B * GDP_c^{PC} + \beta_4 GVC_{sc}^F * GDP_c^{PC} + \beta_5 Z_{sc} + \beta_6 X_{ijsc} + \lambda_s + \epsilon_{ijsc} \quad (7)$$

$$\widehat{RTI}_{ijsc}^{indirect} = \beta_0 + \beta_1 * 0 + \beta_2 * 0 + \beta_3 * 0 * GDP_c^{PC} + \beta_4 * 0 * GDP_c^{PC} + \beta_5 Z_{sc} + \beta_6 X_{ijsc} + \lambda_s + \epsilon_{ijsc} \quad (8)$$

We then use the estimated models from equation (1) to predict wages  $\widehat{w}_{ijsc}^{indirect}$  conditional on  $\widehat{RTI}_{ijsc}^{indirect}$ . To isolate the indirect contribution of GVC participation to wage inequality through RTI, we use the observed values of GVC participation in the wage model:

$$\widehat{w}_{ijsc}^{indirect} = \beta_0 + \beta_1 \widehat{RTI}_{ijsc}^{indirect} + \beta_2 GVC_{sc}^B + \beta_3 GVC_{sc}^F + \beta_4 GVC_{sc}^B * OUT_{sc} + \beta_5 GVC_{sc}^F * OUT_{sc} + \beta_6 Z_{sc} + \beta_7 X_{ijsc} + \lambda_s + \rho_c \quad (9)$$

We describe the indirect contribution of GVCs participation to wage inequality ( $E^{indirect}$ ) as the difference between the Gini coefficients of wages calculated in the baseline scenario ( $\rho_c^{base}$ ) and the Gini coefficients of wages in the counterfactual RTI scenario ( $\rho_c^{indirect}$ ).

$$\rho_c^{indirect} = gini(\widehat{w}_{ijsc}^{indirect}) \quad (10)$$

$$E^{indirect} = \rho_c^{base} - \rho_c^{indirect} \quad (11)$$

### Total contribution of GVC participation

In a fourth step, we calculate the total contribution of GVC participation to wage inequality ( $E^{total}$ ). We set the GVC participation values to zero (as in the calculation of the direct contribution), and we use the counterfactual RTI conditional on zero GVC participation ( $\widehat{RTI}_{ijsc}^{indirect}$ , as in the calculation of the indirect contribution) to predict wages using the estimated coefficients in the models from equation (1).

$$\widehat{w}_{ijsc}^{total} = \beta_0 + \beta_1 \widehat{RTI}_{ijsc}^{indirect} + \beta_2 * 0 + \beta_3 * 0 + \beta_4 * 0 * OUT_{sc} + \beta_5 * 0 * OUT_{sc} + \beta_6 Z_{sc} + \beta_7 X_{ijsc} + \lambda_s + \rho_c \quad (12)$$

We define the total contribution of GVC participation to wage inequality ( $E^{total}$ ) as the difference between the Gini coefficient of wages in the baseline scenario ( $\rho_c^{base}$ ) and the Gini coefficient of wages in this last scenario ( $\rho_c^{total}$ ).

$$\rho_c^{total} = gini(\widehat{w}_{ijsc}^{total}) \quad (13)$$

$$E^{total} = \rho_c^{base} - \rho_c^{total} \quad (14)$$

<sup>17</sup> Equation (7) is equivalent to equation (2) in the main body of the paper.

## Appendix B – Additional results

Table B1. The Correlates of Routine Task Intensity (RTI) at the Worker Level, in the pooled sample, and by broad sectors, standardised (backward and forward GVC)

| <b>Panel A: Pooled</b>   | (1)                 | (2)                | (3)               | (4)                   | (5)                  | (6)                  | (7)                  | (8)                   |
|--|---------------------|--------------------|-------------------|-----------------------|----------------------|----------------------|----------------------|-----------------------|
|  | Total economy       | Industry           | Tradable services | Non-tradable services | Total economy        | Industry             | Tradable services    | Non-tradable services |
| Backward Global Value Chain participation (GVCB) share in exports (std.) | -0.001<br>(0.015)   | 0.017<br>(0.021)   | -0.023<br>(0.023) | -0.003<br>(0.017)     |                      |                      |                      |                       |
| GVCB share (std.) * [Ln(GDP pc) – mean(Ln(GDP pc))]                      | 0.046**<br>(0.018)  | -0.004<br>(0.033)  | 0.047*<br>(0.027) | 0.070***<br>(0.018)   |                      |                      |                      |                       |
| Forward Global Value Chain participation (GVCF) share in exports (std.)  |                     |                    |                   |                       | 0.012<br>(0.012)     | 0.044**<br>(0.018)   | 0.035*<br>(0.019)    | -0.005<br>(0.027)     |
| GVCF share (std.) * [Ln(GDP pc) – mean(Ln(GDP pc))]                      |                     |                    |                   |                       | -0.051***<br>(0.012) | -0.057***<br>(0.019) | -0.060***<br>(0.021) | -0.021<br>(0.027)     |
| Ln(GDP per capita) – mean(Ln(GDP per capita))                            | 0.031<br>(0.039)    | 0.244*<br>(0.130)  | -0.089<br>(0.069) | 0.077*<br>(0.040)     | 0.061<br>(0.044)     | 0.379***<br>(0.131)  | 0.032<br>(0.084)     | 0.080*<br>(0.048)     |
| Observations   | 118,222             | 19,123             | 30,410            | 68,689                | 118,182              | 19,123               | 30,410               | 68,649                |
| <b>Panel B: offshorable occupations</b>                                  |                     |                    |                   |                       |                      |                      |                      |                       |
| Backward Global Value Chain participation (GVCB) share in exports (std.) | 0.064***<br>(0.021) | 0.059**<br>(0.029) | 0.032<br>(0.048)  | 0.048*<br>(0.026)     |                      |                      |                      |                       |
| GVCB share (std.) * [Ln(GDP pc) – mean(Ln(GDP pc))]                      | -0.018<br>(0.025)   | -0.011<br>(0.041)  | -0.018<br>(0.042) | -0.002<br>(0.030)     |                      |                      |                      |                       |
| Forward Global Value Chain participation (GVCF) share in exports (std.)  |                     |                    |                   |                       | 0.065***<br>(0.015)  | 0.074***<br>(0.020)  | 0.031<br>(0.029)     | 0.090**<br>(0.039)    |
| GVCF share (std.) * [Ln(GDP pc) – mean(Ln(GDP pc))]                      |                     |                    |                   |                       | -0.080***<br>(0.016) | -0.077***<br>(0.022) | -0.103***<br>(0.032) | -0.019<br>(0.041)     |
| Ln(GDP per capita) – mean(Ln(GDP per capita))                            | -0.014<br>(0.069)   | 0.151<br>(0.131)   | -0.149<br>(0.097) | 0.120*<br>(0.065)     | 0.056<br>(0.062)     | 0.399***<br>(0.116)  | 0.016<br>(0.109)     | 0.109<br>(0.066)      |
| Observations   | 18,276              | 7,348              | 6,128             | 4,800                 | 18,268               | 7,348                | 6,128                | 4,792                 |
| <b>Panel C: non-offshorable occupations</b>                              |                     |                    |                   |                       |                      |                      |                      |                       |

|  |                     |                     |                    |                     |                      |                     |                     |                   |
|--|---------------------|---------------------|--------------------|---------------------|----------------------|---------------------|---------------------|-------------------|
| Backward Global Value Chain participation (GVCB) share in exports (std.) | -0.018<br>(0.014)   | -0.018<br>(0.022)   | -0.027<br>(0.026)  | -0.006<br>(0.018)   |                      |                     |                     |                   |
| GVCB share (std.) * [Ln(GDP pc) –mean(Ln(GDP pc))]                       | 0.055***<br>(0.017) | 0.001<br>(0.034)    | 0.060**<br>(0.029) | 0.076***<br>(0.018) |                      |                     |                     |                   |
| Forward Global Value Chain participation (GVCF) share in exports (std.)  |                     |                     |                    |                     | -0.001<br>(0.014)    | 0.018<br>(0.022)    | 0.038*<br>(0.020)   | -0.014<br>(0.028) |
| GVCF share (std.) * [Ln(GDP pc) –mean(Ln(GDP pc))]                       |                     |                     |                    |                     | -0.045***<br>(0.013) | -0.046**<br>(0.023) | -0.053**<br>(0.023) | -0.019<br>(0.028) |
| Ln(GDP per capita) –mean(Ln(GDP per capita))                             | 0.036<br>(0.039)    | 0.568***<br>(0.135) | -0.065<br>(0.074)  | 0.074*<br>(0.042)   | 0.062<br>(0.046)     | 0.638***<br>(0.140) | 0.044<br>(0.092)    | 0.075<br>(0.050)  |
| Observations   | 99,946              | 11,775              | 24,282             | 63,889              | 99,914               | 11,775              | 24,282              | 63,857            |

Note: \*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1. Standard errors in parentheses. Standardised weights are used that give each country equal weight. The standard errors are clustered at a sector × country level. Measures for Computer Use, GVCB share and FDI/GDP are standardised. All regressions include controls for technology (computer use, computer use squared), FDI, skills, education, age, gender, sector FE, and sector FE interacted with GDP per capita.

Source: Authors' calculations based on PIAAC, STEP, World Bank, and EORA data.

**Table B2. Pooled regression of backward and forward and by wide sectors and occupational groups, standardised (backward and forward GVC)**

| <b>Panel A: All workers</b>  | (1)                  | (2)                  | (3)                  | (4)                   |
|--|----------------------|----------------------|----------------------|-----------------------|
|  | Total economy        | Industry             | Tradable services    | Non-tradable services |
| Backward Global Value Chain participation (GVCB) share in exports (std.) | 0.003<br>(0.015)     | 0.019<br>(0.019)     | -0.011<br>(0.024)    | 0.020<br>(0.021)      |
| GVCB share (std.) * [Ln(GDP pc) –mean(Ln(GDP pc))]                       | 0.041**<br>(0.021)   | -0.013<br>(0.031)    | 0.014<br>(0.034)     | 0.096***<br>(0.022)   |
| Forward Global Value Chain participation (GVCF) share in exports (std.)  | 0.010<br>(0.011)     | 0.046**<br>(0.018)   | 0.032<br>(0.020)     | -0.013<br>(0.024)     |
| GVCF share (std.) * [Ln(GDP pc) –mean(Ln(GDP pc))]                       | -0.045***<br>(0.012) | -0.057***<br>(0.019) | -0.058**<br>(0.025)  | -0.001<br>(0.023)     |
| Ln(GDP per capita) –mean(Ln(GDP per capita))                             | 0.059<br>(0.040)     | 0.346***<br>(0.123)  | 0.022<br>(0.092)     | 0.084**<br>(0.040)    |
| Observations   | 118,182              | 19,123               | 30,410               | 68,649                |
| <b>Panel B: High-skilled occupations (ISCO 1-3)</b>                      |                      |                      |                      |                       |
| Backward Global Value Chain participation (GVCB) share in exports (std.) | -0.012<br>(0.015)    | -0.029<br>(0.018)    | 0.002<br>(0.031)     | -0.005<br>(0.026)     |
| GVCB share (std.) * [Ln(GDP pc) –mean(Ln(GDP pc))]                       | -0.013<br>(0.021)    | 0.059*<br>(0.032)    | -0.083**<br>(0.034)  | -0.013<br>(0.039)     |
| Forward Global Value Chain participation (GVCF) share in exports (std.)  | 0.009<br>(0.011)     | 0.026<br>(0.023)     | 0.025<br>(0.021)     | 0.003<br>(0.020)      |
| GVCF share (std.) * [Ln(GDP pc) –mean(Ln(GDP pc))]                       | -0.042***<br>(0.013) | 0.006<br>(0.023)     | -0.121***<br>(0.023) | -0.011<br>(0.026)     |
| Ln(GDP per capita) –mean(Ln(GDP per capita))                             | 0.025<br>(0.044)     | -0.192<br>(0.135)    | 0.144<br>(0.089)     | 0.037<br>(0.054)      |
| Observations   | 48,989               | 5,561                | 13,654               | 29,774                |
| <b>Panel C: Middle-skilled occupations (ISCO 4-5)</b>                    |                      |                      |                      |                       |
| Backward Global Value Chain participation (GVCB) share in exports (std.) | -0.037**<br>(0.019)  | 0.020<br>(0.033)     | -0.086***<br>(0.029) | 0.001<br>(0.031)      |
| GVCB share (std.) * [Ln(GDP pc) –mean(Ln(GDP pc))]                       | 0.086***<br>(0.024)  | -0.045<br>(0.037)    | 0.057<br>(0.039)     | 0.137***<br>(0.030)   |
| Forward Global Value Chain participation (GVCF) share in exports (std.)  | -0.011<br>(0.018)    | -0.027<br>(0.039)    | 0.035<br>(0.027)     | -0.033<br>(0.037)     |
| GVCF share (std.) * [Ln(GDP pc) –mean(Ln(GDP pc))]                       | -0.016<br>(0.015)    | -0.002<br>(0.040)    | -0.034<br>(0.029)    | 0.022<br>(0.031)      |
| Ln(GDP per capita) –mean(Ln(GDP per capita))                             | 0.044<br>(0.045)     | 0.118<br>(0.264)     | 0.014<br>(0.103)     | 0.064<br>(0.050)      |
| Observations   | 36,721               | 2,217                | 10,199               | 24,305                |
| <b>Panel D: Low-skilled occupations (ISCO 7-9)</b>                       |                      |                      |                      |                       |
| Backward Global Value Chain participation (GVCB) share in exports (std.) | 0.054***<br>(0.020)  | 0.045**<br>(0.019)   | 0.058*<br>(0.034)    | 0.081**<br>(0.039)    |
| GVCB share (std.) * [Ln(GDP pc) –mean(Ln(GDP pc))]                       | 0.029<br>(0.028)     | -0.019<br>(0.035)    | 0.092*<br>(0.052)    | 0.086**<br>(0.034)    |

|   |                      |                      |                     |                    |
|---|----------------------|----------------------|---------------------|--------------------|
| Forward Global Value Chain participation (GVCF) share in exports (std.) | 0.062***<br>(0.014)  | 0.072***<br>(0.020)  | 0.124***<br>(0.038) | -0.006<br>(0.028)  |
| GVCF share (std.) * [Ln(GDP pc) –mean(Ln(GDP pc))]                      | -0.047***<br>(0.015) | -0.084***<br>(0.022) | 0.048<br>(0.038)    | -0.019<br>(0.028)  |
| Ln(GDP per capita) –mean(Ln(GDP per capita))                            | 0.127**<br>(0.058)   | 0.111<br>(0.133)     | -0.096<br>(0.140)   | 0.124**<br>(0.052) |
| Observations  | 32,472               | 11,345               | 6,557               | 14,570             |

Note: \*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1. Standard errors in parentheses. Standardised weights are used that give each country equal weight. The standard errors are clustered at a sector × country level. Measures for GVCF share and GVCF share are standardised. All regressions include controls for technology (computer use, computer use squared), FDI, skills, education, age, gender, sector FE, and sector FE interacted with GDP per capita.

Source: Authors' calculations based on PIAAC, STEP, World Bank, and EORA data.

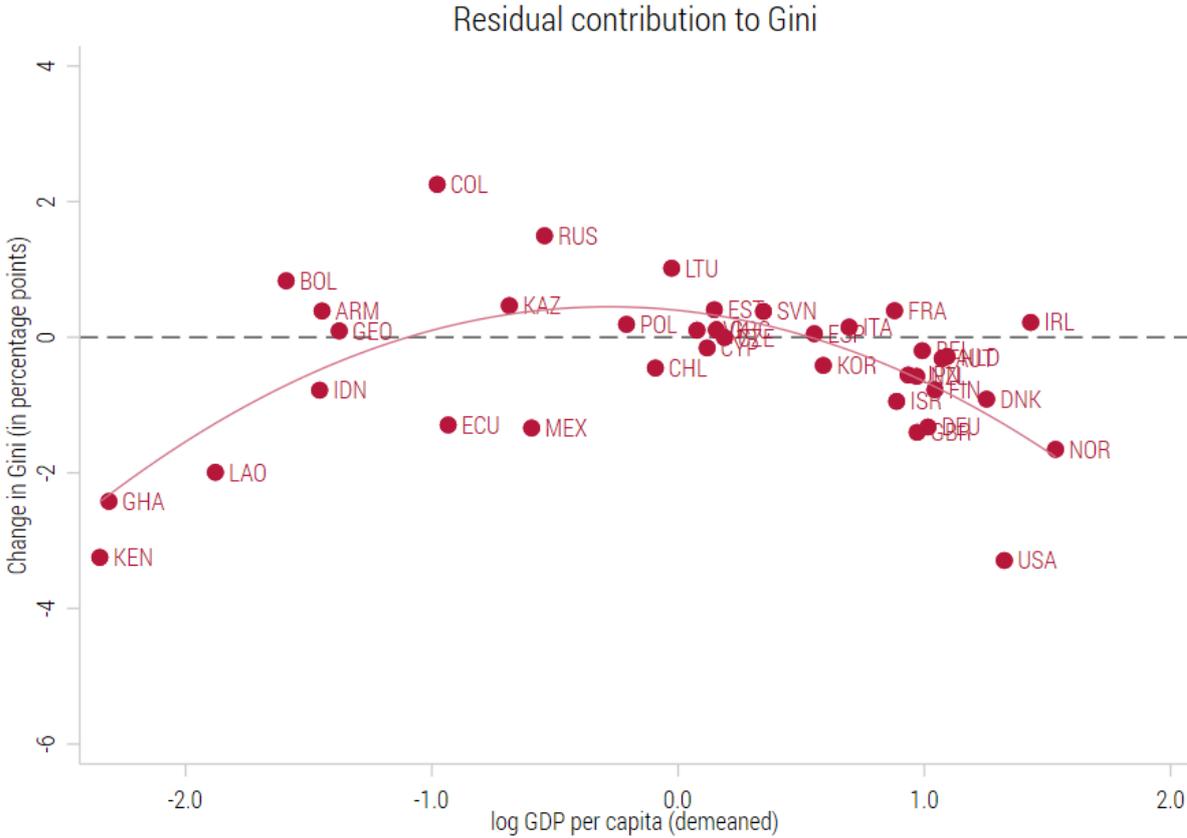
**Table B3. The relationship between the share of workers performing offshorable occupations and GVC participation by sectors**

| Dependent variable: share of workers performing offshorable occupations  | (1)       | (2)      |
|--|-----------|----------|
| Backward Global Value Chain participation (GVCB) share in exports (std.) | 0.089***  | -0.004   |
|  | (0.008)   | (0.007)  |
| GVCB share (std.) * [Ln(GDP pc) – mean(Ln(GDP pc))]                      | -0.007    | -0.009   |
|  | (0.009)   | (0.006)  |
| Forward Global Value Chain participation (GVCF) share in exports (std.)  | 0.024***  | 0.002    |
|  | (0.007)   | (0.008)  |
| GVCF share (std.) * [Ln(GDP pc) – mean(Ln(GDP pc))]                      | 0.010     | 0.002    |
|  | (0.008)   | (0.005)  |
| Ln(GDP per capita) – mean(Ln(GDP per capita))                            | -0.034*** | -0.020** |
|  | (0.012)   | (0.010)  |
| Computer use   | 0.020     | 0.030**  |
|  | (0.012)   | (0.014)  |
| Computer use <sup>2</sup>  | -0.018*   | -0.014*  |
|  | (0.010)   | (0.008)  |
| Tertiary educated  | 0.101**   | -0.027   |
|  | (0.046)   | (0.041)  |
| Primary educated   | -0.001    | -0.037   |
|  | (0.069)   | (0.054)  |
| Literacy skills level: 1 or lower  | 0.089     | -0.026   |
|  | (0.083)   | (0.075)  |
| Literacy skills level: 3   | -0.033    | -0.023   |
|  | (0.087)   | (0.083)  |
| Literacy skills level: 4 and 5   | 0.096     | -0.104   |
|  | (0.138)   | (0.108)  |
| Sector FE  | No        | Yes      |
| Observations   | 759       | 759      |

Note: \*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1. Standard errors in parentheses. Standardised weights are used that give each country equal weight. The standard errors are clustered at a sector × country level. Measures for GVCB share and GVCF share are standardised. All regressions include controls for technology (computer use, computer use squared), FDI, skills, education, age, gender, sector FE, and sector FE interacted with GDP per capita.

Source: Authors' calculations based on PIAAC, STEP, World Bank, and EORA data.

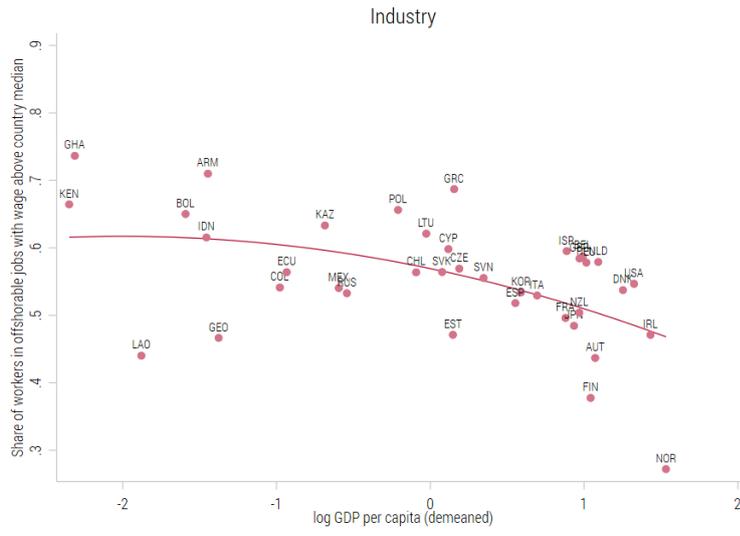
Figure B1. The contribution of GVC participation to wage inequality, residual term.



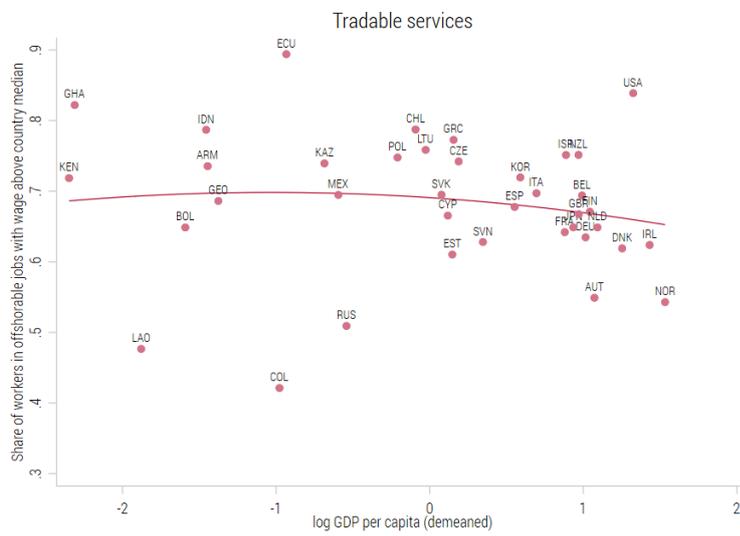
Source: Authors' calculations based on PIAAC, STEP, World Bank, and EORA data.

Figure B2. Share of workers performing offshorable occupations with wages above the country's median

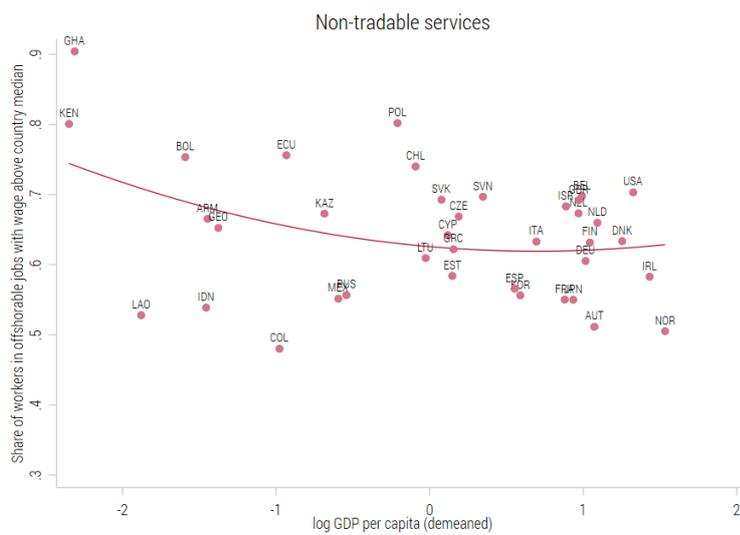
a)



b)



c)



Source: Authors' calculations based on PIAAC, STEP, World Bank, and EORA data.