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"GLOBAL VALUE CHAINS, FUNCTIONAL DIVERSIFICATION AND WITHIN-COUNTRY INEQUALITY: AN EMPIRICAL ASSESSMENT"

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Global value chains, functional diversification and within-country inequality: an empirical assessment

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ABSTRACT

A growing literature has stressed that the geographical dispersion of production and the subsequent rise of global value chains (GVCs) are associated with important social and economic disparities across countries. However, systemic empirical evidence on the distributional consequences of GVCs *within countries* has so far been rather limited. In this work, we take a step forward in the direction of filling this gap by providing a comprehensive empirical assessment of the GVC-inequality nexus on a sample including more than 100 countries over the period 2003-2015. Our results show that (i) the association between trade in GVC and income inequality is conditioned by the GVC positioning of countries; (ii) greater shares of FDIs in the upstream (i.e., knowledge-intensive activities such as R&D, design and training) and downstream (i.e., logistics, marketing and post-sales services) segments of the value chain are associated with lower income inequality; (iii) greater functional diversification in FDI is associated with lower levels of income disparities within countries, consistent with the hypothesis that a larger mix of value-adding activities an economy carries out expands learning opportunities and occupational choices for its workers and is conducive to a more inclusive development.

Keywords:

Global value chains; inequality; international trade, FDI; value chain functions; functional diversification

1. Introduction

A growing literature has stressed that the geographical dispersion of production and the subsequent rise of global value chains (GVCs) are associated with important social and economic disparities *across countries* (Shih, 1996; Mudambi, 2008; Shin et al., 2012; Baldwin & Evenett, 2015; Baldwin & Ito, 2021). In fact, several contributions have shed light on the uneven distribution of value captured by economies and their different opportunities to upgrade from low to higher knowledge-intensive activities along GVCs (Durand & Milberg, 2020; Stollinger, 2021; Coveri & Zanfei, 2022). However, systematic empirical evidence on the distributional consequences *within countries* of the positioning of economies along GVCs has so far been rather limited.

In this work, we take a step forward in the direction of filling this gap by providing a global empirical assessment of the GVC-inequality nexus. Our analysis is performed on a sample including more than 100 countries over the period 2003-2015 and contributes to the extant literature in the following three respects.

First, we explore the extent to which *different forms of trade-related participation in GVCs affect the personal distribution of income*. The aim is to isolate how the position occupied by a country in terms of the value added embodied in its trade flows affects the ability of actors of the economy to capture substantial fractions of the income generated. To this end, we use different indicators based on Multi-Regional Input-Output tables and assess their impact on income distribution. This analysis is conducted using a more extensive array of indicators of trade in GVCs and with reference to a larger number of both advanced and less developed countries than has been done in extant literature so far.

Second, we complement analyses based on trade in GVCs indicators with more direct evidence on how different *activities carried out by countries in value chains can affect inequality*. The idea is that the actual involvement of an economy in different value-adding functions matters when it comes to income distribution. In particular, it is suggested that countries more engaged in intangible intensive stages of GVCs are characterised by greater learning and spillover effects, which are likely to spread throughout the economy. To identify the effects of GVC functions on inequality, we exploit detailed data on inward foreign direct investments (FDIs), which include information on the value chain activities they are aimed to perform. This represents, to the best of our knowledge, the first systematic attempt to address the impact of country's involvement in GVC functions on income disparities within countries. Furthermore, by using data on FDIs by business activity we are also able to shed light on a key dimension of GVCs that can hardly be captured only with trade data, i.e., the impact of multinational corporations (MNCs) in the international fragmentation of production and hence on income distribution. In fact, cross-border capital flows have largely contributed the global dissemination of production stages and to the involvement of low- and middle-income countries in GVCs (UNCTAD, 2013).

Third, we investigate the role played by the *variety of functions undertaken along value chains as a further factor influencing inequality*. This is obtained by computing a measure of "functional diversification in FDI" – namely an indicator which captures the ability of countries to attract FDIs in a more diversified set of economic activities –. Our hypothesis is that greater functional diversification – as opposed to hyper-specialization in selected GVC activities – can have a beneficial effect on income distribution within countries by enabling economies to expand the range of value adding activities and foster more inclusive development.

The remainder of this paper is organized as follows. Section 2 offers a brief review of the literature on the GVC-inequality nexus and clarifies the research questions of the present contribution. Section 3 outlines our empirical strategy, while Section 4 describes the data used in this work. Section 5 shows the results of our empirical investigation. Section 6 summarizes our main findings and concludes.

2. Literature review and research questions

2.1 Global value chains and within-country inequality

Since the 1980s, the "neoliberal turn" in economic policy, together with the lowering of transport, communication and coordination costs, have favoured the geographical dispersion of production activities and their organization through Global Value Chains (GVCs) (Feenstra, 1998; Gereffi et al., 2005; Timmer et al., 2014). The offshoring strategies pursued by firms, including large MNCs in search for cheap labour, low-cost production inputs and localized knowledge-intensive assets, have entailed, on the one side, a growing trade in intermediate products and services on a global scale; on the other side, a surge in cross-border investments, especially in the form of vertical foreign direct investments (FDIs) and interfirm alliances involving actors from all over the world (UNCTAD, 2011, 2013; World Bank, 2020).

The international fragmentation of production (involving both FDI and trade) can impact on within-country inequality through several channels. First, offshoring of low-skill activities towards emerging economies would entail a higher (lower) remuneration of high-skilled workers in advanced (emerging) economies, thereby increasing income inequality in advanced economies while reducing it in less developed ones (Stolper & Samuelson, 1941)

Second, offshoring of labour-intensive tasks from capital-abundant economies to labour-abundant ones entails a higher capital-output ratio in the former countries, reducing the wage share in advanced economies to the extent that capital acts as a gross substitute for labour (Harrison, 2005; Elsby et al., 2013; Helpman, 2016; IMF, 2017a, 2017b). Given that the functional income distribution represents a major driver of personal income distribution (Daudey & Garcia-Penalosa, 2007; Atkinson, 2009; Wolff & Zacharias, 2013; Dao et al., 2017), changes in the wage share due an increased participation to GVCs can have a non-negligible impact on income inequality in high-income countries. Nonetheless, to the extent

that emerging economies are marked by a lower level of education and capital endowment than advanced economies, the value chain functions offshored by the latter may result in relatively high-skill, capital-intensive tasks for emerging countries, ultimately increasing wage inequality in both advanced and emerging economies (Feenstra & Hanson, 1996, 1997; Zhu & Trefler, 2005; Jaumotte et al., 2013; Dao et al., 2017; Sheng & Yang, 2017).

Third, production in GVCs is often more skill-biased and capital-intensive than traditional trade (Antràs, 2020) because of the higher level of capabilities required to perform value chain tasks with strong complementarities with other geographically dispersed value-adding activities (Antràs et al., 2006); and of the more skill- and capital-intensive production techniques used by firms operating in GVCs than domestic firms (Bernard et al., 2018)

Fourth, trade and capital liberalization favors the most mobile production factor, i.e., capital, at the detriment of the relatively less mobile one, i.e., labour (Rodrik, 1997). In line with this thesis, a number of scholars have suggested that the increased footloose character of international production due to the rise of GVCs can pose a credible threat for workers, weakening their bargaining power, reducing the wage share and increasing inequality in both advanced and less developed economies (Burke & Epstein, 2001; Choi, 2001; Harrison, 2005; Stockhammer, 2017; Stansbury & Summers, 2020; Coveri & Pianta, 2022).

In terms of empirical analysis, the economic research focusing on how the GVC participation of economies affects income inequality within countries represents an expanding field of study. Exploring how the GVC involvement of countries can affect their dynamics of income distribution indeed requires capturing the different positioning of economies along GVCs alongside their overall level of participation in GVCs. To this end, several industry-based indicators of GVC positioning have been proposed in recent years. These indicators largely rely on international input-output tables to measure the more upstream (or downstream) position occupied by countries and industries, exploiting sophisticated matrix manipulation techniques to trace the direct and indirect flows of value added embodied in export flows and – more in general – the value of (intermediate) goods and services crossing national borders multiple times (Hummels et al., 2001; Johnson & Noguera, 2012; Timmer et al., 2014; Borin & Mancini, 2023).

A few recent empirical studies have used these indicators to analyse the impact of GVC participation on income inequality. Carpa & Martinez-Zarzoso (2022) used measures of backward and forward GVC participation to assess their relationship with the personal income distribution – proxied by the Gini index – for 39 countries over the period 1995-2016. They found that the backward participation has a negative effect on inequality (i.e., lowers income disparities) for the ten developing countries included in their sample in the long run, although an adverse distributional impact was detected in the short run; while non statistically significant results emerge as for the role of forward participation and the overall GVC positioning of economies. Duarte et al. (2022) explored the relationship linking the "upstreamness" of countries in GVCs, as proxied by the indicator proposed by Antràs et al. (2012), and the intra- and inter-country inequalities for a sample of 67 economies over the

period 1995-2018.[1] They found a U-shaped association between the upstreamness indicator and income inequality (proxied by both the Gini index and the income share of the top percentile and that of the 50%) for developed economies, as well as for African, Latin American, and East and Southeast Asian countries.

However, these studies exclusively rely on GVC participation measures based on input-output statistics of industries' involvement in international trade flows of intermediate inputs, thus disregarding the value adding functions undertaken for the realization of products and services. As stressed by Sturgeon & Gereffi (2009), it is in fact at the functional level that firms' offshoring decisions are taken. Accordingly, industry-based measures of the GVC involvement of economies should be complemented with indicators capturing the different value chain functions which countries mainly perform. The nature of the value-adding activities carried out by countries in GVCs appears indeed crucial, since it is likely to affect the quality and quantity of job creation and destruction in domestic economies as well as the gains and losses that different social segments can experience. Unfortunately, the evidence on this aspect of GVC participation has drawn less attention in the literature, arguably also because of the lack of available data going beyond the industry-level, i.e., at value-chain level. A partial exception is represented by a recent work by Reshef & Santoni (2023), who investigated the impact of the GVC participation on the labour share for a sample covering 39 countries and 30 industries over the period 1995-2014. While their main finding is that the growing forward GVC participation of industries has played a key role in accelerating the decline in the labour share in the considered period, they also exploited measures of "functional specialization" introduced by Timmer et al. (2019) to split the labour income in total value added embodied in export flows into four categories of functions, namely management, research and development, fabrication, and marketing.[2] Following this procedure, they found that a more upstream position of industries, as measured by both forward GVC participation and the upstreamness indicator, is associated with negative changes in labour income shares in the value added of fabrication functions (and to a much lesser extent in management and marketing tasks). The authors suggest that this result is likely due to the fact that increases in the upstreamness of industries are driven by the offshoring of assembly activities.

Adopting an alternative and largely complementary approach, in this work will make use of granular data on inward FDI projects, which report information on the value chain functions they are aimed to carry out. As previously mentioned, FDI flows represent a major driver of the international fragmentation of production and largely contribute to shaping GVCs, whose emergence has prompted countries to increasingly focus on selected value-adding activities while offshoring their non-core competencies (Grossman & Rossi-Hansberg, 2008; Sturgeon & Gereffi, 2009; Timmer et al., 2019; World Bank, 2020).

[1] Further details on the "upstreamness" measure introduced by Antràs et al. (2012), which is also used in this work, are reported in section 4.

[2] On the merits and shortcomings of this approach, see Coveri & Zanfei (2022, 2023).

Notably, we expect FDIs in different GVC stages to have a differentiated impact on the domestic economic structure, resulting in heterogeneous effects on income inequality. For example, inward FDIs in upstream and knowledge-intensive activities (such as research, design and development) might allow domestic firms to take advantage of international technological spillovers, fostering skill and functional upgrading and dynamic returns to scale (Castellani & Zanfei, 2006; Morris & Staritz, 2017; Pöschl et al., 2016; Tajoli & Felice, 2018). On the one hand, they may therefore promote the structural change of recipient economies, offering better-paid jobs in new developing sectors and lowering inequality. On the other hand, knowledge-intensive FDIs might exacerbate the skill- and task-biased character of production in GVCs, increasing the skill premium and rising disparities (Bogliaccini & Egan, 2017; Hale & Xu, 2016).

The reviewed literature leads us to formulate two key research questions (RQ), which we aim to address through a systematic empirical analysis conducted on a large number of both high- and low-income countries:

RQ1: *to what extent does GVC positioning, measured in terms of trade in GVCs, affect within-country inequality?*

RQ2: *to what extent does the involvement of economies in distinct value adding activities, measured in terms of their ability to attract FDIs in specific GVC functions, affect within-country inequality?*

Overall, by jointly considering both FDI and trade modes of countries' involvement in GVCs, our empirical analysis will allow: (a) to distinguish the distributional impact of captive or hierarchical type of governance of GVCs (which largely rely on transnational investments by multinational corporations across different value adding activities) from that resulting from firms' international outsourcing strategies (which greatly fuels trade in intermediate inputs within GVCs); (b) to better control for the omitted variable bias that might arise when failing to include both these forms of countries' involvement in GVCs; (c) to assess how cross-border capital flows in different value chain functions affect the patterns of income inequality within countries.

2.2 The functional diversification argument

Hartmann et al. (2017) showed that the complexity and diversity of products that countries export is a strong predictor of their pattern of income inequality. In particular, they showed that a diversified productive structure is a necessary condition to obtain high living standards and well-paid jobs. In fact, the mix of products a country exports shapes (and enlarges) the occupational choices, skill requirements, learning opportunities, knowledge base and bargaining power of its workers and unions (Hartmann et al., 2017). More in general, the literature on economic complexity stresses that the process of economic development is fundamentally linked with economic diversification (i.e., from a single income source towards a larger range of earnings deriving from multiple sectors and product lines) and that

economic diversification is strictly connected to the patterns of income inequality (Imbs & Wacziarg, 2003; Hidalgo et al., 2007; Hidalgo & Hausmann, 2009; Hartmann et al., 2020).

However, the "slicing up" of GVCs has prompted a hyper-specialization of world economies in selected value chain functions of the GVCs of products, be they a Barbie doll or an iPhone (Tempest, 1996; Kaplan and Kaplinsky, 1999; Dedrick et al., 2010; Grossman & Rossi-Hansberg, 2008; Timmer et al., 2019). It follows that greater attention should be paid to the diversification of economies in terms of GVC functions rather than products (Sturgeon, 2008; Sturgeon & Gereffi, 2009; Coveri & Zanfei, 2023).

Following this line of argument, Paglialunga et al. (2022) tested whether a higher functional diversification, defined as the capability of countries to attract FDIs related to different value chain activities, contributes to enhance the resilience of economies – in terms of capabilities of adaptation and speed of economic recovery – in the face of environmental-related extreme events. Their empirical analysis, based on a sample including a large number of high- and low-income countries over the period 2003-2017, provided support for this hypothesis. In particular, they found that a more even (less skewed) distribution of inward FDIs across value chain activities is associated with a lower adverse impact of climate events on income inequality.

Indeed, while focusing on the limited set of activities in which countries already excel would merely reduce the variety of capabilities that they have, a greater functional diversification would sustain a larger and increasingly diverse set of skills, therefore promoting a more even distributional outcome. Furthermore, performing a wide variety of functions can be associated to greater learning opportunities due to the complementarities and structural interdependencies among GVC activities (Hirschman, 1958; see also Andreoni, 2014; Andreoni & Chang, 2019). Greater functional diversification could therefore be conducive to expand the production matrix of economies by enlarging the spectrum of value-adding activities they are able to carry out, with beneficial effects on income distribution.

Accordingly, in this work we follow Paglialunga et al. (2022) and use information on the value chain functions that inward FDI projects are aimed to perform to build an indicator of "functional diversification in FDI" of economies. From this perspective, it is suggested that greater functional diversification of countries can be a good measure of the ability of countries to carry out diverse and more complex tasks and, through this channel, could foster a more inclusive development.

This leads us to a third key research question, that we wish to address though our empirical analysis:

RQ3: *to what extent does the involvement in a more diversified range of activities along GVCs help moderate within-country inequality?*

In what follows we provide an empirical investigation on a remarkably large sample of economies to shed light on the reviewed dimensions of countries' involvement in GVCs and how these are associated with income inequality.

3. Empirical strategy

Our empirical approach is based on panel methodologies allowing to account for different GVC-related drivers of within-country inequality and to fully consider the main economic, technological and institutional determinants of income disparities. Our identification strategy relies on observing how income distribution is affected by several trade in GVC indicators as well as FDI-based indicators. While the former are relatively standard in analyses of GVCs, the latter are crucial to assess the association between the economies' attractiveness of long-term capital flows across different value chain functions and the distributional patterns experienced by countries.

Notably, by including variables related to trade in GVC together with indicators based on the value chain functions performed by FDIs, we strive to jointly consider both forms of involvement of economies in GVCs, namely through both arm's length relationships (the result of firms' international outsourcing strategies) and more hierarchical or captive forms of offshoring (Gereffi et al., 2005).

Formally, we estimate the following regression equation:

$$Gini_{i,t} = \beta_0 + \beta_1\left(Trade\ in\ GVC_{i,t}\right) + \beta_2\left(FDI\ variables_{i,t}\right) + \beta_3 X_{i,t} + \gamma_i + \delta_t + \varepsilon_{i,t} \qquad (1)$$

where $Gini_{i,t}$ is the Gini index for household market income and represents our measure of income inequality in country *i* at time *t*. We take the Gini index in logarithm terms to mitigate heteroskedasticity and increase the efficiency of the fixed effects estimator. $Trade\ in\ GVC_{i,t}$ includes different indices of participation and positioning of economies in GVCs, while $FDI\ variables_{i,t}$ stands for the FDI-based indicators capturing the involvement and positioning of countries in GVCs from a functional perspective (namely by putting attention on the value chain activities performed by the receiving countries rather than the sectoral dimension). Further details on the trade in GVC indices and FDI variables are provided in the next section.

The term $X_{i,t}$ includes an array of country-year variables controlling for key determinants of income distribution detected by the literature and regarding mainly the economic, technological, and institutional development of economies (see the next section for additional details).

Finally, our model includes both country- (γ_i) and time- (δ_t) fixed effects, with the former allowing us to account for all unobserved time-invariant country-specific characteristics (e.g., geographical location), and the latter for the time trend (otherwise, year-specific effects that impact on all observed variables would be captured by the error term, giving rise to endogeneity concerns). As usual, $\varepsilon_{i,t}$ is the error term and β_0 stands for the intercept.

The estimates are performed on a sample including more than 100 countries over the period 2003-2015. This is the number of economies that received at least one FDI per year and that we can therefore observe over the whole period under investigation. This sample selection

procedure gives us the possibility to work on a remarkably large and balanced panel dataset. In addition, it avoids losing much information, as countries that did not receive at least one FDI per year suffer in any case from missing data for most of the other variables included in our model. As for the time span of the empirical analysis, 2003 is the first year for which FDI data from the fDi Markets database are available, while 2015 is the last year for which data on the Upstreamness and Downstreamness indicator based on EORA's Multi-Region Input-Output tables (MRIOs) are available (Mancini et al., 2023).

The data sources and metrics used to construct the trade in GVC and FDI-based variables, as well as the descriptive statistics, are reported below.

4. Data

This section provides a description of the economic, technological and institutional variables included in our empirical analysis, together with information on the sources of data.

Gini index

The Gini index for household market income is the indicator that we employ to measure the income inequality within countries. We choose to focus on the Gini index based on market income instead of disposable income in order to soften the impact of redistributive policies of countries, the latter representing confounding factors whose data are missing for several countries included in our dataset (thus being factors it is hard for us to control for). The Gini index ranges from 0 to 1, corresponding to perfect equality and inequality of income distribution, respectively.

Data are drawn from the Standardized World Income Inequality Database (SWIID), which aggregates a wide array of official data sources that provide clear welfare definition and a scale of equivalence for household income (Solt, 2020). Compared with other data sources, SWIID data maintain the widest possible coverage across countries and over time, and it is well suited for broad cross-national analysis (Solt, 2009, 2020). In addition, SWIID data are highly reliable since they are harmonized with the Luxembourg Income Study (LIS), the latter being the most trusted database providing Gini data at the country level (the LIS has however the disadvantage of covering fewer countries for fewer years compared to SWIID data).[3]

[3] Solt (2020) estimates the relationships between LIS data and the Gini indices available for the same country-years from other sources, and then uses these relationships to estimate what the LIS Gini would be in country-years not included in the LIS. When it is not possible to compare LIS data with other data sources, the author uses a Bayesian inferential framework to infer the missing data, assuming that changes in the Gini index over time can be modelled with a Monte Carlo Markov Chain (MCMC).

Trade in GVC variables

Data on the GVC participation and positioning of economies are drawn from the UNCTAD-Eora GVC Database (Casella et al., 2019) since it allows us to include in our investigation the largest number of countries at global level.

The measures of trade in GVC that we use are of two types. The first type of measures is represented by trade in value added (TiVA) variables, namely the backward and the forward GVC indices. Backward linkages measure the foreign value added embodied in a given country's exports, namely the non-domestically captured value added in a given country's exports ($FVA_{i,t}$). We compute the backward GVC index of a country as the ratio between its backward linkages and the value-added content of domestic gross exports. Conversely, forward linkages measure the amount of domestic value added embodied in a given country's exports which is further re-exported by importing countries – also known as indirect value-added in exports ($DVX_{i,t}$). It follows that exports by importing countries constitute a source of demand for the country under observation. We compute the forward GVC index of a country as the ratio between its forward linkages and the value-added content of domestic gross exports.[4]

By jointly considering the backward and forward GVC linkages, we get a measure of the overall GVC participation of economies, which is computed as follows:

$$GVC\ participation\ index_{i,t} = \frac{DVX_{i,t} + FVA_{i,t}}{EXP_{i,t}} \qquad (2)$$

where $EXP_{i,t}$ is the value-added content of domestic gross exports (net of double-counting) of country *i* at time *t*.

Further, we include in our model a TiVA-based indicator on the positioning of economies in GVCs. This indicator, which we refer to as GVC position index, was proposed by Koopman et al. (2010) and identifies the relative magnitude of forward and backward GVC linkages of countries as measured by the share of domestic value added in foreign exports (DVX) and the share of foreign value added in domestic exports (FVA), respectively. Formally, this indicator is computed as follows:

$$GVC\ position\ index_{i,t} = ln\left(1 + \frac{DVX_{i,t}}{EXP_{i,t}}\right) - ln\left(1 + \frac{FVA_{i,t}}{EXP_{i,t}}\right) \qquad (3)$$

where $EXP_{i,t}$ is the value-added content of domestic gross exports (net of double-counting) of country i at time *t*. This indicator captures whether a country is predominantly a net exporter or a net importer of value added, i.e., whether the domestic added value embodied

[4] These indicators are built by exploiting the EORA Multi-Region Input-Output tables and details on the methodology and comparisons with other value-added trade databases are reported in Casella et al. (2019).

in exports of intermediate goods and services (forward participation) is higher or lower than the foreign added value embodied in country's exports (backward participation).

Furthermore, we complement the GVC indices based on TiVA metrics with indicators on the GVC positioning of economies based on measures of countries' distance from final demand ("upstreamness") or primary production inputs ("downstreamness"). More specifically, the Upstreamness indicator was developed by Fally (2012), Antràs et al. (2012), and Antràs and Chor (2013, 2019), and captures the average number of production steps the output of a country goes through before reaching final demand, thus allowing to measure the distance to final consumption for a country along GVCs. The Downstreamness indicator was originally proposed by Fally (2012) and captures the distance of a given country from the primary inputs (e.g., raw materials), meaning that a country is relatively more downstream along GVCs if its production embodies a larger value of intermediate inputs compared to value added from primary factors of production.

We compute the Upstreamness and Downstreamness indicators at the country level by relying on the dataset recently compiled by Mancini et al. (2023) (see also Belotti et al., 2021).[5]

Finally, it is worth stressing that all measures of GVC positioning of economies discussed above are industry-based indicators. Consequently, they are not able to capture the value adding activities, also called "functions" or "tasks", performed by economies (Grossman & Rossi-Hansberg, 2008; Sturgeon, 2008; Sturgeon & Gereffi, 2009; Timmer et al., 2019; Coveri & Zanfei, 2022). In other terms, by disaggregating product categories, one can derive no relevant information on what activities or value adding functions are being undertaken by countries to bring those products to market. By disregarding the functional level of analysis, one is likely to miss a fundamental feature of the international fragmentation of production, i.e., the different economic value that is associated with distinct GVC activities (for an expanded discussion on this, see Coveri & Zanfei, 2023). Accordingly, in this work we combine the described indicators of trade in GVC with variables based on FDI data, which allow us to obtain proxies of the value chains functions performed by economies along GVCs.

FDI variables

FDI variables are drawn from the fDi Markets database, an online database provided by fDi Intelligence – a specialist division of Financial Times Ltd – which collects detailed information on announced cross-border greenfield investments (i.e., new wholly-owned

[5] However, a warning must be raised about these indicators. While being among the most famous measures of positioning of economies along GVCs, a puzzling correlation – closer to +1 – exists between the value of upstreamness and downstreamness of several countries (Antràs & Chor, 2019; see also Wang et al., 2017). According to a recent work by Bartolucci et al. (2023, p. 8), this is "simply due to structural and unavoidable algebraic constraints that I-O tables and their surrogates must satisfy". Therefore, we consider the Upstreamness and Downstreamness measures less reliable than variables on trade in GVC based on TiVA statistics.

subsidiaries, including joint ventures leading to a new physical operation) from several publicly available information sources, covering all sectors and countries worldwide from 2003 onwards.[6]

A distinctive feature of the fDi Markets database consists in providing information on the value chain function each FDI project is aimed to carry out, together with information on the economic sector targeted by cross-border investments (e.g., automotive, electronics, publishing services, computer programming industries, etc.). It is worth clarifying that value chain functions represent the value adding activities – from headquarters activities, R&D, design and testing to fabrication and assembly operations, up to logistics, branding and sale services – needed to bring an industry product to market and beyond (as functions also include after-sales services).

We classify inward FDIs according to value chain functions by adopting the canonical classification in three GVC stages: upstream activities (e.g., headquarter services, knowledge-intensive tasks as R&D, design and training), production (e.g., fabrication and assembly) and downstream segments (e.g., logistics, marketing and post-sales services) (Mudambi, 2008; Baldwin & Evenett, 2015; Stöllinger, 2021; Coveri & Zanfei, 2022). These indicators are computed as the share of inward FDIs related to each GVC stage over the total number of FDIs received by each country.

Moreover, we adopt a GVC-oriented approach to the analysis of the productive diversification of economies (Paglialunga et al., 2022). Accordingly, we use the above classification of cross-border investment flows to calculate an index of *functional diversification in FDI* based on the normalized Herfindahl–Hirschman index (HHI). Formally, for each country *i*, GVC stage *k* and year *t*, the index is computed as follows:

$$Functional\ diversification\ in\ FDI_{i,t} = 1 - HHI_{i,t} = 1 - \left[\left(\sum_{k=1}^{3}\left(\frac{FDI_{i,t}^{k}}{FDI_{i,t}}\right)^{2} - \frac{1}{k}\right)\Big/\left(1 - \frac{1}{k}\right)\right] \qquad (3)$$

where the ratio in parenthesis represents the share of FDIs related to the k-th of the three GVC stages over the total inward FDIs for country *i* in year *t*.[7]

Finally, adopting the same methodology, we compute an index of *sectoral diversification in FDI* based on the NACE Rev. 2 sector each FDI has targeted, to compare the role played by the functional diversification of economies with their level of sectoral diversification in affecting the distributional dynamics of countries.

[6] Further details on this dataset can be found in the online appendix of Coveri & Zanfei (2022).

[7] This modified version of HHI is also known as Berry-Herfindahl index (Berry, 1971). By virtue of the normalization process, both the inverse HHI and the dependent variable range between 0 and 1, making the interpretation of the estimated coefficient associated to the inverse HHI easier.

Control variables

Building the dataset, we aimed at achieving the widest possible countries' coverage (including as many low and lower-middle countries as possible). Accordingly, the selection of variables controlling for other time-varying features of economies is constrained by the availability of data for the large array of countries included in our investigation. Nonetheless, our empirical analysis accounts for several key characteristics of countries which affect their distributional patterns.

In particular, we control for (i) the GDP per capita in constant 2017 international PPP dollars, both in linear and squared terms, in order to control for the level of economic development of economies (Kuznets, 1955); (ii) the number of mobile cellular subscriptions (per 100 inhabitants), as a proxy for the level of technological development of countries, which is crucial to distinguish the impact of economic globalization from that due to technological progress on income disparities (Acemoglu & Autor, 2011; Jaumotte et al., 2013; Reijnders & de Vries, 2018); (iii) the number of years of compulsory education, as a proxy for the overall level of skills the workforce is equipped with, in order to control for potential skill-biased effects induced by technological change and economic globalization on inequality (Van Reenen, 2011; Hartmann et al., 2017); (iv) the share (%) of value added from the manufacturing sector, to control for the industrial structure of the economies; (v) the trade openness of economies, which is computed as the percentage ratio between the sum of total exports and total imports, and the GDP of countries, that allows us to distinguish the impact of trade in GVC from the overall effect on income inequality due to the involvement of economies in international trade flows (Constantinescu et al., 2019); (vi) the percentage share of rural population with access to electricity, as a further proxy of the industrial development of countries; (vii) the KOF Financial Globalisation Index (*de facto*), which allows us to distinguish the impact of the economic globalization (driven by trade and FDI flows) from the effects due to financial globalization (i.e., short-term capital flows) on income inequality.[8]

Data on all these variables are drawn from the World Bank's World Development Indicators (WDI) database, except for the KOF Financial Globalisation Index, whose data are retrieved from the KOF Swiss Economic Institute database of ETH Zurich (Dreher, 2006; Gygli et al., 2019).[9]

[8] Financial globalization can affect income distribution through various channels (Claessens & Perotti, 2007). On the one side, capital account openness may foster financial development, improving the access to the credit market by poor people and allowing to overcome the financial constrains which prevent them from consumption smoothing and investing in new activities. From this perspective, financial liberalization might therefore decrease inequality (Beck et al., 2007). On the other hand, the liberalization of capital flows can exacerbate capital account imbalances, thereby increasing countries' vulnerability to financial crises and economic recessions, eventually followed by fiscal consolidation measures. As the economic burden of such incidents is often disproportionately charged by the poorest social groups, a greater income inequality follows (de Haan & Sturm, 2017; Furceri & Loungani, 2018; Furceri et al., 2019, 2020).

[9] Labour market tightness, often proxied by the unemployment rate, represents another important determinant of the bargaining power of labour with respect to capital and is thus likely to influence the patterns of income

Chart 1 shows the summary statistics of all variables included in our empirical analysis.

Chart 1. Summary statistics

	N	Mean	Std. Dev.	min	max
ln(Gini for market income)	1329	3.831	0.132	3.484	4.281
ln(GDP per capita)	1378	9.582	1.023	6.597	11.656
GVC participation index	1391	54.525	14.262	24.581	94.211
Backward participation index	1391	25.296	14.491	0.15	66.494
Forward participation index	1391	29.229	10.562	9.212	81.184
GVC position index	1391	0.034	0.161	-0.392	0.485
Upstreamness	1391	2.019	0.36	1.381	4.117
Downstreamness	1391	2.043	0.342	1.334	3.983
ln(inward FDI)	1391	3.604	1.496	0	7.458
Share of FDI in upstream functions	1391	0.11	0.098	0	0.667
Share of FDI in production functions	1391	0.316	0.223	0	1
Share of FDI in downstream functions	1391	0.574	0.209	0	1
Functional diversification in FDI	1391	0.683	0.231	0	1
Sectoral diversification in FDI	1391	0.738	0.15	0	0.939
Compulsory education (years)	1337	9.618	2.23	4	16
Mobile cellular subs. (per 100 people)	1391	87.177	43.352	0.138	239.437
Manufacturing value added (% GDP)	1349	14.221	6.301	1.027	50.635
Trade (% of GDP)	1366	90.985	60.92	11.855	442.62
Access to electricity (% of rural pop.)	1391	81.89	29.762	0	100
KOF Financial Globalisation Index	1391	64.492	18.54	14.856	99.781

Note: authors' elaboration.

5. Results

5.1 Fixed effects estimator

We start by estimating a model where the Gini index is regressed against the linear and squared GDP per capita, the full set of control variables, and our trade in GVC variables introduced step by step: the GVC participation index; the GVC participation index together with the GVC position index; the forward and backward GVC participation indices; the Upstreamness indicator; and the Downstreamness indicator. The estimation results are shown in Table 1.

distribution (Stockhammer, 2017; Pariboni & Tridico, 2019). However, data on unemployment are not available for a rather large share of countries, so that the inclusion of this variable in our model significantly reduces the size of the sample, also giving rise to the risk of selection bias (the same goes for data on the union density). Besides, even when available, the reliability of data on unemployment rate in emerging and especially least developed economies is often doubtful due to the large informal sector in these countries.

First of all, the signs of the linear and squared GDP per capita suggest an inverted-U shape relationship between economic development and inequality, providing a confirmation of the Kuznets curve. The first term is positive while the second is negative across all specifications of the model, and both are statistically significant, meaning that increasing per capita income is associated first with an increase and then a reduction in inequality. As for control variables, the years of compulsory education and the mobile cellular subscriptions result always negative and significant, although the latter reports very tiny coefficients, possibly revealing mixed effects of technical change. The share of value added coming from the manufacturing sector and the trade openness index are never significant, while the share of rural population with access to electricity always shows very small, significantly negative coefficients. The *de facto* financial globalisation index shows small positive coefficients, which result significant in three out of six of the estimated specifications. Notably, the overall number of inward FDIs always reports a positive and significant coefficient.

As for the trade in GVC variables, column 2 shows that the coefficient of the GVC participation index is not significant, also when controlling for the GVC position index (column 3). The latter does not result identified in the specification reported in column 3, reporting a positive but not significant coefficient.

In column 4 we unpack the GVC participation index in its backward and forward components. The coefficient is positive for the former component while it is negative for the latter, but in both cases they are not statistically significant and very tiny in magnitude.

Columns 5 and 6 show estimates including Upstreamness and Downstreamness, respectively, where the former captures the distance of countries' industries from final demand, while the latter measures distance from primary sources of value added (Fally, 2012; Antràs et al., 2012). Both these variables have positive and significant coefficients, suggesting that a more pronounced positioning of economies at the upper ends of production chains is associated with greater income inequality.

Table 2 reports estimations including the FDI variables, which permit the value chain functions to be included in the analysis, in addition to the industry-level considerations allowed by previous trade-related variables. The sign, magnitude and statistical significance of control variables are largely confirmed across all specifications. Most importantly, columns 1, 2 and 3 show that, when including one by one the variables related to the share of inward FDIs in upstream, production and downstream *functions*, respectively, the coefficients of the first and the third one are negative, although only the share of FDI in downstream functions is significant. As for the share of FDI in production functions, its coefficient is positive and statistically significant. This result is confirmed by column 4, showing that higher shares of FDIs in upstream and downstream activities are associated with lower of income disparities. Column 5 report estimate results of a model in which the share of FDI across functions are replaced by what we have called "Functional diversification in FDI". As expected, this variable shows a negative and significant coefficient, suggesting that a higher diversification of economies across value chain functions is associated with lower

level of inequality. This finding is not confirmed when introducing the FDI-based diversification of economies in terms of industries (column 6), highlighting the importance of focusing on the value adding activities to explore the patterns of income inequality in the era of GVCs.

Table 3 reports the estimates which jointly include the trade in GVC variables based on TiVA statistics and proxies of the functional profiles of economies based on FDI data. All previous results are largely confirmed.

The following two tables show the estimates which jointly include the Upstreamness (Table 4) and the Downstreamness indicator (Table 5) together with variables on the functional dimension of FDIs received by economies. Once again, previous results are largely confirmed, except for the coefficient of FDI-based diversification of economies across sectors, which results negative and slightly significant in column 5 of Table 4. Most notably, the Upstreamness and Downstreamness always report positive and significant coefficients, confirming that these indicators capture a dimension of the GVC positioning of economies which is strikingly different from the GVC position of countries in terms of value chain functions. In fact, the share of FDIs in upstream and downstream activities, proxying the functional position occupied by economies along GVCs, both report negative and significant coefficients. In other words, the functional level of analysis allows us to detect the heterogeneous effects of positioning in GVCs and functional diversification of economies on inequality, which are not captured when only controlling for sectoral upstreamness (or downstreamness). Consistently, our results show that the positioning of countries in terms of industries can have quite different distributional effects depending on the involvement of the economy in the value-adding stages of GVCs: more knowledge-intensive activities undertaken within industries seem to lead to less inequality; and a certain degree of functional diversification is also associated with a less unequal income distribution.

5.2 Robustness check: Two-stage System GMM estimator

A potential bias in our estimates may be present if the strict exogeneity assumption does not hold in our analysis, i.e., if a shock affecting the level of inequality in a year in one country is correlated with future values of inequality in the same country. From a formal standpoint, this would be the case if the residuals obtained from our model are serially correlated (i.e., correlated across time). Moreover, the explanatory variable may be correlated with the error term, for example if a shock in the economy affects both inequality and the participation in GVCs of a given country *i*, e.g., an agreement is signed between country *i* and country *j* such that MNCs in *j* have now an incentive to move part of their production in *i*. The participation and positioning of countries along GVCs and the number of inward FDIs in different value chain functions might also be affected by the distributional patterns of economies. For example, multinational corporations searching for low-cost labour and cheaper production inputs are affected by differences in capital and labour remuneration across countries, with the latter being a crucial determinant of within-country income inequality. This can induce

reverse causality between our dependent variable and our key regressors, giving rise to endogeneity concerns.

To sort out this potential source of endogeneity in our estimates and to account for the potential persistency in the value of the Gini index, we employ the dynamic panel estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998), namely the Two-Step System Generalized Method of Moments (GMM).

Table 6 and 7 report our estimates when using this estimator, yielding results that are broadly consistent with the scenario depicted by fixed effect estimates, albeit with some important nuances. In particular, Table 6 shows the results of a model specification which always includes as regressors the shares of inward FDIs in both upstream and downstream functions, together with trade in GVC variables introduced step by step.[10] The strong persistency over time of the Gini index is highlighted by the positive and strongly significant coefficient of its first lag, whose magnitude always results slightly lower than one. Coefficients for total inward FDIs are positive and significant in four out of five of the estimated equations. Most notably, while the share of FDIs in downstream functions loses statistical significance, the FDI share in upstream activities always exhibits a negative coefficient which result significant in two out of five of the estimated specifications (see column 4 and 5).[11] As for the trade in GVC variables, in columns 1 and 2 the GVC participation index is now positive and significant, while the GVC position index maintains a positive but not significant coefficient. This is consistent with the results in column 3, which shows that the forward GVC index has a positive and statistically significant coefficient, while the one of the backward GVC participation is positive but not significant. This suggests that the adverse impact of the GVC participation on inequality is driven by the forward component, in line with the findings of Reshef & Santoni (2023). Finally, columns 4 and 5 show that the Upstreamness and Downstreamness indicators retain a positive sign but lose significance, highlighting that previous results based on these indicators are less robust.

In Table 7 the shares of FDIs in upstream and downstream functions are replaced by our index of Functional diversification in FDI. The coefficient of this variable is confirmed with a negative sign across all model specifications and turns out significant in two out of five of the estimated equations (column 1 and 2). All findings regarding the trade in GVC indices obtained in the previous table are confirmed.

[10] Estimate results using the same specification, but without controlling for the share of FDI across functions, are reported in the Appendix.

[11] When accounting for the lagged dependent variable, the coefficient of the generic explanatory variable *x* only depends on the variation in *x* that is not included in the lagged dependent variable. Hence, in case of high persistence, a relatively large amount of variation is explained by the lagged dependent variable rather than the other explanatory variables (i.e., if the coefficient of the lagged dependent variable is close to 1, part of the variability of *x* is incorporated in the lagged variable).

Table 1. Fixed effects model with Trade in GVC variables

	(1) FE	(2) FE	(3) FE	(4) FE	(5) FE	(6) FE
ln(GDP per capita)	0.460***	0.461***	0.469***	0.466***	0.481***	0.436***
	(0.128)	(0.128)	(0.129)	(0.129)	(0.124)	(0.127)
ln(GDP per capita)^2	-0.026***	-0.026***	-0.027***	-0.027***	-0.028***	-0.025***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Compulsory education duration (years)	-0.007***	-0.007***	-0.007***	-0.007***	-0.008***	-0.008***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Mobile cellular subs. (per 100 people)	-0.000***	-0.000***	-0.000***	-0.000***	-0.000**	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Manufacturing, value added (% of GDP)	0.000	0.000	0.000	0.000	-0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Trade (% of GDP)	0.000	0.000	0.000	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Access to electricity, rural (% of rural pop.)	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
KOF Financial Globalisation Index	0.001	0.001	0.001*	0.001*	0.001*	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ln(inward FDI)	0.004*	0.004*	0.004*	0.004*	0.005**	0.005*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
GVC participation index		-0.000	0.000			
		(0.001)	(0.001)			
GVC position index			0.055			
			(0.066)			
Forward participation index				0.000		
				(0.001)		
Backward participation index				-0.000		
				(0.001)		
Upstreamness					0.060***	
					(0.019)	
Downstreamness						0.050***
						(0.018)
Constant	1.984***	1.984***	1.919***	1.941***	1.798***	2.029***
	(0.618)	(0.619)	(0.630)	(0.629)	(0.598)	(0.614)
Country FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
Observations	1,238	1,238	1,238	1,238	1,238	1,238
R-squared	0.335	0.335	0.337	0.337	0.362	0.351
Number of countries	101	101	101	101	101	101

Note: The dependent variable is the natural log of the Gini index for market income. Fixed effects estimator with robust standard errors clustered at country level in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 2. Fixed effects model with FDI variables

	(1) FE	(2) FE	(3) FE	(4) FE	(5) FE	(6) FE
ln(GDP per capita)	0.465***	0.489***	0.475***	0.490***	0.486***	0.469***
	(0.128)	(0.127)	(0.128)	(0.127)	(0.128)	(0.129)
ln(GDP per capita)^2	-0.027***	-0.028***	-0.027***	-0.028***	-0.028***	-0.027***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Compulsory education duration (years)	-0.007***	-0.007***	-0.007***	-0.007***	-0.007***	-0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Mobile cellular subs. (per 100 people)	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Manufacturing, value added (% of GDP)	0.000	0.000	0.000	0.000	0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Trade (% of GDP)	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Access to electricity, rural (% of rural pop.)	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
KOF Financial Globalisation Index, de facto	0.001	0.001	0.001*	0.001	0.000	0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ln(inward FDI)	0.004*	0.005*	0.004*	0.005*	0.005**	0.005**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Share of FDI in upstream functions	-0.012			-0.021**		
	(0.008)			(0.009)		
Share of FDI in production functions		0.013***				
		(0.005)				
Share of FDI in downstream functions			-0.008*	-0.012**		
			(0.004)	(0.005)		
Functional diversification in FDI					-0.012***	
					(0.004)	
Sectoral diversification in FDI						-0.010
						(0.007)
Constant	1.967***	1.838***	1.913***	1.846***	1.864***	1.946***
	(0.616)	(0.613)	(0.617)	(0.612)	(0.616)	(0.620)
Country FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
Observations	1,238	1,238	1,238	1,238	1,238	1,238
R-squared	0.337	0.340	0.338	0.341	0.343	0.337
Number of countries	101	101	101	101	101	101

Note: The dependent variable is the natural log of the Gini index for market income. Fixed effects estimator with robust standard errors clustered at country level in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 3. Fixed effects model with Trade in GVC and FDI variables

	(1) FE	(2) FE	(3) FE	(4) FE	(5) FE	(6) FE
ln(GDP per capita)	0.473***	0.499***	0.485***	0.500***	0.495***	0.478***
	(0.128)	(0.128)	(0.129)	(0.128)	(0.128)	(0.129)
ln(GDP per capita)^2	-0.027***	-0.028***	-0.028***	-0.028***	-0.028***	-0.027***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Compulsory education duration (years)	-0.007***	-0.007***	-0.007***	-0.007***	-0.007***	-0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Mobile cellular subs. (per 100 people)	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Manufacturing, value added (% of GDP)	0.000	0.000	0.000	0.000	0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Trade (% of GDP)	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Access to electricity, rural (% of rural pop.)	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
KOF Financial Globalisation Index	0.001*	0.001*	0.001*	0.001*	0.001*	0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ln(inward FDI)	0.004*	0.005*	0.004*	0.005**	0.005**	0.005**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
GVC participation index	0.000	0.000	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
GVC position index	0.054	0.054	0.056	0.053	0.051	0.051
	(0.066)	(0.065)	(0.065)	(0.065)	(0.066)	(0.065)
Share of FDI in upstream functions	-0.012			-0.020**		
	(0.008)			(0.009)		
Share of FDI in production functions		0.013**				
		(0.005)				
Share of FDI in downstream functions			-0.008*	-0.012**		
			(0.004)	(0.005)		
Functional diversification in FDI					-0.012***	
					(0.004)	
Sectoral diversification in FDI						-0.010
						(0.007)
Constant	1.904***	1.774***	1.847***	1.784***	1.807***	1.889***
	(0.628)	(0.624)	(0.629)	(0.623)	(0.626)	(0.631)
Country FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
Observations	1,238	1,238	1,238	1,238	1,238	1,238
R-squared	0.339	0.342	0.340	0.343	0.345	0.339
Number of countries	101	101	101	101	101	101

Note: The dependent variable is the natural log of the Gini index for market income. Fixed effects estimator with robust standard errors clustered at country level in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 4. Fixed effects model with Upstreamness index and FDI variables

	(1) FE	(2) FE	(3) FE	(6) FE	(4) FE	(5) FE
ln(GDP per capita)	0.484***	0.510***	0.497***	0.511***	0.507***	0.492***
	(0.124)	(0.122)	(0.123)	(0.122)	(0.123)	(0.123)
ln(GDP per capita)^2	-0.028***	-0.029***	-0.028***	-0.029***	-0.029***	-0.028***
	(0.007)	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)
Compulsory education duration (years)	-0.008***	-0.007***	-0.007***	-0.007***	-0.007***	-0.008***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Mobile cellular subs. (per 100 people)	-0.000**	-0.000**	-0.000**	-0.000**	-0.000**	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Manufacturing, value added (% of GDP)	0.000	-0.000	-0.000	-0.000	0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Trade (% of GDP)	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Access to electricity, rural (% of rural pop.)	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
KOF Financial Globalisation Index, de facto	0.001*	0.001*	0.001*	0.001*	0.000	0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ln(inward FDI)	0.005**	0.005**	0.005**	0.005**	0.006**	0.006**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Upstreamness	0.060***	0.060***	0.061***	0.060***	0.060***	0.061***
	(0.019)	(0.018)	(0.018)	(0.018)	(0.018)	(0.019)
Share of FDI in upstream functions	-0.010			-0.019**		
	(0.008)			(0.008)		
Share of FDI in production functions		0.013***				
		(0.005)				
Share of FDI in downstream functions			-0.009**	-0.012***		
			(0.004)	(0.005)		
Functional diversification in FDI					-0.012***	
					(0.004)	
Sectoral diversification in FDI						-0.013*
						(0.007)
Constant	1.785***	1.650***	1.719***	1.661***	1.677***	1.748***
	(0.597)	(0.588)	(0.592)	(0.587)	(0.593)	(0.594)
Country FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
Observations	1,238	1,238	1,238	1,238	1,238	1,238
R-squared	0.363	0.367	0.364	0.367	0.369	0.364
Number of countries	101	101	101	101	101	101

Note: The dependent variable is the natural log of the Gini index for market income. Fixed effects estimator with robust standard errors clustered at country level in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 5. Fixed effects model with Downstreamness index and FDI variables

	(1) FE	(2) FE	(3) FE	(4) FE	(5) FE	(6) FE
ln(GDP per capita)	0.440***	0.463***	0.450***	0.464***	0.462***	0.445***
	(0.127)	(0.126)	(0.127)	(0.126)	(0.128)	(0.128)
ln(GDP per capita)^2	-0.025***	-0.027***	-0.026***	-0.027***	-0.027***	-0.026***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Compulsory education duration (years)	-0.008***	-0.007***	-0.007***	-0.007***	-0.007***	-0.008***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Mobile cellular subs. (per 100 people)	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Manufacturing, value added (% of GDP)	0.000	0.000	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Trade (% of GDP)	-0.000	-0.000	-0.000	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Access to electricity, rural (% of rural pop.)	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
KOF Financial Globalisation Index, de facto	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ln(inward FDI)	0.005**	0.005**	0.005**	0.005**	0.005**	0.005**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Downstreamness	0.050***	0.049***	0.050***	0.049***	0.050***	0.050***
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Share of FDI in upstream functions	-0.011			-0.019**		
	(0.008)			(0.008)		
Share of FDI in production functions		0.012**				
		(0.005)				
Share of FDI in downstream functions			-0.007*	-0.011**		
			(0.004)	(0.005)		
Functional diversification in FDI					-0.012***	
					(0.004)	
Sectoral diversification in FDI						-0.010
						(0.007)
Constant	2.013***	1.893***	1.962***	1.901***	1.911***	1.991***
	(0.612)	(0.609)	(0.612)	(0.608)	(0.617)	(0.619)
Country FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
Observations	1,238	1,238	1,238	1,238	1,238	1,238
R-squared	0.352	0.355	0.352	0.355	0.358	0.352
Number of countries	101	101	101	101	101	101

Note: The dependent variable is the natural log of the Gini index for market income. Fixed effects estimator with robust standard errors clustered at country level in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 6. Two-step System GMM with trade in GVC and FDI variables

	(1) GMM	(2) GMM	(3) GMM	(4) GMM	(5) GMM
L.ln(Gini for market income)	0.986***	0.994***	0.992***	0.975***	0.989***
	(0.045)	(0.041)	(0.041)	(0.023)	(0.018)
ln(GDP per capita)	-0.037	-0.052	-0.049	-0.092*	-0.074
	(0.071)	(0.062)	(0.067)	(0.052)	(0.057)
ln(GDP per capita)^2	0.002	0.003	0.002	0.005*	0.004
	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
Compulsory education duration (years)	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Trade (% of GDP)	-0.000	-0.000	-0.000	-0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Mobile cellular subs. (per 100 people)	0.000	0.000	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
KOF Financial Globalisation Index	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ln(inward FDI)	0.003*	0.002*	0.002*	0.002**	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Share of FDI in upstream functions	-0.005	-0.004	-0.004	-0.007*	-0.008*
	(0.005)	(0.004)	(0.005)	(0.004)	(0.004)
Share of FDI in downstream functions	-0.000	0.000	0.000	-0.001	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
GVC participation index	0.001*	0.001**			
	(0.000)	(0.000)			
GVC position index		0.031			
		(0.033)			
Forward participation index			0.001**		
			(0.000)		
Backward participation index			0.001		
			(0.000)		
Upstreamness				0.003	
				(0.005)	
Downstreamness					0.001
					(0.006)
Constant	0.214	0.238	0.234	0.516*	0.380
	(0.362)	(0.333)	(0.346)	(0.300)	(0.297)
Year dummies	YES	YES	YES	YES	YES
Observations	1,172	1,172	1,172	1,172	1,172
Number of countries	102	102	102	102	102
Number of instruments	41	44	44	59	59
AR(1) p-value	0.00453	0.00545	0.00513	0.00482	0.00282
AR(2) p-value	0.201	0.217	0.212	0.200	0.181
Hansen p-value	0.166	0.210	0.202	0.123	0.0243

Note: Two-step System GMM estimator with finite sample correction (Windmeijer, 2005). The dependent variable is the natural log of the Gini index for market income. All explanatory variables, except the years of compulsory education and the KOF financial globalization index (*de facto*), are treated as endogenous. AR(#) tests on the serial correlation of residuals. Hansen tests of overidentification of restrictions. Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 7. Two-step System GMM with trade in GVC variables and Functional diversification in FDI

	(1) GMM	(2) GMM	(3) GMM	(4) GMM	(5) GMM
L.ln(Gini for market income)	1.018***	1.022***	0.989***	0.996***	1.010***
	(0.033)	(0.029)	(0.036)	(0.022)	(0.019)
ln(GDP per capita)	0.014	0.017	-0.047	-0.062	-0.050
	(0.061)	(0.052)	(0.071)	(0.042)	(0.041)
ln(GDP per capita)^2	-0.001	-0.001	0.002	0.003	0.003
	(0.003)	(0.003)	(0.004)	(0.002)	(0.002)
Compulsory education duration (years)	-0.001*	-0.001	-0.001	-0.001**	-0.001**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Trade (% of GDP)	-0.000*	-0.000	-0.000	-0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Mobile cellular subs. (per 100 people)	-0.000	-0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
KOF Financial Glob. Index, de facto	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ln(inward FDI)	0.004**	0.004**	0.003*	0.004***	0.004***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Functional diversification in FDI	-0.004*	-0.005**	-0.002	-0.002	-0.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
GVC participation index	0.001**	0.001**			
	(0.000)	(0.000)			
GVC position index		0.003			
		(0.032)			
Forward participation index			0.001**		
			(0.000)		
Backward participation index			0.001		
			(0.000)		
Upstreamness				0.004	
				(0.004)	
Downstreamness					0.003
					(0.005)
Constant	-0.154	-0.179	0.232	0.294	0.188
	(0.377)	(0.317)	(0.346)	(0.225)	(0.201)
Year dummies	YES	YES	YES	YES	YES
Observations	1,172	1,172	1,172	1,172	1,172
Number of countries	102	102	102	102	102
Number of instruments	70	77	41	70	70
AR(1) p-value	0.00179	0.00149	0.00453	0.00204	0.00166
AR(2) p-value	0.225	0.228	0.213	0.187	0.187
Hansen p-value	0.208	0.253	0.131	0.100	0.0264

Note: Two-step System GMM estimator with finite sample correction (Windmeijer, 2005). The dependent variable is the natural log of the Gini index for market income. All explanatory variables, except the years of compulsory education and the KOF financial globalization index (*de facto*), are treated as endogenous. AR(#) tests on the serial correlation of residuals. Hansen tests of overidentification of restrictions. Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

6. Conclusions

In this work, we provided a comprehensive empirical assessment of the GVC-inequality nexus by jointly considering both FDI and trade modes of countries' involvement in GVCs.

Three main findings have emerged from our empirical investigation.

First, the association between trade in GVC and income inequality is conditioned by the GVC positioning of countries. In particular, higher GVC participation is associated with a higher level of within-country inequality. This result is driven by the forward GVC participation, suggesting that a more upstream positioning of economies in terms of industry-based measures of Trade in Value Added contributes to increase income disparities. This finding might be due to the high concentration of monopoly rents stemming from the control of raw materials, commodities and energy resources by economic elites who retain power over the most upstream industries (Savoia & Sen, 2021).

However, the nature of these indicators does not allow to capture the functional profiles of economies, namely the value adding activities that they mostly perform in GVCs. Accordingly, in this work we combined the indicators of trade in GVC with variables based on FDI data, which allows us to obtain proxies of the value chains functions performed by economies along GVCs. Notably, the results that emerge when accounting for the value adding activities performed by economies in GVCs tell a different story.

In this regard, our second finding is that greater shares of FDIs in the upstream (i.e., knowledge-intensive tasks as R&D, design and training) and downstream (i.e., logistics, marketing and post-sales services) segments of the value chain are associated with lower income inequality, while the opposite emerges with regard to FDIs in production activities (i.e., manufacturing and assembly operations). This finding is consistent with previous evidence showing that a greater involvement in knowledge-intensive GVC stages fosters technological spillovers spreading throughout the recipient economy, creates better-paid jobs and opens upgrading opportunities, possibly lowering income inequality (Castellani and Zanfei, 2006; Pöschl et al., 2016; Morris & Staritz, 2017).

Third, we found that a greater functional diversification in FDI is robustly associated with lower levels of income disparities within countries. This result appears consistent with the hypothesis that a larger mix of value-adding activities an economy carries out allows to expand the learning opportunities and occupational choices for its workers and is conducive to a more inclusive development (Coveri & Zanfei, 2023).

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Appendix

Two-step System GMM with trade in GVC variables

	(1) GMM	(2) GMM	(3) GMM	(4) GMM	(5) GMM
L.ln(Gini for market income)	0.977***	0.990***	0.987***	0.951***	0.983***
	(0.045)	(0.038)	(0.039)	(0.035)	(0.030)
ln(GDP per capita)	-0.030	-0.036	-0.033	-0.092**	-0.076
	(0.071)	(0.067)	(0.071)	(0.046)	(0.066)
ln(GDP per capita)^2	0.001	0.002	0.002	0.005**	0.004
	(0.004)	(0.003)	(0.004)	(0.002)	(0.003)
Compulsory education duration (years)	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Trade (% of GDP)	-0.000	-0.000	-0.000	-0.000**	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Mobile cellular subs. (per 100 people)	0.000	0.000	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
KOF Financial Globalisation Index	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ln(inward FDI)	0.003*	0.003*	0.003*	0.003**	0.003**
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
GVC participation index	0.001*	0.001**			
	(0.000)	(0.000)			
GVC position index		0.046			
		(0.038)			
Forward participation index			0.001**		
			(0.000)		
Backward participation index			0.001		
			(0.000)		
Upstreamness				0.002	
				(0.005)	
Downstreamness					-0.001
					(0.006)
Constant	0.209	0.168	0.169	0.604**	0.413
	(0.350)	(0.332)	(0.344)	(0.264)	(0.321)
Year dummies	YES	YES	YES	YES	YES
Observations	1,172	1,172	1,172	1,172	1,172
Number of countries	102	102	102	102	102
Number of instruments	35	38	38	42	42
AR(1) p-value	0.00512	0.00536	0.00517	0.00655	0.00358
AR(2) p-value	0.200	0.216	0.211	0.207	0.188
Hansen p-value	0.105	0.152	0.153	0.0146	0.000784

Note: Two-step System GMM estimator with finite sample correction (Windmeijer, 2005). All explanatory variables, except the years of compulsory education and the KOF financial globalization index (*de facto*), are treated as endogenous. AR(#) tests on the serial correlation of residuals. Hansen tests of overidentification of restrictions. Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.