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 allows to expand the 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. This calls for more in-depth analysis of how different social segments of economies can extract economic value through their involvement in GVCs.

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 use an array of indicators of trade in GVCs based on Multi-Regional Input-Output tables to empirically assess the impact of different forms of participation in GVCs on within-country income inequality for both developed and developing economies. In particular, we investigate the association between the GVC positioning of countries and income distribution by exploiting indicators based on trade in value added data, as well as on measures of distance of countries from either final demand ("upstreamness") or sources of value added ("downstreamness").

Second, we combine information on the GVC position of countries based on input-output tables with detailed data on inward foreign direct investments (FDIs), which include information on the value chain activities they are aimed to perform. Cross-border capital flows have represented indeed a key driver of the international fragmentation of production and have largely contributed to the involvement of low- and middle-income countries in GVCs (UNCTAD, 2013). This allows us to complement analyses on the impact of trade in GVCs on income inequality with evidence on the value chain activities in which countries are involved.

Third, we compute 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 – in order to investigate the role played by the diversification of economies in terms of value chain functions in affecting their level of income inequality (Paglialunga et al., 2022). Our hypothesis is that greater functional diversification – as opposed to hyper-specialization – 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. 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

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; Helpman, 2016). 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; 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 to 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 favor the most mobile production factor, i.e., capital (Rodrik, 1997): the footloose character of international production poses 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).

Moreover, 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 tends to be 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).

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; Timmer et al., 2014; Timmer et al., 2019). Accordingly, 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). Our research hypothesis is that the ability of countries to carry out diverse and more complex tasks could represent a key factor in fostering a more inclusive development. Indeed, while focusing on the limited set of activities at 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 (Paglialunga et al., 2022).

In what follows we provide an empirical investigation on a remarkably large sample of economies in order to shed light on the different dimensions of countries' involvement in GVCs and how these are associated with income inequality. In particular, by jointly considering both FDI and trade modes of countries' involvement in GVCs, our empirical analysis allows: (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.

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:

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

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). 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 business cycle (otherwise, time-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 101 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., 2022).

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).[1]

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.[2]

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:

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

[1] 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).

[2] 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).

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:

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

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 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, Montalbano, Nenci and Vurchio (2022) (see also Belotti, Borin and Mancini, 2021).[3]

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

[3] 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.

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 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.[4]

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*

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

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:

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

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.

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; (ii) the number of mobile cellular subscriptions (per 100 people), 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; (iii) the number of years of compulsory education, as a proxy for the overall level of skills the workforce is equipped with, control for potential skill-biased effects induced by technological change and economic globalization on inequality; (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; (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.

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, 2019).

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, backward and GVC position index; the Upstreamness indicator; and the Downstreamness indicator. The estimation results are shown in Table 1.

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 forward GVC index reports a negative and strongly significant coefficient, while the backward GVC indicator shows a positive and significant coefficient of slightly greater magnitude. Most notably, the GVC position index (which takes on higher values the higher the forward compared to backward linkages) now turns out to be positive and strongly significant, meaning that, given the intensity of the forward and backward linkages of economies, it is their relative magnitude (i.e., the position of economies along GVCs) which appears most associated with the distributional dynamics. This finding suggests that a more upstream position along production chains – as measured by standard trade in value added indicators – is associated with higher level of income inequality.

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 (except for the share of inward FDI in downstream functions, which loses statistical significance in column 3).

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 participation and positioning of countries along GVCs and the number of inward FDIs in different value chain functions might 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 broadly confirm the scenario depicted by fixed effect estimates, albeit with some 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. 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 three out of five of the estimated specifications (see column 3, 4 and 5). As for the trade in GVC variables, in column 1 and 2 the GVC participation index reports a positive and significant coefficient as in the fixed effect estimates. Previous results for the backward and forward GVC participation indices, as well as for the GVC position index, turn out confirmed (column 3). Conversely, 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.

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***	0.497***	0.481***	0.436***
	(0.128)	(0.128)	(0.129)	(0.131)	(0.124)	(0.127)
ln(GDP per capita)^2	-0.026***	-0.026***	-0.027***	-0.028***	-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, de facto	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*	0.005**	0.005**	0.005*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
GVC participation index		-0.000	0.000			
		(0.001)	(0.001)			
GVC position index			0.055	1.997***		
			(0.066)	(0.739)		
Forward participation index				-0.014***		
				(0.005)		
Backward participation index				0.016***		
				(0.006)		
Upstreamness					0.060***	
					(0.019)	
Downstreamness						0.050***
						(0.018)
Constant	1.984***	1.984***	1.919***	1.754***	1.798***	2.029***
	(0.618)	(0.619)	(0.630)	(0.640)	(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	0.357	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	(6) FE	(4) FE	(5) FE
ln(GDP per capita)	0.501***	0.522***	0.509***	0.523***	0.524***	0.506***
	(0.130)	(0.129)	(0.130)	(0.129)	(0.131)	(0.131)
ln(GDP per capita)^2	-0.028***	-0.030***	-0.029***	-0.030***	-0.030***	-0.029***
	(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	0.000*	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)
Forward participation index	-0.014***	-0.014***	-0.014***	-0.014***	-0.014***	-0.014***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Backward participation index	0.016***	0.015**	0.016***	0.016**	0.016***	0.016***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
GVC position index	2.002***	1.945***	1.964***	1.953***	2.025***	2.003***
	(0.737)	(0.732)	(0.734)	(0.731)	(0.726)	(0.735)
Share of FDI in upstream functions	-0.012			-0.020**		
	(0.008)			(0.008)		
Share of FDI in production functions		0.011**				
		(0.005)				
Share of FDI in downstream functions			-0.006	-0.010**		
			(0.004)	(0.005)		
Functional diversification in FDI					-0.012***	
					(0.004)	
Sectoral diversification in FDI						-0.010
						(0.007)
Constant	1.737***	1.630**	1.698***	1.638**	1.634**	1.720***
	(0.638)	(0.632)	(0.637)	(0.631)	(0.639)	(0.640)
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	0.358	0.360	0.358	0.361	0.364	0.358
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***	0.994***	0.975***	0.989***
	(0.045)	(0.041)	(0.041)	(0.023)	(0.018)
ln(GDP per capita)	-0.037	-0.052	-0.045	-0.092*	-0.074
	(0.071)	(0.062)	(0.037)	(0.052)	(0.057)
ln(GDP per capita)^2	0.002	0.003	0.002	0.005*	0.004
	(0.004)	(0.003)	(0.002)	(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, 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)	0.003*	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	-0.006*	-0.007*	-0.008*
	(0.005)	(0.004)	(0.003)	(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	0.714**		
		(0.033)	(0.316)		
Forward participation index			-0.005**		
			(0.002)		
Backward participation index			0.006**		
			(0.003)		
Upstreamness				0.003	
				(0.005)	
Downstreamness					0.001
					(0.006)
Constant	0.214	0.238	0.224	0.516*	0.380
	(0.362)	(0.333)	(0.252)	(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	47	59	59
AR(1) test statistic	-2.838	-2.779	-2.812	-2.819	-2.986
AR(1) p-value	0.00453	0.00545	0.00493	0.00482	0.00282
AR(2) test statistic	-1.279	-1.234	-1.224	-1.282	-1.337
AR(2) p-value	0.201	0.217	0.221	0.200	0.181
Hansen J statistic	23.67	24.79	21.78	46	54.58
Hansen p-value	0.166	0.210	0.473	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 dependent 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***	1.007***	0.996***	1.010***
	(0.033)	(0.029)	(0.042)	(0.022)	(0.019)
ln(GDP per capita)	0.014	0.017	-0.036	-0.062	-0.050
	(0.061)	(0.052)	(0.043)	(0.042)	(0.041)
ln(GDP per capita)^2	-0.001	-0.001	0.002	0.003	0.003
	(0.003)	(0.003)	(0.002)	(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**	0.001	0.004***	0.004***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Functional diversification in FDI	-0.004*	-0.005**	-0.000	-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	0.743**		
		(0.032)	(0.327)		
Forward participation index			-0.005**		
			(0.002)		
Backward participation index			0.006**		
			(0.003)		
Upstreamness				0.004	
				(0.004)	
Downstreamness					0.003
					(0.005)
Constant	-0.154	-0.179	0.134	0.294	0.188
	(0.377)	(0.317)	(0.297)	(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	44	70	70
AR(1) test statistic	-3.123	-3.177	-2.745	-3.085	-3.145
AR(1) p-value	0.00179	0.00149	0.00604	0.00204	0.00166
AR(2) test statistic	-1.214	-1.205	-1.177	-1.320	-1.320
AR(2) p-value	0.225	0.228	0.239	0.187	0.187
Hansen J statistic	55.69	60.50	21.86	60.88	68.74
Hansen p-value	0.208	0.253	0.348	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 dependent 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, a more upstream positioning of economies in terms of industry-based measures of Trade in Value Added is associated with a higher level of income inequality. 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 (Hartmann et al., 2017; Coveri & Zanfei, 2023).

References

Antràs, P. (2020). Conceptual Aspects of Global Value Chains, The World Bank Economic Review, Volume 34, Issue 3, Pages 551–574, https://doi.org/10.1093/wber/lhaa006Antràs, P., and Chor, D. (2013), Organizing the Global Value Chain, *Econometrica* 81(6): 2127-2204.

Antràs, P. and Chor, D. (2019). "On the Measurement of Upstreamness and Downstreamness in Global Value Chains". In L. Y. Ing and M. Yu (Eds.), World Trade Evolution: Growth, Productivity and Employment, Chapter 5, pp. 126–194. Routledge.

Antràs, P., Chor, D., Fally, T., & Hillberry, R. (2012), Measuring the Upstreamness of Production and Trade Flows, *American Economic Review Papers & Proceedings* 102(3): 412-416.

Antràs, P. Garicano, L., Rossi-Hansberg, E. (2006), Offshoring in a Knowledge Economy, *Quarterly Journal of Economics*, Vol. 121, No. 1, pp. 31-77.

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, 68, 29-51.

Baldwin, R. E., Evenett, S. J. (2015) Value creation and trade in 21st century manufacturing. *Journal of Regional Science*, 55: 31-50.

Baldwin, R. and Ito, T. (2021), The smile curve: Evolving sources of value added in manufacturing. *Canadian Journal of Economics*, 54: 1842-1880.

Bartolucci, S., Caccioli, F., Caravelli, F., Vivo, P. (2023). Correlation between upstreamness and downstreamness in random global value chains. Preprint submitted to *Economics Letters*. Available at: https://arxiv.org/pdf/2303.06603.pdf

Belotti, F., Borin, A., Mancini, M. (2021). icio – Economic Analysis with InterCountry Input-Output tables, *The Stata Journal*, (21)3.

Bernard, A. B., Jensen, J. B., Redding, S. J., & Schott, P.K. 2018. Global Firms. *Journal of Economic Literature*, 56(2), 565-619.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87: 115-143.

Burke, J., & Epstein, G. 2001. Threat Effects and the Internationalization of Production. Working Papers no. 15, Political Economy Research Institute, University of Massachusetts at Amherst.

Casella, B., Bolwijn, R., Moran, D., Kanemoto, K. (2019) Improving the analysis of global value chains: the UNCTAD-Eora Database. *Transnational Corporations*, 26(3): 115-142.

Castellani, D., & Zanfei, A. (2006). *Multinational firms, innovation and productivity*. Edward Elgar Publishing.

Choi, M. 2001. Threat Effect of Foreign Direct Investment on Labour Union Wage Premium, PERI Working Paper Series, no. 27.

Coveri, A., & Zanfei, A. 2022. Functional division of labour and value capture in global value chains: A new empirical assessment based on FDI data. *Review of International Political Economy*. DOI: 10.1080/09692290.2022.2152074

Coveri, A., & Zanfei, A. 2023. The virtues and limits of specialization in global value chains: Analysis and policy implications. *Journal of Industrial and Business Economics*, 50(1): 73–90.

Dao, M. C., Das, M., Koczan, Z., & Lian, W. (2017). Why Is Labor Receiving a Smaller Share of Global Income? Theory and Empirical Evidence. IMF Working Paper No. 17/169.

Dedrick J., Kraemer K.L., Linden G. (2010) Who profits from innovation in global value chains? A study of the iPod and Notebook PCs. *Industrial and Corporate Change*, 19:81–116.

Dreher, Axel (2006): Does Globalization Affect Growth? Evidence from a new Index of Globalization, *Applied Economics* 38, 10: 1091-1110.

Durand, C., Milberg, W. (2020) Intellectual monopoly in global value chains. *Review of International Political Economy*, 27(2): 404–429.

Fally, T. (2012), Production Staging: Measurement and Facts. UC Berkeley. Available at: https://are.berkeley.edu/~fally/Papers/Fragmentation_US_Aug_2012.pdf

Feenstra, R. C., & Hanson, G. H. 1996. Globalization, Outsourcing, and Wage Inequality. *American Economic Review*, 86(2), 240–5.

Feenstra, R. C., & Hanson, G. H. 1997. Foreign direct investment and relative wages: evidence from Mexico's maquiladoras. *Journal of International Economics*, 42(3–4), 371–93.

Gereffi, G., Humphrey, J., & Sturgeon, T. (2005). The governance of global value chains. *Review of International Political Economy*, 12(1), 78–104.

Grossman, G.M., Rossi-Hansberg, E. (2008) Trading tasks: a simple theory of offshoring. *American Economic Review*, 98: 1978–1997.

Gygli, Savina, Florian Haelg, Niklas Potrafke and Jan-Egbert Sturm (2019): The KOF Globalisation Index – Revisited, *Review of International Organizations*, 14(3), 543-574 external pagehttps://doi.org/10.1007/s11558-019-09344-2

Harrison, A. 2005. Has globalization eroded labor's share? Some cross-country evidence. UC Berkeley and NBER. Unpublished manuscript. https://mpra.ub.uni-muenchen.de/39649/1/MPRA_paper_39649.pdf

Hartmann, D., Guevara, M.R., Jara-Figueroa, C., Aristarán, M., & Hidalgo, C.A. (2017). Linking economic complexity, institutions, and income inequality. *World Development*, 93, 75-93.

Helpman, E. (2016), 'Globalization and Wage Inequality', NBER Working Paper No. 22944, Cambridge, MA, National Bureau of Economic Research.

Jaumotte, F., Lall, S., & Papageorgiou, C. 2013. Rising Income Inequality: Technology, or Trade and Financial Globalization? *IMF Economic Review* (2013) 61, 271–309.

Kaplan, D., Kaplinsky, R. (1999) Trade and industrial policy on an uneven playing field: The case of the deciduous fruit canning industry in South Africa. *World Development*, 27(10): 1787–1801.

Mancini M., Montalbano P., Nenci S., Vurchio D., 2022, Positioning in Global Value Chains: World Map and Indicators. A new dataset available for GVC analyses, DiSSE Working Paper.

Morris, A., & Staritz, C. 2017. Industrial upgrading and development in Lesotho's apparel industry: global value chains, foreign direct investment, and market diversification, *Oxford Development Studies*, 45:3, 303-320.

Mudambi, R. (2008) Location, control and innovation in knowledge-intensive industries. *Journal of Economic Geography*, 8: 699-725.

Paglialunga, E., Coveri, A., & Zanfei, A. 2022. Climate change and within-country inequality: new evidence from a global perspective. *World Development*, Vol. 159, 106030.

Pöschl J., Foster-McGregor N. and Stehrer R. (2016), "International R&D Spillovers and Business Service Innovation", *World Economy*, Vol. 39, No. 12, pp. 2025–2045.

Rodrik, D. (1997). *Has Globalization Gone Too Far?* Washington, DC: Institute of International Economics.

Savoia, A., & Sen, K. (2021). The Political Economy of the Resource Curse: A Development Perspective. *Annual Review of Resource Economics*, 13:1, 203-223.

Sheng, L., & Yang, D. T. 2017. Offshoring and Wage Inequality: Theory and Evidence from China. IZA Discussion Paper No. 10924.

Shih, S. (1996). *Me-too is not my style: Challenge difficulties, break through bottlenecks, create values.* Taipei: The Acer Foundation.

Shin N., Kraemer K.L., Dedrick J. (2012) Value capture in the global electronics industry: Empirical evidence for the smiling curve concept. *Industry and Innovation*, 19(2): 89-107.

Solt, F. (2009). Standardizing the world income inequality database. *Social Science Quarterly*, 90(2), 231-242.

Solt, F. (2020). Measuring income inequality across countries and over time: the standardized world income inequality database. *Social Science Quarterly*, 101(3), 1183-1199.

Stansbury, A., & Summers, L. H. 2020. The Declining Worker Power Hypothesis: An Explanation for the Recent Evolution of the American Economy. *Brookings Papers on Economic Activity*, Spring 2020.

Stollinger, R. (2021) Testing the Smile Curve: Functional Specialisation and Value Creation in GVCs. *Structural Change and Economic Dynamics*, 56: 93-116.

Stolper, W., & Samuelson, P. (1941). 'Protection and real wages'. *Review of Economic Studies*, 9 (1): 58–73.

Sturgeon, T. (2008) Mapping integrative trade: conceptualising and measuring global value chains. *International Journal of Technological Learning, Innovation and Development*, 1:237–257.

Sturgeon, T., Gereffi, G. (2009) Measuring success in the global economy: international trade, industrial upgrading, and business function outsourcing in global value chains. *Transnational Corporations*, 18: 1–35.

Tempest, R. (1996) Barbie and the world economy. Los Angeles Times, September 22. https://www.latimes.com/archives/la-xpm-1996-09-22-mn-46610-story.html

Timmer, M.P., Erumban, A.A., Los, B., Stehrer, R., de Vries, G.J. (2014) Slicing up global value chains. *Journal of Economic Perspectives*, 28: 99–118.

Timmer, M.P., Miroudot, S., de Vries, G.J. (2019) Functional specialisation in trade. *Journal of Economic Geography*, 19(1): 1–30.

UNCTAD (2013) *World Investment Report 2013. Global Value Chains: Investment and Trade for Development.* United Nations.

Wang, Z., Wei, S. J., Yu, X., & Zhu, K. (2017). Characterizing global value chains: production length and upstreamness. Working paper No. w23261. National Bureau of Economic Research.

Windmeijer, F. (2005). A finite sample correction for the variance of linear efficient two-step GMM estimators. *Journal of Econometrics*, 126(1), 25-51.