Halle Institute for Economic Research
Member of the Leibniz Association

CompNet
The Competitiveness Research Network

# IWH-CompNet Discussion Papers

No. 2
April 2021

## Globalisation in Europe: Consequences for the Business Environment and Future Patterns in Light of Covid-19

Sergio Inferrera

## Author

**Sergio Inferrera**
Bocconi University and CompNet

The responsibility for discussion papers lies solely with the individual authors. The views expressed herein do not necessarily represent those of IWH. The papers represent preliminary work and are circulated to encourage discussion with the authors. Citation of the discussion papers should account for their provisional character; a revised version may be available directly from the authors.

Comments and suggestions on the methods and results presented are welcome.

IWH-CompNet Discussion Papers are indexed in RePEc-EconPapers and in ECONIS.

## Editor

Halle Institute for Economic Research (IWH) – Member of the Leibniz Association

Address: Kleine Maerkerstrasse 8
D-06108 Halle (Saale), Germany
Postal Address: P.O. Box 11 03 61
D-06017 Halle (Saale), Germany

Tel +49 345 7753 60
Fax +49 345 7753 820

www.iwh-halle.de
www.comp-net.org

ISSN 2513-1303

# Globalisation in Europe: Consequences for the Business Environment and Future Patterns in Light of Covid-19


## Abstract

In this paper, I study the consequences of globalisation, as measured by the involvement of firms in GVC, on the business environment. In particular, I focus on concentration and productivity, firstly by estimating robust elasticities and then isolating the exogenous component of the variation in the participation in GVC. To this aim, I exploit the distance between industries in terms of upstreamness and downstreamness along the supply chain. The evidences suggest that involvement in international supply chains is positively related to concentration at the sector level and positively associated with aggregate productivity, an effect that is driven by the firms at the top of the productivity distribution. Finally, I relate these findings to the current pandemic, going beyond the lack of official statistics and estimating GVC participation for 2020 at the country-level through real time world-seaborne trade data, providing evidences on the re-absorption of the Covid shock in several European economies.

# 1 Introduction

Globalization has always been a widely studied phenomenon, representing together with technological change the largest shock of the 21st century. In particular, at the end of the 20th century and in the early 2000s the decline of trade costs, both in terms of reduced tariffs and technological progress, made it possible for firms in each part of the globe to exchange goods more easily (World Bank, 2020). The globalization process has been particularly fast in connecting agents of the economy across the entire world, accelerating incredibly before the Global Financial Crisis (Autor et al., 2013). This led to a dramatic increase in the trade in intermediate inputs: currently, more than two thirds of world's total trade is made up by trade in intermediate goods (OECD, 2020). However, after the Global Financial Crisis and the Sovereign Debt one, the level of integration of the global and European economy started declining, casting doubts on the chance of survival of globalization. The term *de-globalization* returned to be used in the aftermath of the latter crisis to indicate the process by virtue of which the degree of interconnectedness across countries diminished. Furthermore, tangible signs of de-globalization have arrived in the form of increased tariffs, trade wars, Brexit and the disruptions brought by the novel Covid-19.

The consequences of globalization on the economy have been largely discussed in the economic literature, with a lack of a clear consensus: whereas before the economic literature was more benign towards globalization highlighting its positive effects, either for the economy as a whole or for all its agents (both firms and individuals), more recently globalization has been subject to a larger criticism highlighting its unintended consequences (Garcıa-Herrero & Tan, 2020).

In this paper, I contribute to this literature by focusing on globalization in the form of Global Value Chains (GVC), analyzing the consequences for the economy of an increased participation in international production networks. I focus both on a desirable outcome, that is the effect that globalization has on firms' productivity, and on an undesirable one, namely the effect on firms market power and market concentration. Furthermore, I contribute to the literature related to *de-globalization*, assessing the size of the trade shock brought by the Covid-19 pandemic hit the globalization process.

The remaining of this paper is organized as follows: Section 2 describes the literature concerning the effect of the Covid-19 pandemic, and the consequences of increased integration for the economy; Section 3 outlines the estimation strategy and discusses the results, as well as presenting the GVC-relate trade figures for 2020; finally, Section 4 concludes.

# 2 Literature Review

Amid the Covid-19 pandemic, plenty of studies aimed at explaining the economic impact of the crisis have emerged (see Shrestha et al., 2020 for an overview). In particular, much attention has been devoted by the literature to the role that globalization had in shaping the economic and health crisis. Globalization[1] has been highlighted as one of the main contributors of the current economic crisis for two main reasons:

- during the first wave of the pandemic, trade of medical supplies fell dramatically and most countries relied mainly on national companies to supply their citizens with the necessary medical devices (masks, gloves, hand sanitizing gel, etc.). This has been highlighted as a failure of globalization (Gereffi, 2020). Furthermore, globalization in the form of increased movement of people and trade across countries may have contributed to the physical spread of the virus (Masahisa & Nobuaki, 2020);
- disruptions along the value chains have been highlighted as an important factor in driving the negative effect that the pandemic has had on the business environment (Syverson & di Mauro, 2020). Di Nino and Veltri, 2020 estimate that 25% of the drop in aggregate activity in the Euro Area is due to indirect propagation along the supply chains of the same region.

A thorough assessment of the impact of the pandemic and the role that trade openness (*id est* globalization) has had on the economy has been conducted by Sforza

[1] Issues have been found in defining - and hence measuring - thoroughly globalization. To this aim, various indicators have been proposed starting from the interaction of various metrics, such as movement of goods (trade), people (migration) and of capital, but none has been recognized as systematically better than the others (Dreher et al., 2008). Here, I will focus on globalization in the form of trade of goods, in particular in the form of GVC.

and Steininger, 2020. In their recent research, the authors highlight that the economic effects of a pandemic crucially depend on the extent to which countries are connected in global production networks. Exploiting the unique set-up provided by the Covid-19 pandemic, they study the diffusion of a global production shock along the supply chains and find that the economic crisis due to the pandemic led to an average 12.9% drop in GDP across countries. In their model, calibrated with 43 countries and 50 sectors with similar data to the ones I will use in Section 3, they show that linkages between countries account for a substantial share of the observed total income drop, on average 30% of the total across the countries. In addition to this, they provide evidence of the role of globalization in shaping the reaction of the business environment. They simulate the same model increasing current trade barriers by 100 percentage points, in order to obtain a less integrated world. They find that on average the economic effects of the Covid-19 shock would have been only marginally worse in a closer economy, with an average drop of GDP of 13% across countries. All in all, the authors conclude that trade in the form of global production networks has two effects on the business environment: on the one hand, it allows consumers and firms to access products that otherwise would have been impossible to reach; on the other hand, it transmits the shocks along to the supply chain; the overall effect of any given shock (including the pandemic) depends on which of the two effects dominates, depending on the size of the shock and on the production structure of the economy. Hence, according to the authors, in a less globalized world the impact of the pandemic would have been roughly similar to the one we have currently experienced.

The evidence provided by Sforza and Steininger, 2020 is of particular importance: the pandemic came during a period of crisis of globalization, casting doubts on its chances of surviving the pandemic[2]. Such concerns, however, are not shared by business leaders: in a usual survey conducted by the ECB (Maqui & Morris, 2020), when asked which would be the main long-term consequence of the pandemic, just shy of 10 % of the interviewed business leaders pointed to a crisis of globalization (or, *de-globalization*).

Rather than *de-globalization*, other research points towards a slowdown in glob-

[2]For example, see experts' opinions expressed in this interview: Have We Reached Peak Globalization?, Bloomberg News, January 24, 2020.

alization: Antràs, 2020 finds little systematic evidence indicating that the world economy has already entered an era of *de-globalization*. Instead, he highlights that the observed slowdown in globalization is a natural consequence of its unsustainable increase rate experienced in the late 20th century. He concludes that there are more signs of *slowbalization* rather than *de-globalization*. In particular, he argues that this is due to the resilience of firms' interlinks across the globe: he claims that establishing along international production networks requires some fixed and sunk costs and that only persistent shocks may change the production network. By studying the Global Financial Crisis, he provides evidence that the shock hit mainly the intensive and not the extensive margin of trade, concluding that a similar effect would be in place for the economic crisis due to the pandemic. Hence, the number of firms joining international production network should not be severely affected by the pandemic, signaling that globalization is just bound to slow its pace rather than ceasing to exist because of Covid-19.

A more pessimistic view is presented by Garcıa-Herrero and Tan, 2020. The authors - coherently with a large amount of literature - find that after the global financial crisis there has been a slowing of global trade flows, arguing that the world entered an era of *de-globalization* because of this fall. The slowdown in trade flows is related not only to trade in goods, but even to trade in services and to the integration of GVC, that has also been steadily declining since the Global Financial Crisis. More importantly, the authors point towards the increasing tensions on trade between the US and China as the main responsible for the declining trends in globalization. President Trump's choices of increasing tariffs and establishing sanctions against China reinforced the post-GFC globalization trend, at least in terms of trade and GVC. However, the evidence presented in this paper is more in line with the idea of *slowbalization* rather than *de-globalization*: indeed, the authors actually find similar trends to the ones presented by Antràs, 2020, but they drive different conclusions. This is due to the fact that, in their analysis, *de-globalization* trends are more evident in goods rather than capital movements. All in all, the evidence provided by the authors reinforced the view of *slowbalization*, since systematic evidence of *de-globalization* is not present neither in movement of goods, nor people, nor capital.

The evidence presented so far is of major importance: globalization in the form of increased trade and integration along the supply chains has been usually associated with several positive effects on the economy, hence a slowdown of the integration process could be dangerous. First and foremost, it is a well-established fact in the literature that firms that are able to export are on average more productive than domestic ones (Dhyne et al., 2015). Dhyne et al., 2015 find that the productivity premium of exporters is quite heterogeneous across European countries; on average, exporters have a labor productivity 20% larger than non-exporters in those countries. Similarly, Bernard et al., 2003 report the U.S. exporters' premium to be in the range 9–20% in labor productivity. Powell and Wagner, 2014, on the other hand, argue that the premium is different along the entire distribution and actually find that it is positive at all productivity levels, but highest at the lowest quantiles. A similar result is found in CompNet, 2020a, in which the authors find a positive and significant labor productivity premium for exporting firms in each quantile of the productivity distribution. This literature, of which the researches I presented constitute just some examples, is based on the seminal work by Melitz, 2003 and Melitz and Ottaviano, 2008, whose models show how the exposure to trade will induce only a handful of firms, namely the more productive, to engage in export activities while leaving less productive firms continue to produce only for the domestic market and forcing the least productive firms to exit. Among the exporters, too, plenty of empirical literature has shown that a large share of low productive exporters accounts for a negligible share of the overall sales abroad; on the other hand, only a few highly productive firms constitute the majority of exports (Mayer & Ottaviano, 2008). The latter firms typically engage into both exporting and importing activities (so called two-way-traders) and dominate GVC participation (CompNet, 2020a). For these firms, GVC participation represents a key channel of productivity gains: being a part of the international supply chains enables firms to achieve higher efficiency in the allocation of resources, wider variety and better quality (or cheaper) intermediate inputs, and enhanced technology transfers along the value chain. Altomonte et al., 2018 focus precisely on firms populating GVC and find that, during the period of surge of GVC, a positive effect of trade on growth was present through both productivity growth and capital deepening. For what concerns the channels through which this relation manifests itself, Chiacchio et al., 2018 investigate the way in which GVC participation can boost productivity. The authors find that, particularly in Central Eastern European countries, GVC act as a channel of technology transfer from parent firms to host economies and that technology-frontier firms are directly involved in GVC and exposed to new technology, while non-frontier firms mainly benefit from their participation in domestic production networks, as well as, to a lesser extent, from direct contact with parent companies.

Finally, an important strand of literature has been focusing on the unintended consequences of globalization, *id est* the social ones. Indeed, the sudden increase in the GVC participation across countries has impacted not only the economy by affecting firms' performances, but by affecting other agents, too. In a seminal paper Autor et al., 2013 instrument globalization through the well-known "China shock", that is, the sudden increase in import competition due to China. They analyze the impact that globalization has on local labor markets in the US, by focusing on the manufacturing sector because of the significant decline in the employment figures in this industry due to the competition with China. They find that an increase in import competition from China has had a negative impact on wages, labor force participation, and a positive one on unemployment; furthermore, import competition explains 25% of the decline in manufacturing employment. A more detailed description of the effect has been provided in a subsequent paper: the negative impact on wages has been larger for individuals already in the left tail of the wage distribution, making the globalization shock more costly for workers who were already worse-off before the shock (Autor et al., 2014). Hence, the impact of globalization has been uneven in the US. Furthermore, it has been shown that globalization has affected both the mental health and the political preferences of displaced workers in Europe: exploiting the China-shock, Colantone et al., 2019 explain in detail the mental health problems that are typically common for workers displaced by import competition, while Colantone and Stanig, 2018a, 2018b show that globalization has had an important role in driving the rise of nationalism and Brexit.

This paper is related to all these strands of the literature: firstly, it outlines the productivity premia that firms joining GVC can enjoy, hence being related to the vast literature concerning the benefits of trade; in addition to this, this paper explains two additional unintended consequences of globalization, namely increasing market concentration and market power enjoyed by firms. However, whether rising concentration due to a more globalized world should be viewed as evidence of a weak competitive environment, or a reflection of more efficient market processes is still unclear and more research is needed to answer this question. Finally, this paper is related to the novel and growing literature regarding the Covid-19 pandemic impact on GVC.

# 3 The empirical analysis

The first part of this simple empirical analysis is aimed at estimating the elasticity of productivity to trade in GVC. Throughout this paper, I use the value of GVC-related trade value instead of the more classical GVC participation index as derived by Koopman et al., 2010. In particular, according to Borin and Mancini, 2019a, I classify GVC-related trade as trade of goods that cross border more than once. The reason for this is simple: the figure of trade in GVC is often normalized to the value of total exports in order not to bias this measure for countries whose firms trade more, and hence are endowed with a larger figure for total exports. However, in a regression analysis through an appropriate structure of fixed effects, I can reach the same effect without losing variability in the independent variable. Indeed, the standard deviation and the variance for the GVC-related trade indicator are clearly larger in absolute value with respect to the GVC-participation index ones. Furthermore, even the ratio of the $95^{th}$ percentile over the $5^{th}$ is much larger for the GVC-value (the ratio is more than one thousand and a half) rather than for the GVC-participation index (the ratio is equal to almost three). Exploiting this larger variability, I am able to identify more precisely the coefficients I am interested in (Wooldridge, 2010).

One weakness of my study is that I do not have access to confidential firm-level information. Hence, my best effort in this paper is to rely onto the micro-aggregate approach (Lopez-Garcia & di Mauro, 2015) and conduct this analysis at higher aggregation levels, i.e. at the 2-digit sector-level or at the country one through the CompNet data[3]. However, the CompNet dataset does not have information

[3] A detailed description of all the data employed in this study can be found in the appendix.

on GVC participation of firms: since the dataset is micro-founded, data are taken from firms' balance sheets or from custom agencies, and therefore they do not provide information on firm-to-firm relationships. In order to create the dataset that includes the GVC values, I need to merge the CompNet data with another dataset, *id est* with the World Input-Output Database. This latter set of data is at the industry level, too, and hence I can merge it with the CompNet dataset[4]. This strategy is endangered by the very structure of the CompNet dataset: being a dataset built on micro-data it does not contain values relative to the whole economy, but just idiosyncratic to the specific sample under scrutiny. Even if the sample is a representative one, it might not be entirely correct to merge it with other data sources that provide information relative to the whole economy. For example, this is the case with WIOD, the dataset that I use for the Input-Output tables. Fortunately, merging CompNet and WIOD is not a problematic procedure since CompNet implemented a weighting scheme in its protocol that makes its data fully comparable with other data sources related to the whole economy. Thanks to this, merging WIOD and CompNet is not a problematic procedure (CompNet, 2018).

The first regression analysis will rely on the following equation:

$$y_{c,s,t} = \alpha + \beta \; GVC \; Index_{c,s,t} + X_{c,s,t} + \delta + \gamma + \lambda + \varepsilon_{c,s,t} \tag{1}$$

where GVC Index is the one identified by Borin and Mancini, 2019b in country $c$, sector $s$ and year $t$ and represents the value of production that cross more than one border (excluding the domestic value added directly absorbed by the importer); $y$ the vector of each output variable in which I am interested in, including labor productivity, TFP and concentration level; $X$ is a vector of control variables composed by the ratio of capital and intermediates to labor and total exports; $\delta$ is a vector of country fixed effects; $\gamma$ is a vector of sector fixed effects; $\lambda$ is a vector of time fixed effects; $\alpha$ is the constant term and finally $\varepsilon$ is the error term in the regression. Table A5 presents some descriptive statistics for the main variables included in Equation 1, that is, the average value of the distribution (at the

[4]The industry aggregations of the CompNet and WIOD dataset do not coincide precisely and hence some further aggregation is needed to perform an exact match of the two datasets. A detailed list of the 2-digit sectors available in the two datasets is available in the appendix.

country-sector-year level) and the standard deviation for the same distribution. I did not include the number of observations because it is roughly homogeneous across indicators, *id est* the country-sector pairs are similar across indicators and over time.

Clearly, Equation 1 does not have any causal interpretation: disentangling the causal effect of involvement in international supply chains on the business environment is troublesome and sound identification strategies are needed, such as the one I will present later on. The coefficient $\beta$ identified thanks to Equation 1 will just represent an elasticity purged from the omitted variables that may bias the results. I will first present the results related to the elasticity of firm performances and concentration to GVC-trade.

In order to do so, I do not limit myself to analyze the overall figure of GVC-related trade, but I decompose total GVC-related trade as the sum of two items, domestic value added in third country exports (forward GVC) and foreign value added in own exports (backward GVC). In particular, always following the prescriptions of Borin and Mancini, 2019b, I measure forward GVC trade as the exports in domestic value added absorbed by other countries than the direct importer; backward GVC integration, instead, is measured as the sum of the domestic double-counted value added and the foreign content in own value added. Intuitively, these two metrics measure the position in which the country-sector pair lies within the supply chain, whether more upstream (Forward GVC integration) or downstream (Backward GVC integration). I relate these metrics to the desired concentration measures, that is, the Herfindal-Hirschman Index (known as HHI-index; Herfindahl, 1950 and Hirschman, 1980). This is the index used by the European Commission in the assessment of market concentration in the evaluation of mergers (see article 16 of the Mergers guidelines OJ C 31, 5.2.2004). Then, I relate them to mark-ups derived as in De Loecker and Warzynski, 2012 assuming a Cobb-Douglas production function. This indicator serves to measure the market power that the average firm holds. Results for these models are presented in Table 1[5].

[5]Please note that all the models presented here are fixed effect models, therefore each result needs to be interpreted as the increase (decrease) of $y$ within a country-sector-year associated with the increase of $x$.

Table 1: Correlation (OLS-FE) of GVC trade by component on HHI and Mark up

| | (1)<br>HHI | (2)<br>HHI | (3)<br>HHI | (4)<br>Mark up | (5)<br>Mark up | (6)<br>Mark up |
|---|---|---|---|---|---|---|
| Overall | -0.001 | | | 0.008*** | | |
| | (0.009) | | | (0.00292) | | |
| Backward | | -0.001 | | | 0.0104*** | |
| | | (0.009) | | | (0.003) | |
| Forward | | | -0.036*** | | | 0.011*** |
| | | | (0.012) | | | (0.004) |
| M/L | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** |
| | (0.000) | (0.000) | (0.00) | (0.00) | (0.00) | (0.00) |
| K/L | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** |
| | (0.000) | (0.000) | (0.000) | (0.00) | (0.00) | (0.00) |
| Size | 0.461*** | 0.461*** | 0.469*** | -0.129*** | -0.130*** | -0.130*** |
| | (0.028) | (0.028) | (0.029) | (0.009) | (0.009) | (0.009) |
| Constant | 3.897*** | 3.894*** | 4.079*** | 1.426*** | 1.419*** | 1.422*** |
| | (0.088) | (0.085) | (0.096) | (0.028) | (0.026) | (0.03) |
| Observations | 3,058 | 3,054 | 3,044 | 3,052 | 3,048 | 3,038 |
| R-squared | 0.695 | 0.695 | 0.692 | 0.784 | 0.785 | 0.783 |

All the variables presented in the table are subject to logarithmic transformation. The list of countries and sector included are presented in the Appendix. Country, Sector and Year fixed effects are included in each regression. Robust Standard error in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

The first three columns of Table 1 represent the models relating the concentration index to the GVC-related trade figures. All the models present the same control variables, *id est* the ratio of intermediate goods and capital to labor in order to control for changes in the mode of production, and the average firm size in a given sector, in addition to a full battery of fixed effects at the country, sector and year level. In the first three columns, it is possible to observe that GVC trade is negatively related to concentration levels, although the relation is not statistically significant. The only significant relation is with Forward GVC trade, that is, when upstream participation is larger the degree of concentration on the market diminishes. In addition to this, in absolute value, the relation with forward GVC trade is way larger than the ones for the other GVC indicators. Hence, country-sector pairs in which forward GVC trade is larger, *id est* in which firms that are embedded in international supply networks are placed relatively more upstream within the value chain, face a less concentrated business environment. Although a more robust identification strategy is needed to explain the mechanism driving this correlation, this may be due to international competition, possibly reducing firms' market share when the production is still far away from the final consumer. In the following section, however, I will show that this conclusion will be turned when exploiting the exogenous arm of GVC trade at the sector-level.

Notwithstanding this, columns (4), (5), and (6) show that larger involvement in international supply networks is associated with larger markups. The controls for these regressions are the same as the ones presented earlier. Here, it does not matter whether firms locate themselves upstream or downstream within the supply chain, since for each GVC indicator the relation with markups is significantly positive and of similar intensity. While it may seem counter-intuitive that Forward GVC trade is negatively correlated with concentration level and positively with markups, this does not endanger the quality of this result. Indeed, concentration and markups measure different things, namely, the extent to which market shares are hoarded by few or many firms and the average market power that they have. I provide a similar table to the one presented here in the Appendix (Table A6) analyzing labor productivity.

To test the heterogeneity of the elasticities along the distribution of firm-level indicators, I study the correlation of the GVC indicators with some specific percentiles of the dependent variable. While the structure of the CompNet dataset allows me to do this, I have to limit this analysis to the sectoral-aggregations that are equivalently present in both WIOD and in the CompNet dataset[6]. While in the earlier case I could aggregate myself the non-harmonized industries by taking the weighted average of the indicators of interest, with percentiles I cannot employ this strategy. Indeed, percentiles represent a firm-level figure and, being a

[6]For example, the sector 10, 11 and 12 (Manufacture of respectively food, beverages and tobacco) are aggregated in only one figure in WIOD, they are separated in the CompNet dataset.

singular point in the distribution, they cannot be aggregated. The following analysis, hence, will rely on a lower number of 2-digit industries. With this caveat in mind, Table 2 presents the result for the usual model with percentiles as dependent variables.

The first column of Table 2 displays the elasticity of several dependent variables, i.e. the top and bottom 10% and the median value of the markup and of the labor productivity distribution, estimated in a model with the usual controls and fixed effects. A larger involvement in GVC is correlated with a larger markup along the entire distribution, but the increase in the median value is particularly high. This means that the increase in the average value highlighted in Table 1 is not idiosyncratic to a particular *locus* of the distribution of markup. In other words, virtually every firm gains a degree of market power when in its industry a larger involvement in GVC is present, with the firms in the central *locus* of the distribution accounting for the largest increase.

On the other hand, the positive correlation that is present between aggregate productivity and involvement in GVC is present mainly among the firms populating the right-hand side of the productivity distribution: Column (1) shows that the elasticity of the bottom 10% firms' labor productivity to overall GVC trade is not statistically significant. Moreover, the intensity of the elasticity is increasing along the productivity distribution: this is clearly evident in the overall GVC trade figure (Column (1)) and in the Backward one (Column (3)), that is, in the downstream market. This is not evident, however, in the upstream market (Column (2)), that is, in the one farther from final demand, in which all the elasticities are roughly similar. This simple evidence confirms the hypothesis that the bulk of the increase in labor productivity is driven by the best firms that grow more productive, whereas the rest lags behind. This is confirmed by using as a dependent variable the standard deviation of labor productivity (last row of Table 2), which shows how the distance between the best and the worst firms enlarges when involvement in GVC trade is higher.

Table 2: Correlation (OLS-FE) of GVC trade by component on different percentiles of Mark up and Labor Productivity distribution

| | (1) Overall | (2) Forward | (3) Backward | Controls & FE | Obs. |
|---|---|---|---|---|---|
| Markup (p90) | 0.0115** | 0.0203*** | 0.0171*** | Yes | 2094 |
| Markup (p50) | 0.0190*** | 0.0293*** | 0.0224*** | Yes | 2098 |
| Markup (p10) | 0.0104*** | 0.0210*** | 0.0121*** | Yes | 2086 |
| Lab. Productivity (p90) | 0.0175*** | 0.0106 | 0.0212*** | Yes | 2102 |
| Lab. Productivity (p50) | 0.0107** | 0.0129** | 0.0129** | Yes | 2102 |
| Lab. Productivity (p10) | 0.00782 | 0.0148** | 0.0137** | Yes | 2102 |
| Lab. Productivity (sd) | 0.024*** | 0.018*** | 0.031*** | Yes | 2098 |

All the variables presented in the table are subject to logarithmic transformation. Country, Sector and Year fixed effects are included in each regression. Control variables are: average firm size and ratio of capital and intermediates to labor. Robust standard error in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

## 3.1 Identification strategy

In order to go beyond correlations, I use an instrumental variable approach in the spirit of Kummritz, 2016. In particular, in order to isolate the exogenous variation in the GVC-related values, I exploit the indirect bilateral trade costs at the country-level and the distance in terms of upstreamness and downstreamness between different industries along the supply chain. Hence, the instrument will be composed by the interaction of these two components: i) indirect bilateral trade costs in the spirit of Autor et al., 2013: the indirect trade cost is computed by averaging all the bilateral trade costs and excluding the country pair I am interested in; ii) the distance between industries in terms of positioning along the supply chain.

The first component of the instrument theoretically relies on the work done through gravity structural models (see Johnson and Noguera, 2017 and Noguera, 2012), that highlights the importance of bilateral trade costs in determining value added trade flow. Following Kummritz, 2016, I estimate the "indirect" trade costs by taking the weighted average of bilateral trade costs across all the countries in my sample, but more importantly excluding the country pair I am interested in. The trade cost measure will be weighted by the ratio of bilateral export flows to total exports of a country. To provide a concrete example, if I am interested in indirect trade costs between Italy and Germany, I will take the weighted average of all the Italian bilateral trade costs excluding the Italy-Germany pair, weighted by the ratio of each bilateral trade flow to total Italian export. The general formulation for this measure will be:

$$\bar{\tau}_{l,k} = \sum_{o} \tau_{l,o} * \frac{e_{l,o}}{\sum_{o} e_{l,o}} \tag{2}$$

where $\tau$ represents the trade cost metric, the subscript $l$ identifies the reporting country (Italy, in my example), the subscript $k$ the partner country (Germany, in my example), and the subscript $o$ represents all the countries other than $k$ and $l$. Clearly, to capture indirect trade costs and to have a relevant instrument for GVC, it is crucial that $k \neq l$. Note that for the sake of clarity I excluded from equation (2) the time subscript as all the variables presented are contemporaneous.

The data for trade costs are taken from the UNESCAP-World Bank Trade Cost Database, which estimates bilateral trade costs on the basis of the inverse form of the gravity model developed by Novy, 2013. Note that the reason for which this instrumentation strategy is not sufficient is twofold: i) trade costs are at the country-level while a more granular approach requires the GVC indicators to be at the industry-country level; ii) furthermore, it may well be the case that trade costs themselves are endogenous. Here, the GVC structure of production equally allows for a simple solution.

Indeed, the second component of the instrument is the distance between the industries within the value chain. The position of industries along the supply chain measures how many steps it takes for a company active in that sector to reach the upstream firm or the downstream one. Not acknowledging this difference would imply that I assume the role of different industries to be the same within value chains, *id est* that all industries provide inputs to each industry within the production network. However, empirically this assumption has been proven to be wrong: according to the supply chain positioning literature (see for example Antràs and Chor, 2013; Antràs et al., 2012 or Fally, 2012) some industries act by and large as suppliers of intermediates while others are mainly customers for the same type of products. This idiosyncratic feature of each industry allows me to exploit the different relationships between industries as proxied by their distance along the supply chain. Intuitively, this distance affects the trade in value added between sector pairs: firms active in sectors relatively close are more likely to exchange goods, whereas firms upstream and downstream will need more steps to reach each other. Conceptually, this strategy follows the seminal work by Frankel and Romer, 1999 that uses the geographical distance between two countries as an instrument for aggregated trade flows. However, this strategy is bounded to be at the country-level, and it would be appropriate for the research question of Kummritz, 2016 that studies whether GVC-related trade causes an increase in GDP. On the other hand, this strategy alone is not well suited for studying neither productivity, that features a large heterogeneity even within narrowly defined sectors (CompNet, 2020a), nor for concentration levels, that widely differ between sectors for the presence of superstar firms (Bighelli et al., 2020). Exploiting this theoretical distance between industries allows me to use more granular, and hence better, data while using an identification approach very similar to a well studied one.

Furthermore, I depart from the strategy of Kummritz, 2016 that interacts the index of upstreamness and downstreamness developed by Antràs et al., 2012 and Fally, 2012, by using the more classical GVC position index developed by Koopman et al., 2010. This choice is motivated by the fact that by computing the upstreamness or downstreamness index I would make the assumption that the decision a firm takes when integrating along the supply chain is binary and unidirectional. That is, for each production stage companies make the integration decision only once, and this can be either backward or forward but not in both directions. This, however, is not desirable since the assumption that integration decisions are unidirectional is unrealistic (Del Prete & Rungi, 2020).

Hence, for each 2-digit industry I compute the GVC position index using the expression proposed by Koopman et al., 2010 at the sector-level, *id est*:

$$GVCPosition_{ir} = ln\left(1 + \frac{IVA_{ir}}{E_{ir}}\right) - ln\left(1 + \frac{FV_{ir}}{E_{ir}}\right) \tag{3}$$

Here, the "indirect value added exports" (henceforth, IVA) measures the Domestic

Value Added embodied in intermediate exports used by the direct importer to produce goods for third countries; on the other hand, $FV_{ir}$ measures the foreign value added used in exports, that is the value added from foreign countries embodied in own gross exports. In this case, the larger the value, the more upstream the country sector pair lies within a supply chain; on the contrary, if the second term dominates the equation, it means that the pair lies downstream.

Actually, by exploiting the fact that location measures such as downstreamness or upstreamness of an industry are very stable across countries (Antràs et al., 2012; Fally, 2012; Kummritz, 2016), I compute the index presented in Equation 3 just for a (random) handful of countries[7]. The idea underlying this choice is that, for the position that firms take along the supply chain, the sector in which the company operates is more important than the country in which it establishes its registered office.

The resulting instrument, hence, will be given by the interaction of the indirect trade measure (Equation (2)) and the inverse of the GVC position index (Equation (3)). The measure will be at the country-sector level pair and it will be used to predict flows of exports in value added. Here, the idea is that this measure allows me to predict each element of an Inter-Country Input-Output table. However, following the methodology presented in Kummritz, 2016, I use this instrument to predict the element of a matrix whose components are exports in value added and not intermediate and final consumption values as in more classical IO tables. To do so, I start by using the ICIO table from WIOD for each year and from there I take the estimated value added vector (V). The dimension of this vector will be *1xGN*, with G being the number of countries and N the number of sectors. I will then calculate the Leontief inverse (B) as prescribed by Borin and Mancini, 2019b, which starts from the *GNxGN* matrix providing the industry flows including cross-border relationships (A). Finally, I will use the interaction between this vector and this matrix to calculate the value added origins of exports, by multiplying these two matrices with a GNxGN matrix whose diagonal I fill with each industry's exports (E), leaving empty any other cell. In matrix form, this will be: $VAE = V(I-A)^{-1}E$. Expanding the matrices, in a case of two countries $l$ and $k$ and two

[7] Since I focus on the European region, I randomly take a Southern region (Italy), a Northern one (Germany) and an Eastern one (Hungary).

sectors $j$ and $i$, I will have:

$$V(I-A)^{-1}E = \begin{pmatrix} v_{ik} & 0 & 0 & 0 \\ 0 & v_{jk} & 0 & 0 \\ 0 & 0 & v_{il} & 0 \\ 0 & 0 & 0 & v_{jl} \end{pmatrix} \begin{pmatrix} b^{ii}_{kk} & b^{ij}_{kk} & b^{ii}_{kl} & b^{ij}_{kl} \\ b^{ji}_{kk} & b^{jj}_{kk} & b^{ji}_{kl} & b^{jj}_{kl} \\ b^{ii}_{lk} & b^{ij}_{lk} & b^{ii}_{ll} & b^{ij}_{ll} \\ b^{ji}_{lk} & b^{jj}_{lk} & b^{ji}_{ll} & b^{jj}_{ll} \end{pmatrix}^{-1} \begin{pmatrix} e_{ik} & 0 & 0 & 0 \\ 0 & e_{jk} & 0 & 0 \\ 0 & 0 & e_{il} & 0 \\ 0 & 0 & 0 & e_{jl} \end{pmatrix} =$$

$$\begin{pmatrix} vae^{ii}_{kk} & vae^{ij}_{kk} & vae^{ii}_{kl} & vae^{ij}_{kl} \\ vae^{ji}_{kk} & vae^{jj}_{kk} & vae^{ji}_{kl} & vae^{jj}_{kl} \\ vae^{ii}_{lk} & vae^{ij}_{lk} & vae^{ii}_{ll} & vae^{ij}_{ll} \\ vae^{ji}_{lk} & vae^{jj}_{lk} & vae^{ji}_{ll} & vae^{jj}_{ll} \end{pmatrix} \text{ and } B = \begin{pmatrix} 1-a^{ii}_{kk} & -a^{ij}_{kk} & -a^{ii}_{kl} & -a^{ij}_{kl} \\ -a^{ji}_{kk} & 1-a^{jj}_{kk} & -a^{ji}_{kl} & -a^{jj}_{kl} \\ -a^{ii}_{lk} & -a^{ij}_{lk} & 1-a^{ii}_{ll} & -a^{ij}_{ll} \\ -a^{ji}_{lk} & -a^{jj}_{lk} & -a^{ji}_{ll} & 1-a^{jj}_{ll} \end{pmatrix}^{-1} \tag{4}$$

where $a^{(\cdot)}_{(\cdot)}$ is the share of inputs used in output. The elements of the $V(I-A)^{-1}E$ or *vae* matrix are the estimates for the country-industry level value added origins of each country-industry's exports. Each element of this matrix will be predicted using the instrument given by using a linear approximation:

$$v\hat{a}e_{jlik} = \alpha_0 + \beta_1\Big(\frac{\bar{\tau}_{lk}}{gvc\ position_{ij}}\Big) + \alpha_i + \alpha_k + \varepsilon_{jlik} \tag{5}$$

where $\alpha_i$ is a vector of sector fixed effect, while $\alpha_k$ is a vector of country fixed effect used to capture time-invariant characteristics. These are all the elements of the "zero" step used in this identification strategy. I combine the elements of this final matrix summing up the presented in (4) to obtain an estimate of GVC-related trade to be used in a classical 2SLS analysis.

In order to assess the validity of the instrument, I start by analyzing its relevance. As outlined in Angrist and Pischke, 2008, with all types of instruments the first assumption to be assessed is whether the correlation between the instrumented variable and the instrument is large enough. The other assumption needed to infer a causal effect is the exclusion restriction, *id est* that the instrument influences the outcome (productivity and concentration) just through the independent variable, that is, GVC participation (see the Local Average Treatment Effect - LATE - theorem in Angrist and Pischke, 2008). By virtue of these assumptions, the resulting estimator will measure the average causal response of the output variable to GVC participation. However, only the relevance assumption is empirically testable: I will do that by estimating model (5). Note that, in this case, I will estimate it over the whole time span available transforming the square matrices VAE and the IV one into two vectors. By doing this, I will have two vectors in which each of the respective entry indicates the value added in export (for the VAE vector) for a *country-sector x country-sector* group, while the other vector will feature the instrument value for the same group. The dimension of the vector will be given by the multiplication of the number of countries (G), sectors (N) and years (Y) (squared) that are available in my sample.

Table 3 presents the correlation coefficient of this model with an elasticity larger than one and shows its large significance, with an F-statistic well above any possible rule of thumb (Staiger & Stock, 1997). Hence, I can conclude that the instrument in the "step 0" is relevant and not weak.

Table 3: Correlation (OLS-FE) of bilateral Value Added with the instrument - (Step zero)

| | (1)<br>ln(VAE) |
|---|---|
| $\ln(\frac{\bar{\tau}}{\text{GVC position}})$ | 0.6869*** |
| | (0.00033) |
| Constant | -3.339*** |
| | (0.0039) |
| Country, Sector, Year FE | YES |
| Observations | 5,533,561 |
| R-squared | 0.8911 |
| F( 1,5532599) | 4241175.33 |

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

For what concerns the exclusion restriction, as mentioned above, it is not possible to test for the exogeneity of the instrument. The instrument is constructed at the country-industry level and country-time fixed effects can absorb any endogeneity that indirect trade costs might cause. At the same time, including time fixed effects allows me to avoid having results driven by time invariant characteristics of sectors. Hence, identification springs merely from the differential effect of the aggregated bilateral trade costs on particular industry pairs compared to other industry pairs. Exogeneity of productivity and concentration to this measure is a reasonable assumption, simply because the distance between industries is given by fixed technological processes.

## 3.2 Results

Using the instrument derived earlier, I inspect the role of involvement in international supply chains for the business environment. As earlier, I focus on all the components of the productivity Olley and Pakes decomposition (Olley & Pakes, 1996), the average mark-up enjoyed by firms at the sector-level and the degree of concentration in an industry. Before doing that, I run a first-stage regression, that is the "step one" of my empirical analysis. Indeed, after having built the value added matrix presented in Equation (4) through the results coming from Equation (5), I need to build the instrumented indicator for GVC trade. In Table 4, I present the correlation obtained by relating the fitted indicator to the actual overall GVC one. As in Kummritz, 2016 I obtain a negative correlation coefficient, whose magnitude, although, is smaller in absolute value. The value of the F-statistic, which is useful to assess the relevance of the instrument, is well above any conventional rule of thumb (Staiger & Stock, 1997).

Then, I analyze the second stage of the 2SLS regression. These models differ partially from the ones presented in the earlier section (Tables 1 and 2), given that I do not include fixed effects at the sector-level here. By doing this, I allow the effect of GVC trade on the desired outcome to propagate across industries, therefore estimating the so-called "between-estimator". Hence, the coefficient presented in the following tables has to be interpreted as the difference across sectors in the desired outcome that is caused by a heterogeneous participation in international supply chains. Table 4 presents the first set of causal effects.

The second column of Table 4 shows the causal estimated effect of GVC trade on aggregate productivity at the industry-level. Here, I analyze the relation with firm performances by employing a productivity decomposition. Following Olley and Pakes, 1996, I decomposed at the sector level the labor productivity into two components: i) the unweighted average of labor productivity at the sector level, and ii) the covariance component that measures the extent to which more productive firms are larger. This latter term is known as OP-gap and, under the premise that is desirable that more productive firms should possess larger market shares, larger values of the OP-Gap indicate a higher level of allocative efficiency. Under this logic, changes in the OP-Gap reflect changes in the allocative efficiency or between-firm productivity within aggregation level. In contrast, changes in the unweighted term reflect changes in within-firm productivity (CompNet, 2020b)[8].

The effect is significantly positive and larger than the one identified in the OLS analysis (Table A6), suggesting that the OLS might be downward biased. Still, the OLS point estimate of the coefficient is in the right direction and downward biased in the case of all the terms of the labor productivity decomposition. However, the effect of internationalization on the allocative efficiency term of the productivity decomposition is positive but not significant, signaling that the only driver of aggregate productivity in this respect is the within-sector productivity. On the one hand, this is slightly surprising, given that in the literature the driver of increased aggregate productivity should be a reallocation of production factors across firms (Melitz, 2003; Melitz & Ottaviano, 2008). On the other hand, this result is relative to a specific set of firms involved in GVC-related trade, that form the most productive bulk of the exporting firms (CompNet, 2020a; Mayer & Ottaviano, 2008), as opposed to the findings of most literature that focus on the whole spectrum of exporting firm when analyzing the positive effect that trade should have on the OP-Gap. Hence, the relation between the OP gap and the GVC-related trade could be pushed downward, up until being not statistically significant.

In addition to this, another result that is qualitatively different with respect to the OLS one is presented in column (5) and is related to the concentration level

[8]The models studying the OP gap are the only ones yet presented that have the dependent variable in levels instead of log. This is simply due to the fact that the covariance measure (covariance between productivity and market shares) can be either negative or positive. When it is negative, it shows that the allocation of production factors is not efficient, namely that less productive firms have larger market shares. By taking the logarithm of this measure, I would exclude all the negative values.

(HHI index). In Table 1 the estimated coefficient of overall GVC-related trade on concentration level was negative and not significant; in Table 4 the situation is overturned, with an estimated positive and largely significant effect on the HHI-level. Hence, those sectors that are endowed with larger GVC-trade are - somehow surprisingly - more concentrated. Indeed, one may expect that those industries more involved in international supply networks face larger competition, due to a number of competitors that extends over national borders. However, this analysis leads to the rejection of this hypothesis, showing that larger participation in global supply chains leads to more market concentration.

Table 4: IV estimation of the effect of GVC trade on various outcomes.

| | (1st stage) Overall | (2) Aggregate | (3) Within | (4) OP Gap | (5) HHI | (6) Markup |
|---|---|---|---|---|---|---|
| IV Overall | -0.285*** | | | | | |
| | (0.047) | | | | | |
| $\widehat{\text{Overall}}$ | | 0.117*** | 0.129*** | 1.730 | 0.250** | 0.100*** |
| | | (0.04) | (0.0409) | (1.783) | (0.0976) | (0.031) |
| M/L | 0.003*** | 0.001*** | 0.001*** | 0.0157*** | -0.001*** | 0.001*** |
| | (0.0002) | (0.0002) | (0.000) | (0.006) | (0.000) | (0.000) |
| K/L | -0.001*** | 0.001*** | 0.001*** | -0.027*** | 0.001*** | 0.001*** |
| | (0.000) | (0.00) | (0.00) | (0.002) | (0.000) | (0.000) |
| Avg. Size | 1.029*** | -0.0752* | -0.145*** | 4.151** | 0.437*** | -0.210*** |
| | (0.0432) | (0.043) | (0.04) | (1.89) | (0.103) | (0.033) |
| Constant | 11.56 | 3.616*** | 3.552*** | -6.052 | 3.178*** | 1.217*** |
| | (1.18) | (0.194) | (0.195) | (8.501) | (0.466) | (0.15) |
| F-stat | 37.04 | | | | | |
| Observations | 2,889 | 2,889 | 2,889 | 2,889 | 2,891 | 2,885 |
| R-Squared | | 0.716 | 0.734 | 0.328 | 0.305 | 0.450 |

All the variables presented in the table are subject to logarithmic transformation except for the OP Gap. The list of countries and sector included are presented in the Appendix. Country x Year fixed effects are included in each regression. Robust standard error in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Testing for the channels through which this relation springs would require more detailed data than the ones used in this analysis. However, a possible explanation for this is that larger concentration levels due to GVC come from the intersection of two elements: i) firms that joined international production networks enjoy more market power, eventually leading to higher market concentration; ii) firms involved in GVC are more efficient in their production, making it more difficult for new entrants to join the market and driving less efficient firms out of the market. Notwithstanding the fact that these possible explanation need further research to be confirmed, the evidence related to markups presented in Column (6) gives support to the first argument. Indeed, a positive effect of GVC-related trade is detected even for markups.

Table 5: Correlation (IV-FE) of instrumented GVC trade on different percentiles of the Mark up distribution

| | (1)<br>Markup p90 | (2)<br>Markup p50 | (3)<br>Markup p10 |
|---|---|---|---|
| $\widehat{\text{Overall}}$ | 0.370*** | 0.190** | 0.104** |
| | (0.136) | (0.0761) | (0.0503) |
| M/L | 0.001* | 0.001*** | 0.001*** |
| | (0.000) | (0.000) | (0.000) |
| K/L | 0.001*** | 0.00 | -0.001*** |
| | (0.000) | (0.00) | (0.00) |
| Avg. Size | -0.603*** | -0.276*** | -0.118** |
| | (0.162) | (0.0907) | (0.0594) |
| Constant | 1.064** | 0.685** | 0.215 |
| | (0.515) | (0.289) | (0.192) |
| N | 1,981 | 1,981 | 1,969 |
| R-Squared | 0.899 | 0.897 | 0.733 |

All the variables presented in the table are subject to logarithmic transformation. The list of countries and sector included are presented in the Appendix. Country and Year fixed effects are included in each regression. Robust standard error in parentheses. *** p <0.01, ** p < 0.05, * p < 0.1

As earlier, I provide a distribution of the effect for markups and productivity[9]. Results are presented in Table 5 and Table 6, respectively. From Table 5 it is possible to observe that the causal effect of involvement in international supply chains is larger for firms in the top percentiles of the markup distribution. The effect almost doubles from the $10^{th}$ percentile to the median and almost doubles from the median to the $90^{th}$ percentile. Hence, I can conclude that while the effect is present in the whole distribution of markup, it is stronger on its right tail. This conclusion is slightly different from the one presented in the OLS case, since there the impact was symmetric and stronger in the median. Here, the results presented suggest that the rewards of GVC trade are uneven.

Then, Table 6 analyzes the distribution of the effect of GVC-related trade on the whole distribution of aggregate labor productivity. Here, again, the IV shows that the results presented in Table 2 estimated through an OLS suffer from a downward bias. As in the case of the markup presented in Table 5 the effect is increasing along the productivity distribution, even though it does not increase dramatically moving along the productivity density. The ratio between the estimated effect on the $90^{th}$ percentile over the effect on the $10^{th}$ percentile is slightly above 2, whereas the same ratio for the markup distribution equals 3.5. This evidence shows that the effect on the productivity distribution is less dispersed than the one on the markup.

In addition to this, column (4) shows that the dispersion of the productivity distribution - as proxied by the standard deviation - increases as a reaction to an increased participation in international supply chains. This means that in industries in which involvement in international supply networks is larger, the distance between the top and the bottom performing firms is higher. According to CompNet, 2020a, this is a piece of good news for the business environment, since aggregate productivity is driven by a bulk of (top-performing) firms. Indeed, plenty of literature has underlined the importance of a handful of firms in driving aggregate trends: for instance, with US data Gabaix, 2011 estimated that the business cycle movements of the largest 100 firms explain about one-third of the aggregate movements in output growth; in EU, Mayer and Ottaviano, 2008 show

[9]Here, the same caveat of the results presented in Table 2 applies. The number of sectors used in this analysis is lower due to issues in the harmonization of different datasets.

that on average the 'Happy Few' firms produce the bulk of output or of foreign sales; in China and India, Hsieh and Klenow, 2009 that firms in the top decile are nearly five times productive as firms in the first decile.

Table 6: Correlation (IV-FE) of instrumented GVC trade on different percentiles of the Labor productivity distribution and Standard Deviation

| | (1) Lab. prod p90 | (2) Lab. prod p50 | (3) Lab. prod p10 | (4) Lab. prod sd |
|---|---|---|---|---|
| $\widehat{\text{Overall}}$ | 0.440*** | 0.211** | 0.187** | 0.628*** |
| | (0.164) | (0.0903) | (0.0829) | (0.226) |
| M/L | -0.000 | 0.000 | 0.000 | -0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| K/L | 0.001*** | 0.001*** | 0.00 | 0.0019*** |
| | (0.001) | (0.00) | (0.00) | (0.00) |
| Avg. Size | -0.518*** | -0.163 | -0.0476 | -0.800*** |
| | (0.193) | (0.107) | (0.0978) | (0.266) |
| Constant | 3.323*** | 3.105*** | 2.256*** | 1.927** |
| | (0.629) | (0.347) | (0.319) | (0.867) |
| N | 1,985 | 1,985 | 1,985 | 1,985 |
| R-Squared | 0.973 | 0.701 | 0.852 | 0.925 |

All the variables presented in the table are subject to logarithmic transformation. The list of countries and sector included are presented in the Appendix. Country and Year fixed effects are included in each regression. Robust standard error in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

## 3.3 Robustness checks and limits of the analysis

In a nutshell, in the earlier section I found that increasing involvement in international production network causes a rise all over the distribution of production efficiency, as proxied by labor productivity, and in market power enjoyed by firms; moreover, as a reaction to increased market power, the concentration at the industry level will be higher, too. Clearly, this empirical analysis is subject to some problems. Firstly, it is based on micro-aggregated data that, although being the best possible option for cross-country comparison, do not allow me to exactly identify the effect for a firm of joining GVC; in addition to this, the lack of micro-data impedes the analysis of the mechanism through which the relation of productivity, market power and concentration with GVC participation manifest themselves. Finally, this analysis is not driven by a General Equilibrium model and hence it is a "Reduced Form" one. The issue with these kind of models is that - notwithstanding the amount of factors one can control for - the relations identified could be confounded by some unobservable trend, policy rule or expectations on that rule (Lucas Critique). In order to have a comprehensive view of the relations at play, one should build and then estimate a structural model that is able to explain thoroughly the mechanisms behind the empirical relationships estimated throughout this section. However, these flaws represent promising avenues to be pursued by future research.

Furthermore, I run some robustness checks to validate the results provided. In particular, I run the same regressions used in the earlier section, but employing different metrics: for productivity, I use TFP retrieved from a Cobb-Douglas production function estimated with an OLS and according to Wooldridge, 2009, in order to control for the simultaneity bias. In addition to this, I employ both a production function based on revenues and one based on value added: while the latter should in principle be more appropriate to estimate TFP, in the data I am using value added is more noisy since it is retrieved by simply subtracting the value of intermediates from the turnover. Unfortunately, the metric used to measure intermediate costs accounts for several factors and hence it is more noisy and not well suited for cross-country comparison. Finally, for what concerns the concentration measure, I use the revenue share of the top 10 firms in a sector instead of the HHI index. Results are presented in Table A7 and A8. The estimated models for aggregate TFP always show a positive point estimate that is in line in magnitude with the one presented in Table 4; for what concerns significance, however, only the TFP measures estimated with an OLS production function are significant. This is not cause for concern: the Wooldridge estimation of productivity is more volatile across countries given the data collection process of CompNet, hence this result is not troublesome. For what concerns the within term of the OP decomposition, the only model in line with the one presented in Table 4 is the one in column (5) of Table A8. All the others present point positive but not significant point estimates, different in magnitude from the coefficient identified in the main specification. This is more troublesome because the coefficient is not stable across different specifications, but when using a revenue based production function estimated through OLS (that returns the best TFP measure in these data) I obtain strikingly similar results to the main specification. Finally, the coefficient on allocative efficiency is always positive but larger in magnitude from what presented in Table 4. Furthermore, it is significant in 3 specifications out of five: this signals that when dealing with technological efficiency (TFP) rather than labor productivity, the reallocation mechanism is at work and pushed even further from increased GVC trade. On the other hand, for what concerns the relation between involvement in GVC trade and concentration - the main novelty of this paper - I find that the estimated coefficient in the robustness check is still positive and significant, but smaller in magnitude. This does not cause any concern because the dependent variables have different scales: the HHI is a sum of squared share, whereas the one used as a robustness is a share, hence the reduction in the point estimate is due to this difference.

## 3.4 The future of globalization

At the time of writing, the world is slowly emerging from one of its most challenging crisis. The Covid-19 pandemic has greatly influenced the economic activity of countries in several ways (see Syverson and di Mauro, 2020 for a review), one of which is globalization. Indeed, the pandemic came during a period of slowdown in globalization due to political frictions (e.g.: US-China trade war, Brexit) and, arguably, due to the reach of a peak in commercial interlinks between countries (Antràs, 2020). Participation in international supply chains has diminished recently and the pandemic possibly aggravated this situation by making the connections between firms along the supply chain more cumbersome, at least during 2020. Notwithstanding the gloomy situation, in a survey carried out within the ECB Economic Bulletin (issue 08/2020), when asked which long-lasting changes the pandemic has brought to the economic environment a large share of leading European firms answered that globalization is there to stay. Indeed, only slightly less than 10% of the surveyed leading companies answered that the pandemic will bring *de-globalization*, whereas this idea is more widespread in the public debate.

As mentioned earlier, one of the ways of measuring globalization is through trade. Particular attention has been devoted to trade in GVC as a proxy of globalization for two reasons: i) gross trade measures are inaccurate because of double counting, *id est* goods and services exchanged across borders are increasingly counted more than once, making traditional trade measures less reliable (Borin & Mancini, 2019b; Koopman et al., 2010); ii) trade within global production networks represent more than classical trade the essence of globalization, since companies from all over the world contribute to the production of one good or service. Unfortunately, measuring trade in GVC is a time-consuming process and it is not rare that official statistics become publicly available with huge time lags, whereas classic trade statistics are provided with smaller lags. For example, the whole analysis presented throughout section 3 relies on the input-output tables provided by WIOD, which are available only up to 2014 (Timmer et al., 2015). Other projects publicly available provide similar tables, but the most recent one is published by the EORA project, which provides observations only up to 2015 (Lenzen et al., 2013). For these reasons, a thorough and up to date assessment of the state and the future of globalization - as proxied by trade in GVC - is impossible with official statistics.

Hence, economists rely on proxies to obtain up to date measures of trade and of involvement in GVC. The Covid-19 pandemic has accelerated the need for a real-time predictor of trade in order to promptly assess the changes in the trends that this massive shock has brought. Such a tool has been developed by Cerdeiro et al., 2020, that exploiting the massive amount of world seaborne trade[10] succeed in tracking in real-time and estimate trade volumes at the world, bilateral and within-country levels. They do so by leveraging the maritime data from the Automatic Identification System (AIS), using raw data from the radio signals that the global vessel fleet emits for navigational safety purposes and providing a globally applicable end-to-end solution to transform raw AIS messages into economically meaningful, policy-relevant indicators of international trade through machine-learning

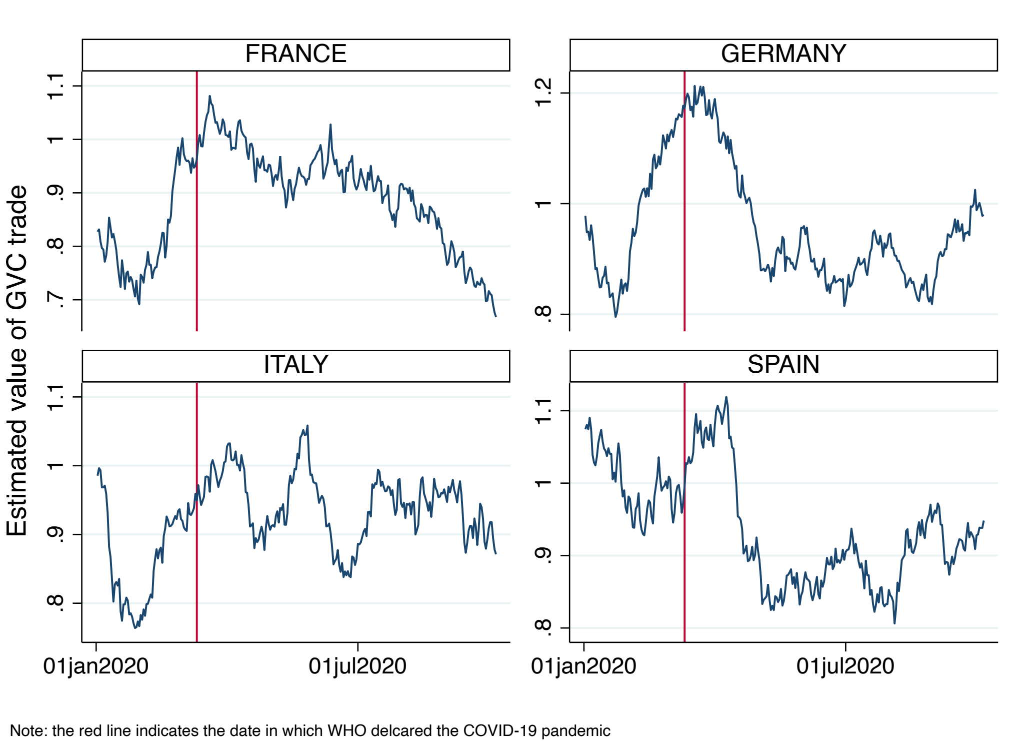
[10]UNCTAD, 2017 estimate that over 80% of global merchandise trade by volume and more than 70% of its value can be traced to maritime transport

techniques.

Exploiting this methodology, I can estimate the GVC arm of the gross export at the country-level, in order to assess whether the pandemic brought some serious disruptions along the supply chains in Europe, or whether the strong share of GVC participation by EU firms within the continent had the potential of sheltering those firms by severe global disruptions in supply chains (di Mauro et al., 2020). To do so, I retrieve the most recent (2015) indicator of GVC participation (estimated as in Borin and Mancini, 2019b) through the EORA database. Then, by interacting this with the most up-to-date estimates of world seaborne trade I can obtain a gross measure of trade along international supply chains. I plot the results of this exercise for the European set of countries I used for the previous analysis in Figure 1 and A1.

Figure 1 plots the moving average over 30 days of the estimated GVC-related trade as a share of the average trade volume from 2017 to 2019, following the methodology related to event studies presented in Cerdeiro et al., 2020. GVC-related trade has been subject to a huge shock in all of the four largest countries in EU, with Germany unsurprisingly being the most hit in this aspect by the pandemic. On the other hand, it is worth noticing that the country least hit on GVC is Italy, the European country in which the virus firstly spread and has been taking away most lives. Another fact worth noticing is that Germany is the only country that succeeded in returning back to the average 2017-19 GVC trade volumes, whether the other countries are still lagging behind. However, by looking at Figure A1 it is not possible to detect any clear and common trend among European countries, mainly because participation in Global Value Chains differs greatly across countries in its composition (di Mauro et al., 2020). Hence, the effect of the Covid-19 pandemic on GVC trade is likely to be asymmetric across countries, depending mainly on countries' exposure to disruptions in international supply networks (Altomonte et al., 2020).

Figure 1: Daily estimates of the GVC-related trade for selected countries (the 4 largest EU economies)




Estimated value of GVC trade according to the Cerdeiro et al., 2020 methodology. The values for 2020 are presented as a share of the average GVC trade value from 2017-2019. This chart is available for a larger set of European countries in the appendix (Figure A1)

# 4 Concluding remarks

The rise of globalization and of international supply chain trade was one of the most radical changes that the global economy has ever experienced. In the last years of the 20th century and at the dawn of the new millennium, globalization has been increasing at an unsustainable pace (Antràs, 2020), whereas from the aftermath of the Global Financial Crisis until more recent days this increasing trend seems to have stopped. Signs of *de-globalization* have emerged, such as the trade war between the United States and China or Brexit. In the context of the

Covid-19 pandemic, a common argument was that the pandemic itself could bring globalization to its end. In this paper I presented evidence in support of the view of Antràs, 2020: although the size of the trade shock brought by the pandemic has been huge, it has been quickly reabsorbed by several European economies. This signals that it is unlikely that the pandemic will terminate the globalization process.

Finally, through an instrumental variable approach I show that globalization - in the form of participation in international production networks - is beneficial to the economy since it raises firms' productivity. However, differently from what I expected, the increase in productivity is not due to productivity-enhancing reallocation processes but rather from the pure increase of productivity within firms.

Finally, by relating to the literature concerned about the unintended effects of globalization, I find that the surge in GVC participation has detrimental effects on the economy, too: those industries with larger GVC participation are more concentrated and firms populating them enjoy more market power. However, more research is needed to clarify whether this increased concentration is sign of a weak competitive environment or rather sign of an efficient market structure rewarding the most efficient firms (Covarrubias et al., 2020).

In conclusion, these findings are relevant not only for the economic literature, but for policy as well: at the time of writing, the world is slowly emerging from the pandemic crisis and governments are trying to build plans for the recovery of their countries. Strengthening global production networks rather than incentivizing firms to reshore their production processes should be at the core of such plans.

# References

Altomonte, C., Bonacorsi, L., & Colantone, I. (2018). *Trade and Growth in the Age of Global Value Chains* (BAFFI CAREFIN Working Papers No. 1897). BAFFI CAREFIN, Centre for Applied Research on International Markets Banking Finance and Regulation, Università Bocconi, Milano, Italy.

Altomonte, C., Coali, A., & Ottaviano, G. I. P. (2020). Back to the future: The forward-looking consequences of covid-19 across eu regions. *CompNet Policy Brief Series*, (10).

Angrist, J. D., & Pischke, J. (2008). *Mostly harmless econometrics: An empiricist's companion*. Princeton university press.

Antràs, P. (2020). *De-globalisation? global value chains in the post-covid-19 age* (tech. rep.). National Bureau of Economic Research.

Antràs, P., & Chor, D. (2013). Organizing the global value chain. *Econometrica*, *81*(6), 2127–2204.

Antràs, P., Chor, D., Fally, T., & Hillberry, R. (2012). Measuring the upstreamness of production and trade flows. *American Economic Review*, *102*(3), 412–16. https://doi.org/10.1257/aer.102.3.412

Arvis, J.-F., Duval, Y., Shepherd, B., & Utoktham, C. (2013). *Trade costs in the developing world : 1995 - 2010* (Policy Research Working Paper Series No. 6309). The World Bank. https://ideas.repec.org/p/wbk/wbrwps/6309.html

Autor, D. H., Dorn, D., & Hanson, G. H. (2013). The china syndrome: Local labor market effects of import competition in the united states. *American Economic Review*, *103*(6), 2121–68.

Autor, D. H., Dorn, D., Hanson, G. H., & Song, J. (2014). Trade Adjustment: Worker-Level Evidence. *The Quarterly Journal of Economics*, *129*(4), 1799–1860.

Bernard, A. B., Eaton, J., Jensen, J. B., & Kortum, S. (2003). Plants and productivity in international trade. *American Economic Review*, *93*(4).

Bighelli, T., di Mauro, F., Melitz, M., & Mertens, M. (2020). Firm concentration and aggregate productivity. *Firm Productivity Report (CompNet)*.

Borin, A., & Mancini, M. (2019a). Measuring what matters in global value chains and value-added trade. *World Bank WP*, (8804).

Borin, A., & Mancini, M. (2019b). *Measuring what matters in global value chains and value-added trade*. The World Bank. https://doi.org/10.1596/1813-9450-8804

Cerdeiro, D. A., Komaromi, A., Liu, Y., Saeed, M., et al. (2020). *World seaborne trade in real time: A proof of concept for building ais-based nowcasts from scratch* (tech. rep.). International Monetary Fund.

Chiacchio, F., Gradeva, K., & Lopez-Garcia, P. (2018). The post-crisis tfp growth slowdown in cee countries: Exploring the role of global value chains. *ECB Working Paper No. 2143*.

Colantone, I., Crinò, R., & Ogliari, L. (2019). Globalization and mental distress. *Journal of International Economics*, *119*(100), 181–207.

Colantone, I., & Stanig, P. (2018a). Global competition and brexit. *American Political Science Review*, *112*(2), 201–218.

Colantone, I., & Stanig, P. (2018b). The trade origins of economic nationalism: Import competition and voting behavior in western europe. *American Journal of Political Science*, *62*(4), 936–953.

CompNet. (2018). Assessing the reliability of the compnet micro-aggregated dataset for policy analysis and research.

CompNet. (2020a). The firm productivity report.

CompNet. (2020b). User guide for the 7th vintage compnet dataset.

Covarrubias, M., Gutiérrez, G., & Philippon, T. (2020). From good to bad concentration? us industries over the past 30 years. *NBER Macroeconomics Annual*, *34*(1), 1–46.

De Loecker, J., & Warzynski, F. (2012). Markups and firm-level export status. *American economic review*, *102*(6), 2437–71.

Del Prete, D., & Rungi, A. (2020). Backward and forward integration along global value chains. *Review of Industrial Organization*, *57*(2), 263–283.

Dhyne, E., Berthou, A., Soares, A. C., Bugamelli, M., Cazacu, A.-M., Lalinsky, T., Meriküll, J., Harasztosi, P., Demian, C.-V., & Oropallo, F. (2015). *Assessing European firms' exports and productivity distributions: the CompNet trade module* (Working Paper Series). European Central Bank.

Di Nino, V., & Veltri, B. (2020). *The viral effects of foreign trade and supply networks in the euro area* (IWH-CompNet Discussion Papers No. 4/2020). Halle Institute for Economic Research (IWH).

di Mauro, F., Altomonte, C., & Inferrera, S. (2020). Eu firms participation in gvc: Bliss or curse after covid? *CompNet Policy Brief Series*, (9).

Dreher, A., Gaston, N., & Martens, P. (2008). Measuring globalisation. *Gauging its Consequences Springer, New York*.

ECB. (2020). Ecb economic bulletin (issue 08/2020).

Fally, T. (2012). Production staging: Measurement and facts. *Boulder, Colorado, University of Colorado Boulder, May*, 155–168.

Frankel, J. A., & Romer, D. H. (1999). Does trade cause growth? *American Economic Review*, *89*(3).

Gabaix, X. (2011). The granular origins of aggregate fluctuations. *Econometrica*, *79*(3), 733–772.

Garcıa-Herrero, A., & Tan, J. (2020). Deglobalisation in the context of united states-china decoupling. *Policy Contribution, Issue n 21*.

Gereffi, G. (2020). What does the covid-19 pandemic teach us about global value chains? the case of medical supplies. *Journal of International Business Policy*, *3*(3), 287–301.

Herfindahl, O. C. (1950). Concentration in the steel industry.

Hirschman, A. O. (1980). *National power and the structure of foreign trade* (Vol. 105). Univ of California Press.

Hsieh, C.-T., & Klenow, P. J. (2009). Misallocation and manufacturing tfp in china and india. *Quarterly Journal of Economics*, *124*(4), 1403–1448.

Johnson, R. C., & Noguera, G. (2017). A portrait of trade in value-added over four decades. *Review of Economics and Statistics*, *99*(5), 896–911.

Koopman, R., Powers, W., Wang, Z., & Wei, S.-J. (2010). *Give credit where credit is due: Tracing value added in global production chains* (Working Paper No. 16426). National Bureau of Economic Research.

Kummritz, V. (2016). *Do Global Value Chains Cause Industrial Development?* (Tech. rep.). Centre for Trade and Economic Integration, The Graduate Institute.

Lenzen, M., Moran, D., Kanemoto, K., & Geschke, A. (2013). Building eora: A global multi-region input–output database at high country and sector resolution. *Economic Systems Research*, *25*(1), 20–49.

Lopez-Garcia, P., & di Mauro, F. (2015). *Assessing European competitiveness : The new CompNet micro-based database* (Working Paper Research No. 1764). European Central Bank.

Maqui, E., & Morris, R. (2020). The long-term effects of the pandemic: Insights from a survey of leading companies. *Economic Bulletin Boxes*, *8*.

Masahisa, F., & Nobuaki, H. (2020). *Globalization as Civilizational Progress and the Covid-19 Pandemic (Japanese)* (Policy Discussion Papers (Japanese)). Research Institute of Economy, Trade and Industry (RIETI).

Mayer, T., & Ottaviano, G. (2008). The Happy Few: The Internationalisation of European Firms. *Intereconomics: Review of European Economic Policy*.

Melitz, M. J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica*, *71*(6), 1695–1725.

Melitz, M. J., & Ottaviano, G. I. P. (2008). Market Size, Trade, and Productivity. *Review of Economic Studies*, *75*(1), 295–316.

Noguera, G. (2012). Trade costs and gravity for gross and value added trade. *Job Market Paper, Columbia University*, *4*.

Novy, D. (2013). Gravity redux: Measuring international trade costs with panel data. *Economic inquiry*, *51*(1), 101–121.

OECD. (2020). Trade policy implications of global value chains. *OECD Trade Policy Brief*.

Olley, G. S., & Pakes, A. (1996). The dynamics of productivity in the telecommunications equipment industry. *Econometrica*, *64*(6), 1263–97.

Powell, D., & Wagner, J. (2014). The exporter productivity premium along the productivity distribution: evidence from quantile regression with nonadditive firm fixed effects. *Review of World Economics*.

Sforza, A., & Steininger, M. (2020). Globalization in the time of covid-19.

Shrestha, N., Shad, M. Y., Ulvi, O., Khan, M. H., Karamehic-Muratovic, A., Nguyen, U.-S. D., Baghbanzadeh, M., Wardrup, R., Aghamohammadi, N., Cervantes, D., et al. (2020). The impact of covid-19 on globalization. *One Health*, 100180.

Staiger, D., & Stock, J. H. (1997). Instrumental variables regression with weak instruments. *Econometrica*, *65*(3), 557–586.

Syverson, C., & di Mauro, F. (2020). *The covid crisis and productivity growth* (VoxEU.org 16 April 2020).

Timmer, M., Dietzenbacher, E., Los, B., Stehrer, R., & de Vries, G. (2015). An illustrated user guide to the world input–output database: The case of global automotive production. *Review of International Economics*, *23*(3), 575–605.

UNCTAD. (2017). Review of maritime transport.

Wooldridge, J. M. (2009). On estimating firm-level production functions using proxy variables to control for unobservables. *Economics Letters*, *104*(3), 112–114.

Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data* (Vol. 1). The MIT Press.

World Bank. (2020). *World development report 2020: Trading for development in the age of global value chains.*

# 5 Appendix

## 5.1 Data sources

For this paper I used several data sources, exploiting micro-aggregated variables. In particular, I used the CompNet dataset, the World Input Output Database and the UN ESCAP dataset. This section is intended to briefly present each data source.

The CompNet dataset is the main product of the Competitive Research Network. It provides granular and micro-aggregated data overcoming the harmonization and confidentiality issues through the micro-distributed approach (Lopez-Garcia & di Mauro, 2015). The dataset presents data at the country, size, 2-digit sector and NUTS2 level. Table A1 and Table A2 present the sample composition in terms of countries and industries. CompNet provides its dataset without ever accessing the micro-data, that are safely stored by the Data Providers and therefore avoiding confidentiality issues[11]. Notwithstanding this issue, harmonization of the raw variables is ensured by the CompNet research team, that works alongside the Data Providers to ensure the best data quality (CompNet, 2020b). The data collection process works in the following way: CompNet sends a harmonized data gathering protocol to collect and calculate various variables and indicators to several data providers (one for each of the 19 European countries in the dataset). The data gathering protocol computes the desired micro-aggregate indicators which are then sent back to the Scientific Staff of CompNet that subsequently builds the CompNet database from the micro-aggregate indicators. A particular feature of this dataset that I will exploit is that it collects joint distributions, i.e. conditional distributions of some variable given a specific condition, that can be either discrete or continuous[12].

[11]Firm-level information is typically not available since it is confidential. Therefore, cross-country comparability is often hampered because data are stored by national statistical institutes. Often, the definition of variables may change, too.

[12]For example this means that I can compare the the exporters' distribution of productivity with the one of domestic firms. This will help me in estimating productivity premia for firms engaged in international trade.

On the other hand, the World Input–Output Database (WIOD) is constituted by annual time-series of world input–output tables from 1995 to 2014. World Input-Output Tables and underlying data, cover 43 countries plus the fictional "Rest of the World" region, that comprises the residual countries of the world. Data for 56 sectors are classified according to the International Standard Industrial Classification revision 4 (ISIC Rev. 4). These tables have been constructed in a clear conceptual framework based on the system of national accounts. They are based on officially published input–output tables merged with national accounts data and international trade statistics (Timmer et al., 2015). A WIOT provides a comprehensive summary of all transactions in the global economy between industries and final users across countries. In addition to a national input–output table, imports are broken down according to the country and industry of origin in a WIOT in order to allow a user to retrieve domestic and foreign value added. Table A3 and Table A4 provide the sample composition in terms of countries and industries present in the WIOD.

Finally, bilateral trade costs data is taken from the UNESCAP-World Bank Trade Cost Database. It estimates bilateral trade costs on the basis of the model developed by Novy, 2013, which estimates trade costs for each country pair using bilateral trade and gross national output. It collects information for over 200 countries, with observations ranging from 1995 to 2018. Through the methodology employed in retrieving the trade costs data, it gives a micro-founded comprehensive trade cost figure that includes both structural factors, such as geography, and policy measures, such as tariffs (Kummritz, 2016). Differences in economic size and endowments are not the only reason why some countries trade more than others: trade flows depend on many other factors that express the degree of separation between countries, such as the aforementioned geography and policy measure. A more detailed description of the database can be found in Arvis et al., 2013.

## 5.2 Additional Tables and Figures

| Country | Country | Country | Country |
|---|---|---|---|
| Belgium | France | Netherlands | Slovenia |
| Croatia | Germany | Poland | Spain |
| Czech Republic | Hungary | Portugal | Sweden |
| Denmark | Italy | Romania | Switzerland |
| Finland | Lithuania | Slovakia | |

Table A1: Countries available in the CompNet dataset. Note: Belgium, Italy, Spain and Switzerland data on trade variables are not available. For Czech Republic, Poland and Slovakia the only sample available is the one comprising firms with at least 20 employees.

| Industry code | Industry code |
|---|---|
| 10 - Manufacture of food | 47 - Retail except motorvehicles |
| 11 - Manufacture of beverages | 49 - Land transport and via pipelines |
| 12 - Manufacture of tobacco | 50 - Water transport |
| 13 - Manufacture of textiles | 51 - Air transport |
| 14 - Manufacture of wearing apparel | 52 - Warehousing and support for transportation |
| 15 - Manufacture of leather and related | 53 - Postal and courier activities |
| 16 - Manufacture of wood, cork, straw and plaiting | 55 - Accommodation |
| 17 - Manufacture of paper products | 56 - Food and beverage services |
| 18 - Printing and reproduction of recorded media | 58 - Publishing |
| 20 - Manufacture of chemicals products | 59 - Multimedia services |
| 21 - Manufacture of basic pharmaceutical products | 60 - Programming and broadcasting activities |
| 22 - Manufacture of rubber and plastic | 61 - Telecommunications |
| 23 - Manufacture of non-metallic mineral products | 62 - Computer programming, consultancy et al. |
| 24 - Manufacture of basic metals | 63 - Information services |
| 25 - Manufacture of fabricated metal prod | 68 - Real Estate activities |
| 26 - Manufacture of computer, electronic, optical prod | 69 - Legal and accounting |
| 27 - Manufacture of electric equipment | 70 - Activities of head offices; consultancy |
| 28 - Manufacture of machinery and equipment n.e.c. | 71 - Architectural and engineering |
| 29 - Manufacture of motor vehicles, trailers | 72 - R&D |
| 30 - Manufacture of other transport equipment | 73 - Advertising and market research |
| 31 - Manufacture of furniture | 74 - Other professional, scientific activities |
| 32 - Other manufacturing | 75 - Veterinary activities |
| 33 - Repair and installation of machinery | 77 - Rental and leasing activities |
| 41 - Construction of buildings | 78 - Employment activities |
| 42 - Civil engineering | 79 - Travel services |
| 43 - Specialised construction | 80 - Security services |
| 45 - Wholesale, retail and repair of motorvehicles | 81 - Services to buildings and landscap noisilye |
| 46 - Wholesale except motorvehicles | 82 - Office admin, office support |

Table A2: List of industries available in the CompNet dataset

| Country | Country | Country |
|---|---|---|
| Australia | United Kingdom | Norway |
| Austria | Greece | Poland |
| Belgium | Croatia | Portugal |
| Bulgaria | Hungary | Romania |
| Brazil | Indonesia | Rest of the World |
| Canada | India | Russia |
| Switzerland | Ireland | Slovakia |
| China | Italy | Slovenia |
| Cyprus | Japan | Sweden |
| Czech Republic | South Korea | Thailand |
| Germany | Lithuania | Turkey |
| Denmark | Luxembourg | Taiwan |
| Spain | Latvia | United States |
| Estonia | Mexico | |
| Finland | Malta | |
| France | Netherlands | |

Table A3: List of countries available in the WIOD dataset

| ISIC Code | | | | | |
|---|---|---|---|---|---|
| A01 | C19 | C28 | G45 | J58 | M71 |
| A02 | C20 | C29 | G46 | J59-60 | M72 |
| A03 | C21 | C30 | G47 | J61 | M73 |
| B | C22 | C31-32 | H49 | J62-63 | M74-75 |
| C10-C12 | C23 | C33 | H50 | K64 | N |
| C13-C15 | C24 | D35 | H51 | K65 | O84 |
| C16 | C25 | E36 | H52 | K66 | P85 |
| C17 | C26 | E37-39 | H53 | L68 | Q |
| C18 | C27 | F | I | M69-70 | R-S |
| T | U | | | | |

Table A4: List of industry codes available in the WIOD dataset. A more detailed description of the industry codes can be found here.

| | Mean | SD |
|---|---|---|
| ln(HHI) | 5.65 | 1.42 |
| ln(Mark-up) | 1.28 | 0.42 |
| ln(aggregate labor productivity) | 4.04 | 0.80 |
| ln(within labor productivity) | 3.90 | 0.83 |
| OP Gap (covariance) | 9.43 | 81.42 |
| ln(GVC) | 6.41 | 2.25 |
| ln(Backward GVC) | 5.76 | 2.37 |
| ln(Forward GVC) | 5.56 | 2.02 |

Table A5: Descriptive statistics for the main variables of Equation 1

Table A6: Correlation (OLS-FE) of Backward and Forward GVC trade on OP decomposition of Labor productivity by component

| | (1) Aggregate | (2) Aggregate | (3) Within | (4) Within | (5) OP Gap | (6) OP Gap |
|---|---|---|---|---|---|---|
| Backward | 0.0231*** | | 0.015*** | | 0.955*** | |
| | (0.00418) | | (0.00396) | | (0.231) | |
| Forward | | 0.022*** | | 0.009* | | 1.093*** |
| | | (0.006) | | (0.005) | | (0.315) |
| M/L | 0.001*** | 0.001*** | 0.001*** | 0.001*** | -0.01** | -0.01** |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.004) | (0.004) |
| K/L | 0.001*** | 0.001*** | 0.001*** | 0.001*** | -0.041*** | -0.04*** |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.01) | (0.002) |
| Size | 0.006 | 0.001 | -0.01 | -0.01 | 5.769*** | 5.80*** |
| | (0.01) | (0.01) | (0.01) | (0.01) | (0.714) | (0.718) |
| Constant | 3.804*** | 3.807*** | 3.771*** | 3.794*** | -9.774*** | -10.61*** |
| | (0.038) | (0.043) | (0.036) | (0.040) | (2.12) | (2.383) |
| Observations | 3,052 | 3,042 | 3,052 | 3,042 | 3,052 | 3,042 |
| R-squared | 0.854 | 0.853 | 0.880 | 0.879 | 0.479 | 0.479 |

All the variables presented in the table are subject to logarithmic transformation except for the OP Gap one. The list of countries and sector included are presented in the Appendix. Country, Sector and Year fixed effects are included in each regression. Robust standard error in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

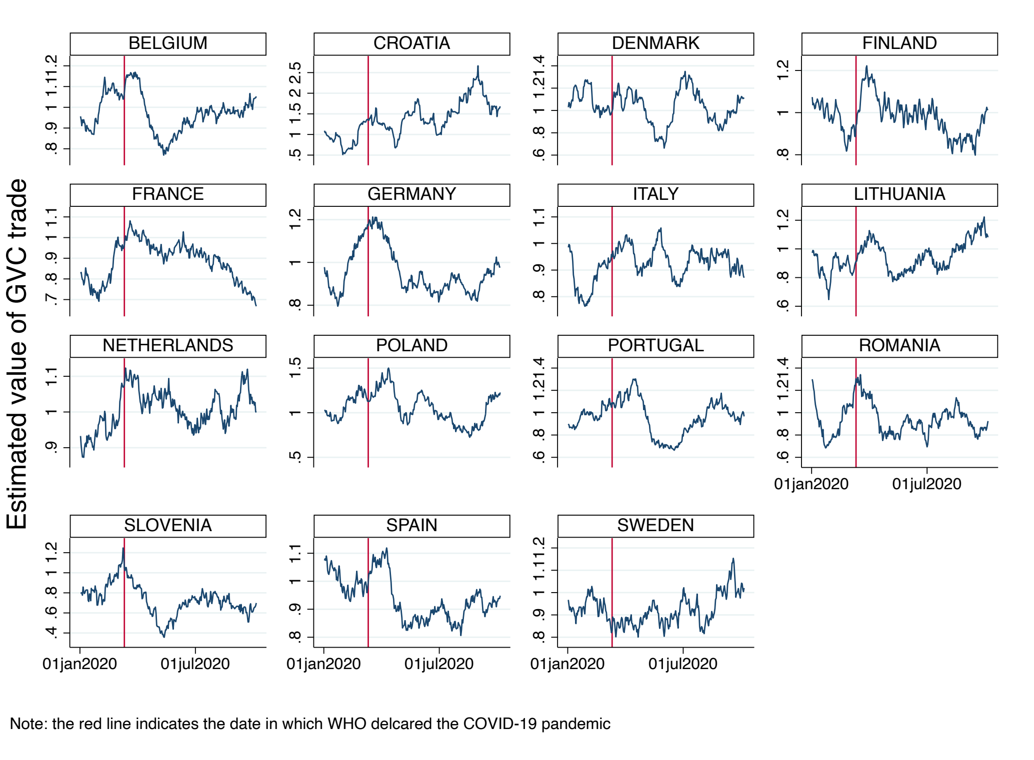



Figure A1: Estimated value of GVC trade according to the Cerdeiro et al., 2020 methodology.

Table A7: Robustness checks. Effect of GVC trade on OP-decomposition components and revenue share of top 10 firms in a sector. The TFP components are based on a Cobb-Douglas production function with Value Added as dependent variable.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| | | WD | | | OLS | | |
| | Aggregate | Within | OP Gap | Aggregate | Within | OP Gap | Top 10 revenue share |
| $\widehat{Overall}$ | 0.0221 | -0.00636 | 11.59*** | 0.152*** | 0.0566 | 9.842*** | 0.0337** |
| | (0.0457) | (0.0395) | (4.423) | (0.0488) | (0.0402) | (2.125) | (0.0156) |
| M/L | 0.00172*** | 0.00142*** | 0.0858*** | 0.000429** | 0.000568*** | -0.0200*** | -0.000145*** |
| | (0.000165) | (0.000142) | (0.0159) | (0.000177) | (0.000146) | (0.00771) | (5.19e-05) |
| K/L | 0.000371*** | 4.14e-05 | 0.0605*** | -9.01e-05 | -0.000333*** | 0.00966*** | 0.000106*** |
| | (7.19e-05) | (6.21e-05) | (0.00696) | (7.65e-05) | (6.30e-05) | (0.00333) | (2.39e-05) |
| Avg. Size | 0.109** | 0.0820* | 6.778 | -0.300*** | -0.153*** | -13.01*** | 0.0874*** |
| | (0.0489) | (0.0423) | (4.737) | (0.0529) | (0.0436) | (2.306) | (0.0172) |
| Constant | 4.340*** | 3.902*** | 10.33 | 3.288*** | 3.346*** | -23.09** | 0.00149 |
| | (0.217) | (0.188) | (21.00) | (0.231) | (0.190) | (10.05) | (0.0736) |
| Observations | 2,884 | 2,884 | 2,884 | 2,875 | 2,875 | 2,875 | 2,691 |
| R-squared | 0.705 | 0.772 | 0.455 | 0.700 | 0.781 | -0.262 | 0.346 |

All the variables presented in the table are subject to logarithmic transformation. The list of countries and sector included are presented in the Appendix. Country and Year fixed effects are included in each regression. Robust standard error in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A8: Robustness checks. Effect of GVC trade on OP-decomposition components and revenue share of top 10 firms in a sector. The TFP components are based on a Cobb-Douglas production function with Turnover as dependent variable.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | | WD | | | OLS | |
| | Aggregate | Within | OP Gap | Aggregate | Within | OP Gap |
| $\widehat{GVCOverall}$ | 0.167 | 0.0934 | 6.698 | 0.273*** | 0.195*** | 7.417*** |
| | (0.130) | (0.107) | (14.37) | (0.0752) | (0.0646) | (1.737) |
| M/L | 0.00162*** | 0.00118*** | 0.244*** | -0.00332*** | -0.00300*** | -0.0427*** |
| | (0.0001) | (0.0004) | (0.0553) | (0.00027) | (0.00023) | (0.00626) |
| K/L | 0.000552*** | 0.000260* | 0.00784 | 0.000502*** | 0.000291*** | 0.00688** |
| | (0.000178) | (0.000147) | (0.0197) | (0.000117) | (0.000101) | (0.00270) |
| Avg. Size | -0.238* | -0.213* | -7.222 | -0.477*** | -0.373*** | -9.391*** |
| | (0.136) | (0.111) | (14.98) | (0.0816) | (0.0702) | (1.886) |
| Constant | 2.908*** | 2.867*** | 389.0*** | 2.023*** | 2.134*** | -20.58** |
| | (0.629) | (0.519) | (69.57) | (0.354) | (0.304) | (8.180) |
| Observations | 2,239 | 2,242 | 2,239 | 2,839 | 2,839 | 2,839 |
| R-squared | 0.388 | 0.440 | 0.140 | 0.604 | 0.658 | -0.344 |

All the variables presented in the table are subject to logarithmic transformation. The list of countries and sector included are presented in the Appendix. Country and Year fixed effects are included in each regression. Robust standard error in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Halle Institute for Economic Research –
Member of the Leibniz Association

Kleine Maerkerstrasse 8
D-06108 Halle (Saale), Germany

Postal Adress: P.O. Box 11 03 61
D-06017 Halle (Saale), Germany

Tel +49 345 7753 60
Fax +49 345 7753 820

www.iwh-halle.de
www.comp-net.org

ISSN 2513-1303

Leibniz
Association