



UNIVERSITÀ
DEGLI STUDI
FIRENZE

DISEI

DIPARTIMENTO DI SCIENZE
PER L'ECONOMIA E L'IMPRESA

WORKING PAPERS - ECONOMICS

The Resilience of Global Value Chains during the Covid-19 pandemic: the case of Italy

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WORKING PAPER N. 07/2021

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The Resilience of Global Value Chains during the Covid-19 pandemic: the case of Italy

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Abstract

This paper shows that, contrary to what could be expected on the basis on past crises, during the current Covid-19 pandemic, Global Value Chains (GVCs) may have sheltered countries and firms, contributing to their resilience. Using the newly released Asian Development Bank input-output table for 2019, we provide some evidence showing that countries more integrated into international production suffered lower GDP losses. Position along the GVCs and timing affect the result: “upstream” inputs supplying countries were more “protected”, but the sheltering effect took time to materialize. It is in the second wave of the Covid-19 pandemic (after the summer) that high GVC participation countries performed better and experienced a more pronounced rebound relative to less integrated countries. Similar results hold also at the firm level. Exploiting Italian firms’ World Bank Enterprise Surveys for 2019, 2020 (June) and 2020 (December), we show that the reduction in sales is lower for internationalized firms and for more complex modes of internationalization. Consistently with the macro-level evidence, the results about the impacts on firms are further reinforced in the second wave. These findings suggest that the Covid-19 shock, despite having hit the world economy harder than the Great Financial Crisis, might impact less the globalization patterns, as international firms seem to be more resilient than their domestic counterparts.

JEL Classification: F14, F23, F60.

Keywords: global value chains, Covid-19, Italy, GVC position.

Acknowledgements: The authors thank Giuseppe De Arcangelis, Francesca Luchetti, Giulio Vannelli, Margherita Velucchi and participants at a seminar in Rome la Sapienza for useful comments. Errors are ours.

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1 Introduction

The Covid-19 pandemic occurred in a phase of high trade integration and slowed or halted the expansion of GVCs, which had remained fairly stable after the Great Financial Crisis (GFC) and the consequent trade collapse a decade ago (Baldwin, 2009). Since the very beginning of the Covid-19 crisis, it was clear that countries' interconnectedness contributed to the fast spreading of the virus, so that many governments limited the international (and national) movements of people. Similarly, when the risk of medical supply shortages manifested, many advocated export bans, disregarding the fact that entirely national production chains of medical supplies as well as of other goods were the exception rather than the norm. Trade and GVCs were rapidly seen by many as shock multipliers, as it happened in the GFC. The new crisis, therefore, enhanced the debate on whether GVCs mitigate or magnify global shocks. So far, to the best of our knowledge, there is no consensus nor solid existing evidence regarding this question. The issue is mostly empirical, since from a theoretical perspective, while it is true that shocks are likely to propagate faster through GVCs, firms also have the opportunity to diversify more in terms of sourcing and destination markets, with respect to domestic firms, and this could make them more resilient and trigger a faster recovery after a shock. Not surprisingly, when looking at the reactions of countries to the GFC and other shocks such as, for instance, natural disasters, a stylized fact from existing studies is that there are remarkable differences between crises¹.

This paper addresses the issue of to what extent, during the Covid-19 crisis, participation into GVCs has exposed countries and firms to economic shocks. The analysis has a focus on Italy, which was the first western economy to be hit by the virus and has an important role into GVCs.

After a short description of the “slowbalization” phase that characterized the world economy after the GFC (section 2), we discuss the data and methodology (section 3). Section 4 discusses the relation between the Covid-19 shock and countries' participation into GVCs, highlighting the existence of a “sheltering effect” for GVCs at world level. The section also addresses the issue of whether and to what extent the country's position in GVCs (forward versus backward integration, i.e., being mainly suppliers or mainly users of intermediate inputs) affects the reaction to the Covid-19 shock and whether there was any significant difference in the transmission between the first two different waves of the

¹ Several studies use shocks due to natural disasters, see for instance Ludvigson et al. (2020), and Bram and Deitz (2020). Antràs (2020), and Giovannetti et al.(2020), amongst others, have instead undertaken a comparison between the shock due to the GFC and the Covid-19 pandemic, highlighting the differences.

pandemic. We show that the unpredicted and sudden shock of the first wave (approximately January to April) was widely disruptive, while, during the largely anticipated second wave, when there were already important policy measures in place, countries and firms, especially those with international linkages, were relatively more prepared. We find that being international “protected” countries and firms by making them more resilient (they reacted faster) and allowing them to experience a rebound in the second wave.

To better understand the underlying mechanisms, Section 5 focuses on firm-level data and provides novel (preliminary) suggestions on the effects on Italian firms. We rely on recently released surveys conducted by the World Bank during Covid-19 that include *ad hoc* questions on the effects of the pandemic in terms of turnover losses, use of digital technologies, inputs reductions etc. The cross-country association between GVC participation and the Covid-19 shock found at the macro-level is in line with the micro-level cross-sectoral evidence on the link between internationalization – either measured by GVC participation from input-output tables as well as by export intensity from the surveyed firms – and the reduction in sales experienced by firms: being international “enhances resilience”² and, both in macro and micro-level data, this result becomes clearer in the second wave.

In summary, with no claim of providing a definite answer to the complex question of whether GVCs magnify or mitigate the Covid-19 shock, we find that in the initial phases of the pandemic (first wave), when the shock was completely unexpected, GVC participation might have contributed to the transmission. However, during the second wave the correlation between GDP variation and GVC participation changes and we find a positive association between the two, that suggests a sheltering effect. Macro and micro-level results point to the same direction: countries and firms with stronger international linkages suffered less from the crisis and adapted faster to the new conditions, for instance, by rapidly increasing their use of digital instruments³. Overall, GVCs seem associated with higher resilience as after the initial shock, countries and firms involved appear more likely to react and adjust to the changing environment.

² Resilience here is intended as the ability to return to normal operations over an acceptable period of time, post-disruption.

³ The increase of smart working as well as e-commerce and other innovative practices is clear from the WBES answers and is further developed in Section 5. The recently published Istat (2021) Report, using a survey on 90000 Italian firms gets similar results.

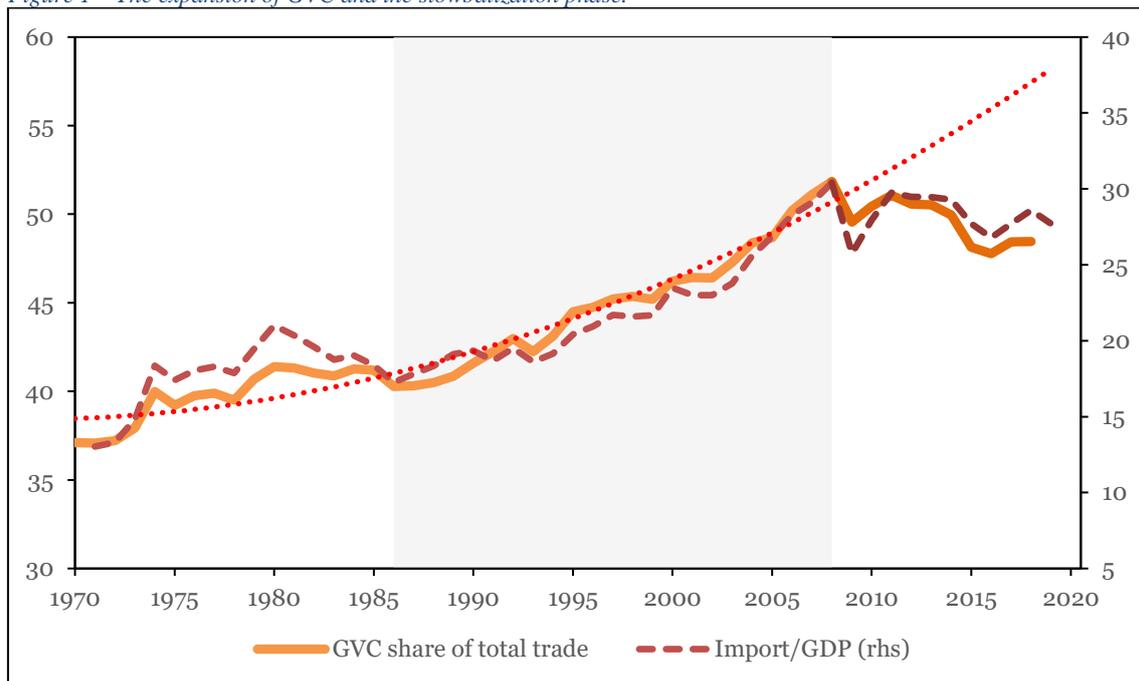
2 Slowbalization and the pandemic

For around twenty years, between the mid-80s and the start of the Great Financial Crisis (GFC), partially because of reductions in transport and communication costs, international trade grew twice as fast as GDP and the organization of production changed dramatically, with the unbundling of production stages, activities and tasks at the international level and the fast development of Global Value Chains. In the same period, China undertook important reforms to enter into the WTO and became a major player in world trade; several other Asian countries adopted export-oriented policies developing strong regional value chains and managed to grow at a fast rate; and almost everywhere in the world trade liberalization policies prevailed. Despite concerns about the growing income inequality within countries, globalization and GVCs were considered a way to reduce poverty and inequality between countries, and to promote efficiency also through knowledge and technology spillovers (World Bank, 2020).

With the GFC, the elasticity of world trade to GDP decreased and the “Age of Global Value Chains” (as the World Bank has named it) apparently came to a halt (Antràs, 2020). During the crisis, countries and sectors more deeply integrated into international trade and GVCs (such as in general the manufacturing industry) suffered more than less open ones (Baldwin, 2009). It became clear that GVCs, implying increased interconnectedness between countries, were acting as a transmission channel for economic shocks. The legacy of the GFCs seems to be that, especially during crises, GVCs are procyclical and are likely to transmit economic shocks internationally (Di Stefano, 2021). The GFC marked the maturity of a two-decade long process of trade integration and globalization, which is now largely completed. This process seems to have lost its momentum. Furthermore, in recent years, the US-China trade, Brexit, and a growing uncertainty on the international scenario led many to question the future of globalization.

Figure 1 shows that both world trade (measured as world import to GDP) and trade related to GVCs after the GFC have systematically been below the world trade forecast based on the 1986-2008 developments.

Figure 1 – The expansion of GVC and the slowbalization phase.



Note: The red dotted line shows the (2nd-degree polynomial) trend before the Great Financial Crisis.
 Source: authors' elaboration on Asian Development Bank, I-O table, IMF based on World Bank (2020).

There are several reasons for the level-off of GVCs in the aftermath of the GFC. First, the level of integration reached by emerging markets before the GFC was very high and therefore there was not much room left for further expansion of GVCs, unless African countries, the least integrated so far, started participating and fueled another boost. Second, after a period of low transport costs that made it rational to fragment the production even at long distances and low communication costs that facilitated the second unbundling (Baldwin, 2016), both transport and communication costs stopped decreasing (if anything they started rising again).⁴ Third, in the “GVCs golden period”, successive rounds of trade liberalization resulted in rapidly falling barriers to trade and investment. Tariffs, especially on manufacturing, declined substantially while nontariff barriers declined at a much lower pace. After the GFC, however, there was no further wave of liberalization, the Doha Round stalled, there was no drastic reform like the one undertaken by China to enter the WTO in 2001 and some non-tariff barriers started to increase again.⁵ Finally, technical progress, one of the main forces behind the early episodes of globalization, with automation and 3D printing technologies, could now push

⁴ During the Covid crisis transport costs increased because of the lockdowns and the stop to several producers. See WTO (2020) on the increase of transport costs.

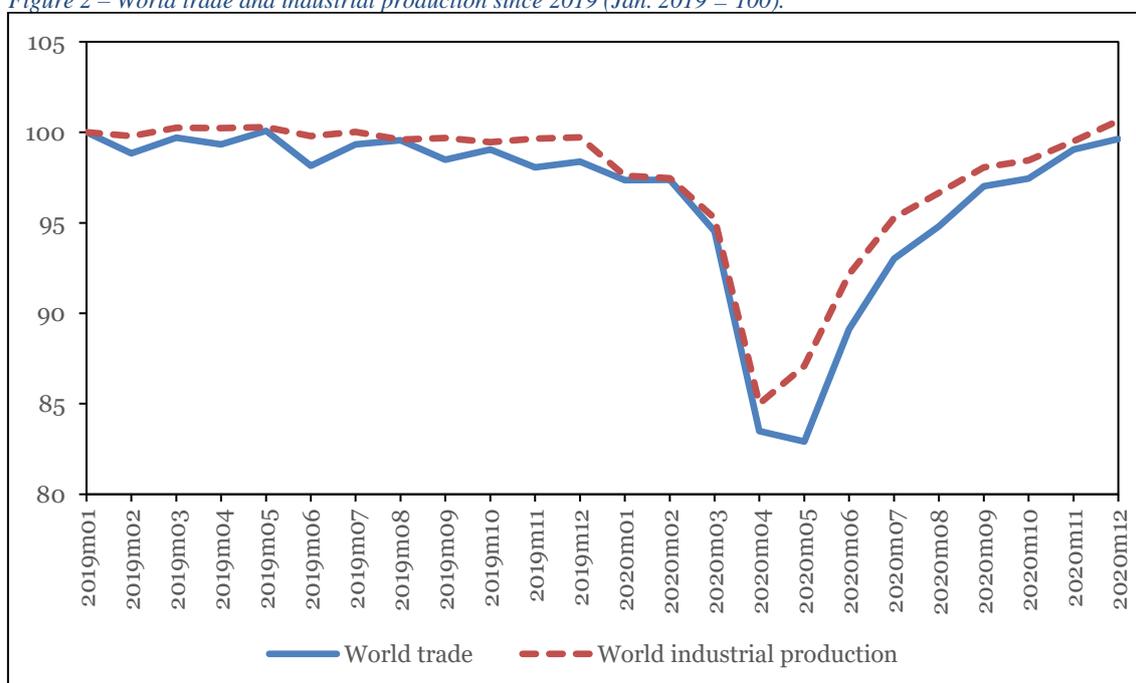
⁵ During the past year, after the start of the Covid 19 pandemic some export restrictions mainly on sensitive goods were decided by different governments. See Evenett et al. (2021).

in the opposite direction, favoring a deglobalization due to the changes in relative costs (see Antras, 2020; Seric and Winkler, 2020).

All these factors contributed to create a scenario that was very different from the one in which the GFC occurred. The world economy witnessed a significant transformation in the structure of international trade: from the “Age of Global Value Chains”, we moved to a situation that some authors have referred to as “deglobalization” and others as “slowbalization” (Antras, 2020). Although trade integration remains historically high, with about half of world trade still related to GVCs, the expansion essentially stopped. When the Covid-19 crisis started in February 2020, the world had been in such a phase for almost a decade.

The overall effects of Covid-19 have been dramatic for the world economy. Figure 2 shows that in the short term, i.e., in the past year, world trade and industrial production severely contracted. We maintain that this was most likely driven by lockdown that stopped production in many locations, disrupting the smooth working of value chains. A very large fall can be noticed between January and March 2020, when Covid-19 hit China interrupting the production chain. The fall was followed by a remarkable recovery in May, which however lost momentum in September, when the so-called Covid-19 second wave strikes.

Figure 2 – World trade and industrial production since 2019 (Jan. 2019 = 100).



Source: Source CPB world trade Monitor.

While, during the GFC, the manufacturing sector, more integrated into international trade, was badly affected and less internationalized activities, especially services, relatively sheltered, the recent pandemic hit the sectors differently: there were temporary but extreme disruptions of GVCs (e.g. medical chains producing many intermediate goods in Wuhan where Covid-19 originated in January 2020), but in general, because of widespread confinement and lockdown, the activities more intensive in face-to-face interactions (e.g., hotels, restaurants) were hit much more severely than others. The service sector suffered the most, with losses of up to 90% of turnover.

Furthermore, the Covid-19 crisis was also special inasmuch it resulted from a very early interaction of demand and supply shocks. Supply chains were initially hampered in their national and international organization and physically disrupted by the lockdowns; then, very soon, also the consumers' demand and habits changed in response to home confinements, remote working, and the need to avoid crowded places (see Bachas et al., 2020).

The transmission of demand and supply shocks to the economy is different and depends on the transitory/permanent nature of the shocks, as well as on the complexity of the relationships between countries/firms and their position in the different phases of production. Input demand shocks impact directly input suppliers, with the initial shock being magnified by disruption to demand for parts and components, which increases the further upstream the country/firm is located in the GVC. The impact of demand shocks, therefore, depends largely on consumers' and firms' behavior (Cigna and Quaglietti, 2020). On the other hand, supply disruptions, such as interruption in the operation of GVCs in the case of Covid-19, are more likely to be transmitted downstream to buyers, but have been mostly temporary (China for instance recovered soon from the shock).

As we proceed through the crisis and learn to face the new conditions, the demand shock (i.e., the change in the consumers' habits) is perceived as more permanent than the supply shock, especially in China and South East Asia where most production activities are now nearly back to normal or firms are finding new ways to operate.

All these elements greatly differentiate the Covid-19 shock from the GFC, not only for the obvious differences between the type of shocks, but most notably for the environment in which they occurred. Given that the current crisis is of different strength and nature, that conditions are very different, and that the policy responses have been unprecedented, the propagation of the shock and its relationship with GVCs need not resemble those observed during the GFC. Whether GVCs yield procyclical effects in the current crisis, as they did in the GFC, is not obvious and should be empirically tested.

3 Data and methodology

Our aim is to verify whether and how internationalization, and more specifically GVC participation, is associated with the Covid-19 shock. In particular, we want to provide evidence on whether GVCs played a role in the transmission of shocks or if countries, sectors, and firms more involved in international productions were somehow sheltered from the negative effects. To this aim, we use different data sources and approaches. We begin with a country-level perspective in which we correlate the Covid-19 economic shock with GVC participation and position. In doing so, we also consider the timing of the pandemic and separate the first and second wave. Then, we move to the firm-level data to see whether the latest available evidence is in line with the general figures from the cross-country analysis. The firm-level analysis focuses on Italian firms and exploits Covid-19-specific surveys recently released by the World Bank. In what follows we describe the data and the methodology employed in the analysis.

3.1 The Covid-19 shock

Since the end of 2019, when the first Covid-19 cases were discovered, but especially from January 21st 2020 when China took the unprecedented decision to lock down the city of Wuhan, the world economy suffered the effects of the Covid-19 pandemic. While the exact timing of transmission of the disease and the policy responses by countries varied, the economic and social consequences were almost everywhere immense, and most countries entered a severe phase of recession. Since the pandemic was largely unexpected, the reduction in GDP represents a first rough measure of the economic shock. Yet, this measure is unsatisfactory for one specific reason: it also depends on pre-existing economic conditions and performance of countries. To overcome this limitation, in this paper we measure the Covid-19 shock using the GDP forecast revisions and updates. The intuition is that, since the GDP forecasts incorporate all the available information at the moment of release, their updates and revisions reflect unexpected news.⁶ Therefore, the difference between the pre- and post-Covid-19 forecasts largely depends on the unanticipated economic effects of the pandemic, i.e., the Covid-19 shock. Specifically, we use the forecasts for GDP in 2020 made by the World Economic Outlook (WEO) of the International Monetary Fund (IMF) in October 2019 (pre-Covid-19), later

⁶ GDP forecast updates are obviously customary also in normal times as they incorporate news and solve some standard issues (e.g., measurements errors), but the adjustments are usually small unless large unanticipated events materialize. In the case of the first wave of the pandemic, the change in the GDP forecasts is likely to be a good proxy of the Covid shock. As for the second wave, other factors could enter into the relation (e.g., the fact that the second wave did not occur in many Asian countries, the policies that most countries had put into places etc.). The proxy for the second wave is thus arguably less precise, but nonetheless pandemic-related news are likely to represent a major driver for the revisions.

revised in April 2020 (first wave of Covid-19) and again in October 2020 (second wave of Covid-19) and January 2021⁷. The difference between the April 2020 and October 2019 forecasts accounts for the 1st wave shock, while the difference between October 2020 and April 2020 for the 2nd wave shock. By looking at the two post-Covid-19 revisions, we can therefore check if there are differences between the first and the second wave. One obvious reason why we may expect to observe differences stems from the fact that while the first wave was truly unexpected, when the second wave arrived it had been somehow anticipated, several countries had implemented policy measures and firms had time to revise their strategies.

As a check and for illustrative purposes, we also study the Covid-19 shock with a different approach. Instead of GDP forecasts, we use carbon emissions coming from the industry sector (i.e. production of materials, manufacturing, and cement) as a proxy for economic activity. This has two advantages. First carbon emissions are available on a daily basis, which allows for a greater level of detail. Second, with these data we can also look at new daily cases of Covid-19, which is a direct measure of the spread of the virus. The overall effects on the economy are arguably better captured by revisions in GDP forecasts, but the daily data allow us to (i) directly check the response of the production activity to the disease, and (ii) track the evolution of the shocks over the days. To this end, we construct orthogonal impulse response functions following Mzoughi et al. (2020) by performing a VAR analysis to assess the impact of Covid-19 on industrial production. The estimated model is defined by the following dynamic equation:

$$Y_{i,t} = \gamma_{i,0} + \sum_{p=1}^P \gamma_{i,p} Y_{i,t-p} + \varepsilon_{i,t}$$

where $Y_{i,t}$ is the vector of variables in logarithms (Covid-19 number of confirmed cases and CO₂ emissions by the industrial sector, as a proxy for the industrial activity) for each country i and each time period t ; $\gamma_{i,0}$ is a column vector of constant terms for each country i ; P is the number of lags, computed optimally for each country (i.e. the minimum lag length resulting from the Akaike information criterion, the Hannan-Quinn criterion, the Schwarz criterion and the final prediction error criterion); $\gamma_{i,p}$ is a matrix of coefficients and $\varepsilon_{i,t}$ is a vector of errors. The VAR is estimated for each country separately. To construct the impulse response functions, we use daily data on Covid-19 from the Johns Hopkins University dataset, which reports every day new confirmed cases of Coronavirus in 192 countries. As a proxy for a daily measure of GDP, we use data on carbon emissions

⁷ We do not present results using this forecast since the number of countries for which it is provided is lower. Results, available on request, are however, very similar.

coming from the industry sector, provided daily for 2020 by the Integrated Carbon Observation System (ICOS), for 67 countries.⁸ Over the period 22 January to 31 December 2020, the average daily CO₂ emissions from the industry sector (representing 22.4% of total emissions and including the production of materials and manufacturing, as also reported by Le Quéré et al., 2020) are 0.2747 megatons, while the mean of new confirmed cases of Covid-19 per day is 3,314. A table with summary statistics of the variables can be found in the appendix.

3.2 Global Value Chain participation

To measure GVC participation we use the very recently released (March 2021) Asian Developing Bank (ADB) input-output (I-O) tables. This data source has a wide country coverage, and the latest release used in this paper is the first – and at the time of writing the only one (relative to similar sources such as WIOD or Eora) – to provide input-output figures for the year 2019. This is therefore the first time that updated GVC figures for 2019 are used for analysis. The ADB data are available for 63 countries and 35 sectors. Several new analytical methods (Koopman et al. 2010, Wang et al. 2013, Koopman et al. 2014, Borin and Mancini, 2015, Borin and Mancini, 2019) use I-O tables to decompose gross exports of goods and services into value-added components as well as to identify origin and destination of value added. These methods allow us to track the international flows of value added along supply chains and to measure each country's participation to GVC. The calculation of the GVC participation involves several steps including the derivation of the value-added, Leontief's inverse and export matrices to obtain the value-added content of exports matrix from which two main indicators can be obtained. The first indicator is the so-called backward participation, which basically measures the foreign value-added content of exports (FVA), therefore giving information about the country's use of foreign inputs in the production of exports. The second is the so-called forward participation, tracking the domestic value-added content of exports (DVA) that is further incorporated into the export of third countries, therefore giving information about the country's supply of domestic inputs used by third countries in the production of their exports. The sum of backward and forward participation as a share of total exports provides a measure of the overall GVC participation of countries. By

⁸ Carbon emission are a good proxy for the daily GDP. According to Hale and Leduc (2020) the GDP growth and the emission “show a strong positive relationship (...), with a correlation near unity. Even controlling for movements in energy intensity and oil prices, real GDP and emissions growth have moved roughly one-to-one since the early 1970s”. A note of caution applies to our case as restrictions and other policy measures affected services more than manufacturing, especially during the second wave. Although this is unlikely to make carbon emission a bad proxy, it may reduce its correlation with overall economic activity relative to normal times, while its association with industrial activity is presumably stable.

construction, GVC participation represents the share of exports due to goods and services that cross at least two borders.

3.3 Firm-level data for Italy

To provide new firm-level evidence on the effects of Covid-19 and to verify to what extent the figures that emerge from the cross-country analysis can be reconciled with firms' behavior, we focus on Italy, one of the few advanced countries included in the latest Covid-19-specific surveys conducted by the World Bank. The case of Italy is of interest per se, but it is also of interest for its GVC participation, with several firms being deeply involved in international production and a strong integration into the European supply chains. For the analysis of the Italian case, presented in Section 5 below, we use the World Bank Enterprise Survey (WBES) recently released in January (baseline), June (round 1) and December (round 2) 2020; the last two rounds with a focus on the pandemic. The last rounds of these WBESs have been conducted in 33 countries (as of April 2021) and they have been devised specifically to monitor the impacts on the private sector and the responses by firms to the pandemic. For Italy, the Covid-19 questionnaires have been submitted to all the 760 establishments sampled in the standard ES⁹ via CATI (Computer Assisted Telephone Interviews). The surveys therefore include a total of 760 firms. The baseline survey provides all the pre-Covid-19 characteristics of firms (e.g., size, sector, exporter status, etc.). We merged the baseline dataset with round 1 and round 2 follow-up WBESs. The final dataset includes all the baseline information plus the answers to the Covid-19 questions. To the best of our knowledge, we are the first to use this newly released data and connect them with GVC participation. The analysis below provides the main figures about the effects of Covid-19 on the Italian firms included in the survey to gauge whether internationalized firms suffered more or less, and whether they reacted differently (in terms of starting business online activities and remote working) with respect to domestic firms.

4 Global Value Chains and the Covid-19 shock

Contrary to the Great Financial crisis, when the GDP changes were negatively correlated with the degree of international integration (here measured by participation in GVCs),

⁹ To account for non-responses in the follow-up, the forthcoming analysis on the Italian case has been conducted using weights provided and recommended by the World Bank ES, that assume that business that could not be re-contacted have exited the market.

during the recent pandemic, GVCs seem to somehow “protect” the countries which are more integrated.¹⁰

Figure 3 reports the correlation between GVC participation and the Covid-19 shock.¹¹ As mentioned above, the latter is the difference between the IMF GDP projections for 2020 carried out in October 2020 and those of October 2019, when no one could have imagined the existence of the pandemic. Also recall that this measure for the shock has the advantage of incorporating the effect of Covid-19 without depending on the trend of growth that a country was experiencing before 2020. We can see a slightly positive (not significant) correlation between the two variables, implying that countries which rely more on GVC are less affected by the shock. In this sense, international integration seems to “protect”, or at least not harm, economies.

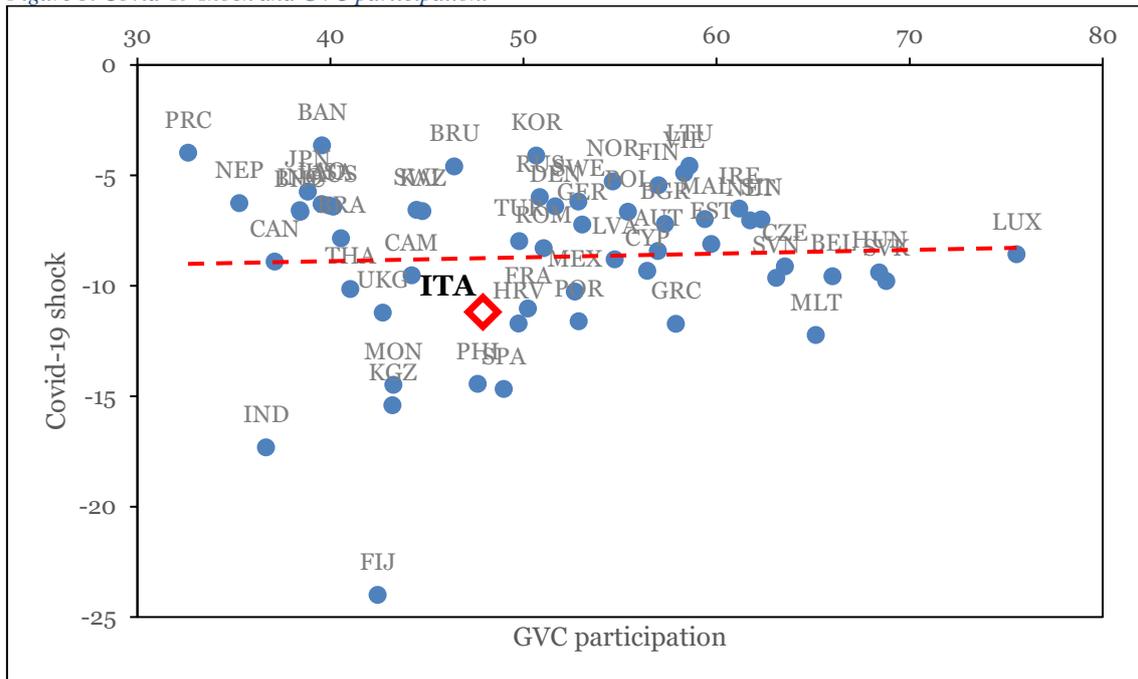
The red square in the plot indicates the position of Italy in this framework: having a GVC participation equal to 47.9%, it experienced a loss of -11.2% of GDP due to the Covid-19 shock.

It is important to note that the observed difference relative to the GFC, while suggestive, cannot be solely attributed to GVC participation and certainly not on the basis of a simple cross-country correlations between aggregate variables. For instance, a characteristic of the Covid-19 crisis – further analyzed in the next sections – that might have interacted with GVC participation to determine the pattern that we observe, stems from the difference between manufacturing and services in terms of intensity of face-to-face interactions and exposure to risk of contagion, on the one hand, and in terms of internationalization and GVC involvement, on the other hand. In any case, the role of GVCs in the current pandemic looks different than in previous crises and, therefore, worth of further investigation.

¹⁰ See Giovannetti et al. (2020), where a comparison between the Great Financial crisis and the Covid-19 crisis is carried out.

¹¹ GVC participation is computed as the amount of to GVC-related trade as percentage of a country’s total exports. We also did several checks, all with similar results. First, instead of GVC participation, as a proxy for integration into world trade, we used trade openness computed as the sum of exports and imports on GDP; the correlation between trade openness and GVC participation is 0.8. Second, instead of our preferred measure for the Covid-19 shock, we repeated the analysis using the simple percentage difference of GDP between 2019 and 2020 rather than the revision in IMF GDP projections for 2020. Results are reported in Appendix A2. Third, to exclude that the observed correlation is driven by specific countries, we also performed the analysis excluding China; the correlation does not change and remains slightly positive (0.093, p-value = 0.494). Results are available on request.

Figure 3. Covid-19 shock and GVC participation.

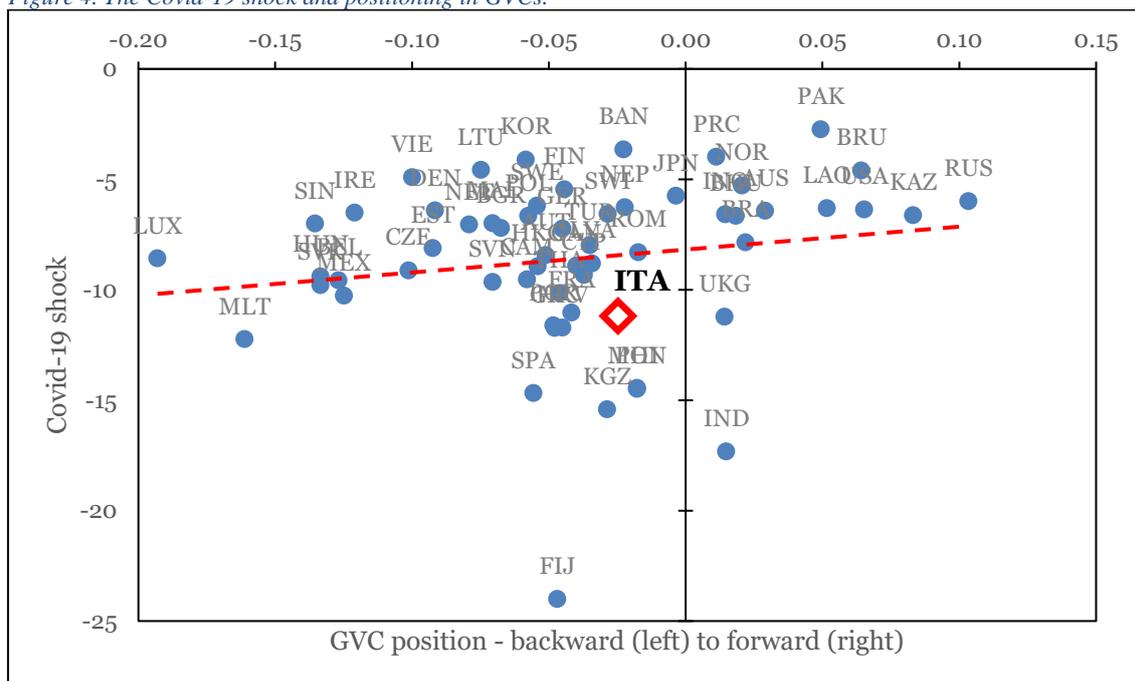


Note: the Covid-19 shock is measured as percentage of GDP. It is computed as the difference between the IMF 2020 GDP growth projections made in October 2020 and in October 2019. The correlation between the variables is 0.045 (p-value = 0.734). See the appendix for country codes.

Source: authors elaborations on ADB and WEO-IMF data.

Other than aggregate GVC participation, countries also differ for their positioning along the value chains and for their sectoral specialization. Countries with a high value of *forward* participation are more active in the initial stages of the production process: their role is to be “input suppliers” and are therefore placed “upstream” in the global value chains. Two types of countries share this “upstream” position: raw material producers and countries specialized in design, R&D or other upstream activities (see OECD, 2013). On the contrary, countries with a high value of the *backward* participation are active in the final stages of the production process: their role is mainly of “input users” and are placed “downstream” in the global value chains. Figure 4 shows a positive correlation between a country’s positioning in the GVC and the Covid-19 shock: economies that are more *forward* in GVCs seem to experience a more moderate loss of GDP.

Figure 4. The Covid-19 shock and positioning in GVCs.



Note: Covid-19 shock is measured as percentage of GDP. It is computed as the difference between the IMF 2020 GDP growth projections made in October 2020 and in October 2019. GVC position is measured as in Koopman et al (2010) as $\ln(1+GVC_F)-\ln(1+GVC_B)$, where GBCF and GVCB denote backward and forward participation as share of exports. The correlation between the variables is 0.169 (p-value = 0.198). See the appendix for country codes. Source: authors elaborations on ADB and WEO-IMF data.

The almost null correlation between the Covid shock and GVC participation, reported in Figure 3, may be the result of the timing of the pandemic and of the interplay of demand and supply shocks. To test this hypothesis, we consider subperiods by dividing the total shock (we have data from January to December 2020) into two waves that have so far characterized the pandemic.

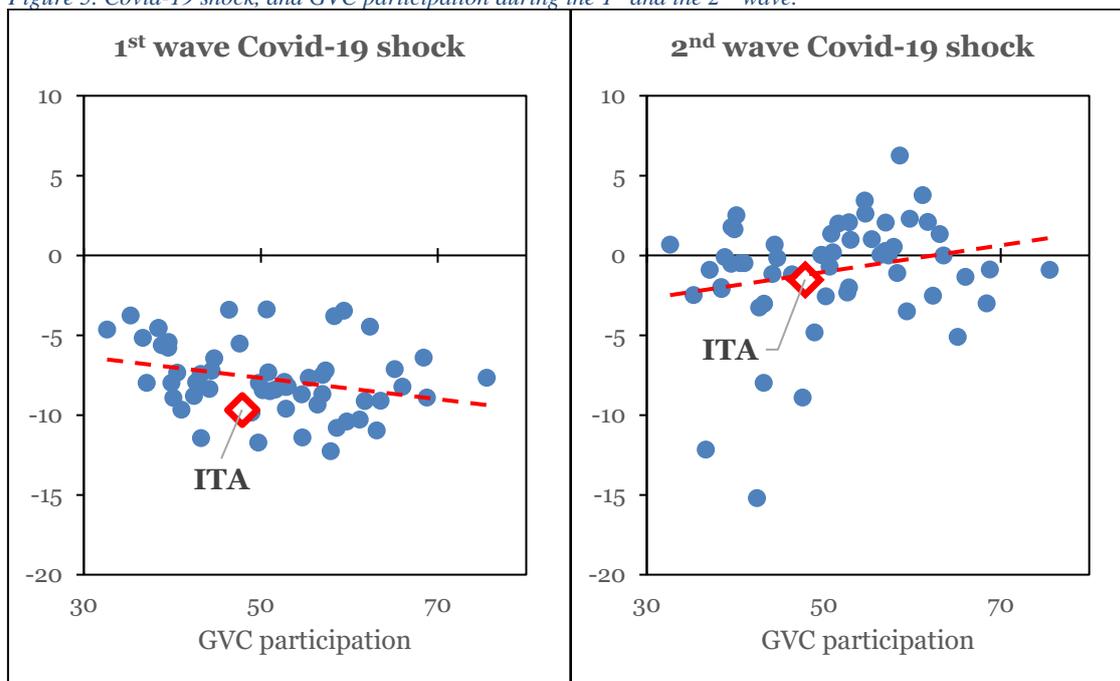
In the first wave (January to April), most countries implemented confinement policies, and this resulted in changes in work modalities and mobility. Between the peak of the first wave of Covid-19 in April until after the summer, both mobility and trade improved gradually. In October, the second wave hit the economy. To measure the first-wave shock, we compute the difference between 2020 GDP projections made in April 2020 and the ones made in October 2019. For the second wave, instead, we take the difference between October 2020 and April 2020 projections.

Figure 5 reports the first-wave shock in the left panel and the second-wave shock in the right one. By looking at the graphs, one can notice different signs of the correlation between the Covid-19 shock and GVC participation in the two waves: while in the first wave more integrated countries tend to suffer more from the shock, during the second wave they appear less affected (slightly positive correlation). A plausible explanation for this result is that China, which is central in many GVCs, was hit first, but then recovered

fast. Also, countries did not expect the first shock and were not ready for that, while they were more “prepared” for the second one, including having some policies in place so that firms could react better (for instance, firms could organize working from home: one can reasonably think that the possibility of remote work can buffer the negative impact of the shock and allow production to continue during the pandemic, or experiment e-commerce and the like).

As indicated by the red squares, Italy experienced a loss equal to -9.67% of GDP due to the first-wave shock, and a minor loss of -1.5% for the second wave. Similarly, many countries suffered much more from the first wave than from the second, thus encountering a “rebound”, which we can measure as the difference between second and first wave shocks. This can be considered an estimate of the rapidity of reaction of countries.

Figure 5. Covid-19 shock, and GVC participation during the 1st and the 2nd wave.



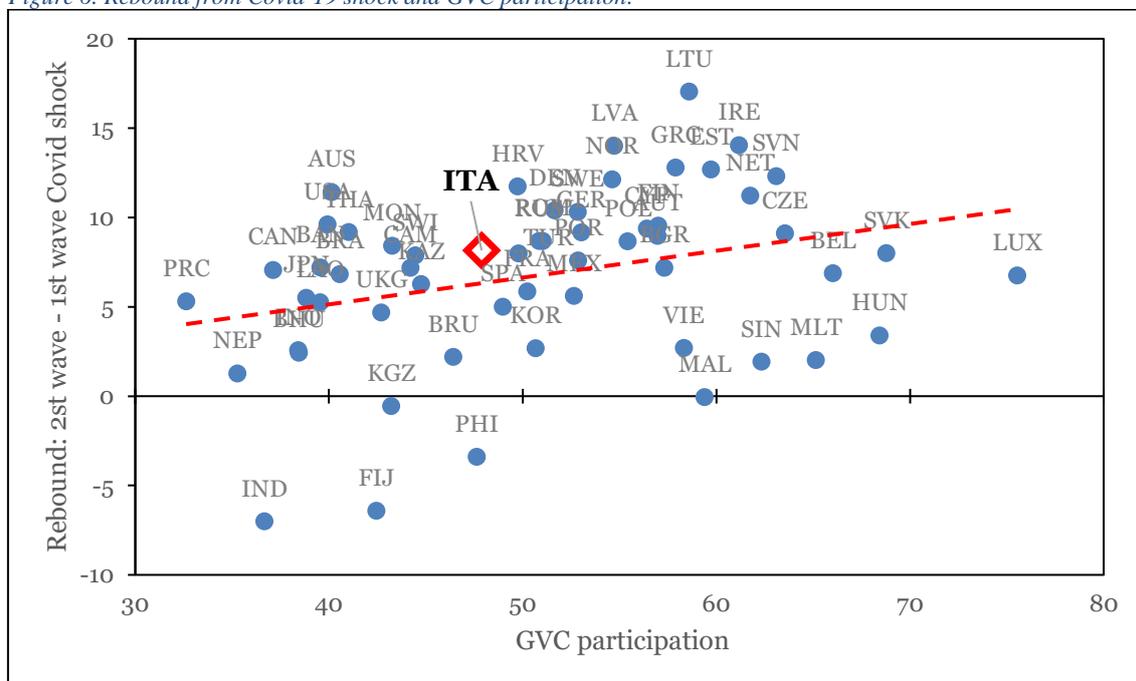
Note: the Covid-19 shock is measured as percentage of GDP. For the first wave, it is computed as the difference between the IMF 2020 GDP growth projections made in April 2020 and in October 2019. For the second wave, it is computed as the difference between the IMF 2020 GDP growth projections made in October 2020 and in April 2020. The correlation between the variables is -0.289 (p-value = 0.029) for the first wave and 0.228 (p-value = 0.087) for the second wave.

Source: authors elaborations on ADB and WEO-IMF data.

To further analyze the velocity of recover from the pandemic shock, we measure the correlation between the rebound of a country and its GVC participation (Figure 6). A higher value for the rebound means that a country was quicker to restore from the loss of GDP suffered during the first wave of the pandemic. One can notice that the correlation between the value of the rebound and GVC participation is positive: countries

which are more integrated into global trade tend to recover faster (Italy, in this case, has a value for the rebound equal to 8.2%).

Figure 6. Rebound from Covid-19 shock and GVC participation.



Note: the rebound from Covid-19 shock is measured as percentage of GDP. It is the difference between the second wave and the first wave shocks. For the first wave, the shock is computed as the difference between the IMF 2020 GDP growth projections made in April 2020 and in October 2019. For the second wave, it is the difference between the projections made in October 2020 and in April 2020. The correlation between the variables is 0.311 (p-value = 0.019). See the appendix for country codes.
 Source: authors elaborations on ADB and WEO-IMF data.

To better investigate this rebound using a different approach, we construct the orthogonal impulse response functions (IRFs) following Mzoughi et al. (2020), which however confine their analysis to the first wave. We assume that a shock equals an increase of 1% of confirmed cases of Covid-19 infections.¹² The output of our estimation (carried out for the two different waves) is presented in Figure 7, where the dashed lines indicate the 95% confidence bounds. In particular, the IRFs presented here are a simple mean of the IRFs for countries with a GVC participation above the median (the two panels on the left) and below the median (the panels on the right) and the same for the respective confidence intervals. Moreover, the entire dataset for 2020 has been split in two parts, as to distinguish the first wave of the pandemic from the second wave. Months from January to August account for the first wave (the two panels at the top) while from

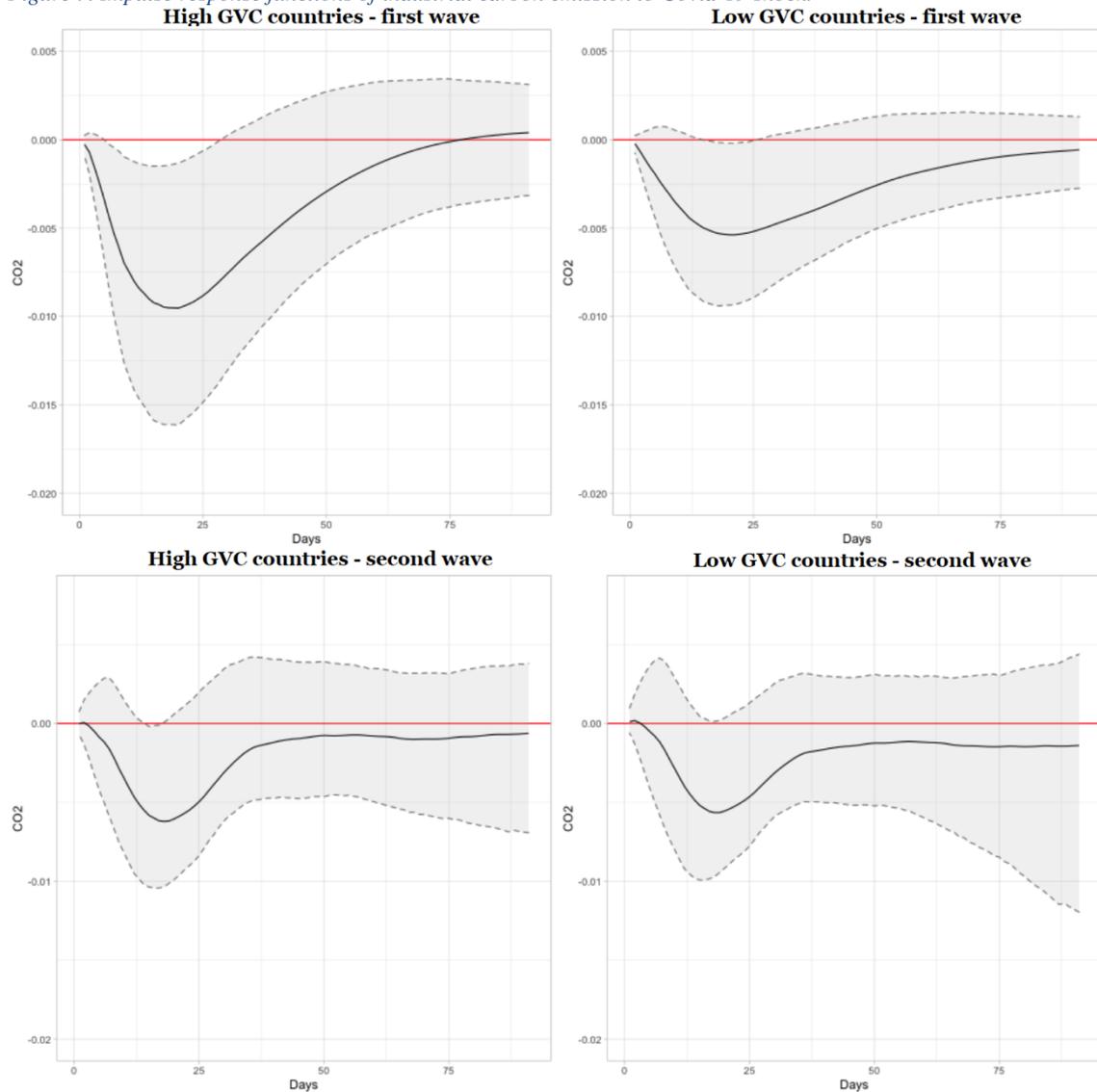
¹² Although confirmed Covid-19 cases are taken from a single source for all the countries, which enhances comparability, caution must be used when interpreting the results due to possible under-reporting in some countries or to the fact that the number of cases can be highly dependent on the number of tests carried out, which in turn varies across countries and might be correlated with GDP.

the period September to December for the second wave (the two at the bottom). GVC participation, as before, is computed as the amount of GVC-related trade as percentage of total exports¹³.

As shown, the response of economic activity, proxied by carbon emissions, to a shock on Covid-19 infections is negative in all the four cases considered here. However, we can see that more integrated countries seem to react more: their GDP falls more (almost 1% at the negative peak level, compared to 0.5% for the less integrated ones) but then it recovers faster. This difference is visible in both waves: in the first one, economies with a higher GVC participation completely go back to the pre-shock level of emissions after 75 days from the initial point, while it takes more than 90 days for less integrated ones. The severity of the second-wave shock is similar in the two types of countries. It seems to be less intense than the first one (and not significantly different from zero) but more persistent: although there is no full recover during the three months after the shock for neither types, highly integrated countries get closer to the initial level and experience a more rapid rebound. These results are in line with the correlation shown in Figure 6.

¹³ As an additional control, we also added mobility data as a variable in the VAR, that allow us to explicitly account for confinement (sourced from Apple). The results, available on request, are similar. We also tried to split our sample of countries into European vs. non-European economies, and OECD vs. non-OECD economies. We observe that European and OECD countries react to the Covid-19 shock more similarly to countries with a high GVC participation, while non-European and non-OECD countries' reaction is closer to less integrated countries. We also tried to remove some Asian countries which have not experienced a significant second Covid-19 wave from the sample, obtaining similar results, available on request. We amplified our analysis by distinguishing, among European economies, the reaction in the two waves. As for the full-sample case, we note that countries recover faster after the shock in the second wave, although there is no return to the starting point. Finally, we divided our sample into countries in the northern and southern hemispheres, but we found no evident differences in their reactions. All these results are available on request.

Figure 7. Impulse response functions of industrial carbon emission to Covid-19 shock.



Source: Integrated Carbon Observation System (ICOS) and Johns Hopkins Coronavirus Resource Center

5 Evidence from Italian firms

Our cross-country macro-level analysis suggests that GVCs participation, and more generally, internationalization during the initial phases of the pandemic might have contributed to the transmission of the shock. However, during the second wave, the relationship between the GDP variation and GVC participation changes and we find a positive association between the two, which seems to suggest a moderating effect on sales reduction. We now perform some micro-level analysis to check whether results at the macro level are consistent with those at the firm level.

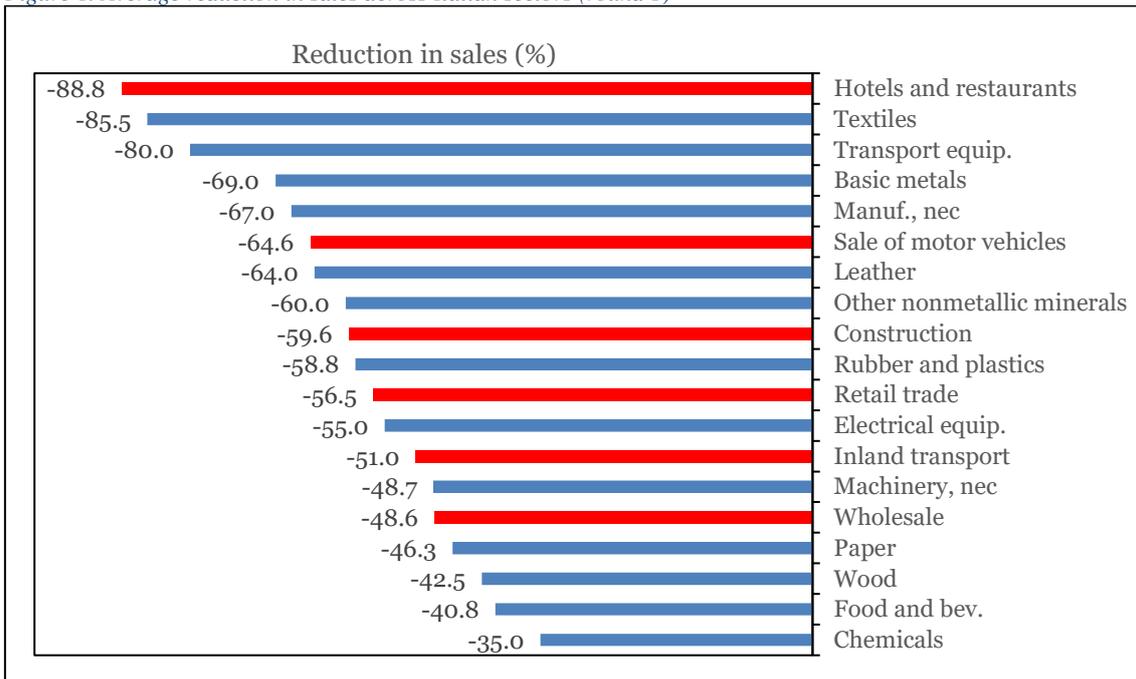
The timing of the pandemic matters for the expected results. As mentioned above, Italy was the first amongst the high-income countries to be struck by the shock. Italian firms therefore were among the first to directly face, not only the international disruption to

GVCs and international trade, but also and foremost the domestic lockdowns and confinement measures. The first Covid-19 case was reported on the 17th of February, and already by the 22nd of March most of the industrial and commercial activities were suspended. Given the time span between the beginning of the pandemic period in Italy and the Round 1 (June, 2020) of the WBES, our data are likely to detect both the magnitude of the shock as well as some of the early strategies put in place by firms to mitigate the losses. If, as the macro-level evidence suggests, openness and GVC participation are associated with resilience, then we are likely to capture some initial sheltering effects accruing to internationalized firms already in Round 1 of the WBES, whereas with data from Round 2 (December 2020), we can expect to fully grasp the rebound or sheltering effect of internationalization.

Figure 8 below shows that all sectors have been badly affected by the pandemic, with the mean and median reduction in sales of 52.69% and 50%.¹⁴ Differently from the GFC, the pandemic outbreak hit harder firms operating in the service sectors (in red). This effect can be largely attributed to the nature of the operations of these sectors which tend to be more intensive in face-to-face interactions and to the policy measures undertaken to reduce contagion. The service sectors report an average reduction in sales of 60.27%, against the still dramatic but smaller reduction, 48.6%, reported by manufacturing firms (in blue). Some of the most harshly hit service sectors, as tourism, hospitality, and retail, are key for Italy. The sector that reported the highest reduction in sales is Hotel and Restaurant, with a 88.81% decrease.

¹⁴ Reduction in sales is expressed as percentages, comparing sales in the last completed month before the interview with sales of the same month in 2019.

Figure 8. Average reduction in sales across Italian sectors (round 1)



Source: authors elaborations on WBES.

In line with the cross-country analysis, we want to inquire how the Covid-19 pandemic has hit sectors and firms more internationalized and integrated into GVCs. Moving from the macro-level analysis to the micro-level analysis is of course not trivial, first and foremost because the type of information and the available data differ greatly. While at the country level, the use of input-output tables to construct GVC measure has become relatively standard in the last years, there is no equivalent at the firm-level. In our case, as in general in the firm-level literature on the topic, having good measures of firms' involvement in GVCs is hard, and several proxies are typically used, depending on data availability (e.g. trader, two-way trader, use of imported inputs, use of internationally recognized certifications, foreign ownership etc.) (Amador & Cabral, 2016). Similarly, while measuring the country-level shock in terms of GDP is rather natural, the firm-level shock can be measured in several ways, such as change in sales, in employment, in debt levels, which again are limited by data availability.

To check the correlation between firms' GVC participation and their performance during the Covid-19 outbreak, and to verify whether the macro- and micro- level data point to the same direction, we take a double path: first, we combine our two data sources, and we plot sectoral GVC participation as measured from the ADB Input-Output tables against the sectoral average reduction in sales experienced by firms (from the WBES

dataset) for both Round 1 and Round 2;¹⁵ second, we do a similar exercise based on WBES data only, using the export intensity of firms as a proxy for their internationalization (instead of the macro-level input-output based GVC participation).

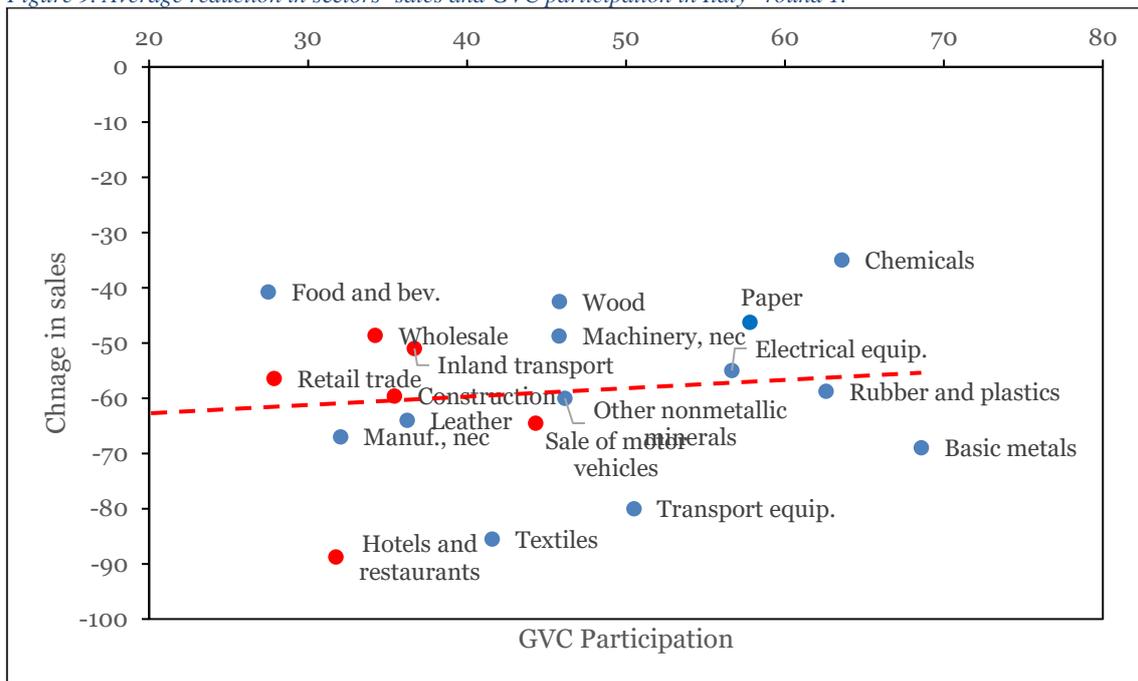
As we can see in Figure 9, already in June (Round 1) the relationship between GVC participation and changes in sales is slightly positive, indicating that internationalization sheltered the more integrated sectors. Furthermore, the relationship becomes stronger with data from the Round 2 (Figure 10), where the sales from December 2020 are compared with sales in December 2019. This suggests that not only internationalization (in here measured as sectoral GVC participation from ADB Tables) did not penalize sectors' performance, but also mitigated reduction in sales and possibly facilitated the recovery process during the second wave. It can be noted that the services sectors (in red) tend to be less integrated in GVCs and to report higher losses, while the manufacturing sectors (in blue in the graph) are more internationally integrated and at the same time seem to suffer lower sales reduction.¹⁶

Using the WBES only (and aggregating the dataset at the sectoral level, as above), as in Figure 11 and Figure 12, we find a very similar pattern. There is a positive correlation between sectoral average export intensity of firms (export as share of total sales) and sectoral average reduction in sales. This applies to both rounds of the WBES, but again the correlation seems stronger in the second wave. And again, the difference between services (in red) and manufacturing sectors (in blue) in terms of export intensity and reduction in sales is quite clear.

¹⁵ Note that sectors in the WBES dataset follow the ISIC Rev. 3.1 classification and are more disaggregated than in the ADB Input-Output Tables. To match the two sources at the sectoral level, we aggregated the WBES sectors using employment-weighted averages.

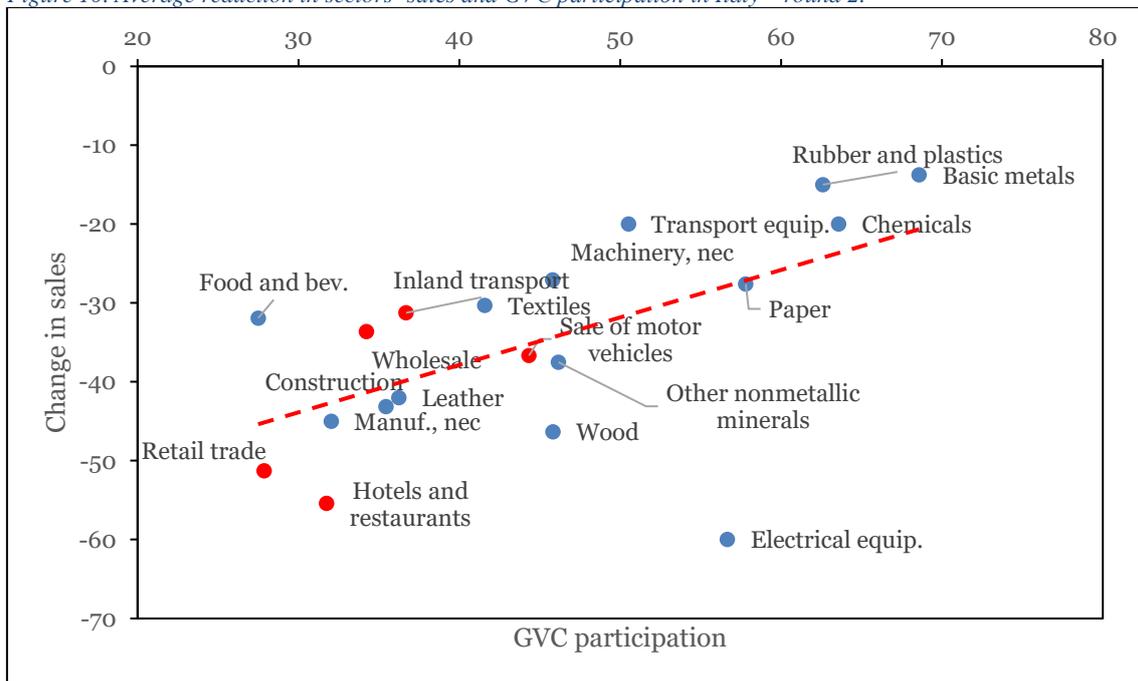
¹⁶ We acknowledge the fact that service sectors have been more impacted than manufacturing regardless of their degree of GVC participation, due to the severe restriction and lockdown measures. To prevent this from altering our results, we test the correlations in Figure 9 and 10 excluding the service sectors. Results, very similar to the ones presented, are available on request.

Figure 9. Average reduction in sectors' sales and GVC participation in Italy— round 1.



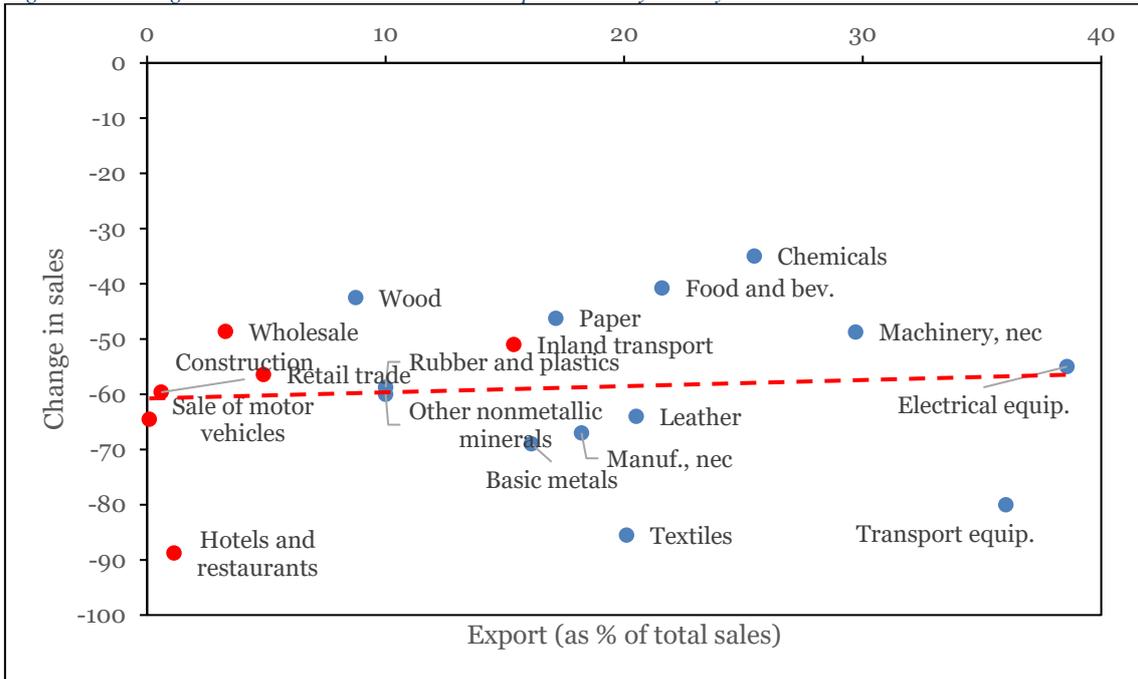
Source: authors' elaborations on WBES and ADB.

Figure 10. Average reduction in sectors' sales and GVC participation in Italy – round 2.



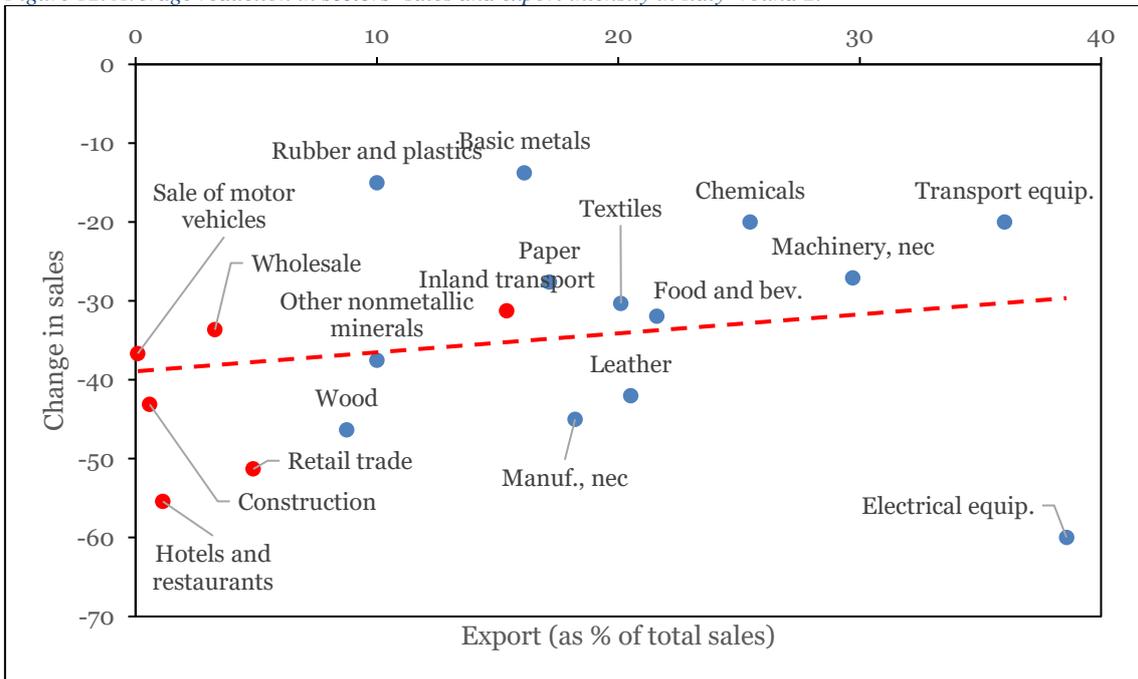
Source: authors' elaborations on WBES and ADB.

Figure 11. Average reduction in sectors' sales and export intensity in Italy- round 1.



Source: authors' elaborations on WBES.

Figure 12. Average reduction in sectors' sales and export intensity in Italy- round 2.



Source: authors' elaborations on WBES.

These preliminary correlations suggest that internationalized sectors perform relatively better than domestic ones, having reported lower reductions in sales during the pandemic. To better understand the relationship between internationalization and performances, which has important policy consequences, as well as to understand whether the different dynamics that at the aggregate level may be the result of offsetting forces, we look into firms' characteristics. We construct a series of (non-mutually exclusive) firm-level categories expressing different modes of internationalization¹⁷. We categorize firms as domestic when they adopt no form of internationalization, i.e., they are not exporter, nor importer nor foreign-owned. Purely domestic firms are the most numerous: 290 (out of 760) and cover all the different sizes (there are 180 small, 73 medium and 37 large firms). We compare the performance of domestic and internationalized firms – namely exporters, two-way traders (i.e., both exporter and importers), two-way traders with an internationally recognized quality certifications, high intensity two-way traders (two-way traders exporting and importing more than 50% of their total sales) and multinational firms.¹⁸ Among the internationalization categories, the certified two-way traders and high intensity two-way traders are more likely to capture deeper forms of global value chain participation, but unluckily their number is limited in our sample.

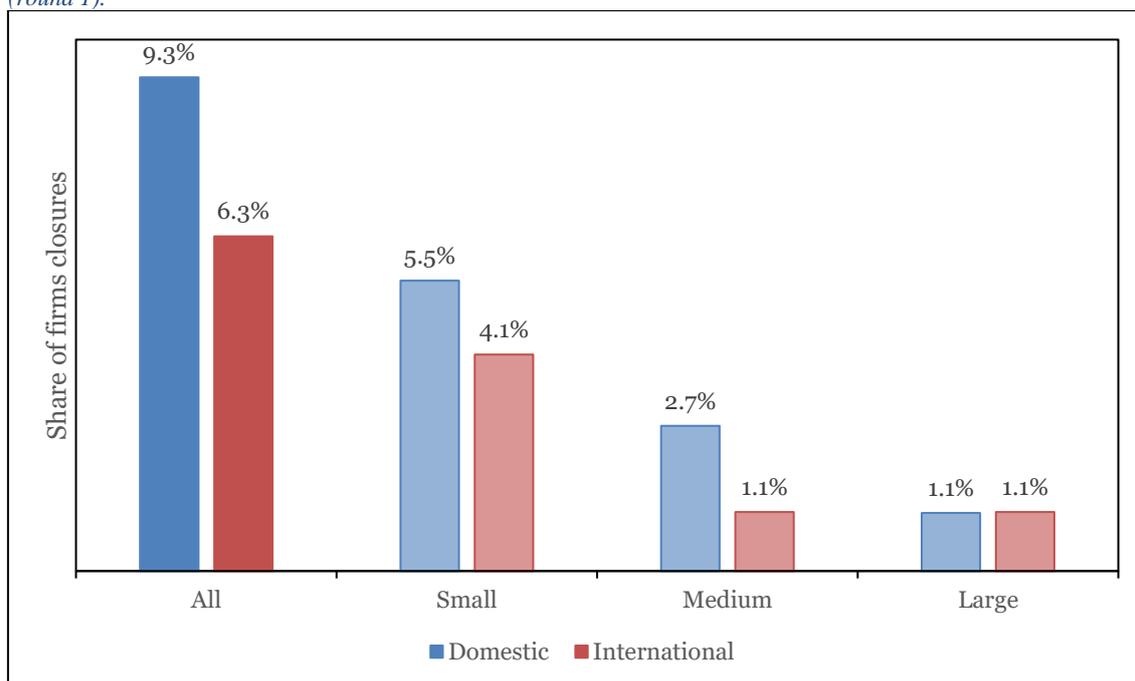
Figure 13 below shows the percentage of firms that reported to have permanently closed due to the pandemic when interviewed in round 1. A relatively high percentage of domestic firms closed permanently (9.29%), while the share is lower for internationalized firms (6.30%); as predicted by the literature, size seems to play an important role: the share of small firms that closed down is substantially higher than that of medium and large firms.¹⁹

¹⁷ Some important information is missing in this dataset, such as which and where are the firms' trade partners, with how many markets firm trade or whether the Italian firms own affiliates abroad.

¹⁸ Generally, foreign ownership of at least 10 % qualifies a firm to be considered a multinational (Taglioni and Winkler, 2016).

¹⁹ This result is in line with findings by the Istat (2021): small firms (3-9) are those being at risk of closure and that suffered the largest turnover losses in all the different sectors (manufacturing, services, constructions (fig. 31.1 pag. 76).

Figure 13. Percentage of international and domestic firms' closure due to the Covid-19 pandemic in Italy, by size (round 1).



Source: authors' elaborations on WBES.

Table 1. The impact of Covid-19 on Italian firms' changes in sales by mode of internationalization (shares of firms).

	<-30%		<-50% (median)		Number of firms
	Round 1	Round 2	Round 1	Round 2	
Domestic	77.10%	53.51%	61.07%	33.33%	290
Exporter	66.94%	40.00%	44.35%	13.33%	268
Two-way trader	71.80%	34.15%	44.58%	13.41%	179
Certified two-way trader	70.67%	33.78%	41.33%	10.81%	164
High-intensity two-way	58.82%	17.65%	33.33%	5.88%	33
Foreign owned	61.54%	6.25%	38.46%	0%	57

Source: authors' elaborations on WBES.

More internationalized firms perform better also when we consider the percentage of firms reporting reductions in sales during the pandemic outbreak. In Table 1 above, we report firms experiencing a reduction over 30% and above the median (here 50%) in round 1 and in round 2.²⁰ In both rounds domestic firms suffered more than international firms, with more than 77% reporting a reduction in sales above 30% and 61% above 50% in June. On the contrary, the respective shares for high-intensity two-way traders, for instance, are the 58.82% and the 33.33%.²¹ During the second wave, as

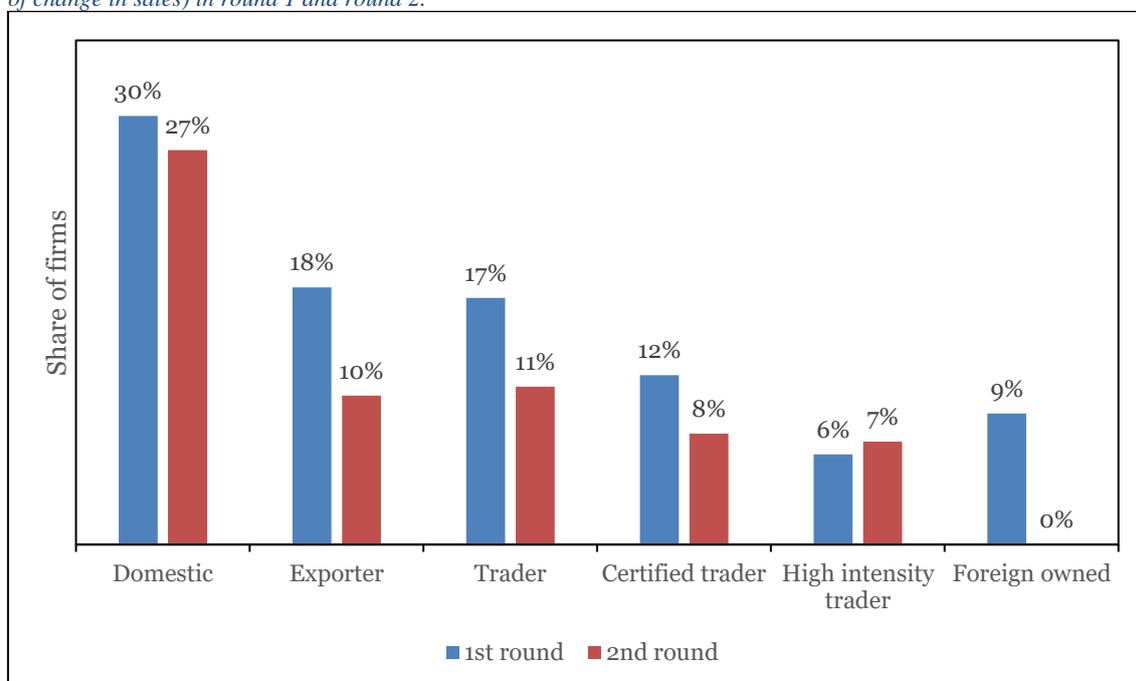
²⁰ The threshold of -30% of sales (with respect to 2019) is of particular interest for Italian firms because, as specified in the dL Sostegni (n.41/2021), is the upper bound under which firms have the right to be provided with a compensation.

²¹ Our results from Table # mirror quite well the tendency that emerges from the report "Le imprese esportatrici durante l'emergenza sanitaria ed economica" (Istat, 2020). In fact, Istat also analyses the differential impact of Covid19 on domestic and exporting firms and find for instance, that the 54.2% of non-exporting firms report a reduction in sales over -50%, against 48.1% of exporting firms and 29.8% of foreign controlled firms. Istat (2021) reports losses above

firms were more prepared to face the new situation, those reporting losses are fewer in all categories, but again internationalized firms sales had lower reductions, independently on their internationalization mode.

The same pattern holds also if we look at the highest losses reported by firms (i.e., the bottom quartile of the distribution of firms by sales losses, with changes in sales between -71% and -100%). Figure 14 shows the share of firms reporting a decrease in sales that falls in the 4th quartile of the distribution: in June, almost 30% of domestic firms reported reductions in this class against, for instance, 6.25% of high intensity two-way traders. The pattern repeats also in the second round, with 27.37% of domestic firms against 10.34% of exporters or 10.96% of traders.

Figure 14. Share of Italian firms suffering extreme sales reductions across modes of internationalization (4th quartile of change in sales) in round 1 and round 2.



Source: authors' elaborations on WBES.

This descriptive evidence is partly driven by the fact that, as widely discussed in the literature, internationalized firms tend to be larger and more productive, or to be more concentrated in some sectors. To control for these potential factors, we run some explorative regressions on the probability of experiencing reductions in sales conditional on the internationalization mode and controlling for the size of firms (proxied by number

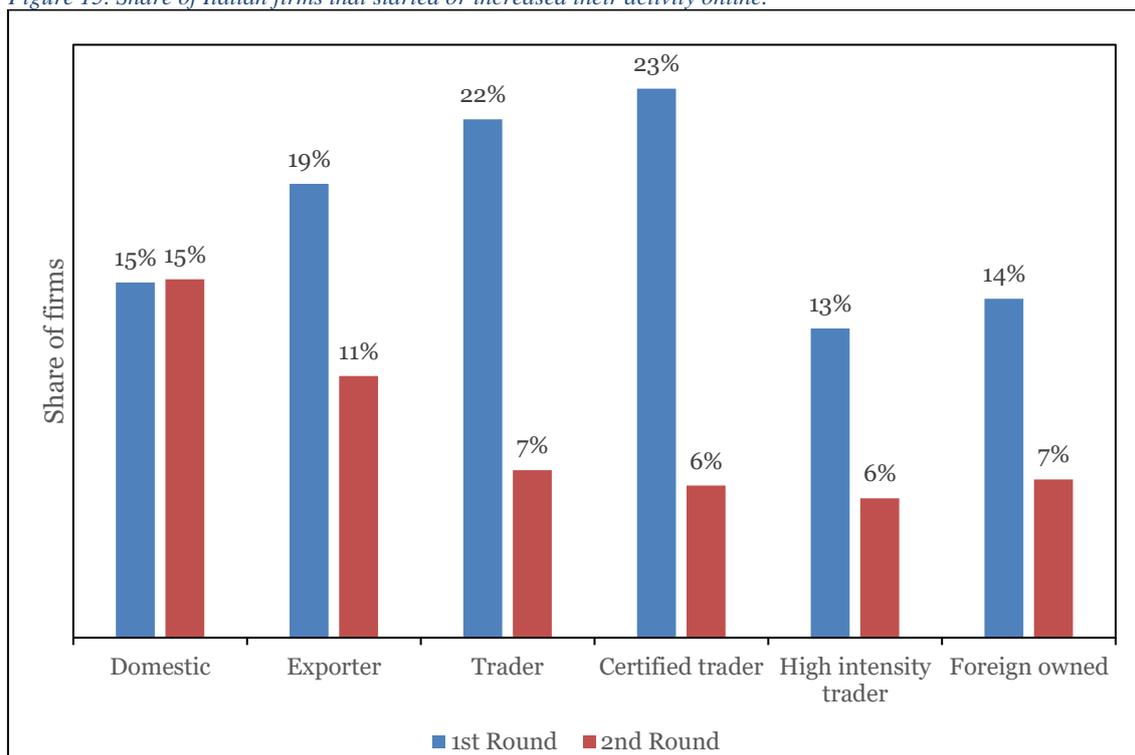
10% and results are in lines with ours; indeed, the report highlights how advanced forms of internationalization, especially being part of a multinational group, produced a mitigating effect on sales reduction.

of employees or classes of size) and sector.²² Estimation results point to the same direction of the descriptive analysis: being an internationalized firm is associated with a lower probability of reporting a reduction of sales above 30%, with coefficients being always positive for all modes of internationalization and statistically significant for almost all categories (significance varies from p-value<10% for exporters to <1% for foreign owned firms), for instance, the status of trader is associated with a conditional probability of around -12/13% of reporting a reduction in sales above -30%, whereas being a domestic firm appear to be positively correlated, although not significantly, with a high reduction in sales. It has to be noted though that these results hold only for changes in sales reported in round 2 (second wave), whereas internationalization turns out to be not significant for decrease in sales reported in round 1 (first wave), suggesting probably that being international worked as shield against reduction in sales only after the first wave.

A potential, preliminary explanation of the better performances and resilience by more internationalized firms could be their readiness and reactivity to adapt to changes. The blue bars in Figure 15, from round 1 of the WBES (i.e., from interviews conducted until June 2020), show for instance that more internationalized firms were relatively more rapid than domestic firms in starting or increasing their business online as a response to Covid-19, while only a small proportion of them started in round 2. Interestingly, if domestic firms were slower in round 1 in bringing parts of their business online, they seem to have been able to partially catch up with their more internationalized counterpart in round 2 (colored in red).

²² The controls for size and sectors are introduced separately in different specifications due to the limited number of observations. For the same reason, we preferred to report here the results from linear probability estimations. As a check we also run logit regressions, with consistent results. Results are reported in Table A4.1 and A4.2 in the Appendix.

Figure 15. Share of Italian firms that started or increased their activity online.



Note: For firms' numerosity see Table 1 above.

Source: authors' elaborations on WBES.

An important signal for firms' capacity to adapt to changes due to the Covid.19 pandemic is the ability to switch to smart working. Using the available data, we run some regressions and report graphically the average marginal effects of the internationalization modes in Figure 16.²³ All regressions follow a logit specification, where the binary outcome variable takes the value of 1 if the firm has started or increase remote work arrangements for its workforce after the pandemic outbreak. To prevent our results to be driven by firms' dimension, in all the regressions we insert a dummy variable for large firms (100 or more employees); moreover, we add sectors fixed effects to control also for the differences in firms' outcome between manufacturing and services sectors, and heteroskedasticity-robust standard errors.²⁴

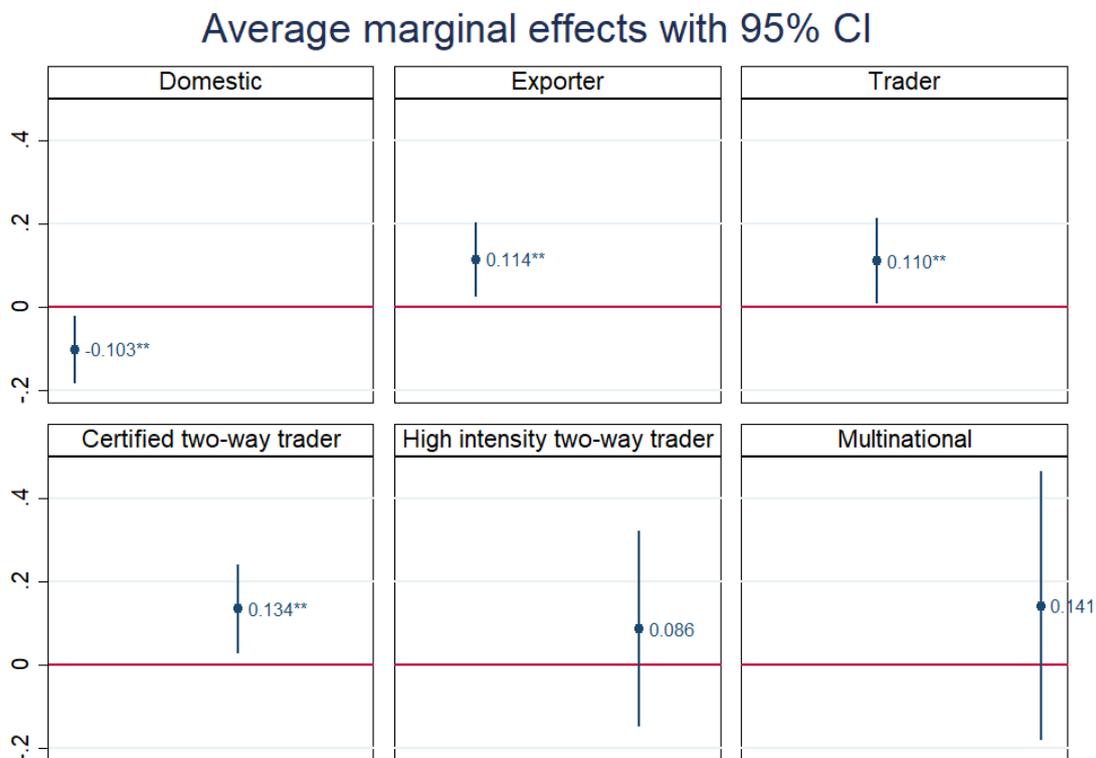
The plots show that more internationalized firms (in almost all specifications) are more likely to have resorted to strategies to implement remote working during the pandemic outbreak than domestic firms, the only category with a negative effect. Given the low number of available observations, the scarcity of controls and the fact that we are still in the eye of the storm, we are far from claiming any causal relationship and that these

²³ Regressions reporting the log of odd ratios are in Table A4.3 in the Appendix.

²⁴ We also use the number of employees' variable for comparison with the previous regressions. Results are confirmed, but the significance in some regressions is at 10% instead of 5%. Results are available on request.

results have to be intended more as conditional probabilities; in any case, they can work as preliminary suggestions useful to support the evidence provided above.²⁵

Figure 16. Average marginal effects of internationalization modes on the probability of smart working.



Source: authors' elaborations on WBES.

6 Conclusion

The current crisis is very different than previous ones and the global economic environment has changed significantly since the GFC. This paper has shown that the impact of Covid-19 has so far been different from that of the GFC. Specifically, the strength of the crisis was greater in terms of trade and GDP; the sectors most affected were different, with stronger impacts on face-to-face intensive service sectors which were sheltered in the GFC; and, while GVCs have been procyclical for many years, therefore amplifying the episodes of crisis, this time they seem to have contributed to mitigate the negative effects of the Covid-19 shock.

²⁵ This faster reactiveness we impute to more internationalized firms has been detected also by the Istat report (2020); indeed, they find that over 75% of exporting firms have formulated reaction strategies to the shock, against the 60% of non-exporters. Among these strategies, 14.2% of exporting firms report to have started digital acceleration programs against the 4.5% of non-exporters.

We highlight the importance of positioning and timing in determining the way in which countries and firms are affected by the current shock. Economies that are in a more forward position in GVCs experienced overall weaker negative effects. The relation between GVC participation and the Covid-19 shock, however, seems to depend crucially on the timing of the pandemic. High GVC-participation countries suffered relatively more from the shock in the first wave of the pandemic, but less in the second, experiencing a greater rebound than less integrated countries. Overall, GVCs participation enhanced resilience and acted as a shelter, allowing more integrated economies to benefit from a faster recovery.

Similar results emerge from the analysis of the impacts on Italian firms. For instance, firms operating in sectors more involved in GVCs and with higher export intensity tended to suffer less; and, consistently, more internationalized firms experienced lower reductions in sales. Moreover, these effects become even stronger in the second round of the survey.

The consistency of our findings at the macro and micro level, suggests that the relationship observed between GVCs and the Covid-19 shock is probably a general feature of the current crisis and is therefore likely to apply either between countries as well as within countries. If this is true, the main mechanism has to do with firms' characteristics and behavior within GVCs.

When investigating, with the available data, the specific actions that firms can undertake to offset the shock and try to transform it in an opportunity, we see, for instance, that moving to smart or remote working, and increasing online activity may represent a valid option. We observe that internationalized firms tended to react faster and to adopt new strategies to remain in the market. This result is in line with the growing literature on firms' heterogeneity, which suggests that internationalized firms are more productive, larger, and more resilient.

The implications of our findings are twofold. First, as a more general point, GVCs do not necessarily operate as shock multipliers as they can contribute to risk management through appropriate diversification. From this perspective, domestic firms are much more exposed to specific shocks occurring to the national economy and have no instruments to mitigate them domestically. Inward oriented or protectionist policies, by hampering risk diversification, might be counterproductive exactly for those firms and workers that they intend to protect. Second, although GVCs provide sheltering effects per se, nonetheless part of the higher reactivity and resilience of GVC-firms must be attributed to their ex-ante characteristics. Policies to foster internationalization and

integration in GVCs may therefore help individual firms to develop such characteristics and become more resilient.

In summary, our result support the idea that promoting a sustainable GVC participation can yield benefits in terms of resilience both from a systemic perspective, related to risk management and diversification opportunities within GVCs, as well as from an individual firm perspective, since internationalized firms tend to adapt better and faster to shocks.

It is important to note that such a result does not imply that increasing GVCs participation is beneficial in any situation, as the lessons from the GFC and other crises show. What seems to matter, in fact, are the type of participation, the quality of the international linkages as well as the balance between intensive and extensive margins, or between short-run technical efficiency, e.g., focusing on the single “most cost-efficient supplier”, and long-run risk management, e.g., sourcing from and selling to multiple reliable partners (Mirodout, 2020) Also, the type of governance and the role of firms within specific supply chains are likely to matter as arm’s length trade of standardized products based on pure cost-price motives is possibly more fragile than deeper relational linkages with a greater specific-investment component in which firms cooperate to realize more complex products (Gereffi, 2021). Of course, the type of contract firms have with suppliers or buyers also matters as does the complexity of the intermediate inputs bought or sold. Attitudes and policies towards GVC should embrace this complexity and focus on a set of multifaceted factors.

Lastly, our work also contributes to the recent debate on regionalization of GVCs and reshoring.²⁶ Although GVCs may have initially contributed to transmission, they did not increase fragility, but rather enhanced the reaction to the Covid-19 shock. In line with this results, other studies have found that, despite few notable cases, reshoring is, for the moment, not a widespread phenomenon but rather a very minor one (Giovannetti et al., 2020). Based on these findings, the current debate in favor of reshoring does not seem grounded on evidence, but rather on strategic and political considerations. While these considerations are fully legitimate and surely relevant in a debate that goes beyond a pure economic perspective, it should be made clear that GVCs proved to be more resilient than many expected and that reducing international integration might actually hamper countries’ and firms’ capability to deal with negative shocks.

²⁶ The debate goes beyond the specialized literature cited throughout the paper. See, for instance, The Economist “*Is a wave of supply-chain reshoring around the corner?*” (Dec. 16th, 2020) or The Financial Times “*Coronavirus-induced ‘reshoring’ is not happening*” (Sep. 20th, 2020).

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Appendix

A1. Country codes and names

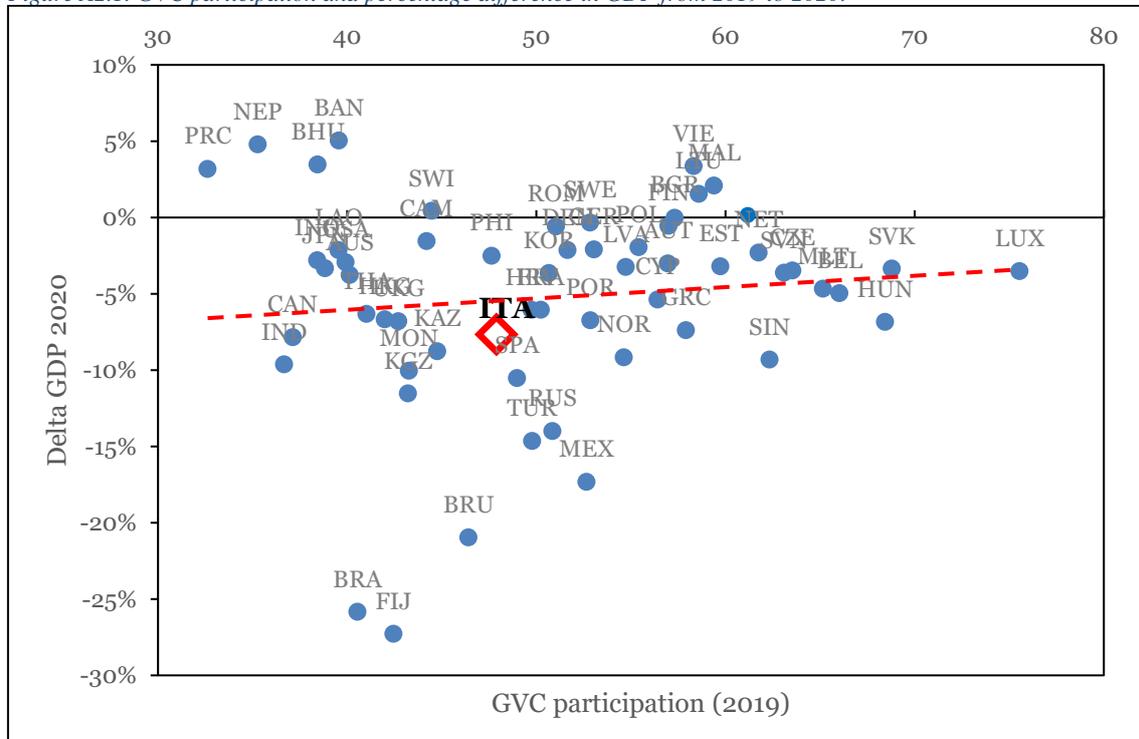
Table A1.1. Countries included in the macroeconomic analysis

Country Code	Country Name	Country Code	Country Name
AUS	Australia	LAO	Lao P.D.R.
AUT	Austria	LTU	Lithuania
BAN	Bangladesh	LUX	Luxembourg
BEL	Belgium	LVA	Latvia
BGR	Bulgaria	MAL	Mali
BHU	Bhutan	MEX	Mexico
BRA	Brazil	MLT	Malta
BRU	Brunei	MON	Montenegro
CAM	Cambodia	NEP	Nepal
CAN	Canada	NET	Netherlands
CYP	Cyprus	NOR	Norway
CZE	Czech Republic	PHI	Philippines
DEN	Denmark	POL	Poland
EST	Estonia	POR	Portugal
FIJ	Fiji	PRC	China
FIN	Finland	ROM	Romania
FRA	France	RUS	Russia
GER	Germany	SIN	Singapore
GRC	Greece	SPA	Spain
HRV	Croatia	SVK	Slovak Republic
HUN	Hungary	SVN	Slovenia
IND	India	SWE	Sweden
INO	Indonesia	SWI	Switzerland
IRE	Ireland	THA	Thailand
ITA	Italy	TUR	Turkey
JPN	Japan	UKG	United Kingdom
KAZ	Kazakhstan	USA	United States
KGZ	Kyrgyz Republic	VIE	Vietnam
KOR	Korea		

A2. GVC participation and Δ GDP

Besides looking at the correlation between GVC participation and the Covid-19 shock computed as the revision in IMF projection for GDP in 2020 (results are shown in Figure 3), we investigated the correlation of the first with the percentage difference in GDP from 2019 and 2020 (Figure A2.1). Our findings are very similar to the ones reported above: there exists a slight positive correlation between the two variables. As with the Covid-19 shock measure, it implies that more integrated countries have suffered a minor loss of GDP from 2019 to 2020. However, as explained in the paper, the use of our Covid-19 shock proxy is preferable as more likely to capture the true consequences of the crisis rather than pre-existing country specific trends.

Figure A2.1. GVC participation and percentage difference in GDP from 2019 to 2020.



Source: authors elaborations on ADB and WEO-IMF data.

A3. Covid-19 and CO2 emissions: descriptive statistics

Table A3.1. Descriptive statistics on Covid-19 cases and CO2 emissions.

Variable	Obs	Mean	Std. Dev.
Daily Covid-19 new cases	23115	3314.03	13646.42
CO2 emissions	23115	0.27	1.13

Note: CO2 emissions are measured as megatons per day (MTCO2/day). As reported by Le Quéré et al., (2020), at their peak in early April 2020, daily global CO2 emissions decreased by 19% compared with the mean 2019 levels. At their peak, emissions in individual countries decreased by 27% on average.

Source: Integrated Carbon Observation System (ICOS) and Johns Hopkins Coronavirus Resource Center.

A4. Regression results

To investigate deeper the relationship between internationalization and firms' performance during the pandemic, we run some preliminary regressions on the probability of reporting a reduction in sales larger than 30% compared to firms' sales from December 2019. We choose the 30% threshold for policy reasons; indeed, this is the threshold under which firms are entitled to receive subsidies from the Italian government, as stated in the dL Sostegni (n.41/2021). To control for the fact that internationalized firms tend to be larger and more productive, or to be more concentrated in some sectors, as suggested by the literature, we insert among the covariates alternatively the number of full-time employees and sector fixed effects (respectively in Table A4.1 and Table A4.2). Results point in the same direction as the ones reported in the main text: more internationalized firms show a lower probability of reporting a reduction in sales.

Note that data availability prevents the simultaneous inclusion of sector fixed effects and firms' size (number of employees or dummies by size categories): although the signs and size of coefficients hold, they become statistically not significant; we attribute this to the low number of observations. In Table A4.3, where we the data allow us to have more than 100 additional observations, most of the coefficients remain significant when we introduce both controls simultaneously.

Table A4.1. Regressions on sales; control for employment; Italian firms.

VARIABLES	(1) Reduction <-30%	(2) Reduction <-30%	(3) Reduction <-30%	(4) Reduction <-30%	(5) Reduction <-30%	(6) Reduction <-30%
Domestic	0.0609 (0.0597)					
N of employees	-0.0005*** (0.0002)	-0.0005*** (0.0002)	-0.0005*** (0.0001)	-0.0005*** (0.0002)	-0.0005*** (0.0001)	-0.0004*** (0.0001)
Exporter		-0.0949* (0.0571)				
Two-way trader			-0.1376** (0.0632)			
High intensity two-way trader				-0.2391** (0.1022)		
Certified trader					-0.1312** (0.0656)	
Foreign owned						-0.3525*** (0.0757)
Constant	0.4895*** (0.0395)	0.5506*** (0.0378)	0.5434*** (0.0336)	0.5218*** (0.0309)	0.5384*** (0.0331)	0.5229*** (0.0306)
Observations	315	315	315	315	315	315
R-squared	0.0339	0.0391	0.0444	0.0418	0.0422	0.0530

In all regressions, the dependent variable is a dummy that takes the value of 1 if the firm reports a change in sales over -30%, 0 otherwise. In all six regressions, to control for firms' size we include the number of their permanent full-time employees as covariate. Regressions are robust also to the inclusion of a dummy for large firms (100 or more workers), instead of the number of employees. Heteroskedasticity-robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A4.2. Regressions on sales; sector-level controls; Italian firms.

VARIABLES	(1) Reduction <-30%	(2) Reduction <-30%	(3) Reduction <-30%	(4) Reduction <-30%	(5) Reduction <-30%	(6) Reduction <-30%
Domestic	0.0003 (0.0632)					
Exporter		-0.0364 (0.0621)				
Two-way trader			-0.1220* (0.0671)			
High intensity two-way trader				-0.2872*** (0.1020)		
Certified trader					-0.1061 (0.0675)	
Foreign owned						-0.3930*** (0.0550)
Constant	0.4254*** (0.0805)	0.4426*** (0.0796)	0.4437*** (0.0749)	0.4255*** (0.0740)	0.4413*** (0.0749)	0.4339*** (0.0735)
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	316	316	316	316	316	316
R-squared	0.1033	0.1043	0.1130	0.1182	0.1104	0.1315

In all regressions, the dependent variable is a dummy that takes the value of 1 if the firm reports a change in sales over -30%, 0 otherwise. In all six regressions, we include sector fixed effects. Heteroskedasticity-robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A4.3. Remote working: Italian firms.

VARIABLES	(1) Smart working	(2) Smart working	(3) Smart working	(4) Smart working	(5) Smart working	(6) Smart working
Domestic	-0.5391** (0.2208)					
Large	1.9004*** (0.2987)	1.8485*** (0.3017)	1.8613*** (0.3024)	1.9887*** (0.2965)	1.8293*** (0.3022)	1.9353*** (0.2977)
Exporter		0.5920** (0.2420)				
Two-way trader			0.5705** (0.2764)			
High intensity two-way trader				0.4448 (0.6177)		
Certified trader					0.6976** (0.2897)	
Foreign Owned						0.7268 (0.8542)
Constant	-0.4798* (0.2913)	-1.0005*** (0.2934)	-0.8048*** (0.2729)	-0.7413*** (0.2666)	-0.8193*** (0.2749)	-0.7362*** (0.2678)
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	483	483	483	483	483	483

In all regressions, the dependent variable is a dummy that takes the value of 1 if the firm reports to have started or increase remote working arrangement for its workforce, 0 otherwise. In all six regressions, we include sector fixed effects. Regressions are robust also to the inclusion of the number of firms' employees, instead of the dummy for large firms (100 or more workers). Heteroskedasticity-robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1