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COLLANA DEL
DIPARTIMENTO DI ECONOMIA

GLOBAL VALUE CHAIN RESILIENCE AND RESHORING DURING COVID-19: CHALLENGES IN A POST-COVID WORLD

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ISSN 2279-6916 Working papers

(Dipartimento di Economia Università degli studi Roma Tre) (online)

Working Paper n° 271, 2022

I Working Papers del Dipartimento di Economia svolgono la funzione di divulgare tempestivamente, in forma definitiva o provvisoria, i risultati di ricerche scientifiche originali. La loro pubblicazione è soggetta all'approvazione del Comitato Scientifico.

Per ciascuna pubblicazione vengono soddisfatti gli obblighi previsti dall'art. l del D.L.L. 31.8.1945, n. 660 e successive modifiche.

Copie della presente pubblicazione possono essere richieste alla Redazione.

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Global Value Chain resilience and reshoring during Covid-19: challenges in a post-covid world

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Abstract

This paper provides an overview on the evolution of Global Value Chains (GVCs) and on how they were impacted by Covid-19. Evidence from recent studies on Italy shows that GVCs displayed a high degree of resilience, with GVC firms better equipped to face the covid-shock and suffering less in terms of closures and turnover. Moreover, reshoring and substitution of foreign suppliers with domestic ones were chosen only by a small minority of firms. GVCs will probably continue to characterize the world economy, but the uncertainty about the future developments remains high. The last part of the paper discusses the challenges and the possible GVC reconfigurations in a post-covid world.

Keywords: Global Value Chains, resilience, reshoring, Covid-19, Italy.

JEL: F140, F230, F600.

Acknowledgements: I thank Giorgia Giovannetti, Anna Giunta and Luca Salvatici for useful discussions and comments. I also thank Enrica Di Stefano, Simona Giglioli, Michele Mancini, Giulio Vannelli and Arianna Vivoli for the exchanges of ideas on our previous works together. I thank Beniamino Quintieri for supporting and promoting our research projects on GVCs in Italy. I thank Davide Castellani and the participants to the 2022 AIB-UKI conference in Reading (UK). Finally, I thank Katiuscia Lavoratori for her interest in my research and support in all the phases of this project. All errors are mine.

1 Introduction

Covid-19 hit the world at the beginning of 2020. The death toll was immense.[1] It was the biggest economic shock in over a decade, with severe negative impacts on world GDP and trade. Global Value Chains (GVCs) faced supply disruptions and bottlenecks. The fear of scarcity of medical supplies and other strategic goods fired a debate on export bans and reshoring, with the idea that global interconnectedness and exposure to shocks had become excessive. Despite the initial downturn, GVCs displayed an incredible level of resilience. Also thanks to massive fiscal and monetary policy interventions, global trade and GDP were unexpectedly fast to get back to their pre-covid levels with a V-shaped recovery. Yet, the pandemic signed a historical event that changed our perception of the world economy and its development, and posed crucial questions about the future of globalization. Moreover, Covid-19 was not alone as it was preceded by events like Brexit and the US-China trade war, which also crucially changed the international scenario, and it was followed by the outbreak of the war in Ukraine, which brought intensified geopolitical tensions, further GVC disruptions, and a renewed political attention towards securing energy supply and strategic goods. Against this backdrop, the challenges ahead are many, and a reconfiguration of GVCs seems underway.

This paper contributes to the debate on GVC resilience during Covid-19 and discusses some of the main challenges that firms will have to address in a post-covid world. The first part of the paper (Section 2) briefly tracks the evolution of GVCs in the last decades, highlighting how Covid-19 hit a world economy that had been in a slowing down phase for at least a decade. Firms were already dealing with slow growth and increased uncertainty; and Covid-19, despite its big impact, does not seem to have induced dramatic structural changes. The second part of the paper (Section 3) provides some evidence and discusses the impact of the covid-shock through GVCs for countries, sectors and firms. The empirical focus is on new firm-level data from Italy, the first western country to be hit by Covid-19. The analysis reviews the findings from recent studies carried out at different levels of analysis, showing how countries, sectors and firms more integrated into GVCs were initially hit more severely, but also recovered faster from the shock. GVCs, thus, played a dual role: on the one hand, they contributed to the international transmission of shocks, but, on the other hand, they facilitated the recovery thanks to diversification and fast reaction of GVC firms. During Covid-19, GVC firms and

[1] More than 500 million confirmed cases and 6 million deaths worldwide as of 28 June 2022, according to the WHO (https://covid19.who.int). Also thanks to GVCs and international cooperation, vaccine development has been incredibly rapid, with almost 12 billion doses administered as of 28 June 2022.

MNEs performed better than other firms in terms of sales and closures, and there is no evidence of substantial waves of covid-induced reshoring. The third part of the paper (Section 4) discusses some of the main challenges that firms and GVCs will have to face in a post-covid world. The crucial issues regard exposure to risk and diversification in order to increase resilience and robustness. GVCs may become more regionalized, but this does not need to happen at expense of diversification. GVC reconfiguration also poses a trade-off between security, e.g. reached through redundancy and inventory, and efficiency. Moreover, there is a fundamental difference between temporary and permanent shocks as well as between idiosyncratic and systemic shocks; and firms will have to find ways to manage the different types of risk. Finally, the conclusion (Section 5) stresses how firms will have to pursue new strategies to increase flexibility and agility, and how governments can play an important role in helping firms and GVCs to build resilience, especially at a higher systemic level, where individual incentives may be more lacking.

2 Hyperglobalization and slowbalization

The structural changes that have led the economy where it is today will be the basis for the reconfiguration of GVCs. Embedding the Covid-19 shock into a historical process allows to clarify in what phase of globalization the shock arrived and, in light of the long-run trends and structural changes, what further developments might be more likely in the future.

Since the second half of the 1980s and essentially up to the Great Financial Crisis (GFC) of 2008, the process of economic integration was so rapid and widespread that it has been called the era of hyperglobalization (Rodrik, 2011). The trade-to-GDP ratio went from about 20% in the 1990s to over 30% in 2007 (WTO data). GVC-related trade went from less than 40% to more than 50% of total trade (World Bank, 2020). Today, GVCs contribute to the vast majority of world trade.

Thanks to specialization, scale economies and knowledge spillovers, GVCs are generally regarded as positive contributors to productivity growth and development (Amiti & Konings, 2007; OECD, 2013; Pahl & Timmer, 2020). However, GVCs tend to be procyclical (di Stefano, 2021; Hoeckman, 2015). Interconnectedness also facilitates shock propagation depending on the type of shock (Acemoglu et al., 2016; Carvalho & Tahbaz-Salehi, 2019) and implies a greater degree of synchronization of economic activity between countries (Cigna et al., 2022; Gaillard & de Soyres, 2020). When the GFC hit the world economy in 2008, the propagation of the shock through GVCs was

fast, the collapse of trade was larger than that of GDP and, crucially, almost simultaneous across several countries, especially those more integrated into GVCs, leading to the 2009 "great trade collapse" (Baldwin, 2009). With the GFC, the hyperglobalization that led to the "Age of Global Value Chains" came to a halt (Antràs, 2020).

After the GFC, trade rapidly recovered to its pre-crisis level, but not to its pre-crisis trend. The world economy had entered a phase of slow globalization, or *slowbalization* (Antràs, 2020; The Economist, 2019). The post-GFC scenario was one of increased uncertainty. The World Uncertainty Index (WUI) increased by 100% between 2008 and the 2012 eurozone debt crisis (Ahir et al., 2022). Scepticism towards the benefits of globalization became increasingly relevant, with mounting calls for protectionist measures (Baldwin & Evenett, 2009).

The structural aspects that may have contributed to the slowdown include the shift to a new equilibrium, characterized by the integration of some emerging economies, primarily China (Constantinescu et al., 2020a), and the attainment of historically low tariffs making further liberalisation relatively difficult (Baldwin, 2016). Moreover, the new technological advances, such as robotization and 3D printing, were not distinctly trade-enhancing (Antràs, 2020; Laplume et al., 2016; Seric & Winkler, 2020a).

Since the GFC, other events contributed to casting doubt on the possibility that trade and GVCs could rapidly return to their previous trend. With the eurozone debt crisis, followed by Brexit and by the US-China trade war, the World Uncertainty Index further increased by another 50 percentage points between 2012 and 2016, i.e. it went from 100 to 200 and then to 250 between 2008, 2012 and 2016 (Ahir et al., 2022). In 2020, with the outbreak of Covid-19, the world economy had been characterized by high levels of uncertainty for about a decade. The pandemic, thus, not only was of a very different nature relative to the GFC, but it was also very different in timing as the GFC hit the economy after decades of hyperglobalization, while Covid-19 arrived after a decade of slowbalization.

3 The covid-shock on countries, sectors and firms

The impact of Covid-19 was unprecedented. In just two months since February 2020, world industrial production went down by 15% and world trade decreased by almost 17% (Giglioli et al., 2021, on CPB world trade Monitor data). The economic activity of some sectors had to be almost completely halted to contain the spread of the virus. The sudden interruption of international supplies caused severe bottlenecks to GVC activity, also creating enormous organizational strain to transport, shipments and logistics (Frohm et

al., 2021). Despite the strength of the shock, and although GVC disruptions are causing troubles still today at the time of writing (summer 2022), world production and trade demonstrated an incredible degree of resilience, with a very fast rebound back to pre-covid levels in just a few months. How GVCs were impacted, what was their role in the transmission of the shock, how they reacted, and whether and how they contributed to the rebound are crucial questions. In this section, we briefly review the main channels through which the covid-shock impacted GVCs by looking at countries, sectors and firms.

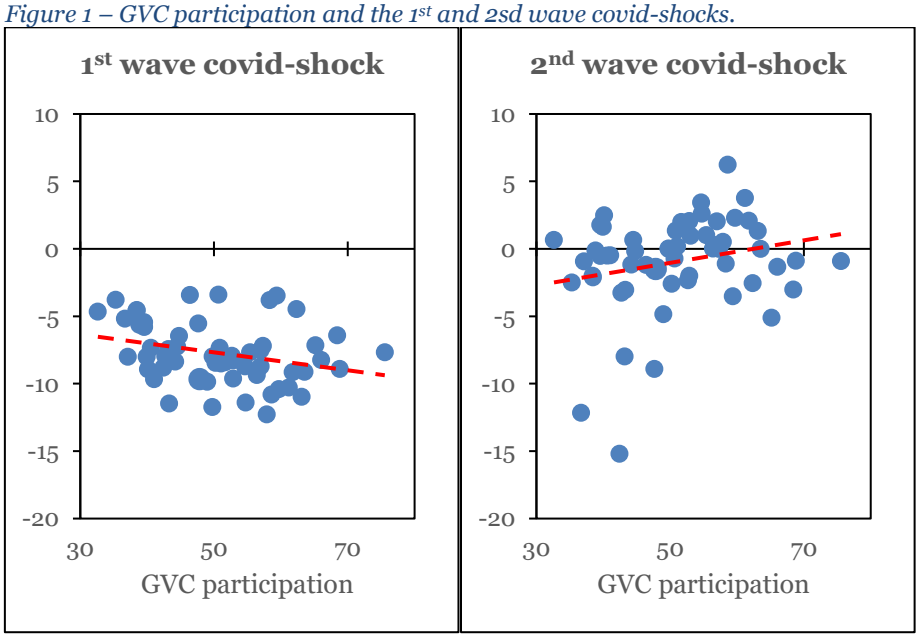
3.1 Country-level GVC participation and resilience

Countries participate in GVCs with different intensity and modality. We can investigate whether GVC participation is in fact related to the intensity of the economic downturn suffered by economies. To this end, we need a measure of GVC participation and a measure of the covid-induced economic downturn. A standard measure of aggregate GVC participation can be obtained from multi-regional input-output tables (Koopman et al., 2014). By tracking how value-added produced in different locations contributes to gross exported values, we have a precise way to measure GVC-related trade as the value of goods and services that are processed in at least two countries (Borin & Mancini, 2019). GVC participation represents the intensity with which countries participate in global production and is measured by GVC-related trade as a share of exports.[2] The second measure that we need regards the covid-induced economic downturn. Based on the idea that GDP growth forecast updates largely reflect the newly available information, and given that the Covid-19 outbreak was truly unexpected and exogenous, Giglioli et al. (2021) propose a simple way to proxy the covid-shock. In particular, they take the GDP growth forecast revisions by the IMF released in October 2019 (pre-covid), April 2020 (first wave of Covid-19), and October 2020 (second wave). Considering GVC participation and this measure of the covid-shock together is insightful (Figure 1). During the first wave of Covid-19, GDP growth forecasts were strongly revised downward across all countries. But, more importantly, there is a clear negative correlation between GDP growth forecast revisions and GVC participation: with the outbreak of Covid-19 and in the next few months, countries that were more integrated into GVC suffered more in terms of GDP. In other words, GVCs exposed countries to the covid-shock and acted as a transmission channel. During the second wave, however, the sign of the correlation flips: now higher GVC participation is associated with larger positive forecast revisions. That

[2] It is worth recalling that the GVC participation, although normalized for each country's exports, also tends to be negatively correlated with GDP.

is, during the second wave of Covid-19, countries more integrated into GVCs were also more likely to recover from the initial downturn. This is even more apparent if we consider the difference between the two waves, i.e. the rebound from the initial covid-shock, in relation to GVC participation (Figure 2). The clear positive correlation between the rebound and GVC participation is immediately suggestive of what we may call GVC resilience. Thus, the aggregate evidence shows that GVCs both (i) exposed countries to the covid-shock and acted as a transmission channel, and (ii) contributed to resilience and recovery of economies. All these results also hold when using actual GDP growth rather than forecast updates.

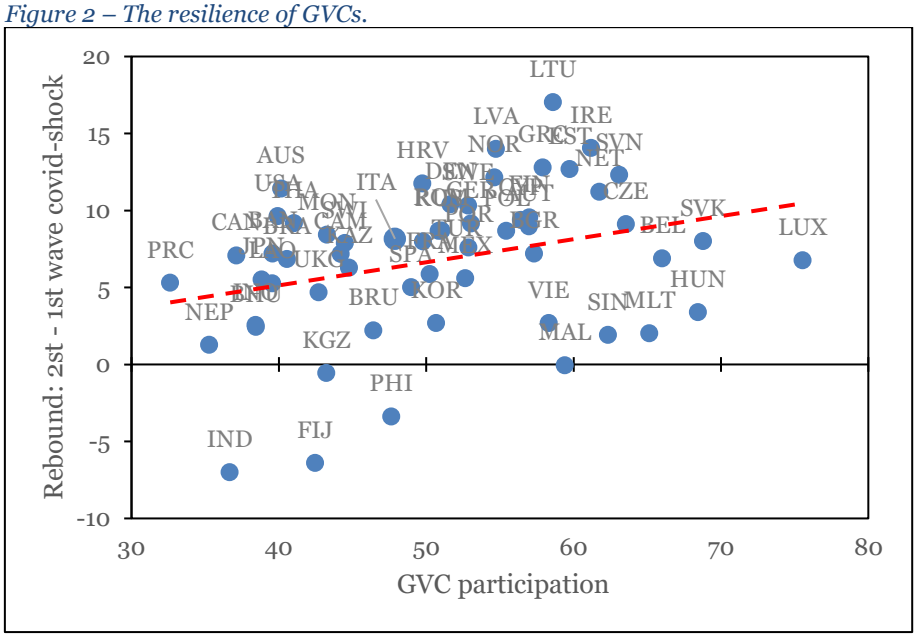
Figure 1 – GVC participation and the 1st and 2sd wave covid-shocks.



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: Giglioli et al. (2021) on ADB and WEO-IMF data.

Figure 2 – The resilience of GVCs.



Note: the rebound from covid-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: Giglioli et al. (2021) on ADB and WEO-IMF data.

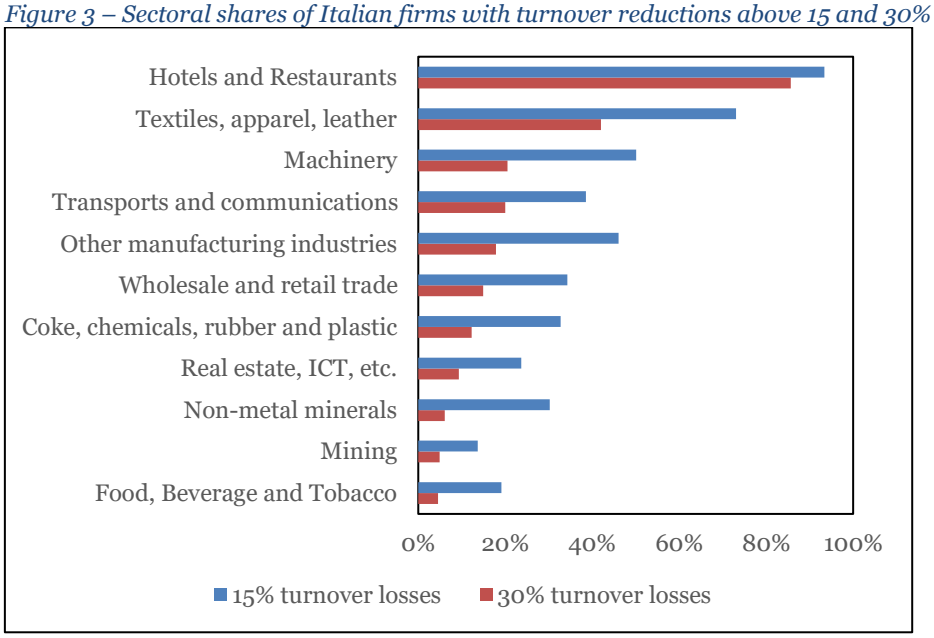
3.2 Sectoral heterogeneity

GVCs in different sectors present distinct characteristics. Covid-19 had differentiated effects on the various sectors in relation to the intensity of face-to-face interactions and other sectoral specificities. In discussing these impacts, as well as the impact on firms in the next subsection, we focus on Italy.[3] According to official statistics, the impact of the covid-shock on the Italian economy has been a GDP contraction of about 9%, a number aligned with the IMF growth forecast revisions reported in Figure 1 (Istat, 2021b). The Bank of Italy's Business Outlook Survey of Industrial and Service Firms shows very clearly how firms operating in different sectors suffered very heterogeneous turnover decreases (Giovannetti et al., 2020). In Figure 3, we see that large turnover reductions

[3] A few recent studies provide suggestive evidence for this country (Ayadi et al., 2021; Di Stefano et al., 2021; Giglioli et al., 2021, 2022; Giovannetti et al., 2020). Italy is among the top world exporters, its GVC participation is relatively high and has increased over time reaching almost 50%. Moreover, Italy was the first western country to be hit by Covid-19 and the first to introduce stringent restrictions on mobility. The first Covid-19 case was registered on the 17th of February 2020, and, by the end of March, many activities had been restricted. Between March and April 2020, Italian exports dropped by 45.8% and imports by 32.2% (Giglioli et al., 2022).

affected 9 out of 10 firms in face-to-face intensive service activities such as Hotels and Restaurants, but less than 2 out of 10 firms in essential industries as Food and Beverage. In general, differently than during the GFC, the covid-shock impacted the service sectors more severely than manufacturing; this is of course in part due to the fact that some services are more likely to rely on interpersonal interactions and some of them have been regarded as non-essential by policy measures. Other data sources confirm this sectoral evidence. For instance, data from the World Bank Enterprise Surveys (WBES) on Italian firms provide a similar sectoral ranking by turnover reductions. In Hotels and Restaurants, turnover decreased by 88.8% on average (round 1 of the survey was conducted in June 2020), while it decreased by 40.8% in Food and Beverages (Giglioli et al., 2021). Thus, some sectors saw simultaneously enormous and very widespread turnover reductions, while in other sectors average reductions were relatively smaller (but still large in absolute size) with very large ones concentrated among a minority of firms.

Figure 3 – Sectoral shares of Italian firms with turnover reductions above 15 and 30% in 2020.

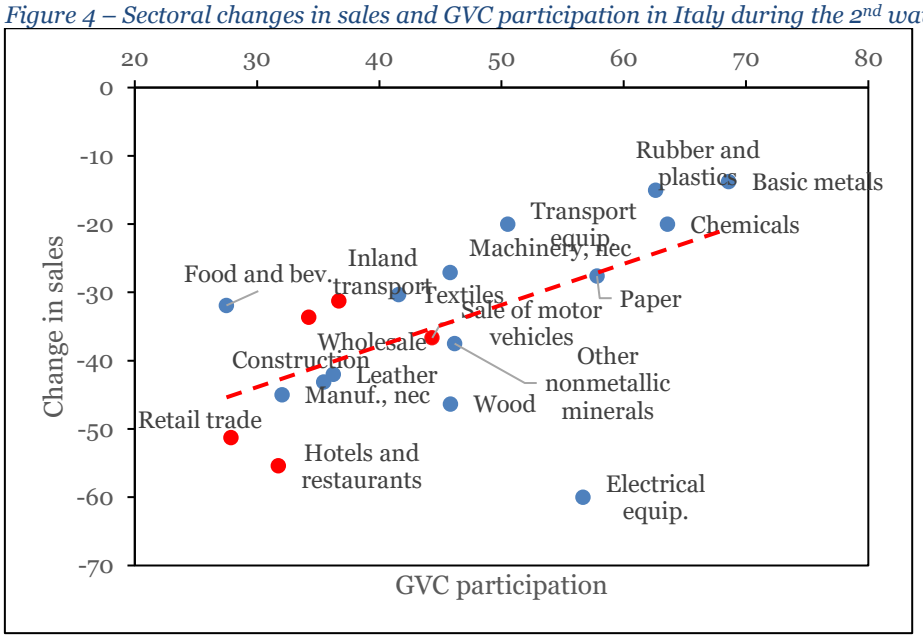


Source: Giovannetti et al. (2020) on Bank of Italy's Business Outlook Survey of Industrial and Service Firms.

Sectoral turnover reductions can be related to export intensity of firms or to GVC participation. From round 1 (June 2020) to round 2 (December 2020) of the surveys there is an increase in the correlation between sectoral turnover changes and either export as a share of turnover or sectoral GVC participation (Giglioli et al., 2021). In Figure 4, we clearly see that, also at the sectoral level, GVC participation is positively correlated with turnover growth during the second phase of Covid-19. Again, this finding

is suggestive of a certain degree of GVC resilience. The sectoral evidence adds elements of complexity to the analysis. Some sectors, mostly services, were hit more because of their intrinsic characteristics (i.e., higher face-to-face intensity and lower tradability). There is heterogeneity both in the intensive (size of turnover reductions) and the extensive (how widespread across firms) margin; and GVCs likely played an active role both in transmitting the shock as well as in contributing to resilience.

Figure 4 – Sectoral changes in sales and GVC participation in Italy during the 2nd wave.

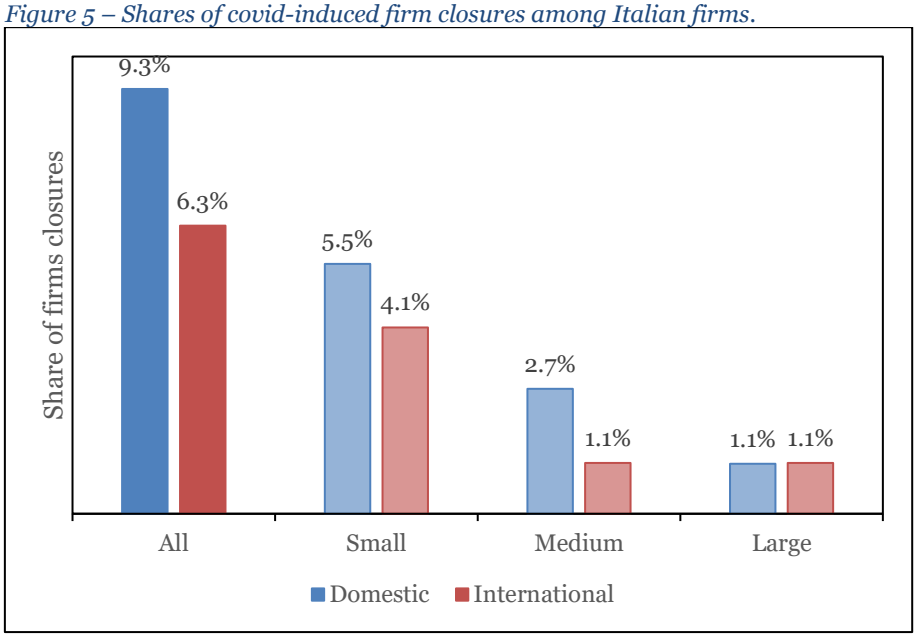


Source: Giglioli et al. (2021) on WBES and ADB.

3.3 Firms' reactions and reorganization of GVCs

Firms are heterogeneous even within narrow defined product categories, with larger and more productive firms more likely to operate internationally (Melitz, 2003; Wagner, 2012). This heterogeneity may lead to apparently counterintuitive results. In fact, larger and more productive firms, are not only more likely to be in a GVC, but they are also typically more innovative and more equipped to face negative shocks. Using the WBES, in Figure 5, we see that the likelihood of covid-induced closure (self-reported by surveyed firms) drops with the size of the firm. This evidence is confirmed also by other data sources (Istat, 2021a). Moreover, within each size category, except among large firms, internationalized firms are less likely to interrupt their activity because of Covid-19, even during the early phase of the pandemic.

Figure 5 – Shares of covid-induced firm closures among Italian firms.

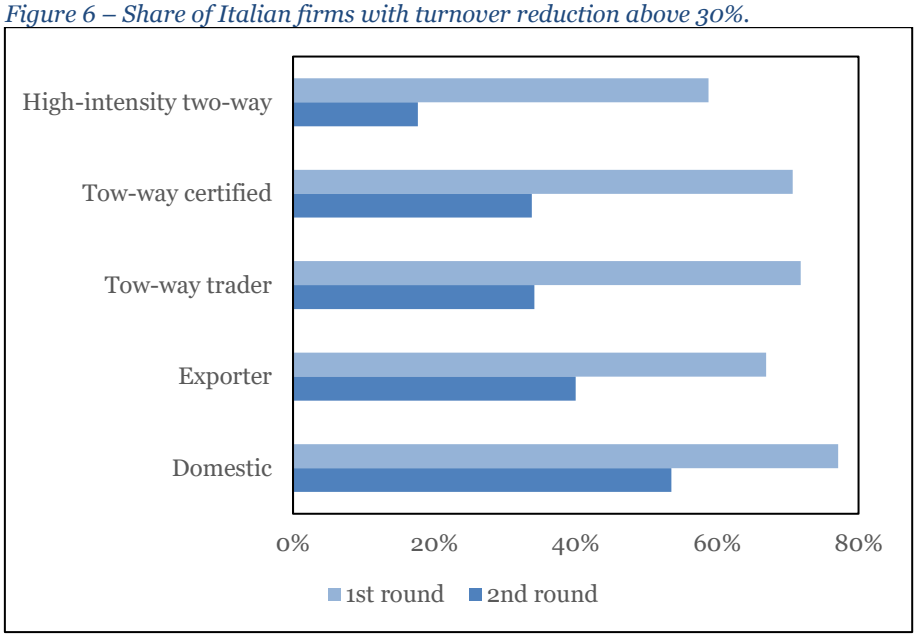


Note: Small: 5-19 employees; Medium; 20-99; Large: 100 and above. Internationalized firms are either exporters and/or importers.
Source: Giglioli et al. (2021) on WBES (round 1).

Figure 6 reports the shares of firms with large turnover losses (i.e. above 30%, which, according to the Italian law DL "sostegni" n. 41/2021, was the threshold to be eligible for compensation) by type of internationalization for the 1st and 2nd round of the WBES. During the early phase of the pandemic (1st round), the intensity of internationalization does not appear closely related to the probability to suffer turnover reductions; that is, internationalization did not shield firms. Considering that more internationalized firms also tend to be larger and more productive (for Italy see, e.g., Agostino et al., 2019; Giovannetti et al., 2015; Giovannetti & Marvasi, 2018), the fact that they did not perform better in the first wave is consistent with GVCs having facilitated shock propagation at the firm level. As we have seen from the sectoral and country-level findings, however, the figure changes during the second phase of the pandemic. In fact, in round 2 of the WBES, there is a clear ranking by internationalization intensity: more deeply internationalized firms are much less likely to register large turnover reductions. Importantly, this evidence holds also controlling for sector and other firm characteristics (Giglioli et al., 2021; Giovannetti et al., 2020). Again, these findings point towards a GVC-specific role both in the initial transmission of the shock as well as in the resilience of firms. Being a purely domestic firm is found to actually have exposed firms to domestic shocks; furthermore, being disconnected from the international market also provided fewer options once the foreign economies started to recover. The micro-level evidence adds one crucial element of complexity: the covid-shock through GVC participation is confounded

by the fact that GVC firms not only are more exposed to foreign shocks, but are also on average larger, more productive, and generally better equipped to face shocks.

Figure 6 – Share of Italian firms with turnover reduction above 30%.



Note: two-way traders are firms that both import and export. Two-way certified traders are those with an internationally recognized certification (e.g. ISO etc.). High-intensity refers to firms that export more than 50% of their turnover and directly import more than 50% of their intermediate products.
Source: Giovannetti & Marvasi (2022) on World Bank Enterprise Survey.

The idea that internationalized firms managed to cope better with Covid-19 is further corroborated by several other statistics (Giglioli et al., 2021, 2022). For instance, they were less likely to resort to wage integration measures, especially in round 2 of the WBES. Moreover, internationalized firms were faster to adapt and make use of smart or remote working: by June 2020 (WBES round 1) only about 30% of domestic firms declared to have started or increased the use of remote working, while more than 80% of deeply-internationalized firms (high-intensity two-way traders) had already made use of it. Similarly, in the early phase of the pandemic (WBES round 1), more internationalized firms were faster to resort to online activities such as e-commerce.

Importantly, the fact that GVC firms seem to have suffered less from the covid-shock overall, does not imply that they were lightly impacted nor that they needed not to take action in order to revise their internationalization strategies. Faced with disruptions, firms may have had to close foreign plants, switch to alternative suppliers or repatriate some activities. With the outbreak of Covid-19, even media and policy makers became rapidly concerned with exposure to foreign shocks, and many started to advocate for

reshoring or similar policies that could apparently reduce risks.[4] To this regard, the Bank of Italy's Business Outlook Survey of Industrial and Service Firms contains useful information.[5] Among Italian firms having production facilities abroad, more than 85% did not close foreign plants in the last three years nor intend to do so (Figure 7). Only 7% of multinationals actually closed foreign plants: 2.9% completely stopped foreign production, 2.6% reshored back to Italy, 1.5% moved to a different foreign location. That is, only very few multinationals chose to undo or drastically modify their internationalization patterns. In a recent paper, Di Stefano et al. (2021) investigate this evidence further, and rationalize it with a multiperiod theoretical model showing that high sunk costs are likely to be a major factor in determining the high degree of hysteresis or "stickiness" of GVC activity, especially against temporary shocks (Antràs, 2020). Considering external foreign suppliers as opposed to owned subsidiaries – the former typically entailing lower (sunk) fix costs and investment, thus being a more flexible strategy than direct foreign production – corroborates the evidence above. Among Italian firms having foreign suppliers, 90% did not reduce their numbers nor intend to do so; and only 3.8% substituted foreign suppliers with domestic ones (Figure 8). In line with the aggregate country and sectoral evidence, also from the firm-level perspective, GVCs show a high degree of robustness against shocks.

All in all, the available data suggest that GVC reconfigurations have not been massive, at least as an immediate reaction to Covid-19 alone. The covid-shock impacted and propagated along GVCs through several channels and in heterogenous ways. GVC firms had to face bottlenecks, policy changes, unexpected shifts in demand, and a high level of uncertainty while finding new ways to remain competitive. How GVCs will adapt to the new scenario and what challenges they will face in the future are open issues that we discuss in the next section.

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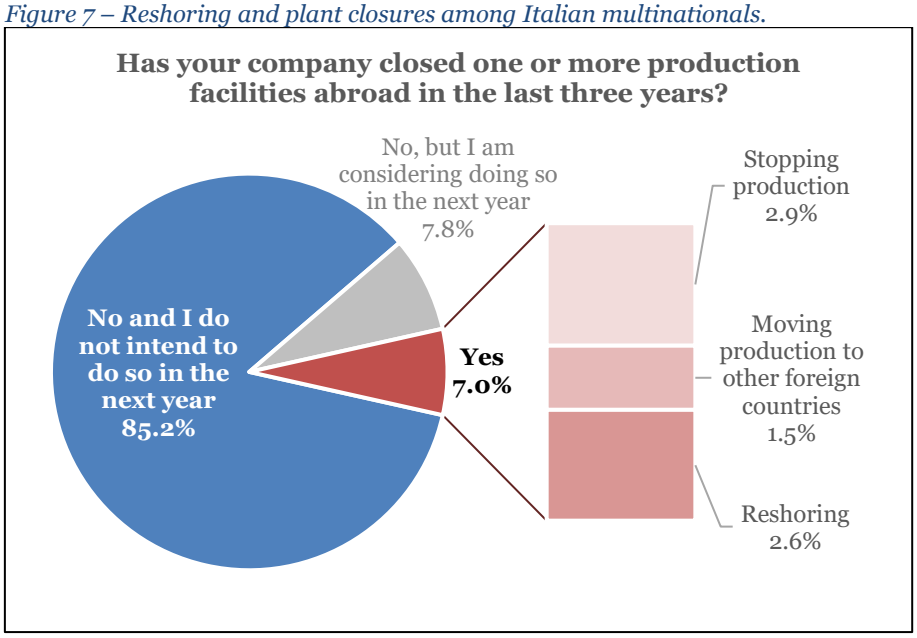
[4] The term reshoring has been used with slightly different meanings in different contexts. Reshoring can used in a strict sense to indicate the repatriation of foreign production activities (pure reshoring), or in a broad sense to indicate a general reorganization of international production including *backshoring* (moving production back home, i.e. pure reshoring), *nearshoring* (moving production closer to home) or *farshoring* (moving production farer from home). Moreover, the foreign activities involved may include owned subsidiaries or external suppliers. Recently, due to geopolitical tensions, the neologism *friendshoring* has been used to indicate the relocation of activities towards foreign countries with more stable geopolitical relationships with the home country.

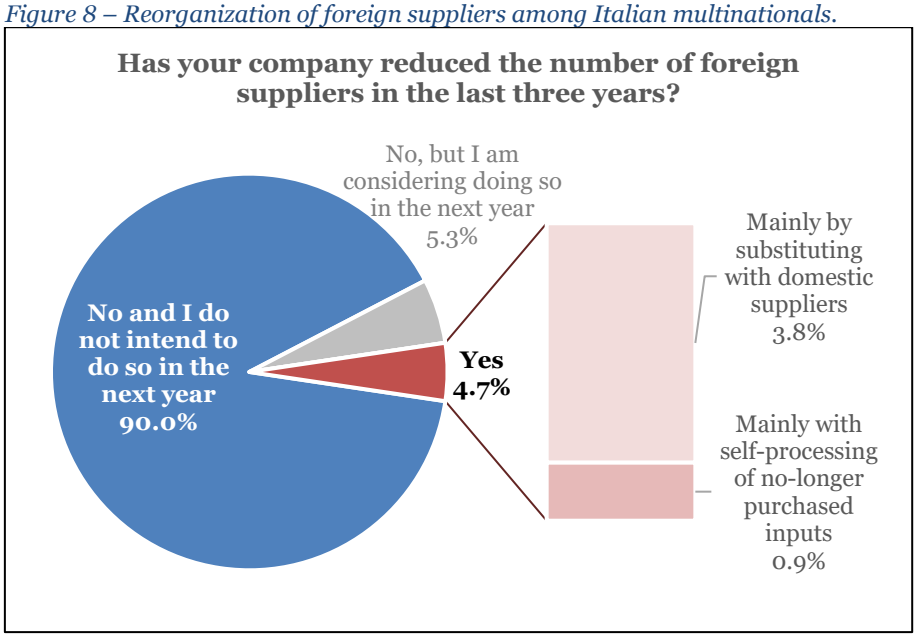
[5] The survey answers have been collected by Bank of Italy in spring 2021. The sample includes about 5,000 industrial and service firms with 20 or more employees, and is representative of the Italian economy. For detail see https://www.bancaditalia.it/pubblicazioni/indagine-imprese/index.html and https://www.bancaditalia.it/pubblicazioni/sondaggio-imprese/index.html.

Figure 7 – Reshoring and plant closures among Italian multinationals.



Source: adapted from Giovannetti et al. (2020) on Bank of Italy's Business Outlook Survey of Industrial and Service Firms.

Figure 8 – Reorganization of foreign suppliers among Italian multinationals.



Source: adapted from Giovannetti et al. (2020) on Bank of Italy's Business Outlook Survey of Industrial and Service Firms.

4 Challenges in a post-covid world

After a decade of slowbalization and increased uncertainty, Covid-19 was a major disruption that exposed risks and fragility of certain GVC configurations. Firms were severely challenged in their internationalization strategies, and responses could not be limited to minor adjustments, but rather required new levels of awareness regarding the risks and new approaches towards international competitiveness. In this section, we discuss the challenges for GVCs in a post-covid world. The main issue regards the opportunity to change current GVC configurations, which in turn depend on what kind of fragilities emerged and how well GVCs handled disruptions. The pandemic made clear that the degree of exposure to foreign shocks of firms and countries was very high and could have negative impacts on economic activity. Whether it was in fact too high, what could be done to reduce it, and at what cost are open issues.

4.1 Reducing Exposure

4.1.1 Diversification

Interconnectedness implies a certain degree of exposure to foreign shocks. However, the fragility of the entire system depends on the particular configuration of the network of bilateral relations (Acemoglu et al., 2012, 2016; Carvalho & Tahbaz-Salehi, 2019). With Covid-19, one crucial issue was the excessive reliance on and, thus, exposure towards specific suppliers and markets. China is the main example of this as, for instance, it provides about 25% of all the intermediate inputs used in high-tech exports of US, Japan, Korea and Mexico (Javorcik, 2020). During the early phase of Covid-19, between February and June 2020, French firms more exposed to the lockdown in China experienced larger sale reductions (Lafrogne-Joussier et al., 2022). In the Mediterranean area, countries with lower country-sector GVC diversification were exposed to larger average GDP contraction by their supply and demand partners (Ayadi et al., 2021). Greater diversification of suppliers and markets would allow spreading the risk across many partners to balance out specific idiosyncratic shocks (Unctad, 2020). Evidence from the impact of natural disasters shows the positive effects of diversification, and suggests that GVCs may in fact adjust in this direction: after the 2011 earthquake in Japan, the motor vehicle sector reacted by increasing diversification of suppliers (Matous & Todo, 2017). But diversification is costly as it entails a higher number of collaborations and larger coordination costs. The trade-off between exposure and diversification poses a challenge in terms of efficiency. Alternative suppliers may not be as productive or reliable, while having a few highly productive suppliers enhances economies of scale and

lowers coordination costs. Firms, thus, have clear economic incentives to limit the number of suppliers. Furthermore, individual firms may have limited information on the risks, which tilts their perceived incentives towards excessive exposure.

Effective diversification requires two elements: first, substitutability between suppliers must be high; second, shocks must not be positively correlated. Substitutability allows to switch from one supplier to the other. This is much easier when inputs are standardized, while for highly complex and customized inputs it can be hard and very costly to find alternative suppliers (IMF, 2022). Moreover, substitutability may imply a redundant replication of activities. Replicating segments of the supply chain in different geographical regions (e.g. double sourcing) obviously leads to a duplication of (fix and sunk) costs as well as lower exploitation of scale economies, with clear efficiency costs (Unctad, 2020). Furthermore, even when some degree of duplication or redundancy is feasible, it might not be enough to reduce exposure if the duplicated activities or the alternative suppliers share similar economic conditions making their shocks positively correlated. In this situation, the costs of diversification are not matched by the gains in terms of risk reduction. Therefore, even if diversification is a possibility, it requires a complex evaluation of efficiency versus redundancy. This is a challenge that GVC firms will have to address.

4.1.2 Resilience and robustness

Substitutability and redundancy both help reduce exposure but they have different implications on how they allow firms to respond to shocks. Substitutability allows to quickly respond, adapt and adjust when there is a shock. Redundancy allows to continue operations with only minimal adjustments and possibly no reconfiguration at all, since the alternatives are already there and ready to operate. Inventory stocks operate in a similar manner, and, in fact, also played a similar role during the pandemic. Firms with low inventories were more sensitive to input supply disruptions and suffered more relative to firms that could count on large inventory stocks (IMF, 2022). Not surprisingly, the covid-shock did not propagate because of low diversification by itself, but because the type of diversification revealed insufficient in terms of either substitutability or redundancy or inventory stocks. Among French firms, in the early phases of the pandemic, the shock propagation has been found to be stronger among firms with low levels of inventory, while substitution away from China was limited even among diversified firms (Lafrogne-Joussier et al., 2022). This evidence points towards a low degree of immediate substitutability among GVC suppliers, which is consistent with the idea that customized inputs and a strong degree of input specificity make the propagation

of idiosyncratic shocks through GVCs easier (Barrot & Sauvagnat, 2016). In more complex GVCs, redundancy and inventory stocks may thus be relatively more valuable, while in more standardized GVC substitutability could be more effective. These differences are embedded into the concepts of resilience and robustness used in the risk management literature. Resilience is the ability to quickly return to the normal level of operations after a disruption. Robustness is the capacity to maintain the level of operations throughout a crisis (Brandon-Jones et al., 2014; Miroudot, 2020a). Different types of GVCs are likely to present different combinations of resilience and robustness. International linkages characterized by a large specific investment and sunk cost, and by low substitutability, tend to make GVCs more robust and less responsive to environmental changes (Antràs, 2020; Constantinescu et al., 2020b). However, as seen above, the general evidence on how gross world trade and GVC-related trade reacted to the covid-shock shows that on aggregate GVCs have been incredibly resilient, collapsing in the early phase of the pandemics to quickly return to pre-pandemic levels within a few months. The challenge for GVCs is to find the right balance between resilience and robustness.

4.1.3 Regionalization

Regionalization aims at reducing exposure to geographically distant economies outside the home region. A more extreme way to reduce foreign exposure is through reshoring, that is by closing plants abroad and moving them back to the home economy or by shifting to domestic suppliers (Unctad, 2020). While the cost of regionalization primarily stems from the diminished productivity gains and learning possibilities as well as from the reduced possibility to exploit wage and production cost differentials between countries, the advantages include lower transport costs, easier coordination of GVC activities and possibly lower geopolitical uncertainty. Strongly regionalized GVCs imply less scope for diversification and substitutability between suppliers and markets either because the pool of potential partners is smaller or because shocks can be region specific, a possibility that seems more likely exactly when regions are more deeply integrated (Arriola et al., 2021). The costs of reshoring relative to regionalization extend to the complete loss of previously made specific investments and to the renunciation of any international spillover, while the additional benefits may include superior input quality and a “Made in” effect (Barbieri et al., 2020). With reshoring, the economy disconnects from foreign shock propagation through GVCs, while with regionalization foreign shocks can still be transmitted. One crucial difference is that while diversification is still possible under regionalization, reshoring provides protection from foreign shocks at the cost of

increasing the already high exposure towards domestic shocks. This is because there exists a "home bias" in the sourcing of intermediates, so that in practice greater diversification is typically obtained by sourcing more inputs from abroad, not less. Worldwide firms largely source intermediate inputs in the home economy, up to 82% in Western countries (Lan et al., 2022). Sectors that were hit more severely by the covid-shock such as hospitality, finance and health care, happen to also be those with the greatest room to diversify (IMF, 2022). Despite contributing to shock propagation, GVCs also provided diversification, reduced vulnerability and contributed to resilience when domestic production was disrupted (Eppinger et al., 2020; Espitia et al., 2022). In a world of reshoring where GVCs were renationalized, the GDP contraction would have been even larger than the observed one (Bonadio et al., 2020). Thus, while regionalization and reshoring might be possible ways to reconfigure GVCs, they are costly choices, and there is the danger of increasing risk exposure, rather than reducing it. Hence, a strong reversal of globalization is probably unlikely and undesirable. Yet some degree of regionalization and reshoring may be an option especially under long-run structural changes in the economic environment towards more uncertainty, more restrictive trade policies, lower wage differentials or diffusion of new less-trade-enhancing technologies such as 3D printing and robotization (Artuc et al., 2018, 2019; Dachs & Seric, 2019; Seric & Winkler, 2020b). Additive manufacturing and industry 4.0 technologies may reduce the benefits of locating in distant (low-cost) countries (Antràs, 2020; Laplume et al., 2016; Seric & Winkler, 2020a) and thus favour regionalization and reshoring (Castellani et al., 2022; Dachs et al., 2019; Gray et al., 2013; Hannibal & Knight, 2018).

4.2 Understanding the nature of shocks

4.2.1 Temporary and permanent shocks

Fix and sunk costs, and specific investments make GVCs sticky and less responsive to change (Antràs, 2020; Constantinescu et al., 2020b). History and past decisions matter and carry a weight onto current economic incentives. The incentive to undo previously made choices are low because the upfront costs have already been paid while changing the current patterns implies new additional investments. This makes the status quo relatively more appealing even against adverse shocks. Furthermore, in the presence of uncertainty firms may choose to postpone investment decisions (Constantinescu et al., 2020b). Trade policy uncertainty has been shown to have reduced US investment by about 1.5% in 2018 (Caldara et al., 2020) and led Chinese firms to reduce investment and

R&D expenditures, and make lower profits (Benguria et al., 2022). In evaluating the possibility to afford costly decisions that have an impact on future economic incentives, firms must carefully consider their time horizon. This implies that the nature and type of shocks are crucial. Temporary shocks can have long-lasting effects, but to trigger them they often need to be exceptionally large in magnitude. If the relevant time-horizon is long enough (and if the discount factor is not so big that future payoff is nearly irrelevant), temporary shocks may even not produce significant impacts at all. On the contrary, permanent shocks do not have to be particularly large to yield long-run implications, and small permanent shocks might be enough to induce behavioural changes. Firms are more likely to change their internationalization strategy if they perceive a shock as permanent, e.g. a long-lasting policy shift (Antràs, 2020). Even the anticipation of a permanent shock may be enough as, for instance, "tariff scares", that is threats to raise tariffs in the future, can reduce trade even if they never actually materialize (Crowley et al., 2018). Whether the covid-shock per se was or was perceived as permanent by GVC firms, and whether it was large enough, is ultimately an empirical issue. The shock has been obviously severe and long-lasting enough to spur some permanent effects for at least some firms, but it is unclear whether it had permanent effects on GVCs as a whole, given the high degree of resilience observed in the data. Evidence on manufacturing trade and output of French firms suggests that the shock has been largely perceived as temporary, at least in the early months of the pandemic (Lafrogne-Joussier et al., 2022). The average US and UK firm perceived more downside risk at the beginning of the pandemic, but by 2021 the upside risk started to dominate, i.e. firms began to be more concerned about facing a strong rebound in sales rather than a strong contraction; at the same time, however, dispersion of the distribution of one-year-ahead own-sales growth rate forecasts increased, reflecting heterogeneity of exposure and perception, with some firms more concerned with downside risk and others with upside risks (Bunn et al., 2021). Similar evidence that on average the perceived downside risk increased dramatically with the outbreak of Covid-19, but then the perception shifted towards upside risk, has been found among Italian firms as well (Fiori & Scoccianti, 2021). Because the impact and the response to temporary and permanent shocks can be very different, the challenge ahead for GVC firms is to understand what kind scenario is more likely in a post-covid world.

4.2.2 Idiosyncratic and systemic shocks

The actions aimed at mitigating risks from temporary and permanent shocks largely regard individual firms and their own cost and benefit trade-offs. A different challenge,

however, stems from the possible misalignment between individual incentives and systemic risk. Evaluating this issue requires a broader perspective. We stressed that diversification is not effective when shocks are positively correlated. Against exceptionally correlated shocks, or simultaneous ones or against a global shock, there is not much that individual firms can do. In this case, the issue is systemic and is hardly incorporated into individual incentives. Consider the case of many independent firms that unknowingly select and diversify across the same set of suppliers (e.g. the pool of suppliers might be limited) so that each supplier sells to all the buyers. From an individual perspective, this scenario is one of high diversification since buyers and suppliers are individually diversified. But this is not enough against systemic shocks, because, in this example, the network structure is such that a single shock to, say, one supplier impacts all the downstream buyers simultaneously. Moreover, if all the buyers try to substitute towards the same alternative supplier, it may be impossible to satisfy the demand spike, resulting in a big systemic disruption. While this is a very specific example, it illustrates well how firms' individual diversification can be ineffective when systemic factors are ignored. In the example, diversification is in fact effective against idiosyncratic disruptions of single buyer-supplier links, but not against disruptions of nodes (i.e. either buyers or suppliers with all their links). It is easy to imagine that with multiple tiers of suppliers, the complexity of the system and the information gap drastically increase. Automobile manufacturers have on average about 250 direct suppliers, but the number grows to 18,000 when indirect suppliers are included; similar evidence applies to aerospace and technological companies (Baumgartner et al., 2020). In complex networks as GVCs, disruptions can easily be magnified and there is a crucial difference between idiosyncratic and systemic shocks (Acemoglu et al., 2012, 2016; Barrot & Sauvagnat, 2016). GVC firms tend to be aware of idiosyncratic shocks that might affect specific sectors or single suppliers in given countries, and have a clear incentive to consider this information (Baldwin & Freeman, 2022). But individual firms ignore how all other firms are interconnected and cannot possibly internalize this systemic information; or they may lack the incentive to do so. The result is a misalignment between individual and social trade-offs, with asymmetric information causing firms to bear too much risk, a negative externality that increases exposure to systemic shocks. This is another challenge that GVCs will have to face in the years ahead. In this case, Governments may play a crucial role in closing the information gap and helping individual firms internalize systemic risk in order to make more strategic decisions (IMF, 2022).

5 Conclusion

This article provided an overview on GVC resilience during Covid-19 and discussed some of the challenges ahead. The future of globalization and GVCs remains unclear in a world increasingly characterized by VUCA (volatility, uncertainty, complexity and ambiguity) (Bennett & Lemoine, 2014; Tulder et al., 2019). The Covid-19 pandemic did not halt globalization, but it hit the world in a slowing down phase and probably accelerated some existing trends. GVCs demonstrated an incredible level of resilience; and GVC firms, despite being exposed to foreign shocks and having been severely hit, also proved to be the best at mitigating risks (Sheffi, 2015). Recent evidence shows that firms did not undo their international production networks; and reshoring (either of own subsidiaries or suppliers) was only chosen by a small minority of multinationals in the aftermath of Covid-19. Nonetheless, with the new geopolitical tensions brought about by the war in Ukraine, the possibility of a reinforcement of regional blocks does not look remote. Despite its great impact, Covid-19 was largely perceived as temporary; on the contrary, trade policy changes, the surge of inflation, and the last geopolitical developments are expected to have long-lasting effects which are very likely to induce firms to revise their internationalization strategies. Globalization is not going to end, but some reconfiguration of GVCs is underway. In the new type of globalization, security and resilience matter more than mere efficiency as businesses need to find reliable partners in countries linked by stable relationships. Firms and policy makers need to be aware of the situation, and carefully evaluate costs and benefits. The idea that resilience can be obtained by increasing the reliance on domestic production does not find support in the facts. The academic literature and the available evidence show that policy proposals to reduce the dependence on foreign suppliers are probably misguided (Baldwin & Freeman, 2022; IMF, 2022; Miroudot, 2020b). Redundancy and larger inventories are possible strategies, but also costly ones. Recent news report that the largest 3,000 firms globally have increased inventories from 6% to 9% of world GDP since 2016; and there is wide use of dual sourcing and longer-term contracts (The Economist, 2022). Firms should primarily point towards solutions that enhance flexibility and agility in order to mitigate risks with minimal efficiency losses. This is more likely to be attained through collaboration, also at the international level, rather than in isolation (Scholten & Schilder, 2015). Toyota, for instance, used a combination of actions to increase resilience: standardization of components allowed shared inventories, enhancing flexibility across sites; new technologies were used to build an integrated database of suppliers and components; reliance on single locations was reduced through regional diversification;

moreover, specialized single-source suppliers were asked to locally diversify production sites and to hold extra inventory (IMF, 2022).

Against this backdrop, while firms are reorganizing autonomously, governments and policy makers are looking for actions. Moves towards protectionism or reshoring, with no consideration for GVC complexity, are short-sighted as long-term policies. Where there seems to be more room for successful policy interventions is in creating the right environment for GVC firms to take actions towards diversification, flexibility and agility. Government regulation contributes to shaping the economic incentives of individual firms. Through appropriate regulation, governments can help share information and take into account systemic factors that are hardly internalized by individual agents. Trade facilitation measures, eliminating red tape, or transparent certification procedures can contribute to reducing policy uncertainty and giving firms more viable options to diversify and reconfigure their network. Similarly, information sharing and regulation favouring actions to mitigate systemic risk that private agents would have little incentive to undertake, including on environmental issues, can be an additional source of resilience. The idea of "stress tests" in which companies need to show that their operations reach a minimum level of resilience goes in this direction (Miroudot, 2020b; Simchi-Levi & Simchi-Levi, 2020). Even more, these stress tests, or more generally policies aimed at increasing general GVC resilience, should go beyond firms and adopt a GVC perspective (Gereffi & Sturgeon, 2013). Implementing these policies is challenging because their success depends on policy makers having the right vision as well as on fruitful international cooperation. On the former, promoting dialogue with the private sector is important, and scholars from a range of disciplines can play a relevant role in informing the debate on GVCs (Kano et al., 2020). The current possibilities to increase international cooperation are instead uncertain, especially in multilateral environments. In the meanwhile, GVC firms need to prepare to face the new challenges in a post-covid world.

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