



## Macroeconomic implications

### Key findings

- **Global value chains (GVCs) are associated with greater synchronization of economic activity across countries.** When production in one country relies on inputs from another country, then economic activity in the two countries is linked.
- **GVCs create strong links in price formation, implying that inflation in one country is more likely to spill over to its direct and indirect trading partners.** In this sense, GVC participation is associated with the rising synchrony in inflation across countries.
- **In GVC countries, episodes of export growth are linked to episodes of import growth.** This finding implies that the consequences of currency movements for export volumes are likely to be dampened.
- **GVCs amplify the costs of protectionism for trade and growth.** The back-and-forth movement in tasks and parts across borders means that trade barriers are incurred multiple times. Protectionism is therefore costlier for growth and welfare.
- **Trade agreements have the potential to reshape the geography of production.** The prevalence of rules of origin as well as the productivity gains associated with a reduction in the price of imported inputs imply that trade agreements have systemic consequences for the allocation of production across countries in GVCs.

**G**lobal value chains (GVCs) strengthen the economic connections between countries. Instead of individually selling final goods and competing for the same customers, countries are increasingly related through rigid production linkages that bind them to a common fate. This international interdependence means that policies and economic conditions in one country affect its trading partners and propagate to the rest of the world. As a result, the benefits of international coordination (and the costs of not coordinating) have increased. Four are investigated in this chapter.

First, production linkages are associated with greater synchrony of economic activity across countries. When production in one country relies on inputs from its trading partners, the economic conditions in other countries affect its domestic activity and its ability to thrive. Although international trade in finished products cannot be associated with any change in the synchronization of GDP across countries, trade in intermediate inputs can be.

Second, input–output linkages create strong links in price formation, implying that inflation in one country is more likely to spill over to its direct and indirect trading partners. In this sense, GVC participation is associated with the rising synchrony of both real economic activity and inflation across countries. At the same time, the actions of national central banks, through production linkages between domestic and foreign firms, can have important consequences in other countries as well.

Third, because of the interconnections in production, episodes of export growth are linked with similar growth in imports. Thus the consequences of currency movements for export volumes are likely to be reduced and become harder to predict. Export volumes do not react to the exchange rate with the direct partner; they react to the exchange rate in the country of final consumption. When a government changes the value of its currency, it affects the trade flows of other countries throughout the production chain.

Fourth, the rise of GVCs influences the impact of regional trade agreements and how policy makers should think about the possible diversion of trade flows. When firm-to-firm relationships are rigid, the benefits of accessing new markets can be shared throughout the production chains with countries not part of the trade agreement. Conversely, the disruption created by trade wars and dismantled agreements may be transmitted to other trading partners and may not be easily avoided by reorganizing buyer–seller relationships.

Posing new challenges for governments and policy makers, these realities require closer cooperation between countries. National policies are now transmitted to other countries, and the GVC feedback loop can reduce their effectiveness. Because of the high interdependence of production structures, decisions by governments and central banks are more likely to have a systemic impact, and their effectiveness depends on policies in various parts of the world. Moreover, regional agreements can have global ripples, and economic issues are more global, calling for coordinated solutions. In view of their rigid ties, GVCs would benefit from multilateral institutions helping to coordinate policy worldwide, including through the formulation of product standards, investment and intellectual property protections, or the timing of fiscal adjustments.

## Synchronizing economic activity

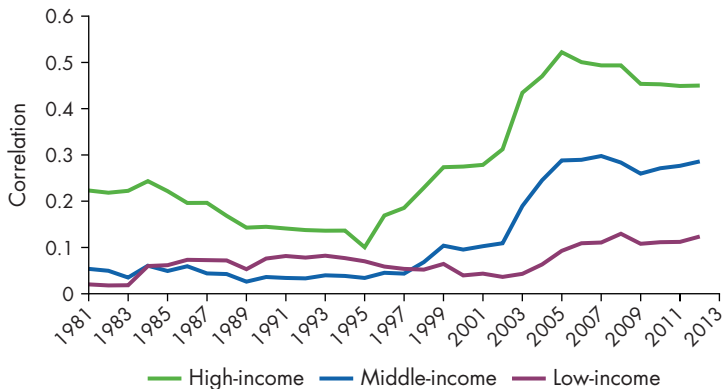
When the production of a good in Vietnam requires inputs from Indonesia and is then used for production in China, it is only natural that supply and demand shocks in one country will be felt by its suppliers and customers. One example of such an arrangement is Nike, one of the world's most valuable sport brands. It has segmented its footwear production across these three South Asian countries.

Over the past 30 years, the co-movement of economic activity has surged globally. In the 1980s, economic cycles in different countries were largely independent of one another, especially in middle- and low-income countries, with correlations of less than 0.1. But economic activity has since become much more correlated—the most for high-income countries followed by middle-income and low-income countries (figure 4.1).

The recent worldwide increase in economic synchrony stems in part from the rise of GVCs. Production is increasingly organized according to a “world factory” view, which drastically changes how shocks are transmitted across borders. To understand the importance of those changes, one could start by taking a look at the world before the recent increase in international production linkages.<sup>1</sup>

If two countries were open to trade and produce a similar final good—say, clothes—their firms competed in the same markets for the same customers. As a result, a country's increase in productivity could enhance consumer welfare everywhere, but it could also mean tougher competition for its competitors. In this sense, good news in one country could be bad

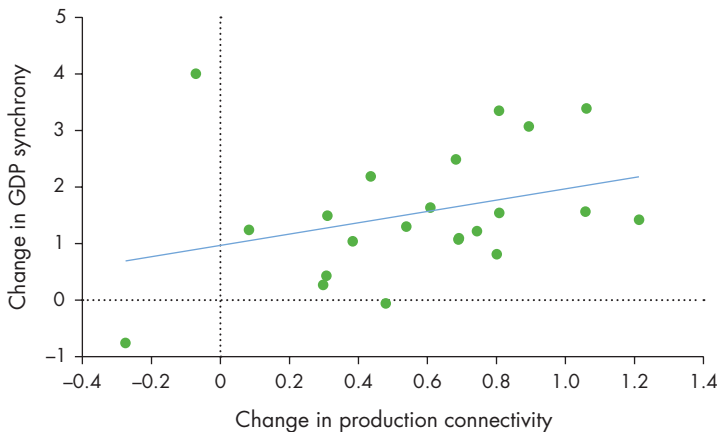
**Figure 4.1** In all income groups, countries' economic activity has become more synchronized since the mid-1990s



Source: WDR 2020 team, using data from the World Bank's WDI database. See appendix A for a description of the databases used in this Report.

Note: Each year represents the midpoint of a 10-year moving window. Each line represents the average of all country-pair GDP correlations, taken over all country-pairs containing at least one country in the income group considered (high, middle, and low).

**Figure 4.2** Greater synchrony of economic activity is associated with GVCs



Sources: WDR 2020 team, using data from the World Bank's WDI and WITS databases.

Note: Each dot represents a pair of regions—for example, East Asia and Pacific and Sub-Saharan Africa are one region-pair, and Latin America and the Caribbean and South Asia are another. The x-axis measures the change in production connectivity defined as the total trade in intermediates as a share of GDP of both regions, taken between the 2002–11 and 1982–1991 time windows. The y-axis measures the proportional change in the GDP correlation over time. Region-pair values are computed by taking the simple average of all country-pairs between two regions.

news for its trading partners. For example, higher efficiency in the garment industry in Bangladesh could be linked to a contraction in production in India.

In a world dominated by GVCs, however, countries increasingly trade intermediate inputs and are tied by rigid production linkages. From the iPhone to Nutella,

the design, production, and after-sales services of many goods are spread over many countries. This new reality changes the extent to which economic fluctuations are transmitted across countries. If a country's productivity rises, the consequences are good for trading partners buying its goods as inputs as well as for the country's own suppliers: they can share the competitive gains throughout all production stages, and they are less likely to cannibalize each other's market shares.<sup>2</sup>

The positive historical association between total trade and business cycle co-movement was driven by trade in intermediate inputs (figure 4.2). Although GVCs are not the only factor explaining the surge in GDP correlation across countries, evidence about their role is growing. From both a microdata and firm perspective<sup>3</sup> and a more macroaggregate perspective,<sup>4</sup> studies have shown that the recent increase in input-output linkages enhanced the co-movements in economic activity.

The economic fates of countries participating in GVCs are tied to one another. Even if at the microeconomic level individual firms in different countries continue to compete, the aggregate health of an economy now depends on the health of other economies supplying inputs or buying outputs. Based on a panel of 150 countries for the last 50 years, one study finds that moving from the 25th to the 75th percentile of trade in intermediate inputs is associated with an increase in the GDP correlation of 28 percentage points.<sup>5</sup>

Synchrony of economic activity across countries is a key indicator for many macroeconomic policies. For example, the extent to which the West African Economic and Monetary Union (WAEMU) can be considered an optimal currency area largely depends on the synchrony of business cycles among all member countries. And beyond currency considerations, the synchrony of economic activity among countries signals interdependence, so both good news and bad news are transmitted from one country to the next.

Large firms dominate the global economy. For 32 developing countries, the five largest exporters in a country account on average for a third of its exports and nearly half of its export growth.<sup>6</sup> Although the importance of large firms in driving economic growth is not new, their impact reached a more global scale with the expansion of GVCs. With production more fragmented across countries, any local decision that improves a global firm's ability to thrive will have a positive impact on many countries.

## Propagating shocks

The strength of propagating shocks across firms and countries is a function of the “specificity” of the input–output relationship, which is not always well represented by simply looking at cost shares across countries. When an input is needed for production, losing access to it can be disastrous, even though the input may not represent a large share of total production costs (box 4.1). The interdependence of firms and countries thus increases to the extent that GVCs involve custom products that cannot be easily replaced.

GVCs are also linked to greater synchrony of financial cycles and stock market returns. Looking at the consequences of natural disasters, firms experience a larger drop in stock market returns when disasters hit their specific suppliers than their non-specific ones.<sup>7</sup> A specific supplier is a supplier that produces an input tailored just for its customers. When such a relationship exists, both buyer and supplier may face less flexibility in changing their business partners when needed, as it takes time to find another firm willing and able to produce or buy specific inputs.

### Box 4.1 The Japanese earthquake and the costs of supply chain disruptions

Businesses tend to focus on the possibility that inputs will increase in price or be delivered late. But disruptions by extreme events are a rising threat. In 2018 extreme weather caused \$81 billion in global losses; in 2017, \$300 billion.<sup>a</sup> Natural disasters can have unanticipated cascading impacts along GVCs, shocking distribution and supply networks worldwide.

In March 2011, the Tōhoku earthquake, measuring 9.0 on the Richter scale, hit Japan’s northeast coast. Several tsunamis followed, devastating coastal areas, flooding and disabling local nuclear power stations, and creating a national nuclear crisis. The triple disaster was catastrophic for GVCs, particularly the automotive, computer, and consumer electronics producers that rely heavily on Japanese suppliers of specialized parts and components. As Japanese production of automotive equipment drew to a halt, senior executives at Toyota, Honda, Opel, Nissan, and General Motors froze production lines in several factories worldwide, leading to losses of \$70 million a day.<sup>b</sup>

Famously, automakers temporarily stopped orders for cars in colors that required a specialty pigment called Xirallic, which gives cars a glittery shine. Xirallic is produced only in Japan, and its production was badly affected during the nuclear crisis.

In electronics, the problems were similar. The many specialized connectors, speakers, microphones, batteries,

and sensors produced in Japan had few or no substitutes. At the time, it was estimated that about a third of Apple’s flash drives came from Toshiba, Japan, and the rest from the Republic of Korea.<sup>c</sup>

Quantifying the global impact of such a disaster is not easy. For the transport equipment industry, the disruption cost an estimated \$139 billion (in value added), with Japan suffering about 40 percent of the impact and the rest falling mainly on the United States (25 percent), China (8 percent), the European Union (8 percent), and Canada (7 percent).<sup>d</sup>

The substitutability of inputs is a critical determinant of supply chain shocks. In one study of U.S. affiliates of Japanese firms, the degree of the shock depended not on the level of Japanese ownership, but on the U.S. affiliate’s ability to replace in the short run imported intermediates from Japan with alternative inputs.<sup>e</sup> In the month following the crisis, U.S. manufacturing output fell about 1 percent and remained significantly below previous levels for the next six months.

These findings are particularly relevant to buyers and suppliers holding low inventories and relying heavily on just-in-time production to keep inventory costs low. Risk management strategies to diversify suppliers and reduce firm sensitivity to inventory shortages and delays in logistics will become more important as environment-related disasters increase.

a. Swiss Re (2019).

b. *Automotive News* (2011).

c. Lohr (2011).

d. Arto, Andreoni, and Rueda Cantuche (2015).

e. Boehm, Flaaen, and Pandalai-Nayar (2019).

## Synchronizing inflation

International input–output linkages also create strong links in price formation, implying that inflation in one country is more likely to spill over to its direct and indirect trading partners (figure 4.3). Such linkages account for an estimated half of the global component of producer price index inflation.<sup>8</sup> Although imported inflation has been a factor in the consumer price index, its extension to producer prices has policy implications for central banks.

When designing their monetary policy and targeting a given inflation rate, authorities need to account for the economic conditions and strategies of their direct and indirect trading partners. In this sense, GVC participation is associated with the rising synchrony of not only real economic activity but also inflation across countries.

Backward GVC participation is associated with an increase in the globalization of inflation. For each country, the change in the correlation between domestic and world inflation over the past decade is associated with an increase in the amount of imported inputs used in production.

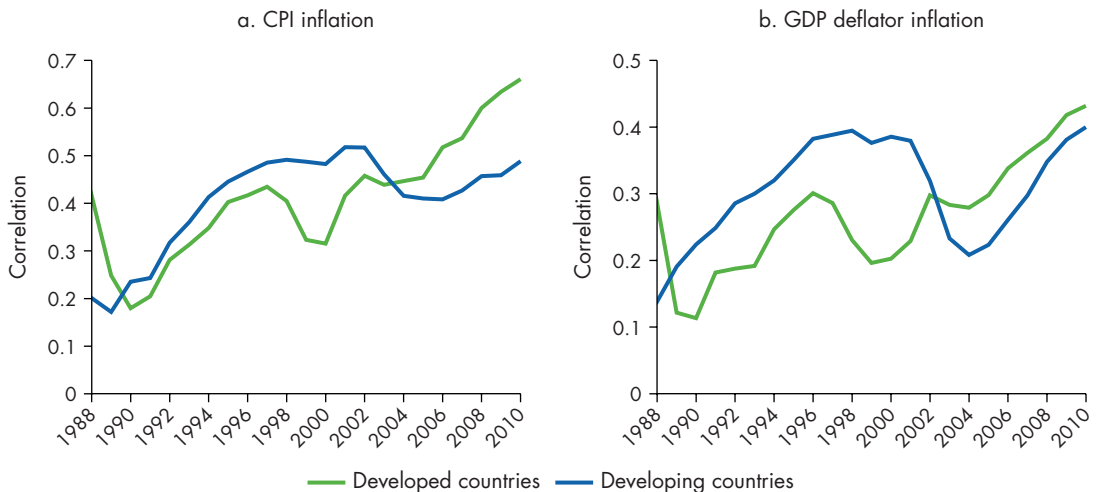
The fragmentation of production across countries also plays a role in the synchrony of inflation expectations, which feeds back into current inflation (figure 4.4). For example, although economists have long recognized domestic and global output gaps (measures of

the “slack” in an economy) in estimating the inflation pressure in the economy, GVCs have been shown to significantly increase the global factors at the expense of purely domestic ones.

Furthermore, an increase in imports and exports of intermediate inputs is associated with a decline in the relative weight of the domestic output gap in favor of global economic conditions in the formation of inflation (figure 4.5). Because imported intermediates can be used to produce goods that are either reexported further or consumed in the domestic economy, such a result points to a synchronization of inflation across all sectors. This finding is in line with Ha, Kose, and Ohnsorge (2019), who show that inflation synchronization has been significant across all inflation measures since 2001, whereas it was previously prominent only for inflation measures that included mostly tradable goods.

Finally, GVCs are not only associated with the co-movement of inflation patterns but also may be linked to the global reduction in inflation. The emergence of independent central banks and better monitoring in many countries has played an important role, but a recent study by the Organisation for Economic Co-operation and Development (OECD) also suggests that GVCs have contributed to lower inflation via downward pressures on labor through heightened competition across countries to attract tasks, in particular when low-wage countries are integrated in supply chains.<sup>9</sup>

**Figure 4.3** The synchrony of inflation increased between 1988 and 2010



Source: WDR 2020 team, using data from the World Bank’s WDI database.

Note: For each country, the correlation between domestic and world inflation was determined using two measures of price levels: the consumer price index (CPI) in panel a and the GDP deflator in panel b. An average was then taken across two income groups in order to plot the evolution of this average correlation. Each year represents the midpoint of a 15-year rolling window.

## Reducing the effect of devaluations

Economics textbooks presume a relationship between movements in a country's exchange rate and its export volumes. When the currency depreciates, export volumes are expected to increase by some amount, and that amount is called the exchange rate elasticity of exports. Yet some recent significant exchange rate movements, such as those in the United Kingdom in 2007–09 and in Japan in 2012–14, were not associated with large movements in trade volumes.<sup>10</sup> This perceived unresponsiveness of exports to exchange rate fluctuations has raised the question of whether the exchange rate elasticity of export volumes has changed or even dropped to zero.

For all country income groups, changes in a country's exports and imports have become more correlated over time (figure 4.6). Upper-middle-income countries especially, many of whom are engaged in GVCs in Europe, have seen a sharp rise.

Over the last decades, short-term growth in exports has been accompanied by import growth. Contrary to what the standard quantitative trade models of importing predict, a country's aggregate imported input share increases after large depreciations.<sup>11</sup> This can be explained by the fact that exporting firms are often also importers, and export opportunities are accompanied by a need to import.

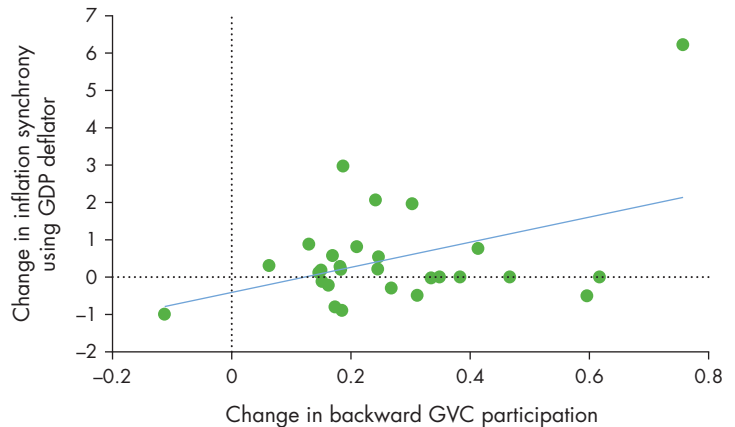
The latest research suggests that all production linkages can have an impact on export elasticities and that GVCs can have complex effects on devaluation. By loosening the effectiveness of devaluations, the expansion of GVCs complicates the task of policy makers and creates the need for international coordination (box 4.2).

Greater participation in GVCs is expected to generate larger *bilateral* balances, but it is not necessarily associated with a larger *overall* trade balance. Indeed, current accounts at the country level are mostly determined by savings, investments, and cross-border finance and are little affected by changes in trade policy or by the links between imports and exports.

Policy makers in countries participating in GVCs should track not only the currency composition of inputs for production, but also the currency in the country of final absorption (figure 4.7).<sup>12</sup> In doing so, they should keep in mind the following points:

- An increase in an export's share of foreign value added from a country with a different currency

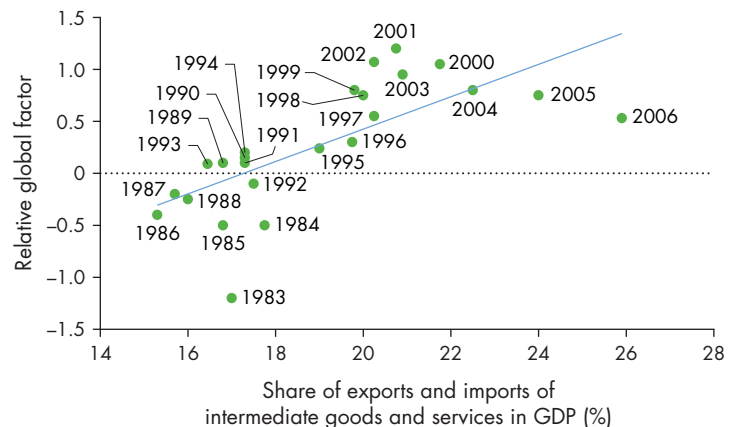
**Figure 4.4** GVCs are associated with greater inflation synchrony in some countries



Sources: WDR 2020 team, using data from the World Bank's WDI database.

Note: Each dot represents a pair of regions—for example, East Asia and Pacific and Sub-Saharan Africa are one region-pair and Latin America and the Caribbean and South Asia are another. The x-axis measures the change, taken between the 2000–2009 and 1990–1999 time windows, in production connectivity defined as the total trade in intermediates as a share of GDP of both regions. The y-axis measures the proportional change in inflation correlation for the same time windows, where inflation is measured by the changes in the GDP deflator.

**Figure 4.5** Trade in intermediate inputs increased the weight of global factors in inflation formation from 1983 to 2006



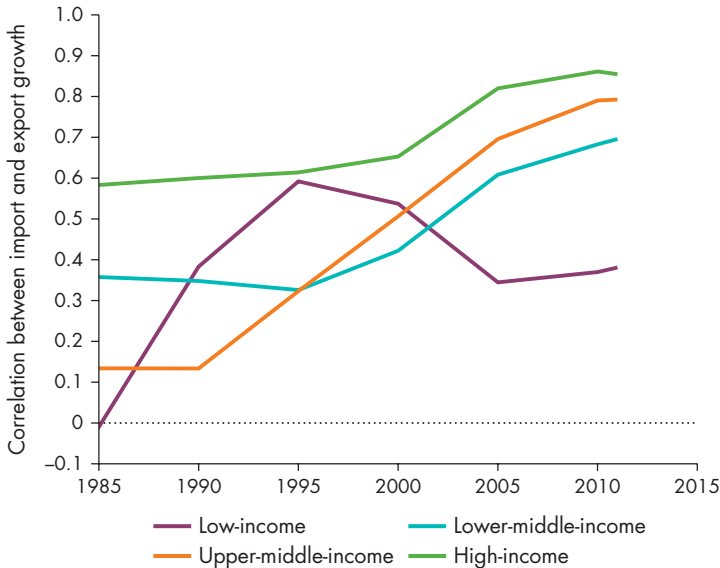
Source: Auer, Borio, and Filardo 2017.

Note: The relative global factor is the difference between domestic and global output gaps in the formation of inflation. The upward-sloping line shows the positive relationship between the global weight in domestic inflation (y-axis) and participation in GVCs (x-axis).

reduces the change in export price in response to exchange rate movements, thereby lessening the associated change in export volumes.

- A greater share of exports that return as imports to a country sharing the same currency weakens the

**Figure 4.6 Export boosts tend to coincide with import boosts—more now than 30 years ago**



Sources: WDR 2020 team, using data on annual trade flows from the World Bank's WITS database and income group classification from the World Bank (2017 version).

Note: The year-on-year growth rate of total imports and exports was computed for each year. Then the correlation between these growth rates was computed for a rolling window of 10 years. Each year represents the midpoint of the 10-year rolling window.

exchange rate responsiveness of exports. Simply put, if the final demand driving exports is located at home or in a country with the same currency, a devaluation can do little to boost those trade flows.

- An increase in the share of exports used in the destination country to produce further reexports that are ultimately consumed in a third country increases the responsiveness of trade flows to the direct trading partner's nominal effective exchange rate, creating significant interdependence across countries. This mechanism underlines the international interconnections that characterize today's production processes.

With the international fragmentation of production across countries, export performance in one country can be driven by the demand addressed by firms located in other countries. In this sense, the consequences of devaluing a country's currency value propagate upstream in the supply chain and trigger export growth from its suppliers.

Interestingly, greater participation in international production decreases the exchange rate elasticity of exports, and a currency devaluation could also reduce a sector's exports to a specific destination. This happens whenever a sector has both a high share of foreign value added in exports and a high share of exports reimported and consumed in a country with the same currency.

Current GVC participation around the world already accounts for a significant decline in the efficiency of devaluation in boosting exports (figure 4.8). Sectors in the top decile of the backward GVC participation have an export elasticity that is only two-thirds

### Box 4.2 Blunting the effects of devaluation on Turkey's exports

Changes in imports and exports are driven by many elements, and the value of currency is only one of them. Other important determinants are economic and financial conditions and the uncertainty in both direct and indirect trading partners, as well as possible changes in tariffs and nontariff barriers and the design of industrial policy in both domestic and foreign economies.

Without accounting for all these other factors, it is difficult to draw strong conclusions about the way GVCs are changing the link between devaluations and export volumes. With those caveats in mind, the recent devaluations in Turkey illustrate the mechanisms described in this chapter.

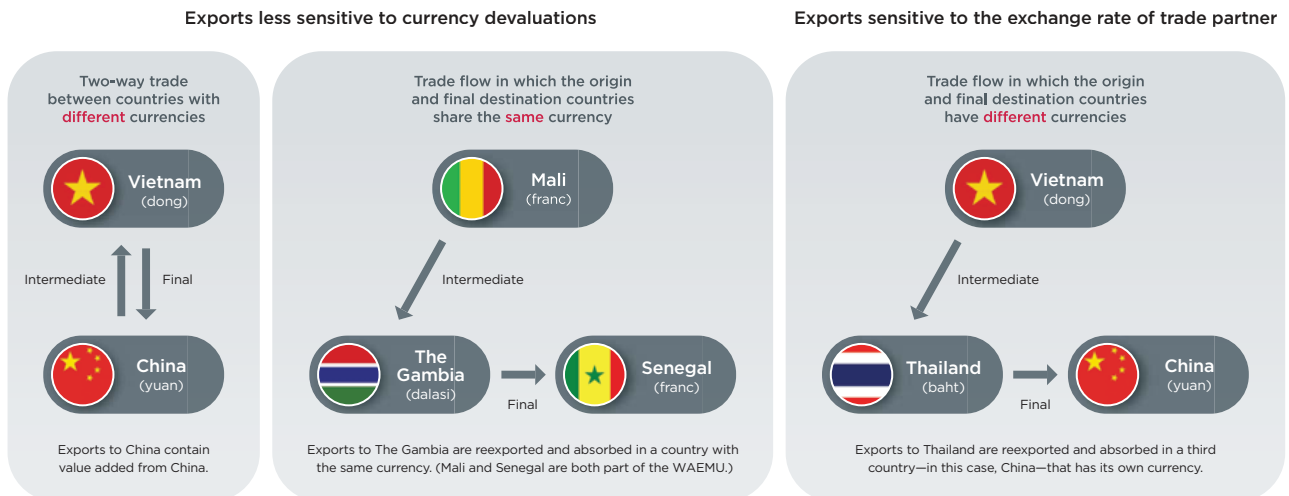
Turkey has moved rapidly from a current account that was relatively in balance up to 2000 to sustaining relatively

large current account deficits over the past 15 years. In 2015 the country was well integrated in GVCs, with its share of foreign value added in exports reaching 30 percent, almost 10 percentage points above the world average. Between 2015 and 2018, the real effective exchange rate depreciated by 25 percent, and such a large movement translated into only a modest 5 percent in export growth (much slower than the world's export growth of 8 percent during the same period) and 11 percent in import growth.

This relatively small adjustment is especially striking because recent World Bank studies have shown that historically Turkey's current account balance has been less persistent than is typically found in the cross-country literature, suggesting that it adjusts more rapidly to shocks.<sup>a</sup>

a. Knight, Nedeljkovic, and Portugal-Perez 2019.

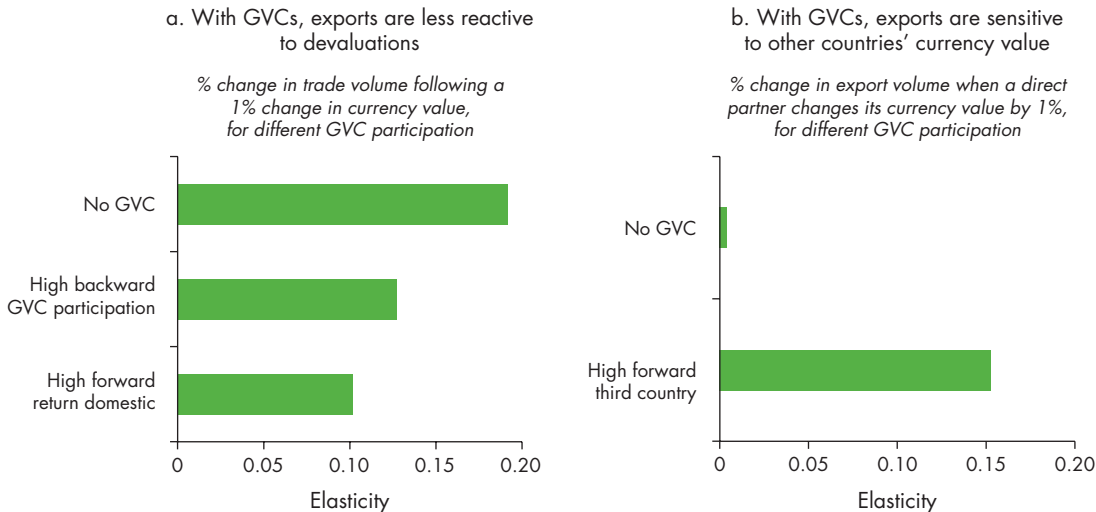
**Figure 4.7 With GVCs, devaluations can have complex consequences**



Source: WDR 2020 team.

Note: This figure summarizes the different channels through which GVCs can influence the elasticity of exports to devaluations. WAEMU = West African Economic and Monetary Union.

**Figure 4.8 GVCs dampen the reaction of export volumes to currency movements**



Source: WDR 2020 team.

Note: In panel a, the bars plot the value of the exchange rate elasticity for the 10 percent highest GVC participation indexes. "High backward GVC participation" refers to the foreign value added embedded in exports. "High forward return domestic" refers to the domestic value added embedded in exports and reexported back in the domestic economy. In panel b, the bars plot the value of the elasticity of export volume to the change in the nominal effective exchange rate of a direct partner. The values displayed in this figure use the estimation coefficients from de Soyres et al. (2018) on the elasticity of exports to exchange rate, as well as the interaction of this elasticity with a variable marking the intensity of GVC participation.

of the elasticity corresponding to sectors with no participation in GVCs. Moreover, the rise of production interconnections is associated with a significant sensitivity of export volume to foreign devaluations.

The relationship between exchange rate movements and export growth is also affected by the choice of invoicing currency as well as possible changes in markups. For example, because many international

transactions are invoiced in U.S. dollars, some countries are more sensitive to the U.S. dollar exchange rate than the bilateral exchange rate.<sup>13</sup> Moreover, foreign investment enterprises in China are absorbing currency movements to partially stabilize their prices in local currency terms. By contrast, the prices charged by private, locally owned Chinese firms exhibit much more sensitivity to currency movements.<sup>14</sup>



Most current measures of trade imbalances are based on gross trade data, reflecting the difference between the value of total exports and total imports. But for GVCs, gross exports and gross imports are poor measures of the domestic value added exported and of the foreign value added consumed (box 4.3). Thus GVCs bias the distribution of trade deficits across trading partners, which might mislead trade policy. For example, the U.S. bilateral trade deficit with China

is smaller when measured in trade in value added than when measured in gross trade. The reason? China buys many of the inputs for its exports from other countries. But U.S. bilateral trade deficits with many of those other countries are larger (or U.S. trade surpluses with them are smaller) when measured in trade in value added. The reason? Many U.S. imports from China incorporate the value of inputs originating in these countries.

### Box 4.3 Trade imbalances in using value-added data

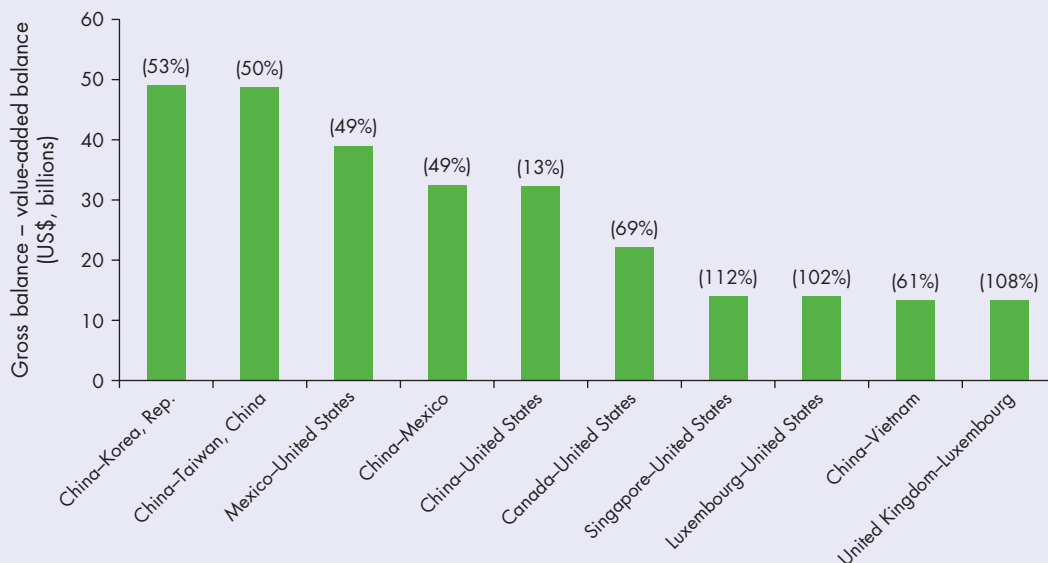
Most current measures of trade imbalances are based on gross trade data and simply reflect the difference between the value of total exports and total imports. For GVCs, however, gross exports and gross imports are not accurate measures of the domestic value added exported and of the foreign value added consumed. Thus over the past few years several researchers have highlighted the importance of building a more accurate picture of bilateral trade flows and the need to account for the evolution of bilateral value-added balances.<sup>9</sup>

For example, the U.S. bilateral trade deficit with China is smaller when measured in trade in value added than when

measured in gross trade because China buys many of the inputs for its exports from other countries. However, U.S. bilateral trade deficits with some of those other countries are larger when measured in value-added terms because many U.S. imports from China contain inputs originating in these countries.

Based on the Trade in Value Added (TiVA) database from the Organisation for Economic Co-operation and Development (OECD) for 2015, figure B4.3.1 shows the 10 country-pairs with the largest differences between bilateral trade balances using gross exports and value-added

**Figure B4.3.1** Computing bilateral trade balance in gross exports or in value-added exports matters



Source: WDR 2020 team, using data from OECD's TiVA database.

Note: The figure shows the 10 pairs of countries with the largest differences between their gross trade balance and their value-added trade balance. At the top of each bar, the difference in the gross and value-added balance is also expressed as a share of the gross trade balance. The indicator used to compute the gross trade balance is "EXGR: gross exports" in the TiVA database. The value-added trade balance is given by "BALVAFD: Value added embodied in final demand, balance" in the TiVA database. It is computed as the difference between domestic value added in foreign final demand, FFD\_DVA, and foreign value added in domestic final demand, DFD\_FVA.

(Box continues next page)

### Box 4.3 Trade imbalances in using value-added data (continued)

exports, respectively. The difference, also expressed as a share of gross balance, shows how important it is to account for the value-added balance.

One method often used to compute value-added trade flow is based on manipulation of input–output tables to calculate the share of value added coming from any country embedded in any gross flow. Such a method, however, relies on strong proportionality assumptions. For example, when looking at the automotive industry in Mexico, this method assumes that the share of inputs from the United States is the same regardless of the destination of the trade flows—in other words, it assumes the same production process for all destinations for a given industry in a given country.

New findings from de Gortari (2019) reveal that this assumption does not hold in the data. Using data from the automotive industry, de Gortari finds a strong link between the destination of exports and the origin of the imported inputs: about 74 percent of all the foreign parts used by vehicle assemblers in Mexico that export to the

United States are imported from the United States itself. By contrast, only 18 percent of the imported parts used by Mexican firms exporting to Germany come from the United States. This finding implies that just looking at sectors to understand trade flows is not enough: one needs to deepen the analysis at both the sector and destination levels.

Finally, even though greater participation in GVCs is expected to generate larger bilateral balances, such an outcome is not necessarily associated with a larger overall trade balance. According to the International Monetary Fund's 2019 *World Economic Outlook*, there is a strong positive relationship between a country's participation in GVCs and the size of its absolute bilateral balances, whereas the relationship is much weaker when it comes to the size of the overall trade balance. Moreover, it has been shown that targeting bilateral trade deficits does not, in general, reduce a country's overall current account deficit. Indeed, macroeconomic policies as well as financial conditions tend to be the key forces explaining countries' overall trade balances.<sup>b</sup>

a. Johnson and Noguera (2012a, 2012b, 2017); Koopman, Wang, and Wei (2014).

b. IMF (2019). See also Ahn et al. (2019) for more on this subject.

Moreover, as noted by Amiti, Freund, and Bodine-Smith (2017), production linkages across countries lead to bilateral imbalances across countries, in the same way that large companies routinely run deficits with their suppliers: the company purchases inputs but sells little to these smaller firms. For example, Germany, despite running a large aggregate trade surplus, runs bilateral trade deficits with the Czech Republic, Hungary, and the Slovak Republic, the main low-cost suppliers in the European production chain.<sup>15</sup> Indeed, a bilateral deficit has little meaning for the aggregate trade balance. The same is true for the U.S.–Mexico relationship, where new measures from de Gortari (2019) highlight the high integration in the automotive industry (box 4.3).

### Mitigating trade diversion and increasing trade

Production fragmentation knits together the economic interests of firms (and workers) up and down the supply chain. Before the proliferation of GVCs, trade liberalization often benefited local consumers at the expense of local producers. But with these new linkages, the producer gains from trade that used to

accrue only to foreign exporters are shared—and often divided differently—on both sides of the border.<sup>16</sup>

GVCs also change another standard paradigm of trade policy: the diversion of trade from a more efficient producer outside of a trade agreement to a less efficient producer inside of it. Traditionally, signing a trade agreement has been associated with an increase in trade flows within the agreement zone as well as a decrease in trade flows between the agreement zone and the rest of the world.<sup>17</sup> However, because of production linkages within GVCs, this standard view has been challenged.

A look at all regional trade agreements over the past 60 years reveals that agreements are associated with strong, positive trade creation: on signing the agreement, exports between member countries grow significantly, with estimates ranging from less than 10 percent to more than 80 percent, depending on the agreement and the countries. But there is also trade diversion: exports from nonmember to member countries can decrease, while exports from member to nonmember countries tend to increase slightly.

The reduction in imports within the agreement zone is, among other things, related to rules of origin on final goods. Those rules are defined to prevent

nonmember countries from transshipping products through low-tariff agreement members to avoid high tariffs. In effect, the rules act as an input tariff in the sense that they distort sourcing decisions and divert trade in intermediate goods to higher-cost agreement members. Those mechanisms are quantitatively quite relevant: on average, Mexican imports of intermediate inputs from third countries relative to its partners in the North American Free Trade Agreement (NAFTA) would have been 45 percent higher without rules of origin.<sup>18</sup>

GVCs thus fundamentally change how local trade agreements affect global trade flows. With production fragmented across countries, rigid linkages have the potential to mitigate the diversion usually associated with regional trade agreements. For example, if a member country relies significantly on intermediate inputs from other member countries, signing a trade agreement actually strongly increases its exports to nonmember countries. The explanation comes from the supply side: firms gaining preferred access to their supplier within the free trade zone have a lower marginal cost and can expand their market share in other countries. In other words, countries forming a trade agreement import less from and export more to the rest of the world. Such an effect can lead to efficiency gains not only within the regional free trade zone but also in other parts of the world.<sup>19</sup>

Despite the rules of origin, when the share of intermediate goods increases between a nonmember country and a member country, the trade diversion of exports from the nonmember country to the member country is largely mitigated. Indeed, firms in member countries gaining access to larger markets within a free trade zone can transmit this positive shock to their own suppliers outside the agreement zone.

Moreover, an increase in the share of intermediate inputs between two countries is associated with higher trade creation upon signing a trade agreement and lower trade diversion when one of the two countries enters a separate trade agreement with other partners. This finding has consequences for trade negotiations. If signing a trade agreement creates positive spillovers to nonmember countries, the whole design of trade negotiations could be adapted to allow for more cross-country coordination, including countries that are not directly part of the trade agreement.

## The return of protectionism

Protectionism saw a resurgence over the last two years, fueled by tensions between the United States and China. In 2018 the two countries imposed tariffs

on each other, covering more than half of their bilateral trade (approximately 70 percent of U.S. exports to China and almost half of U.S. imports from China). The United States also imposed tariffs on other countries covering solar panels, washing machines, steel, and aluminum, sparking retaliation from the affected trading partners. At the same time, negotiations continued over the terms and timing of the United Kingdom's departure from the European Union (EU).

In the age of GVCs, this new wave of protectionism is likely to have significant costs:

- The hyperspecialization in tasks and parts across borders means that trade costs are incurred multiple times.
- Protective measures against any country have knock-on effects on all its trading partners in the value chain.
- GVCs also amplify the costs of trade policy uncertainty because firms are more reluctant to make further investments in new or existing relationships with foreign suppliers.
- Significant tariffs on inputs can force firms to incur large costs to reshape their existing supply chains, thereby causing potentially long-lasting disruptions in global investment and production.

According to a recent estimate, the tariffs already implemented would lead to a decline in U.S. imports of intermediate goods from China over the longer term by over 40 percent, much more than the declines in consumption and investment goods.<sup>20</sup> Furthermore, if the trade conflict worsens and leads to a slump in investor confidence, effects on global growth and poverty could be significant—up to 30.7 million people could be pushed into poverty measured as an income level of less than \$5.50 a day, and global income could fall as much as \$1.4 trillion in a worst-case scenario.<sup>21</sup> Low- and middle-income countries other than China would bear roughly half of the global income loss.<sup>22</sup>

### GVCs amplify the costs of protection for trade and growth

A large body of empirical research has shown that an increase in trade costs significantly reduces trade flows. GVCs are affected to an even greater extent. The hyperspecialization in tasks and parts across borders means that trade barriers are incurred multiple times. Recent evidence reveals that protection and disintegration reduce both backward and forward linkages.<sup>23</sup> As shown in chapter 3, GVC trade has a bigger effect on growth and employment than standard trade. Protectionism is therefore costlier for growth and welfare.

Protection not only affects whether and how much countries participate in GVCs; it also affects *how* they participate. In sequential (or snakelike) GVCs, trade costs compound along the value chain and have a bigger effect on the downstream stages than on the upstream stages. This effect leads remote countries to specialize in upstream stages and more central countries to specialize in the more downstream stages.<sup>24</sup> An implication is that the effect of trade costs would be more significant for backward GVC participation than for forward participation and therefore would have stronger negative impacts on growth. Consistent with this view, recent studies estimate that the negative impacts of Brexit on trade and employment will be considerably larger than commonly expected because of backward linkages.<sup>25</sup>

### **GVCs fuel the transmission of protection**

In a world of GVCs, bilateral trade barriers may spill over to products and countries not directly targeted by those barriers. As noted, protective measures against any country have knock-on effects on all its trading partners in the value chain.<sup>26</sup> For example, China's exports to the United States have significant value added from developed countries such as Japan, the Republic of Korea, or the United States and from developing countries including Indonesia or Malaysia (figure 4.9). U.S. tariffs on Chinese final goods therefore affect the intermediate producers in those economies. Similarly, Chinese tariffs on U.S. goods affect producers in Canada and Mexico. The supply chain *diffusion channels* determine how the local effects of a shock propagate upstream and downstream to trade partners in the same supply chain.

### **Protection may cause lasting disruptions in supply chains**

Bilateral measures of protection create incentives for firms to reorganize their supply chain. The effects of protection on GVC participation may differ when GVCs are relational in nature. Because of protectionism, some of the links in the chain may be unable to provide parts, components, or services in time or under prespecified terms. These supply chain disruptions are particularly costly when firms cannot easily resort to alternative suppliers.

The lock-in effects associated with costly search and relationship-specific investments also have implications for the role of market size in attracting GVC activity. With relational GVCs, a large market may reduce search frictions.<sup>27</sup> Trade barriers imposed on large markets such as China or the European Union may therefore be particularly disruptive for firms in

the country that imposes protection. For example, U.S. tariffs on the car industry would penalize U.S. companies reliant on Chinese parts, which are often difficult to source at home. Brexit will likely hit the U.K. producers relatively harder than those in the EU-27 because the United Kingdom is losing a larger market for suppliers.<sup>28</sup>

Evidence reveals that in the months after tariffs were imposed by the United States in 2018, they were paid in full by U.S. importers, generating aggregate welfare losses.<sup>29</sup> The resulting price hikes also affected supply chains. Imports of products subject to tariffs declined sharply, in part because importers turned to domestic products, but in part because companies shifted their sourcing to more expensive nontargeted sources such as Mexico and Vietnam.<sup>30</sup>

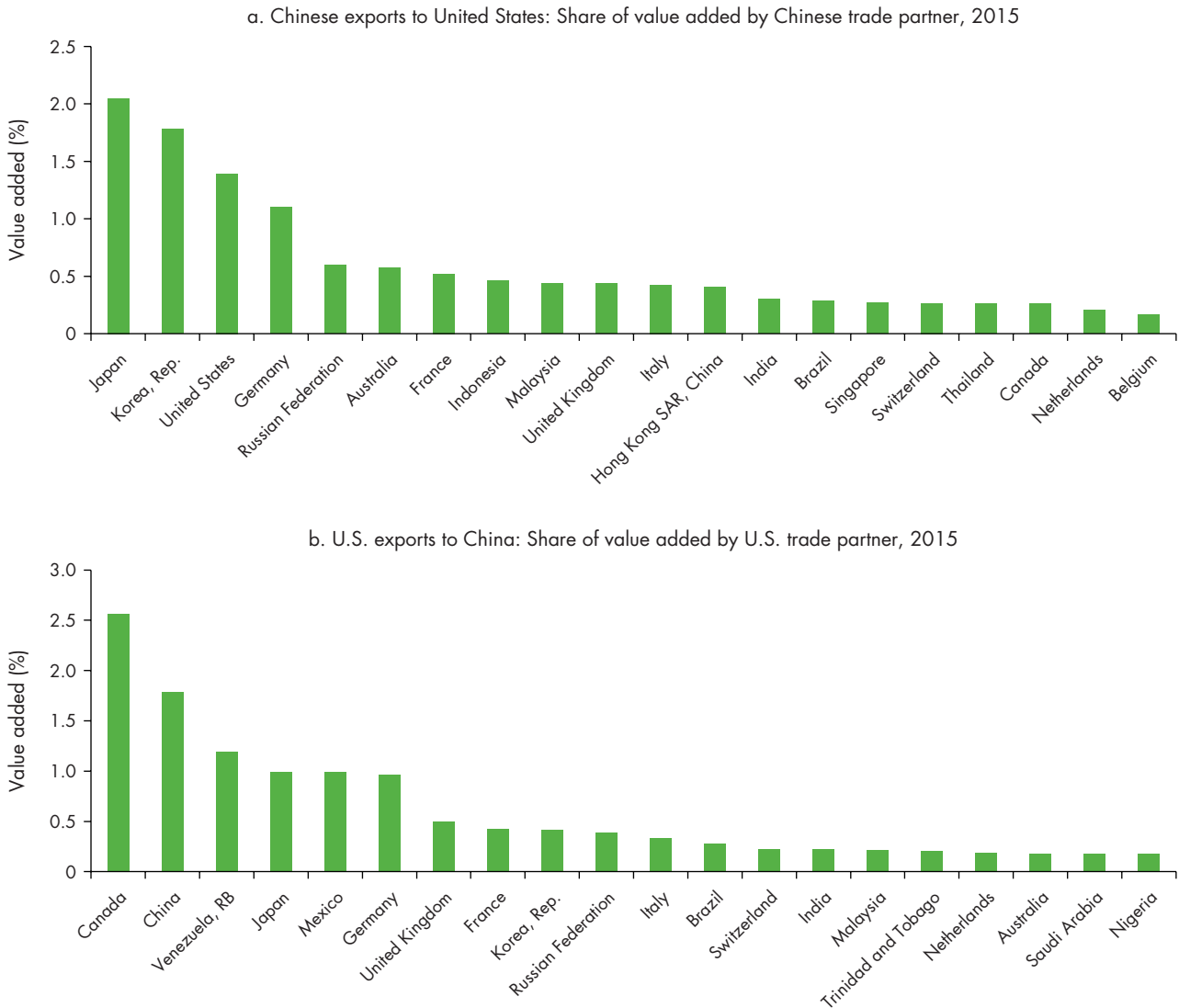
The effects of protection on consumer prices and welfare are likely to be even stronger if tariffs are applied globally, leaving firms unable to shift to other suppliers. Recent evidence reveals that when global tariffs on washing machines were applied in early 2018, their prices climbed about 12 percent for U.S. consumers—foreign manufacturers could no longer shift production to other countries.<sup>31</sup> Because protection and disintegration create incentives for firms to restructure their supply networks, the consequences of even a temporary increase in protection could persist.

If U.S.–China trade tensions are not resolved, they could disrupt GVCs. In particular, tariffs imposed by the United States on intermediate goods are likely to lead to a reallocation of sourcing of inputs across value chains between the United States and China, possibly causing adjustment costs in the sectors and locations affected by trade diversion.

Recent evidence also reveals how the impact of U.S.–China tariffs changes with time, the magnitude of protection, and the nature of products. Econometric analysis of the value and quantities of imports in the United States in 2018 and the first quarter of 2019 finds that the tariffs have led to significant declines in the affected imports by the United States from China.<sup>32</sup> This decline is relative not only to imports of affected products prior to tariff implementation, but also to imports of unaffected products, whether from China or third countries. The analysis also shows that higher tariff rates lead to larger declines and that declines become bigger over time as the policy change is perceived to be ongoing and agents adjust to the new situation (figure 4.10).

The U.S.–China tariffs have also affected products traded via GVCs. For intermediates likely to be associated with GVCs, such as parts and components and

**Figure 4.9 The multilateral dimension of the U.S.–China trade war**



Source: WDR 2020 team, using data from Eora database.

Note: All countries including self are considered as sources of value added in U.S. and Chinese bilateral exports. That is, we include U.S. and Chinese domestic value added into the respective total value added in exports. The figures, however, plot only the share of the top 20 foreign partner countries in the total value added embedded in the U.S. and Chinese bilateral exports. Exports of goods and services are considered.

processed industrial supplies, the decline in import values and quantities are smaller than those for other products. This finding is consistent with the existence of long-term relationships in GVCs. Moreover, the finding that declines are larger and statistically significant for products targeted by higher tariff rates holds for GVC products as well. Although more data are needed, this result points to the first signs of GVC disruptions associated with the trade tensions.

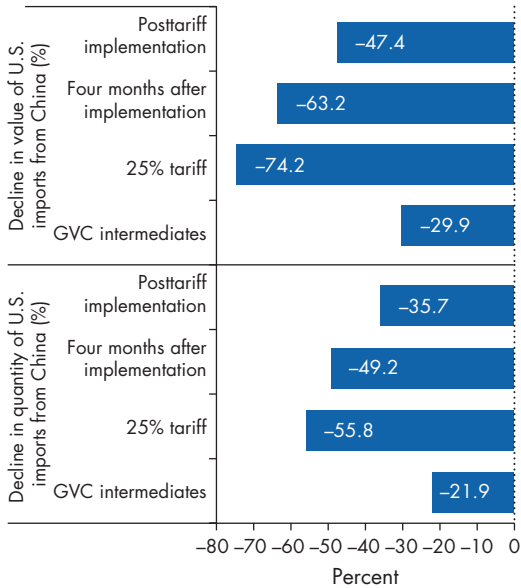
Analysis using a computable general equilibrium model suggests that the longer-term effects may be

even larger. It is estimated that U.S. imports of intermediate goods from China are likely to decline in the longer term by over 41 percent, or much more so than the declines in consumption goods by 9 percent and investment goods by 26 percent.<sup>33</sup>

**Policy uncertainty is costlier under GVCs**

GVCs also amplify the costs of sudden increases in trade policy uncertainty because firms may wait to invest in relationships with foreign suppliers until the uncertainty is resolved.<sup>34</sup> Firms experiencing more

**Figure 4.10 Impact of U.S. tariffs on imports from China (average decline)**



Source: WDR 2020 team, using data from U.S. Census (as of April 2019).

Note: Intermediates are defined as categories 42 and 53 in the Broad Economic Categories (BEC).

permanent uncertainty in specific countries are likely to shift sourcing to more expensive nontargeted markets and diversify their set of suppliers. Generalized and long-lasting trade policy uncertainty is likely to have even stronger negative impacts on GVC trade and investment. The increase in policy uncertainty in 2018 likely contributed to the recent trade slowdown. The negative association between economic policy uncertainty and trade growth emerges from a broader sample spanning 18 countries over 30 years.<sup>35</sup>

## Notes

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- Johnson (2014).
- Boehm, Flaaen, and Pandalai-Nayar (2019); di Giovanni, Levchenko, and Méjean (2018); Liao and Santacreu (2015).
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- de Soyres and Gaillard (2019a).
- Freund and Pierola (2015).
- Barrot and Sauvagnat (2016).
- Auer, Borio, and Filardo (2017); Auer, Levchenko, and Sauré (2019).
- See Andrews, Gal, and Witheridge (2018) and de Soyres and Franco (2019).
- IMF (2015).
- Blaum (2018).
- See Amiti, Itskhoki, and Konings (2014) for a discussion of upstream GVC participation as well as its link with

markup fluctuations. See Ahmed, Appendino, and Ruta (2017) and de Soyres et al. (2018) for the role of downstream GVC participation. See Mattoo, Mishra, and Subramanian (2017) for related evidence on the role of third-country effects.

- Boz, Gopinath, and Plagborg-Møller (2017).
- Corsetti et al. (2018).
- See Amiti, Freund, and Bodine-Smith (2017) for more details.
- Blanchard (2010, 2017).
- Mattoo, Mulabdic, and Ruta (2017).
- Conconi et al. (2018).
- de Soyres, Maire, and Sublet (2019).
- Corong et al. (2019).
- Constantinescu et al. (2019).
- Constantinescu et al. (2019).
- Laget et al. (2018).
- Antràs and de Gortari (2017).
- See Vandenbussche, Connell, and Simons (2017).
- Bellora and Fontagné (2019).
- Grossman and Helpman (2005).
- Sampson 2017; Vandenbussche, Connell, and Simons (2017).
- Amiti, Redding, and Weinstein (2019); Fajgelbaum et al. (2019).
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- Flaaen, Hortaçsu, and Tintelnot (2019).
- Constantinescu et al. (2019).
- Corong et al. (2019).
- Graziano, Handley, and Limão (2018) find that Brexit uncertainty induced a net exit of traded products and a reduction in U.K.–EU bilateral trade flows, especially in industries with high sunk costs. Crowley, Exton and Han (2018) estimate that in 2016 over 5,200 U.K. firms declined to export new products to the European Union, and almost 4,000 U.K. firms halted product exports to the European Union. Entry (exit) in 2016 would have been 5.1 percent higher (4.3 percent lower) if firms exporting from the United Kingdom to the European Union had not faced greater trade policy uncertainty after June 2016.
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