
Global value chains and the fragmentation of trade policy coalitions

Ari Van Assche, and Byron Gangnes*

Recent decades have seen the emergence of global value chain (GVC) production arrangements in which firms fine-slice production processes and disperse activities over multiple countries. This paper analyses how the rise of GVCs affects trade politics in developed countries. Our theoretical model shows that GVCs drive a wedge between the interests of workers and of managers in unskilled-labour-intensive industries, upsetting a traditional coalition that has favoured protectionism against competing imports. Managers of GVC firms switch towards favouring trade promotion since they can substitute foreign for local unskilled workers. The loss of their management ally further weakens the position of low-skilled workers, whose jobs and income are threatened by foreign competition. This new trend may help to explain the recent surge in anti-trade sentiment, while indicating the importance of an active policy response to deal with the economic challenges for affected workers.

Keywords: global value chains, trade policy, coalition, trade politics

1. Introduction

Economists have long recognized that the benefits from international trade are unequally distributed across workers and time. International commerce creates both winners and losers, and there are currently no institutions in place to ensure that the winners sufficiently compensate the losers so that everyone gains (Autor et al., 2016). Key research questions for political economists are thus whose welfare is enhanced or worsened by trade, how this affects political interests and coalitions, and what the resulting implications are for policymaking.

In this paper, we contribute to this line of inquiry by exploring how recent changes in the way that firms conduct international trade – the emergence of global value chains (GVCs) – alters the types of firms and workers that win and lose from trade liberalization in developed countries. In recent decades, firms have globalized

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their production processes as they have separated value chain tasks and moved them to different countries. Most international trade no longer involves exchanging finished goods but rather intermediate inputs, which firms increasingly use to produce their own exports. We show that this trend alters trade policy coalitions in ways that further disadvantage low-skilled workers and explain how this may have exacerbated populist anti-trade sentiment.

Our study is particularly pertinent in the current context where questions about the distributional effects of international trade have moved to the forefront of political discourse in many developed countries (Rodrik, 2018). In the United States, the 2016 presidential election saw renewed resistance to trade. Both major party candidates pointed to job losses associated with foreign competition. Hillary Clinton backed away from her earlier support for the Trans-Pacific Partnership (TPP), and Donald Trump called for sweeping punitive tariffs on imports by U.S. companies who offshore production. In the two years since his inauguration, President Trump has formally abandoned the TPP, forced a renegotiation of the North American Free Trade Agreement (NAFTA) and begun to take punitive actions against foreign competitors in specific industries. He continues to rail against allegedly unfair foreign trade practices.

The anti-trade populist movement has been more muted in Canada, yet the discussion of the effect of trade on workers has entered the political scene with the same vigour in the form of the Canadian Government's "progressive trade agenda." In a speech at the Conference of Montréal in May 2016, International Trade Minister Chrystia Freeland proposed that "the middle class in western industrial societies [...] has begun to fear very profoundly that the two great economic transformations of our time — globalization and the technology revolution — may have been good for a narrow elite [...] but that they haven't been good for most people." The progressive trade agenda attempts to respond to these concerns by ensuring that trade contributes to broad-based prosperity through the inclusion of provisions related to gender, indigenous issues, labor, and the environment in Canada's three priority free trade negotiations: the launch of bilateral talks with China, the signing of a Comprehensive and Progressive Trans-Pacific Partnership (renamed at Canada's behest) and the renegotiation of NAFTA.

The recent surge in political focus on trade and workers is to a large extent about jobs and the suspicion that firms' decisions to offshore production are to blame for manufacturing job losses. And, in fact, there has been a substantial decline in manufacturing jobs in the United States over the past two decades (Pierce and Schott, 2016). The shift away from manufacturing to services activities is not new, of course. Since 1950, the share of manufacturing in total U.S. non-farm payroll employment has fallen from about 30 per cent to roughly 8.5 per cent. But recent losses have been pronounced and concentrated in a number of states that were decisive in the 2016 election. More than six U.S. states have each seen the loss

of at least 300,000 manufacturing jobs since 2000, with declines in percentage terms of 30 per cent to nearly 40 per cent. Although trade may only account for a limited part of these losses, it certainly has played a role. Autor et al. (2014) found that import shocks from China imposed substantial labor adjustment costs on U.S. workers, which disproportionately hurt blue-collar workers.¹ Because of this, it is not surprising that organized labor in import-competing industries has come out strongly against liberal trade policies.

What is new, we argue, is a divergence that has developed between the trade policy demands of labor and those of management in these same import-competing industries. In many cases, managers now favour freer trade, rather than barriers to imports in their sector. This divergence between worker and manager interests is starkly different from the unified resistance to trade liberalization by import-competing firms and workers that typified much of the post-war period.

As we will show in our theoretical framework, this fragmentation of the trade policy coalition between managers and workers in import-competing industries is exactly what one would expect in a world where production is increasingly conducted by networks of firms operating within GVCs. A key reason for managers to offshore labor-intensive production activities is to substitute cheap foreign labor for expensive domestic workers, but that substitution comes at the price of tariffs and other barriers to imports. Many managers who traditionally lobbied for protection to keep their local factories open now fight for trade liberalization in order to allow the goods that they produce in their offshore factories to come in at a lower cost.

This fragmentation of traditional trade policy coalitions may have helped stir the recent anti-trade populist movement. Autor et al. (2017) find that exposure of local labor markets to heightened competition from China has contributed to rising political polarization in the United States. They suggest that this trend is consistent with political economy theories that connect economic adversity to in-group/out-group identification, as motivated by group-based resource competition. We argue that the loss of a key political ally in blue-collar workers' quest for trade protection may only have intensified their political attachment to their in-group, exacerbating the process of political polarization.

Our paper contributes to two streams of research which use distinct approaches to study GVCs. Researchers in economic sociology and development studies have primarily focused on the social and territorial consequences of GVCs. For this purpose, they have developed frameworks that analyse the various actors involved in global supply chains, the governance of these activities, and the possibilities or

¹ It is important to note that Feenstra et al. (2017) attribute similarly large job gains in the United States to export expansion.

barriers that GVCs present for upgrading and regional development (Gereffi, 1999; Gereffi et al., 2005; Humphrey & Schmitz, 2002). More recent research has used these models to study how trade liberalization shapes new GVC relationships, but also to show that this is a contested process marked by asymmetric gains (Curran & Nadvi, 2015; Gereffi, 2014; Horner & Nadvi, 2018).

Economists, not surprisingly, have focused on the economic causes and consequences of GVCs. A vast literature has analysed GVCs by investigating the drivers of firms' decisions to fragment their production internationally (Grossman and Rossi-Hansberg, 2008; Van Assche, 2008), the type of firms that are more likely to offshore production activities (Defever and Toubal, 2013; Farinas and Martin-Marcos, 2010; Tomiura, 2007) and the effects of offshoring on a firm's productivity, employment and wages in both the home and host countries (Amiti and Konings, 2007; Goldberg et al., 2010; Hummels et al., 2014; Kasahara and Rodrigue, 2008). Our paper fits in the economics tradition of GVC research but highlights distributional effects that would in some ways be familiar territory for researchers in economic sociology and development studies.

Our paper also relates to a growing political economy literature which studies the effect of global supply chains on firms' trade preferences. Jensen et al. (2015) provide evidence that GVC firms are less likely than others to support anti-dumping actions against foreign countries, especially those in which they have investments or with which they trade. Eckhardt (2013) and Eckhardt and Poletti (2016) find that European companies whose operations depend on imported components are more likely to favour trade liberalization. There is also evidence that these new trade preferences affect trade policy. Blanchard and Matschke (2015) find that the United States is more likely to offer preferential market access to countries that host U.S. multinational affiliates than to other countries. Blanchard et al. (2016) show that a country's discretionary final goods tariffs are decreasing in the domestic content share of foreign-produced final goods. We add to this literature by digging deeper into how the emergence of GVCs affects the trade policy preferences of various stakeholders.

Finally, our research relates to studies that apply trade models with firm heterogeneity to analyse trade policy coalitions. Madeira (2016) sets up a framework with horizontal intra-industry trade and shows that high-productivity and low-productivity firms have opposing preferences concerning trade liberalization. High-productivity firms favour trade liberalization because it improves their access to foreign markets, but low-productivity firms oppose it because they are unlikely to export and they face intensified pressure from imports. Using data on lobbying expenditures in the United States, Madeira found that industry-based associations are indeed less active relative to individual firms in industries with higher horizontal intra-industry trade. Using Japanese data, Plouffe (2017) finds that highly productive manufacturers are more likely to support trade liberalization than low-productivity firms. Our research

complements these studies by showing that the emergence of GVCs induces a similar division in trade preferences between high-productivity and low-productivity firms in import-competing industries.

Our paper consists of six parts. In section 2, we describe the evolution that is occurring in global production arrangements. In section 3, we consider the various ways that these changes would be expected to affect the trade policy positions of firms that take different approaches to production and of their workers, and we review the evidence to date on shifting trade policy stances. In section 4, we offer a theoretical model that, by incorporating key aspects of GVC production, can be used to understand these changes in constituent interests and policy pursuits. In section 5, we look at two high-profile cases where these issues have been playing out: the different trade policy positions taken by New Balance and Nike in the U.S. shoe industry and the shifting policies of Canada's export finance agency, Export Development Canada. Section 6 discusses the political implications of our analysis and concludes.

2. GVCs and international trade

In recent decades, many firms have undertaken rapid transformations that are changing the way products and services are produced. Thanks to reduced communication and transportation costs, they have abandoned the practice of producing goods and services themselves in a single country. Through offshoring and outsourcing, they have sliced up their value chains and dispersed production activities across the globe, creating GVCs.

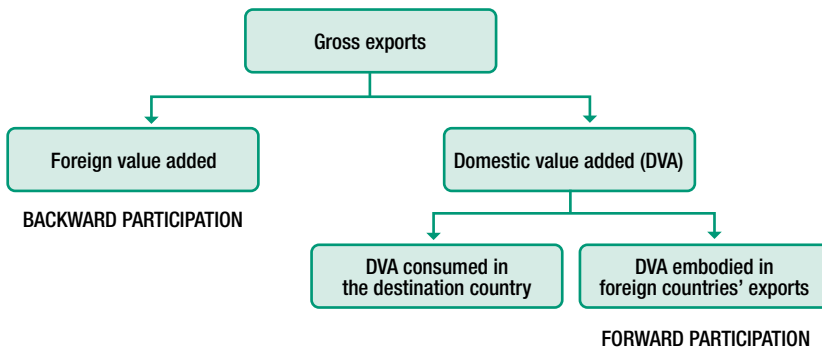
The introduction of GVCs has fundamentally altered the nature and determinants of trade patterns between countries. It has been widely documented that production chains for goods and services are not concentrated within single countries but are now increasingly fragmented, with corporations dispersing activities across multiple countries and companies (Feenstra, 1998; Johnson and Noguera, 2012). Many firms only concentrate a sliver of the value chain in their home country, not the production of entire goods. Furthermore, they connect more and more with foreign value chain partners to make final goods and services. As a result, trade in intermediate inputs – those goods and services which are used in the production process to produce other goods or services rather than for final consumption – now accounts for roughly two-thirds of all international trade (Johnson and Noguera, 2012).

Firms can connect with foreign value chain partners in two directions to produce goods and services: upstream and downstream. Upstream, they can import intermediate inputs from their foreign value chain partners which they then use for the production and export of their own goods. This is called *backward participation* in GVCs. Downstream, firms can export intermediate goods to their foreign value

chain partners which in turn use them to make their own exports, known as *forward participation* in GVCs.

The Trade in Value Added (TiVA) data set compiled by the Organization for Economic Co-operation and Development (OECD) and the World Trade Organization (WTO) provides aggregate insights into the extent of a *country's* backward and forward participation in GVCs (De Backer and Miroudot, 2014). By combining input-output data for multiple countries with trade statistics, the data set allows a country's gross exports to be decomposed into two parts: (1) *domestic value added*, which is generated in the exporting country, and (2) *foreign value added*, which comes from outside the exporting country. Foreign value added depicts a country's backward participation in GVCs. Domestic value added can be further decomposed into two subparts: *domestic value added consumed in the destination country* and *domestic value added embodied in a foreign country's exports*. The latter term captures a country's forward participation in GVCs. In the remainder of this section, we will use the TiVA data set to document the growing importance of GVCs in North American trade. These relationships are outlined in figure 1.

Figure 1. Decomposition of gross exports



2.1 Backward participation

Starting with Hummels et al. (2001), scholars have used the foreign value added share embodied in gross exports as an indicator of a country's backward participation in GVCs, since it indicates how heavily a country relies on imported inputs to produce its exports (see also Johnson and Noguera, 2012). As table 1 shows, foreign value added is responsible for a significant portion of North American countries' gross exports. In 2011, it accounted for 15 per cent of U.S. exports, 24 per cent of Canadian exports and 32 per cent of Mexican exports. In other words, for the three

Table 1. Integration in global value chains, NAFTA countries, 1995 and 2011

	Share of foreign value added in gross exports		Domestic value added embodied in foreign exports as share of gross exports		GVC trade as share of gross exports	
	1995	2011	1995	2011	1995	2011
United States	11.5	15.0	19.4	24.9	30.9	39.9
Canada	24.2	23.5	11.1	19.0	35.3	42.5
Mexico	27.3	31.7	11.1	15.1	38.4	46.8

Source: Authors' calculations using the OECD-WTO TiVA database.

North American countries, foreign inputs account for one-sixth to nearly a third of their gross export value.

Note that the significantly smaller foreign value added share for the United States should not come as a surprise. The large size of the U.S. economy implies that firms have a substantially bigger pool of local intermediate input providers in their proximity to draw on than do countries with smaller economies such as Mexico and Canada. Consequently, there is less need to partner with foreign suppliers to produce goods or services.

Canada is the only North American country that has seen a decrease in its share of foreign value added in gross exports between 1995 and 2011. This is due primarily to the rise in oil prices, which has made the composition of Canada's exports more oil-intensive. Since the foreign value added share of oil exports is relatively lower than that of other industries, the foreign value added share of aggregate gross exports has therefore also declined.

2.2 Forward participation

North American countries also export intermediate inputs to foreign value chain partners who use them to produce their own exports. For example, a Canadian aerospace company may export an intermediate good to Seattle, which Boeing then uses to produce and sell planes around the world. As we noted above, to capture a country's *forward participation* in GVCs, the TiVA data set allows a further decomposition of a country's domestic value added into two subcategories: (1) domestic value added consumed in the destination country and (2) domestic value added embodied in foreign countries' exports. The latter term captures a country's forward participation in GVCs.

Table 1 shows that a significant portion of exports from North American countries are intermediate goods that are used in the exports of other countries. In 2011, forward participation accounted for 15 per cent of Mexico's gross exports, 19 per cent of

Canada's gross exports and 25 per cent of U.S. gross exports. Furthermore, for all three countries the forward participation rate increased between 1995 and 2011.

A country's forward participation in GVCs means that its exports are not necessarily determined by demand conditions in the destination country, but rather in the country where they are ultimately consumed. Table 2 demonstrates the importance of taking this distinction into account. If one country exports a larger share of its value added to another country than what is ultimately consumed there, it suggests that the latter country serves as a downstream partner in GVCs. It is clear from the table that North American countries do tend to use GVC partners in this way. Canada and Mexico (but also China) are important downstream partners for the United States. For Canada, the United States and China are leading downstream partners. For Mexico, Canada and the United States are important downstream partners.

Table 2a. Share of the United States' exports by destination country, 2011

	Domestic value added content in gross exports	Domestic value added in foreign final demand
EU 28	24.5	25.2
Canada	13.7	12.5
Mexico	9.3	7.2
China	7.3	6.8
Japan	6.6	7.7

Table 2b. Share of Canada's exports by destination country, 2011

	Domestic value added content in gross exports	Domestic value added in foreign final demand
United States	65.9	59.9
EU 28	9.5	11.1
China	5.1	4.6
Japan	3.3	4.1
Mexico	2.3	2.6

Table 2c. Share of Mexico's exports by destination country, 2011

	Domestic value added content in gross exports	Domestic value added in foreign final demand
United States	69.3	63.5
Canada	6.7	6.6
EU 28	5.4	7.1
China	3.4	3.4
Japan	1.1	1.8

Source: Authors' calculation using the OECD-WTO TiVA database.

3. Implications for trade politics

The fact that companies connect with foreign value chain partners to produce goods and services (which they own or do not own) has important implications for firm managers' trade policy preferences. In this section, we outline a theoretical framework that allows us to look formally at these implications, but it is possible to make some general observations first.

To understand the implications of GVCs for trade policy preferences, it is useful to revisit the way we have traditionally viewed trade politics. For decades, our thinking about trade has been based on the notion that the production processes for goods and services are concentrated within the geographical boundaries of a country. A Canadian export product or service was considered entirely "Made in Canada"; a product or service imported from China was considered "Made in China."

This national production paradigm has helped shape the main tenets of trade politics. To illustrate this, consider the Heckscher-Ohlin model. Firms' trade preferences are shaped by the industry in which they operate. Companies in import-competing sectors gain from import restrictions because the restrictions protect them from foreign competition. In skill-abundant countries such as the United States, it is firms in labor-intensive sectors that prefer import restrictions. In labor-abundant countries such as Mexico, it is companies in skill-intensive industries that lobby for import tariffs.

Such firm-level trade preferences influence trade politics because governments not only care about national welfare but also about political support. Indeed, a government that cares about political contributions has the incentive to unilaterally impose import tariffs as long as the financial support that it obtains from companies in import-competing industries outweighs the welfare losses that consumers face due to higher prices (Grossman & Helpman, 1994).

Firms in exporting industries have opposing trade preferences. They benefit from improved foreign market access since it increases their export opportunities and strengthens their competitiveness in foreign markets. As a result, they want foreign countries to reduce tariffs on their goods. In skill-abundant countries, for example, firms in skill-intensive industries benefit from a tariff reduction on foreign imports. In labor-abundant countries it is the firms in labor-intensive industries that care about reductions in foreign countries' import tariffs.

Governments do not have the power to unilaterally reduce the import tariffs of foreign countries, but they can enter trade agreements with foreign countries that lead to reciprocal tariff reductions. In such trade liberalization scenarios, the government inevitably loses political support from its firms in import-competing industries, but it gains political support from its firms in exporting industries

(Regan, 2015). Government may thus decide to enter trade agreements if the political support gained from exporting industries (as well as from consumers) exceeds the loss in political support from import-competing industries.

Traditional models of trade and trade politics, which are built on the assumption that production processes are concentrated locally, generally predict that firms and workers will form narrow industry-based or broad class-based coalitions (Madeira, 2016). If factor mobility is low (as in the Ricardo-Viner framework), all firms and workers in an import-competing industry benefit from trade protection, while workers in exporting industries are hurt. If factor mobility is high (as in the Stolper-Samuelson model), firms share the same trade preferences as the production factor that they use intensively. Skill-abundant countries such as the United States and Canada import unskilled-labor-intensive goods (e.g. textiles, shoes), and so unskilled-labor-intensive firms and their unskilled workers benefit from trade protection. Skill-intensive firms and skilled workers in those economies, in contrast, favour trade liberalization.

The departure we are seeing from these predictions stems from the failure of traditional trade models to capture the fundamental restructuring that has occurred in the way that goods and services are produced. Counter to the models, production no longer takes place in factories located within the geographical boundaries of a single country. Instead, as we have seen, today's value chains are now spread across multiple countries. The emergence of these firms generates conflicting trade preferences between the managers of GVC firms and those of firms with local value chains (LVCs) producing primarily within the home country. The latter continue to support trade restrictions because they strengthen their market share compared with both foreign and GVC firms. GVC firms, however, prefer certain types of trade liberalization that facilitate their ability to connect cheaply and effectively with their foreign value chain partners. In some sense, they no longer view trade policy through a national lens, but rather through an internationalist lens necessitated by their international production structures.

GVC firms want policymakers to focus not only on greasing the wheels on the export side, but also on eliminating barriers on the import side. Indeed, the productivity of GVC firms depends critically on their ability to connect to the most competitive foreign suppliers. Through backward participation, companies can reduce input costs and increase their overall productivity (Grossman and Rossi-Hansberg, 2008). There is ample evidence to back this up. Amiti and Konings (2007), for example, show that a 10-percentage point drop in tariffs on inputs leads to a 12 per cent productivity gain for Indonesian firms that import their inputs. Goldberg et al. (2010) and Topalova and Khandelwal (2011) have found similar results for Indian firms.

Recent studies provide evidence that GVC firms are more likely to support trade liberalization than firms with LVCs. Jensen et al. (2015) show that firms with

global supply chains are less likely than others to support anti-dumping actions against foreign countries, especially those in which they have investments or with which they trade. Studies of trade policymaking in the European Union (EU) have traced the emergence of a new category of actor: companies whose operations are dependent on imported components and which, consequently, favour trade liberalization (Eckhardt, 2013; Eckhardt and Poletti, 2016).

4. Theoretical framework

In this section, we develop a theoretical framework based on Melitz (2003) that articulates the ways in which the emergence of GVC arrangements alter the structure of preferences over trade policy in skill-intensive countries like the United States and Canada. In the model, firms with different productivities choose whether to manufacture at home (LVC) or abroad (GVC). Manufacturing offshore entails extra coordination costs, and so only the most productive firms in an industry set up GVCs, while less productive firms manufacture locally. We show that offshoring generates conflicting trade preferences among firms in the same industry. The less productive LVC firms support import tariffs because this strengthens their market share compared with GVC firms. The more productive GVC firms, in contrast, oppose import tariffs because they increase their costs and weaken their competitiveness.

Second, we illustrate that – counter to the Stolper-Samuelson theorem – GVC production arrangements drive a wedge between the trade preferences of unskilled workers and the owners of unskilled-labor-intensive GVC firms. The elimination of import tariffs makes offshoring more attractive, inducing some firms to substitute foreign for domestic unskilled labor. This shrinks the demand for local unskilled workers, which pushes down their real wages. Unskilled workers therefore oppose the elimination of import tariffs, while the GVC firms favour it. In a sense, a firm's ability to offshore unskilled-labor-intensive activities overseas flips its trade preferences towards those of skilled workers, even in an industry that is a heavy user of unskilled labor.

In this section we present the model and its predictions verbally. The model in mathematical form is included in the appendix.

Consider a world of two small countries, “North” and “South.” Consumers in North spend a fixed amount of money on a differentiated good – say, footwear. Northern consumers' welfare increases when they buy more of a shoe type and when they buy different shoes (they love variety). In the model, consumers' demand for each shoe variety depends in the same way on changes in shoe prices, and we assume this relationship to be independent of the overall level of their consumption.

In North, there are many footwear companies, each of which have the knowledge to produce a single shoe type.² An entrepreneur who wants to enter the footwear sector must hire workers to develop a production technology, which in turn determines his productivity. The precise productivity that he will obtain is unclear, but the distribution of possible productivities is known. Once he learns his productivity, the entrepreneur determines whether to start producing. If it is profitable to start producing, the entrepreneur turns into a firm. The skilled-labor cost to develop a technology equals the fixed cost of entry and is identical for all entrepreneurs.

Producing a shoe variety requires two consecutive value chain stages: headquarters services and manufacturing. In the first stage, the firm needs to use skilled workers to produce headquarters services such as product design and marketing. We assume that headquarters services can be produced only in North (where the skill base is more sophisticated). In the second stage, the firm uses unskilled workers to manufacture the shoes. Manufacturing is footloose in that it can be performed either in North (at a high unit labor cost) or in South (at a low unit labor cost). South's cost advantage in unskilled labor provides firms the incentive to offshore manufacturing and create GVCs.

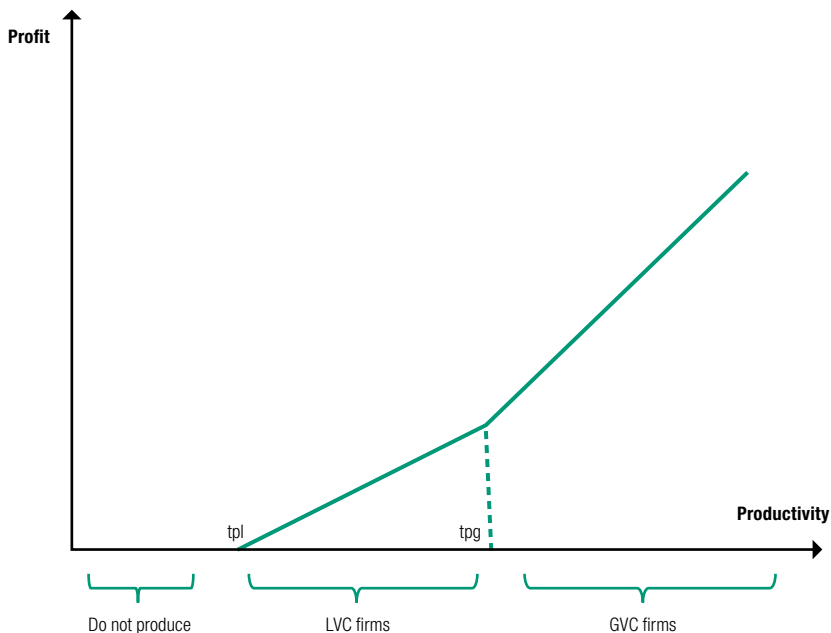
Offshoring comes at a cost: firms are subject to a tariff when they import their manufactured shoes from South. We assume that the tariff does not entirely wipe out the Southern labor cost advantage so that firms still have the incentive to offshore production to South. But firms also have to pay a fixed cost to coordinate activities across borders, which provides a counter-incentive to keep manufacturing in North.

Because firms vary in their productivity, the marginal cost of production differs across shoe companies. A firm's average cost falls if it produces more (due to the fixed cost of production), and the average cost varies across firms (due to differences in their production level and differences in their marginal cost of producing). We call firms that require a relatively high amount of unskilled labor to manufacture shoes low-productivity firms; firms that can produce a shoe with less labor input are called high-productivity firms.

For simplicity, we assume that firms sell all their output in the Northern market, although that is not crucial for our results. They each sell a unique type of shoes but face competition with closely substitutable shoes. Each firm is too small to influence overall market prices (i.e. the market structure is monopolistically competitive.)

As long as the fixed cost of coordinating across borders is not too high, two types of Northern firms will coexist in the industry (figure 2): less productive LVC firms that

² Our model does not have foreign firms. Adding them would not alter the main results.

Figure 2. Co-existence of LVC and GVC firms

manufacture in North, and more productive GVC firms that manufacture in South. We develop the intuition behind this conclusion in the following paragraphs.

In this model there are two key productivity thresholds. The first threshold productivity level, tpl , determines the productivity at which it becomes profitable for firms to start producing using LVCs. Entrepreneurs with a productivity below the threshold simply do not set up a firm. Entrepreneurs with productivity above this threshold set up firms with manufacturing plants in North. The second threshold, tpg , determines the productivity at which it becomes profitable for firms to manufacture in South. One way to think of this is that only the more productive firms have sufficient profits to cover the fixed cost of coordinating across borders. Therefore, the less productive firms (those with a productivity between tpl and tpg) choose to operate as LVC firms, with production remaining within the home country. The most productive firms, with a productivity above tpg , become GVC firms.

4.1 Trade liberalization

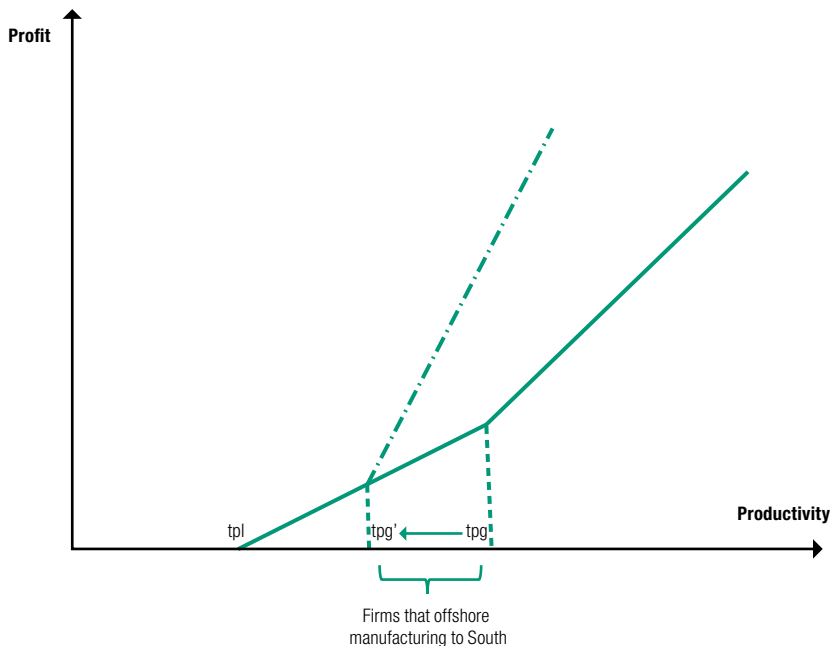
The impact of trade liberalization can now be analysed by looking at the effect of a decrease in tariffs on shoe imports from South. A reduction in tariffs into North

generates two changes. First, it lowers the marginal cost of production for incumbent GVC firms, since they can now bring in their manufactured shoes without a large tariff. Because in this framework firms always apply the same markup over costs, the marginal cost reduction lowers GVC incumbents' prices and increases their sales and profits. (This is known as an increase at the *intensive margin*). In figure 3, this is depicted as an increase in the slope of the curve that depicts profits as a function of firm productivity. Second, the tariff reduction reduces the threshold productivity tpg at which firms decide to offshore manufacturing to South and become GVC firms. This shift in the threshold productivity suggests that numerous firms switch from LVC to GVC (known as an increase at the *extensive margin*).

Trade liberalization affects the economic fortunes and political positions of various stakeholders differently.

Managers. The tariff reduction affects managers of GVC and LVC firms differently. Not surprisingly, managers of GVC firms favour trade liberalization. Due to the intensive and extensive margin effects, a tariff reduction reduces the costs and improves the profits of both GVC incumbents and entrants. They thus favour import tariff reductions. In contrast, the position of LVC firms is generally disadvantaged by

Figure 3. The effect of trade liberalization on profits of LVC and GVC firms



trade liberalization. In our model the profits of LVC incumbents are not negatively affected (no intensive margin effect). However, the reduction in the market share of LVC firms compared with that of GVC firms (due to the extensive margin effect) plausibly reduces the political clout of LVC firms in the industry.

Consumers. The fall in tariffs benefits consumers in the model, because it induces lower prices and increased overall consumption opportunities.

Workers. The effect of trade liberalization on workers is mixed. The skilled workers employed in headquarters services are unambiguously better off. Since GVC firms expand their production more than LVC firms contract theirs, demand for skilled workers increases, putting upward pressure on their real wages. Unskilled workers may be worse off, however. As the output of LVC firms contracts, demand for unskilled workers shrinks, pushing their wages downward. Therefore, trade liberalization has distributional effects across skill levels within the same industry.

The country as a whole. At the national level, trade liberalization brings aggregate welfare gains. The total gains to individuals who are better off after the liberalization (skilled workers) exceed the total losses to individuals who suffer reduced real income (unskilled workers). Although the government could in principle design taxes and transfers to ensure that no individual is worse off after trade liberalization, in the real world there are significant political impediments to doing so.

We summarize the results in table 3.

The model illustrates how the fortunes and political interests of various stakeholders depend on characteristics of the economic environment and the roles they play. It is easy to see how the most productive multinational firms may tend to be big supporters of free trade in a world where there are large cost advantages to producing abroad and the costs of coordinating such activities have come down

Table 3. Impact of trade liberalization on various stakeholders

Stakeholder	Gain	Lose
Consumers	X	
Workers		
<i>Skilled workers</i>	X	
<i>Unskilled workers</i>		X
Firms		
<i>GVC firms</i>	X	
<i>LVC firms</i>		X

over time. Firms that cannot thrive in this environment will have incentives to press for more restrictions on trade. While all consumers benefit from lower prices of imports, less-skilled workers will lose out in skill-abundant North, consistent with the backlash against trade that we saw reach a head in the United States during the 2016 presidential campaign. Skilled workers, in contrast, gain as North's production pattern falls in line with its comparative advantage.

In the following section, we look at several case studies that highlight these forces at work and how firms in the same industry have taken divergent positions on trade policy.

5. Case studies

5.1 Nike, New Balance, and Viet Nam footwear tariffs³

During the TPP negotiations in 2012, a heated topic of discussion was whether the United States should accept a reduction of tariffs on imported footwear products. On the one hand, TPP negotiating partner Viet Nam was the second largest foreign supplier of footwear to the United States and was lobbying strongly for the elimination of tariffs as part of the TPP agreement. Obtaining concessions for other industries might therefore have depended on the willingness of the United States to reduce footwear tariffs. On the other hand, opponents including U.S. labor unions argued that Viet Nam's strength in the footwear industry was based on unfair subsidies and labor practices, and that the elimination of tariffs would sound the death knell for a key U.S. manufacturing industry.

The discussions came at a sensitive time for the footwear manufacturing sector in the United States. As in other unskilled-labor-intensive industries in the United States, manufacturing jobs were down. According to the Bureau of Labor Statistics, between 2003 and 2012, employment in the footwear manufacturing industry dropped from 19,440 to 13,290 workers. This decrease was due largely to a 41 per cent decline in the number of unskilled production workers. In comparison, white-collar office and administrative support occupations in the footwear industry had dropped by just 25 per cent, and management occupations had almost returned to 2003 levels.

The main reason for the decline in footwear industry employment was growing import competition from low-wage countries. In 2012, nearly 99 per cent of the footwear sold in the United States was imported from low-cost manufacturing locations, especially in East and Southeast Asia. China alone accounted for 72 per cent of U.S. footwear

³ A lengthier version of this case was presented in Brodeur and Van Assche (2014).

imports in 2012, while TPP negotiating partner Viet Nam accounted for 10 per cent of those imports (see table 4). The pace of Viet Nam's growth in the footwear market was particularly rapid: exports to the United States jumped an astounding 24 per cent annually between 1997 and 2012, albeit from a very low base.

In line with the predictions of our model, however, there was widespread disagreement among U.S. footwear companies on the trade policy stance the United States should adopt. New Balance, the only U.S. athletic footwear company still producing shoes in the United States, was vehemently opposed to the elimination of tariffs. According to a spokesperson of New Balance, it was already 25 per cent to 35 per cent more expensive to produce in the United States than in Viet Nam and so a tariff reduction would only chip away at the tariff buffer that allows New Balance to produce in America (Aeppel, 2013). In line with the extensive margin story in our model, New Balance pointed out that a tariff reduction on footwear imports from Viet Nam would force New Balance to close its U.S. factories and move all of its production facilities overseas.

In contrast to New Balance, U.S. footwear giant Nike was a strong supporter of reducing import tariffs. None of Nike's employees in the United States are factory workers (Nike, 2013). Rather, they are mostly involved in providing headquarters services, designing and engineering new equipment, promoting products, and selling them in Nike stores. As with most U.S. footwear companies (with the notable exception of New Balance), Nike has completely outsourced its footwear manufacturing to foreign contractors. In December 2016, it was estimated that Nike's external contractors employed more than 600,000 workers in 133 factories around the world to produce their footwear products. More than 90 per cent of these workers were in Viet Nam, Indonesia and China.

Table 4. Growth of U.S. Footwear Imports, by Country of Origin, 1997-2012

Country	U.S. footwear imports			Share of U.S. footwear imports	
	(US\$ millions)		Compound annual growth (%)	(%)	
	1997	2012	1997-2012	1997	2012
China	7,737	17,876	5.74	53.03	71.90
Viet Nam	102	2,512	23.83	0.70	10.11
Italy	1,244	1,230	-0.07	8.53	4.95
Indonesia	1,139	982	-0.99	7.81	3.95
Mexico	393	497	1.57	2.69	2.00
Rest of the world	3,560	1,233	3.62	27.24	7.09

Source: United Nations Comtrade Database: <http://comtrade.un.org/>

The arguments of Nike were much in line with the predictions of our model. First, consumers would benefit from the tariff reduction, because being able to import footwear products without being penalized by tariffs would make footwear more affordable. As argued by Oregon's U.S. Representative Earl Blumenauer, whose constituency is home to Nike employees as well as the U.S. headquarters of Adidas, keeping the tariffs would tax millions of Americans on their footwear purchases to protect only a few thousand manufacturing jobs (Martin, 2012). This argument is especially compelling when one considers that 99 per cent of the footwear purchased in the United States is produced in other countries.

Nike further suggested that the tariff reduction would benefit many (high-skilled) workers. U.S. footwear manufacturers would be able to save on production costs and reinvest their savings in modern, high value added jobs in headquarters services in the United States. As Erin Dobson, a Nike spokesperson, said, "[t]he question comes down to, is one kind of job more important than another? What are the jobs for the 21st century? They're not necessarily jobs that existed 30 years ago" (Martin, 2012).

The case of New Balance and Nike demonstrates how the evolving nature of production arrangements is altering the trade preferences of developed-country firms (table 5). Companies that, like Nike, have fully embraced GVC production are more likely to favour liberalization of imports in order to access low-cost foreign component imports as they increasingly specialize domestic employment in higher-skilled headquarters services. Companies that retain a significant local production presence, such as New Balance, continue to resist import liberalization, as of course do their lower-skilled domestic production workers. And these changing business interests are influencing policymakers, as seen in the stance taken by the Oregon Congressman.

Table 5. Impact of tariff reduction on footwear imports for various U.S. stakeholders

Stakeholder	Gain	Lose
Consumers	X	
Footwear workers		
<i>Skilled workers</i>	X	
<i>Unskilled workers</i>		X
Firms		
<i>Nike</i>	X	
<i>New Balance</i>		X

5.2 EDC's Volkswagen loan

The increasing importance of GVC production is also affecting the practice of public institutions tasked with carrying out trade policy. Export Development Canada, or EDC in short, is Canada's official export credit agency. Created in 1944, its primary mandate is to help Canadian firms expand their international business abroad by offering innovative commercial financing and insurance solutions, often at below-market rates.

As a Crown corporation, EDC needs to balance its public policy goals with the need to operate the programme at no cost to the taxpayer. All transactions that EDC facilitates must be shown to benefit the Canadian economy. In the past, when value chains were largely local, this came down to supporting export sales of Canadian-based companies and ensuring that the goods and services being exported were primarily produced with Canadian inputs. This would help to grow Canadian businesses, which in turn would create Canadian jobs and contribute to Canada's economic growth, all with the goal of improving Canadians' standard of living.

EDC has gradually modernized its interpretation of Canadian benefits to reflect the growing role of GVCs. As we have shown, for GVC firms the competitiveness equation has moved from one of local efficiency and productivity to one that also encompasses the ability to link with strong foreign suppliers, logistics providers, financial intermediaries and foreign affiliates. In line with this shift, EDC has started giving loans and export credits to foreign companies if the case can be made that this will help facilitate the integration of Canadian firms into GVCs.

In April 2015, EDC announced that it would lend roughly C\$526 million to Volkswagen, a German company that has no manufacturing presence in Canada, to help it consider doing business with Canadian parts makers. The loan came at a sensitive time. The performance of Canada's automotive exports had been lacklustre over the previous 15 years. In 2013, Canada's automotive exports were only slightly larger in nominal terms than they had been in 2000. Like the global automotive industry overall, Canada's motor vehicle export sector contracted significantly during the Great Recession, with its export value shrinking 34 per cent in 2009. Since then, Canada's motor vehicle exports have seen a strong rebound and have nearly returned to pre-crisis highs.

Automotive imports, in contrast, have risen sharply in the past decade and a half. Between 1998 and 2013, they grew at an annualized rate of 7.5 per cent, tripling in value. Consequently, Canada's traditional trade surplus in the automotive sector has been wiped out: in 2013 the sector had a trade deficit of US\$7 billion.

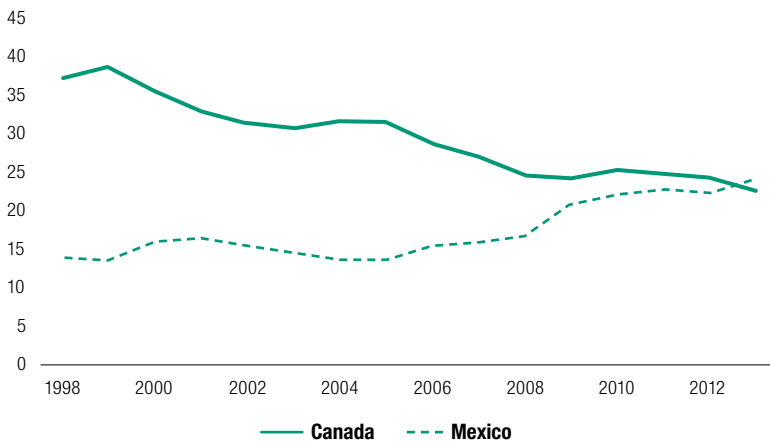
One of the key reasons for the growing trade deficit is heightened competition from Mexico. Powered by cheap labor and a growing supply base, the country has scooped up tens of billions of dollars in new greenfield auto investment by BMW,

Volkswagen, Toyota, Honda, Kia, Daimler and the Detroit Three (General Motors, Ford and Fiat Chrysler). With many automakers choosing Mexico over Canada as the site for new assembly plants, the share of U.S. automotive imports from Mexico recently surpassed that from Canada (see figure 4).

According to Carl Burlock, senior vice-president of finance and investment at EDC, the agency is providing financial support for Volkswagen to facilitate participation by Canadian suppliers in developing GVCs. “[T]his financing is really about relationship building, both for EDC and for Canadian [small and medium-size enterprises (SMEs)] in the tooling and automotive supply industries. The value here is that qualified Canadian SMEs get a real chance to be considered by a major industry player, where they might not have an opportunity to gain that kind of access on their own,” Burlock said (EDC, 2015). “With the Southern [United States] and Mexico increasingly becoming prime production locations for global automakers, EDC has a role to play in making sure that Canadian companies have the opportunity and financial wherewithal to compete for that business,” he added.

According to Flavio Volpe, president of the Automotive Parts Manufacturers’ Association, representing Canadian companies that employ over 40,000 Canadians, “this is great news for our companies and their employees, and we’re confident that the stronger connection with Volkswagen, created through this loan, will help

Figure 4. Share of U.S. automotive imports, 1998–2013 (per cent)



Canadian toolers and parts manufacturers win new business with VW” (Burlock, 2015). Volpe added, “Volkswagen has already purchased \$85 million worth of parts from Canadian-based suppliers over the past year, and they appear ready to buy more.”

The decision by EDC to provide financing to Volkswagen was received with much scepticism, however, by manufacturing workers in Canada. Canada’s largest private sector union, Unifor, was swift to denounce the move. Its president, Jerry Dias, stated that the financing deal did not guarantee that a Canadian company will benefit or that Canadian jobs will be created, and that the deal will probably lead to deals with part plants in Mexico, where Volkswagen has an assembly plant. He followed by saying, “it is absolutely incredible that a Canadian Government agency is helping to facilitate and accelerate the migration of the continental auto industry to Mexico” (Keenan and McKenna, 2015).

Like the New Balance and Nike case, EDC support for Volkswagen demonstrates how corporate interests are changing in the GVC era, how policy is changing in response, and how new sets of winners and losers are being created (see table 6). It is particularly interesting in the way it highlights how the interests of domestic supplier firms and their workers are also evolving in an environment where production arrangements increasingly extend across international borders. Many of these companies produce sophisticated parts that are well tuned to the capital and skills of Canada, and that can therefore benefit from integration with lower-skilled assembly operations in Mexico.

Table 6. Impact of EDC loan to Volkswagen on various Canadian stakeholders

Stakeholder	Gain	Lose
Consumers	?	?
Automobile workers		
<i>Parts manufacturing</i>	X	
<i>Assembly</i>		X
Firms		
<i>Parts manufacturers</i>	X	
<i>Assembly</i>		X

6. Concluding remarks and policy implications

We have argued that the emergence of GVCs can at least partially explain the growing dissatisfaction about trade in developed countries. Traditional theories tell us that unskilled workers have always benefited least from trade liberalization in skill-abundant countries. We show, however, that they have now lost a big ally in their quest for protectionism: big business. In many import-competing sectors, large companies have offshored their manufacturing plants to developing countries such as Mexico and China, effectively substituting unskilled foreign labor for unskilled domestic labor. For these firms, import tariffs are no longer a boon that acts as a protective buffer against foreign competitors, but rather a hindrance that negatively affects their own competitiveness. To meet corporate objectives, they thus have an incentive to lobby for import liberalization even if this disproportionately helps foreign workers to the detriment of American or Canadian blue-collar workers.

The diverging policy interests of workers and firms under GVCs may help to explain why the debate over trade and jobs has become so prominent in recent years. A number of policy pundits have jumped to the support of blue-collar workers by suggesting that policymakers should consider disregarding the trade policy preferences of GVC firms. Robert Reich (1990), for example, famously questioned whether firms headquartered in the United States that employ most of their workers in other countries should really be considered “American.” As we noted, both major-party U.S. presidential candidates were critical of foreign outsourcing. And following the election, former Democratic presidential candidate Bernie Sanders (2017) said that he would be “delighted” at least in principle to work with the Trump administration to “develop a trade policy that finally works for American workers and not the CEOs of large multinational corporations.”

This type of trade policy comes with important downsides, however. Penalizing GVC firms will likely damage the local economy. While import tariff liberalization hurts unskilled workers, our model shows that it positively affects multiple other stakeholders. It increases the real wages for skilled workers and reduces the prices for consumers. In addition, what our model does not capture is that, in a GVC world, even many blue-collar workers will suffer from trade restrictions. Citing Brookings Institution analysis, Porter and Gates (2018) report that far more communities stand to lose from steel and aluminium tariffs than will gain because of the widespread use of these materials as intermediate inputs. This is true for manufacturers who serve the domestic market, not just exporters who are hurt by foreign retaliation. In these industries, the interests of workers and owners are well-aligned. Still, while American businesses as whole—and many conservative politicians—have come out strongly against unilateral U.S. tariffs, many workers and unions have applauded the restrictions. Whether that will change as the adverse impacts begin to hit remains to be seen.

Despite the likely preponderance of losses and the potential for popular backlash, the Trump administration continues to ratchet up the scope of restrictions, particularly against China. Why? The formal U.S. argument against China alleges unfair trade practices, particularly excessive subsidies and the forced expropriation of U.S. intellectual property (USTR, 2018). Tariffs are unlikely to be an effective response to such concerns and will hit successful GVC-oriented U.S. high-tech firms particularly hard (Lovely and Liang, 2018). At the end of the day, targeting the GVC structure itself may be the main goal, with the belief that if punitive tariffs are maintained long enough, they will force U.S. companies to dismantle GVCs and reassemble them as LVCs within the United States (Hornby, 2018). Other pundits consider this unlikely, given lower foreign costs, the ability to shift overseas production to countries not targeted by unilateral measures and the high level of competence that has been built up by foreign value chain partners (Baldwin, 2016). One thing is clear: more academic research is needed to investigate how trade policy uncertainty (e.g. Brexit) and trade wars affect the structure of GVCs, to what extent they induce reshoring of low-skilled jobs to the United States, and whether they realign the trade policy preferences of low-skilled workers and firms.

At the end of the day, economics tells us that, with few exceptions, trade restrictions reduce welfare at the aggregate level in all trading countries. The gains from trade are large enough that they more than offset losses at the national level. Trade liberalization should be an overall boon. The problem, of course, is not new. Trade liberalization creates winners and losers. When the winners are large corporations and the most visible losers are blue-collar workers, liberalization is a recipe for social discord, particularly in an era of diminished expectations about future job and income security. Although our economics tells us winners could compensate losers and still come out ahead, that does not happen in practice. Public programmes to compensate workers displaced by trade, such as the U.S. Trade Adjustment Assistance Act, do not have a good track record in getting workers back into well-paying employment (see, for example, Schochet et al., 2012). Unless we do a better job at that, we risk imposing ongoing costs on precisely those workers who are least able to bear them. We also risk inviting knee-jerk trade policy reactions that do more harm than good, as well as a continuation of the social and political discord that is hampering the ability of government to address other important policy objectives.

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Appendix

This section presents a simple model in the spirit of Melitz (2003), but allows firms to manufacture their final goods either in a Northern country (local value chain, or LVC) or in a Southern country (global value chain, or GVC).

Consider a world that includes a small Northern country and a small Southern country, eponymously called North and South. In North, households spend the fixed amount $Y > 0$ on a specific differentiated goods sector. The demand function for a variety v in this sector manufactured in country $i \in \{N, S\}$ and sold in N equals

$$y^i(v) = A p^i(v)^{-\varepsilon}, \quad (1)$$

where $\varepsilon = \frac{1}{1-\alpha} > 1$ is the elasticity of substitution between any pair of differentiated goods and the demand level A is exogenous from the point of view of the individual firm.⁴

In North, a continuum of firms has the know-how to each produce a single variety. Southern firms do not have this know-how. We assume that each firm draws a productivity φ from a cumulative Pareto distribution $G(\varphi)$ with shape parameter $z > \varepsilon - 1$ (Helpman, Melitz and Yeaple, 2004):

$$G(\varphi) = 1 - \varphi^{-z}. \quad (2)$$

An inverse measure of the heterogeneity in a sector is given by z . If z is high, firms are more homogeneous, in the sense that more output is concentrated among the smallest and least productive firms.

The value chain of a product consists of three stages: *headquarters service*, *manufacturing* and *sales*. A firm can only produce its headquarters services in North. Manufacturing, in contrast, is footloose in that it can be conducted either in North at a unit labor cost of 1 or in South at a unit labor cost of $\omega < 1$. If manufacturing is not co-located with headquarters services, the firm faces a fixed cost g of coordinating its GVC activities across borders. Finally, to sell its product variety to consumers in the destination country j , a firm faces a fixed cost f .

Exports from South to North are subject to an ad valorem tariff t where $\tau = 1 + t$. The tariff implies that for those firms which manufacture in South, the consumer price that they charge in North is higher than the price charged in South. We assume that the following condition holds:⁵

⁴ As is well known from previous studies, $A^i = Y^i / [\int_0^{n_i} p^i(v)^{1-\varepsilon} dv]$, where n_i is the measure of varieties available in country i and $p^i(v)$ is the price of variety v in country i . Firms treat A^i as fixed since they are too small to individually affect A^i .

⁵ Under this condition, the marginal profit of manufacturing an extra unit in South compared with that in North. One can obtain this condition by using equation (6).

$$\omega^{1-\varepsilon}\tau^{-\varepsilon} > 1. \quad (3)$$

Under this condition, any firm has a marginal cost advantage of manufacturing its products in South compared with North. In other words, the wage advantage of manufacturing in South is sufficiently large to outweigh the cost advantage of avoiding tariffs by producing in North.

Consider the scenario where the fixed coordination costs g exceeds $f[\tau^{-\varepsilon}\omega^{1-\varepsilon} - 1]$. In that case, two organizational forms coexist in the industry: (1) firms with LVCs, and (3) Northern firms with GVCs.⁶

As illustrated in figure A1, two types of Northern firms sell their products to the destination country: less productive firms ($\varphi^L < \varphi < \varphi^G$), which manufacture in North, and more productive firms ($\varphi > \varphi^G$), which manufacture in South. We consider their optimization problems in turn.

[Insert figure A1 about here]

Firms with GVCs ($\varphi > \varphi^G$) perform their manufacturing in South and choose y to maximize $\pi^G = \left(p^G\tau - \frac{\omega}{\varphi}\right)y^G - f - g$. For these firms, their optimal price equals $p^G = \frac{\omega}{\alpha\varphi}$, their firm-specific sales equal

$$x^G = \frac{B}{1-\alpha} \left(\frac{\varphi}{\omega}\right)^{\varepsilon-1} \tau^{-\varepsilon}, \quad (4)$$

and their firm-specific profits equal

$$\pi^G = \left(\frac{\varphi}{\omega}\right)^{\varepsilon-1} \tau^{-\varepsilon} B - f - g. \quad (5)$$

Using equation (4), the aggregate sales from firms with GVCs equal the integral of firm-level sales (firms with a productivity ($\varphi > \varphi^G$)):

$$X^G = \int_{\varphi^G}^{\infty} x(\varphi) dG(\varphi). \quad (6)$$

Firms with LVCs (L)

Firms with LVCs ($\varphi^L < \varphi < \varphi^G$) choose y to maximize $\pi = \left(p^L - \frac{1}{\varphi}\right)y^L - f$. It is straightforward to check that this profit maximization problem yields the optimal price $p^L = \frac{1}{\alpha\varphi}$, the optimal firm-specific sales

$$x^L = \frac{B}{1-\alpha} \varphi^{\varepsilon-1} \quad (7)$$

and the optimal firm-specific profit

⁶ If $f\left[\left(\frac{1}{\omega\tau}\right)^{\varepsilon-1} - 1\right] > g$, it is optimal for all Northern firms to manufacture in South. In this unrealistic case, there will be no extra extensive margin effect and the elasticity of bilateral exports with respect to a country-specific tariff change reverts to that of the case of no vertical specialization.

$$\pi^L = \varphi^{\varepsilon-1} B - f, \quad (8)$$

$$\text{where } B = (1 - \alpha) A \alpha^{\varepsilon-1}$$

Not all firms are able to generate enough profits to cover the fixed cost f of selling their output in the domestic market. Define φ^L as the threshold productivity at which $\pi^L = 0$. Using equation (8), the cut-off productivity coefficient for firms to start selling on the market equals

$$\varphi^L = \left(\frac{f}{B} \right)^{\frac{1}{\varepsilon-1}} \quad (9)$$

The second threshold productivity φ^G occurs when the profits for firms with local and GVCs are equal. In other words, it solves $\pi^L(\varphi^G) = \pi^G(\varphi^G)$. By using equations (5), (8) and (9), and solving for $\pi^L(\varphi^G) = \pi^G(\varphi^G)$, the threshold equals

$$\varphi^G = \left(\frac{g}{B(\omega^{1-\varepsilon} \tau^{-\varepsilon-1})} \right)^{\frac{1}{\varepsilon-1}} \quad (10)$$

Firms with a productivity $\varphi > \varphi^G$ manufacture in South, while firms with a productivity $\varphi^L < \varphi < \varphi^G$ perform manufacturing at home in North.

The sales of firms in the local value chain equal the sum of sales by firms with productivities $\varphi \in [\varphi^L, \varphi^G]$. Using the firm-level sales equation (7), aggregate sales equal

$$X^L = \int_{\varphi^L}^{\varphi^G} x^L(\varphi) dG(\varphi). \quad (11)$$

Tariff reduction and GVC sales

We can use equation (6) to investigate the elasticity of aggregate sales with respect to a decrease in tariffs on South. As illustrated by Chaney (2008), the effect can be decomposed into two margins:

$$-\frac{dX^G/d\tau}{X^G/\tau} = -\frac{\tau}{X^G} \left(\int_{\varphi^G}^{\infty} \frac{\partial x(\varphi)}{\partial \tau} dG(\varphi) \right) + \frac{\tau}{X^G} \left(x(\varphi) G'(\varphi) \frac{\partial \varphi}{\partial \tau} \right). \quad (12)$$

The first term is the intensive margin and the second is the extensive margin. The intensive margin determines by which amount incumbents change the size of their sales. The extensive margin defines the amount that aggregate sales change due to the decision of firms to switch from LVCs to GVCs.

We can solve equation (12) to obtain the elasticity of a country's exports to a tariff change. We show that the intensive margin effect equals ε . That is, we demonstrate that a 1 per cent decrease in the tariff rate induces incumbent GVC firms to increase their sales in North by the elasticity of substitution $\varepsilon > 0$. The extensive margin effect, then again, equals $(z - (\varepsilon - 1)) \frac{\varepsilon}{\varepsilon-1} \chi > 0$. That is, our model shows that the tariff reduction pushes a number of firms at the margin to switch their manufacturing from North to South, leading to an extra increase in aggregate sales by firms with

GVCs. Putting the two together, the total elasticity equals

$$-\frac{dX^G/d\tau}{X^G/\tau} = \varepsilon + (z - (\varepsilon - 1)) \frac{\varepsilon}{\varepsilon - 1} \chi, \quad (13)$$

where

$$\chi = \frac{\omega^{1-\varepsilon}\tau^{-\varepsilon}}{\omega^{1-\varepsilon}\tau^{-\varepsilon}-1} > 1.$$

Due to the expansion of sales of GVC incumbents and the entry of new of GVC firms, the tariff reduction leads to an expansion of aggregate sales by GVC firms.

Tariff reduction and LVC sales

We can use equation (11) to investigate in a similar fashion the elasticity of aggregate sales with respect to a decrease in tariffs on South. Once again, the effect can be decomposed into an intensive and an extensive margin effect:

$$-\frac{dX^L/d\tau}{X^L/\tau} = -\frac{\tau}{X^L} \left(\int_{\varphi^L}^{\varphi^G} \frac{\partial x(\varphi)}{\partial \tau} dG(\varphi) \right) + \frac{\tau}{X^L} \left(x(\varphi^L) G'(\varphi^L) \frac{\partial \varphi^L}{\partial \tau} - x(\varphi^G) G'(\varphi^G) \frac{\partial \varphi^G}{\partial \tau} \right). \quad (14)$$

We can solve equation (14) to obtain the elasticity of LVC sales to a tariff change. We show that there is no intensive margin since the marginal cost of LVC firms is unaffected by the tariff decline. There is a negative extensive margin effect however. The tariff reduction induces a number of LVC firms to switch from North manufacturing to South manufacturing, which leads to a movement of the threshold productivity and leads to a reduction in the aggregate sales of LVC firms:

$$-\frac{dX^L/d\tau}{X^L/\tau} = -(z - (\varepsilon - 1)) \frac{\varepsilon}{\varepsilon - 1} (\chi - 1) * \frac{X^G}{X^L} < 0 \quad (15)$$