Commerce, Coalitions, and Global Value Chains: Evidence from Coordinated and Collective Lobbying

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Abstract

Global Value Chains (GVCs) have connected firms in increasingly complex networks within and across national borders. However, recent political economy models assume away interdependencies between producers and thus fail to explain pervasive trade coalitions across industries and firms. I argue that linkages through the same foreign partner foster common interests and collective actions among GVC firms. I compile supply chain datasets for all public firms and directly test my theory using network models. I find that US firms with GVC linkages tend to lobby together, hire the same lobbyist, and lobby on the same bill. Furthermore, GVC linkages among lead firms increase collective lobbying through trade associations. Finally, I document the independent effects of GVC coalitions on the network of preferential trade agreements among 62 major economies. These results provide microfoundations for new coalitional politics under GVCs and challenge the common assumption about industries and firms as isolated actors.

Keywords— global value chain, trade coalitions, preferential trade liberalization

Note: Complete appendices will be ready soon. Please do not cite or circulate this version without the author's permission.

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1 Introduction

The rise of GVCs is the defining feature of the 21st century international economy. With production stages dispersed across multiple countries and regions, firms have formed increasingly complex networks through trade in intermediate goods and services (Neilson et al., 2014). According to the recent estimate, input trade has now accounted for over three quarters of global trade (World Trade Organization, 2017). Meanwhile, specialization along the GVCs leads to "lock-in" effects for both buyers and sellers, as most firms have to incur significant costs to substitute any of their supply chain partners (Antràs and Staiger, 2012; Carvalho et al., 2021; Carnegie, 2014). As the 2008 Financial Crisis and the 2019 Global Pandemic vividly illustrate, disruptions to any production stage could bring dire consequences to immediate suppliers and customers and many more along the value chains. The simple fact that production partners are "too interconnected to fail" forms the basis for common interests and collective actions at the policy market.

However, traditional political economy frameworks often build on the centuries-old perception of trade in final goods (Ricardo, 1819) and assume away complex production linkages between factor owners and industries (Ohlin, 1933; Rogowski, 1987; Hiscox, 2002). Most recent models follow the same assumption and argue that high levels of product differentiation eliminates collective actions, as large and productive firms lobby for their specific products (Kim, 2017; Kim and Osgood, 2019; Gilligan, 1997). Consequently, they are unable to predict pervasive pro-trade coalitions across industries and firms along the GVCs (Osgood, 2021). Consider the example of the US apparel and footwear industry. The factor- and industry-based model would predict protectionist demand from the seemingly labor-intensive and import-competing industry, while the firm-based model forecasts that only large and productive exporters would individually lobby for trade liberalization. On the contrary, the US apparel and footwear producers are among the most vocal supporters for free trade.[1] Top brands like Nike and Crocs have reportedly worked together to press against punitive tariffs.[2] Furthermore, the American Apparel and Footwear Association (AAFA) has mobilized wider support along the supply chains, including fashion designers, input suppliers, supply chain managers, and distribution centers.[3] In fact, these collective political actions cut across factor intensity, industries, and firms, challenging all of the existing frameworks.

This paper aims to bring back *coalitions* to the trade politics literature in this era of global production. To do so, I develop a new theoretical framework where GVC linkages are the primary determinant of interdependent preferences and collective political actions. In contrast to the previous frameworks, my alternative starts from the premise that industries and firms do not exist in isolation but are interconnected through various production linkages. In terms of trade politics, the most important type is *GVC linkages* that operate through the same foreign partner and foster common interests in trade liberalization. Additionally, GVC linkages represent highly specialized relationships that bring large domestic firms into small groups of repeated interactions and political collaboration. Therefore, *domestic firms with GVC linkages (hereafter termed as "GVC partners")* are most likely to coordinate their political actions and mobilize collective support.

To illustrate my theoretical framework, I first develop a stylized model that incorporates GVC linkages into trade policymaking. The proposed model extends Ludema et al. (2019) and Blanchard et al. (2016) by considering both upstream and downstream producers of the imported product as well as multiple producers at these stages. Based on the results, domestic upstream producers that add value to the imported product and the domestic downstream producers that rely on the imported product as input share the same preference over liberal trade policy. With increasing participation in GVCs, their trade preference becomes *interdependent*, as they cannot find an easy substitute. Combining the insights from the model and the theory of collective action (Olson,

[1] The political activities of US producers can be accessed at https://www.aafaglobal.org/AAFA/Priority/Trade.aspx.
[2] https://www.cnbc.com/2019/05/20/nike-adidas-sign-letter-to-trump-urging-against-tariffs-on-footwear.html.
[3] As an example for each category, the AAFA includes Fashion Brands, Cotton Incorporated, BSI Supply Chain Services and Solutions, and Ascena Retail Group Distribution Center.

1965), I argue that GVC linkages also bring together small groups of like-minded producers, facilitating information flows and aligning expectations. As interdependencies deepen, these GVC partners can further exploit industry trade associations for larger representation and political effectiveness (Barnett, 2013; Lorenz, 2020; Dwidar, 2022).

To test my theory, I compile a comprehensive firm-level supply chain dataset for all public firms around the globe from 2003 to 2020. "[H]ow to capture a firm's embeddedness in global production presents a challenge for scholarship" (Kim and Rosendorff, 2021), and previous research on global production has relied on industry input-output tables (e.g., Osgood (2018)), confidential census data (e.g., Jensen et al. (2015)), and firm surveys (e.g., Johns and Wellhausen (2016)) to approximate production linkages. In this paper, I overcome this challenge by exploiting over 3 million intercompany relationship records from `FactSet` and constructing direct measures of GVC linkages among US firms. Combining these data with over 82,000 lobbying reports on trade and tariff, I find that GVC partners are more likely to lobby together, hire the same lobbyist, and lobby on the same bill. Furthermore, I identify all lobbying reports filed by trade associations and characterize collective lobbying across industries. My analysis shows that GVC linkages among lead firms[4] significantly increase the probability of collective lobbying from 0 to over 30%.

This paper is the first to develop a GVC-centered framework of trade coalitions and to offer direct and systematic evidence in the US context. While the previous generations of trade models explicitly focus on trade coalitions formed along the factor and the industry line, recent turn to firm-level theory has reconceptualized trade policy as a "private good" that only incentivizes individual lobbying at the firm level. My paper theorizes and demonstrates that trade coalitions are still relevant and prevalent, as GVC linkages provide microfoundations for interdependent preferences and collective actions among firms. Therefore, I renew the theoretical focus on trade

[4]I define lead firms as publicly listed firms in an industry, as they are mostly large firms organizing the supply chain relationship of the entire industry.

coalitions while respecting the primacy of firms as unit of analysis. In so doing, I also contribute to the rising literature on the politics of GVCs that has explained relevant but distinct outcomes, including international institutions (Kim and Spilker, 2019; Yildirim et al., 2018), trade preferences (Kim et al., 2019; Gulotty and Li, 2020; Meckling and Hughes, 2017; Owen, 2017; Milner, 1987), individual lobbying activities (Zeng and Li, 2021; Zeng et al., 2020), and environmental and labor politics (Cory et al., 2020; Malesky and Mosley, 2018). Empirically, I employ comprehensive firm-level supply chain datasets to directly test my theoretical framework. It is worth noting that my analyses construct GVC measures across firms and industries, including service providers. These service providers, ranging from product design, quality control, transportation, marketing, customer support, and even banking, are rarely captured in the previous research due to data unavailability, but they are the "hallmark of the GVC approach" (Kim and Rosendorff, 2021).

The rest of the paper proceeds as follows. The next section presents my theory about new trade politics under GVCs. Section 3 introduces my datasets and lays out my empirical tests. The final section concludes with implications for future research.

2 GVCs and New Trade Politics

This section presents my new theoretical framework of trade politics. While most recent models assume industries and firms as isolated actors, my alternative challenges this assumption and puts production linkages at its center. The first subsection reevaluate the established frameworks in the context of GVCs and compare them with my proposed alternative. Subsection 2 lays the foundation of my theoretical model where GVC linkages foster common interests both vertically across multiple production stages and horizontally across multiple producers at the same stage. The subsequent subsection illustrates how GVC linkages facilitate collective actions due to their specialized and relational nature. To sum up, GVC networks are the key driver for trade coalitions in this era of global production.

2.1 GVCs as Alternative Theoretical Framework

The rise of GVCs has profound implications on our understanding of trade politics. There are roughly speaking three generations of theoretical frameworks on trade politics. The first-generation model (e.g., Rogowski (1987)) implies that trade benefits owners of abundant factor and hurts owners of scarce factor in a country. Therefore, it requires that industries be categorized based on factor intensity (e.g., labor- vs. capital-intensive) so as to predict their political alignments. However, as production stages are fragmented across national borders, producers now routinely outsource production tasks where they have comparative *disadvantages* while focusing on others where they have comparative *advantage* (Grossman and Rossi-Hansberg, 2008; Baldwin and Robert-Nicoud, 2014). For instance, the top US footwear companies have all worked with East Asian partners for labor-intensive processing and assembly, whereas they specialize in capital-intensive tasks such as design, branding, and marketing. Henceforth, it is no surprise that the US footwear industry calls itself "capital-intensive," though it is clearly labor-intensive considering the entire process.[5] In sum, trade in tasks blurs the line of factor intensity. It is often impossible to categorize industries as labor- or capital-intensive without examining the specific tasks along the production chains.

The second-generation model differentiates industries into export-oriented and import-competing and predicts political alignments along this line (e.g., Hiscox (2002)). What is neglected here is that GVCs connect both exporters *and* importers and many more that rely on trade in intermediaries. A 2021 report points out that imports support more than 21 million net American jobs across US, including a net positive number in every state.[6] As GVC networks continue to expand across and within national borders, these constituents for trade liberalization become a diverse and formidable force against import-competing industries. This is why we observe the liberalizing de-

[5] For the quote from the US footwear industry, see https://www.bbc.com/news/business-48360373. It is clear that footwear industry is labor-intensive according to the definition given by the International Labor Organization. See https://www.ilo.org/global/industries-and-sectors/textiles-clothing-leather-footwear/lang–en/index.htm.

[6] See https://tradepartnership.com/reports/imports-work-for-american-workers-2021/.

mand from fashion designers, cotton producers, supply chain managers, distribution centers, and other AAPL members, even though the policy priority is tariffs on apparel and footwear. More broadly, most trade associations nowadays encompass supply chain stakeholders across industries, despite the fact that they set up to represent a single industry such as semiconductor.

The most recent theoretical advance at the firm level successfully predicts the political behaviors of monopolistic and productive exporters (Kim, 2017; Kim and Osgood, 2019). However, it also remains silent on lobbying by importers that depend critically on affordable foreign inputs. More importantly, the theoretical framework tends to focus on firms as isolated actors, making it unsuitable to explain collective political actions. While Osgood (2021) has attempted to integrate collective actions into firm-level theory, the key mechanism is still concentrated benefits for individual firms. I contend that no firms operate in isolation, and any explanation for political coalitions cannot be complete without theorizing *inter*-firm interactions.

Given the theoretical and empirical challenges brought by the GVCs, I propose an alternative framework that puts GVC linkages at its center. I follow two steps to develop this framework. First, I offer a formal model that explains when and why GVC linkages foster common interests among their stakeholders and lead to new political alignments around trade policy. Second, combining the insights from the model with the theory of collective action, I argue that common interests translate to distinct political organizations such as lobbying networks and broad-based trade associations. A brief summary table is presented below.[7]

2.2 GVC Linkages and Preference Formation

Overview of the Model In this subsection, I present a simplest possible model that incorporates global production into trade politics. The setup is such that the production of final goods

[7] The definition of GVC stakeholders is given in Figure 1. Compared with GVC stakeholders, GVC partners only involve domestic firms whose political activities are more prevalent. While foreign firms also join these coalitions, the focus of this paper remains domestic firms. This is consistent with the previous frameworks of trade politics.

Table 1: **Frameworks of Trade Politics**

	Factor	**Industry**	**Firm**	**Global Value Chain**
Liberalizing Forces	Owners of abundant factor	Export-oriented industries	Productive exporting firms	Global Value Chain stakeholders
Protectionist Forces	Owners of scarce factor	Import-competing industries	Domestic firms	Excluded producers
Political Organization	Class-based mobilization	Industrial associations	Individual lobbying	Lobbying networks, expansive trade coalitions

involves three consecutive stages, and a portion of midstream production is outsourced abroad.[8] The primary goal is to characterize policy preferences of domestic upstream, midstream, and downstream producers along the production chain. In so doing, I show when and why GVC linkages can lead to convergence of interests in trade liberalization.

Model Setup I analyze trade policy under the following scenario. There are two countries, home and foreign (denoted as superscripts H and F), and one primary good (z) produced by three stages. Home has established one production chain that involves upstream, midstream, and downstream products denoted as x, y, and z respectively. The upstream producer (U) takes in exogenously given factor (e.g., labor or/and capital) and outputs x, the midstream producer (M) uses x to produce y, while the downstream producer (D) processes y and obtains z. Finally, to introduce a simple production network beyond national borders, I let a portion of midstream production shift abroad due to economic efficiency, i.e., home becomes the exporter of x and importer of y. I assume that the import of y is subject to τ measured as one plus the ad valorem tariff rate, such that $p^M = p^{M*}\tau$ (p^* means foreign price).

This stylized environment as depicted in Figure 1 turns out to be fairly general in this era of global production. Domestic upstream producers, foreign midstream producers, and domestic downstream producers (all in circles) are integrated into the same GVC in the production of

[8] I choose to model three stages, because outsourcing naturally partitions domestic production chains into three parts: the production of the input for the outsourced product, the production of the outsourced product, and the production of the output that uses the outsourced product.

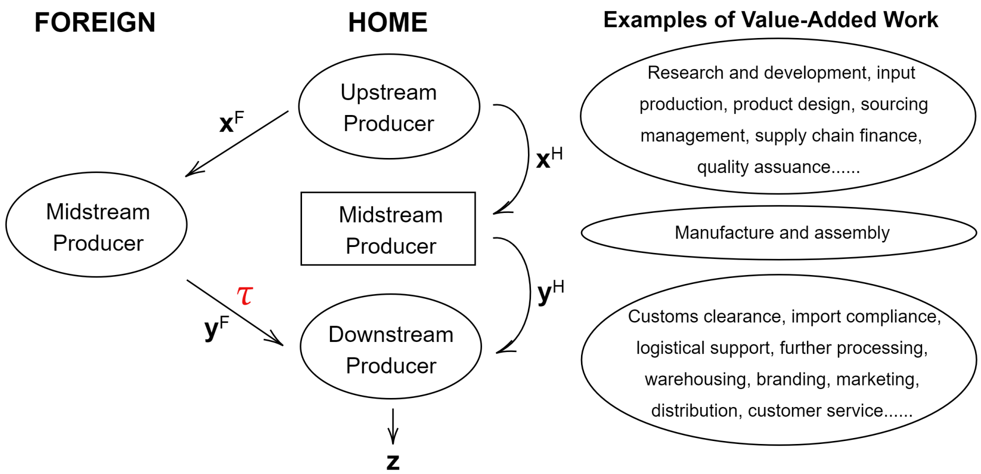


Figure 1: **Model Setup:** This figure shows the stylized yet general setting where trade policy τ responds to producers at different stages of global production. The right panel lists examples for each production stage. GVCs fosters common interests of its stakeholders (all in circles) and may facilitates coordination between domestic upstream and downstream producers (GVC partners).

z. The typical example corresponds to the so-called "smile curve" where developed economies add value from upstream research and design as well downstream processing and service, while developing economies focus on manufacturing and assembly (Meng et al., 2020). However, the setup is flexible enough to nest the traditional view of trade in final goods without domestic upstream and downstream producers. With varying levels of added value from all three stages at home, this model can generate useful insights into the political economy of GVCs in general.

Policymaking under Global Production We now consider the home government's maximizing the "weighted" welfare specified below, where λs are political weights assigned to different producers, πs the profits, ps the prices, and W the consumer welfare. The primary assumption here is that firms' policy preferences are determined by their profits. With this objective function, we can derive different levels of the optimal tariff $\tau^{o'}$ that is determined by producers' preferences as well as their political weights.

$$\Omega = W + \lambda^U \pi^U(p^U, p^{U*}) + \lambda^M \pi^M(p^U, p^M) + \lambda^D \pi^D(p^M, p^D) \quad (1)$$

Proposition Given the above objective, the home government will optimally set the tariff $\tau^{o'}$:

$$\tau^{o'} = \tau^o - \underbrace{\frac{\lambda^U}{\xi^*}\frac{x^F p^{U*}}{y^F p^{M*}} - \frac{\lambda^U y^H}{p^{M*}\frac{dy^F}{dp^M}}\frac{x^H p^U}{y^H p^M}}_{\text{upstream producer}} - \underbrace{\frac{\lambda^M y^H}{p^{M*}\frac{dy^F}{dp^M}}(1 - \frac{x^H p^U}{y^H p^M})}_{\text{midstream producer}} - \underbrace{\frac{\lambda^D (y^H + y^F)}{p^{M*}\frac{dy^F}{dp^M}}[\frac{zp^D}{(y^H + y^F)p^M}\frac{dp^D/p^D}{dp^M/p^M} - 1]}_{\text{downstream producer}} \quad (2)$$

where τ^o is the benchmark optimal tariff when government assigns equal weight to different producers, and ξ^* is the foreign import elasticity specified in Ludema et al. (2019) and Grossman and Helpman (1994). Formal proofs and detailed explanations are available in the Appendix.

Discussion This proposition demonstrates that the optimal tariff is co-determined by domestic upstream, midstream, and downstream producers that have different interests and constraints. Specifically, we can derive the following three implications.

First, domestic upstream producers would demand a lower tariff as they add more value to the foreign imported product (high "forward participation"). Upstream producers face competing priorities, but if they add more value to the foreign midstream production as opposed to the domestic midstream production, then the first term will dominate the second term and vice versa (note ($\frac{dy^F}{dp^M} < 0$)). The intuition is clear, the more value domestic upstream producers add to the GVC, the greater stakes they will have in the import of the foreign midstream product. Tariff protection will suppress the demand for the foreign midstream product as well as the upstream input, and thus upstream interests lie in liberalization.

Second, domestic downstream producers will ask for a lower tariff as they rely more on the foreign midstream product (high "backward dependence"). The mathematical expression highlights the conditions under which downstream producers would require a lower tariff and thus input costs. Taken together, when downstream producers import highly differentiated ($\frac{dp^D/p^D}{dp^M/p^M} \approx 0$) and/or closer-to-finish product ($zp^D \approx (y^H + y^F)p^M$), their reliance on foreign producers increase, and so should their demand be for trade liberalization.

Third, domestic midstream producers tend to press for a higher tariff as they add more value relative to the upstream producers. When midstream producers add more value to the domestic production chain compared with their upstream counterparts, they would have higher stakes in protecting their products. Meanwhile, they would also become less sensitive to the impact of trade protection on upstream production. The traditional view about import competition still holds in this new environment with global production.

Simple as it seems, this model delivers a strong intuition about interdependent political alignments under GVCs. With the strengthening of GVCs linkages, domestic upstream and downstream producers would come to share the same interests in trade liberalization. Whereas their preferences are aligned through vertical GVC linkages, domestic midstream producers are excluded from the GVC and directly harmed by outsourcing. Relatedly, this model also implies that GVC linkages diffuse liberalizing preferences to a broader set of producers cutting across firms and industries, while the trade opponents are much more concentrated (Osgood, 2021).

Generalization The above discussion highlights the interest convergence between domestic upstream producers with high forward participation and domestic downstream producers with high backward dependence (i.e., vertical convergence). The key reason is that they are connected to the same foreign producer. Similar intuitions may hold for multiple upstream and downstream producers at home. With increasing level of specialization, these producers add their unique value to the production chain independently, but their operations all depend critically on the imported product. Therefore, we should expect horizontal convergence of interests among upstream and downstream producers due to their common connections to foreign partners as well (Refer to the Appendix for a slightly more formal treatment). This specialized nature of the GVCs is also key to producers' collective actions, which is discussed in the next subsection.

2.3 GVC Linkages and New Trade Coalitions

While the formal model clarifies when and why GVC linkages foster common interests in trade liberalization, it is far from clear whether such common interests would translate into collection actions. In fact, the setup seems to trigger the classical collective action problem where multiple actors share the same goal but fail to act together (Olson, 1965). Given that entering the policy market and coordinating between one another is highly costly, the concern for free-riding is real. In this subsection, I argue that GVCs not only contribute to interest convergence but also facilitate collective actions among lead firms. On the one hand, specialization along the GVCs strengthens mutual interdependencies and thus preference alignments. On the other hand, information exchanges and repeated interactions lower the cost of political participation while raising the perceived return to joint efforts due to political effectiveness. In other words, GVCs can result in "strategic complementarities," as firms' political actions reinforce each other.

A well-established economics literature has highlighted the specialized nature of GVCs (See Antràs and Staiger (2012) for a review). From the very beginning, firms have to incur significant costs to find their best possible partners all over the globe. Once the production linkages are formed, they almost always invest in capabilities to process customized inputs and produce specific outputs for the target market. As a simple example, firms may have to develop special carbon-reducing methods in order to meet the standard of certain partners. Specialization should be particularly prominent among large firms, as they often monopolize standard-setting and technological development. Indeed, estimates based on the `FactSet` Dataset show that among the direct suppliers of the same foreign firm, 63% of them specialize in different products. For the remaining producers, 36% work in service industries that routinely make relationship-specific investment. Even for manufacturers producing the same product based on the NAICS 6-digit codes, their level of differentiation is significantly higher than average.

Specialization along the GVCs has major implications on the interdependencies between firms and their collective political actions. As firms cannot easily substitute their immediate supply chain partners, their survival heavily relies on the smooth operation of the GVCs - That is, stable delivery of suppliers and timely purchase of the customers. Indeed, disruptions to any stage of production, from protectionist trade policy to global pandemics, would bring severe distress to immediate partners and beyond, paving the way for political mobilization. As early as the economic turbulence in the 1970s, Milner (1987) has observed that firms with international linkages were collectively pressing for trade liberalization. "Collective action problems should be minor," she argued, since all firms were faced with strong pressure to act, and "inactivity would mean their demise." Similar episodes have repeated itself multiple times, when an alliance of "New China Lobby" demanded the renewal of China's most-favored-nation (MFN) status in 1996[9] and when an army of globalized automakers hit the Capitol Hill for preserving the North American Free Trade Agreement (NAFTA) in 2017.[10] Shared and vital interests among GVC partners have all played an important role in coalition-forming and collective actions.

Furthermore, the operation of the GVCs requires high levels of coordination which involves intense bilateral information flows in the long run. Firms - especially a small group of large firms - often engage in long-term interactions. The estimates from `FactSet` show that the average length of supply chain relationships is over four years, and more than 80% of them are longer than one year, the typical threshold for stable GVC linkages (Alfaro-Urena et al., 2022). Not surprisingly, recent studies have found that trade between GVC firms resemble intra-firm trade rather than arm's-length transactions, and supply chain partners tend to offer various technological and legal assistance to each other (World Bank, 2020). Such intense and repeated interactions help align expectations between firms and naturally transfer to coordination in the policy market.

[9]See https://prospect.org/world/new-china-lobby/.

[10]See https://www.nytimes.com/2017/10/24/us/politics/nafta-lobby-congress.html

More importantly, the relational nature of GVCs can also lead to strategic complementarities between firms, so that acting together becomes a dominant strategy. On the one hand, GVC linkages facilitate information flows and learning about the policy market where knowledge about issue areas, lobbyists, and politicians are extremely valuable. Firms incur smaller costs as more of their GVC partners join the political alliance for the same goal and share relevant experiences. On the other hand, coordinated actions pool available resources and increase representativeness of the political demand, augmenting influence on agenda setting (Dwidar, 2022; Lorenz, 2020) and bureaucratic rulemaking (Nelson and Yackee, 2012). As a result, the marginal return may increase as the members of GVC networks join the political efforts.

Taking a step further, it would be reasonable to expect that when GVC linkages among lead firms are particularly strong, they could turn to a more costly but potentially more effective platform - trade associations. Barnett (2013) has shown that although trade associations are large in size, a small group of big firms always play the major role in defining shared problems and putting forth initial efforts and resources essential for new collective actions. As benefits and risks propagate through supply chains, other firms tend to develop similar international orientations (Carvalho et al., 2021). Smaller firms are also likely to simply follow the social cue in offering nominal if not substantial support. In so doing, stronger GVC linkages enable lead firms to exploit larger platforms which generate multiple benefits: mobilizing even more resources, increasing diversity of coalitions, strengthening leadership positions, and bypassing contribution limits.

To sum up, GVCs not only contribute to common interests among multiple actors but also create an environment that is drastically different from the classical setup in Olson (1965). Essentially, these linkages foster small groups of distinct and mutually dependent actors that also engage in repeated interactions. I argue that this is the very reason why trade coalitions are so pervasive that Olson's original theory should be reevaluated (Hansen et al., 2005). This theoretical discussion also leads to my major empirical expectation of this paper: GVC partners are more likely to take political actions together and press for trade liberalization.

3 Empirical Analysis

This section presents my research design and empirical evidence for my GVC-centered framework of trade politics. To characterize firms' political actions, I focus on the lobbying activities of the US firms, because lobbying expenditure is ten times as large as campaign donation (Bombardini and Trebbi, 2012), and firms are most likely to influence specific trade policy through lobbying (Kim and Milner, 2020). I examine three interrelated hypotheses based on my theory: (1) GVC partners are more likely to lobby together for trade liberalization; (2) Stronger GVC linkages among lead firms tend to increase collective lobbying through trade associations; and (3) GVC coalitions bring about preferential trade liberalization across countries. Taken together, these hypotheses imply that GVCs have been a major determinant of coalitional politics in trade and trade policy outcomes. I will now turn to each of these hypotheses in the following three subsections.

3.1 GVCs and Firm-Level Coordinated Lobbying

My first hypothesis states that domestic firms with supply chain linkages through common foreign partners tend to lobby together for trade liberalization. This hypothesis departs from the existing literature where producers are assumed to form trade preferences and take political actions independently. On the contrary, my formal model (subsection 2.2) suggests that firms' policy preferences are interrelated due to their GVC linkages. Furthermore, my theory (subsection 2.3) indicates that increasing specialization augments mutual interdependencies, so that firms cooperate over complimentary tasks rather than compete over homogeneous ones. Their intense bilateral interactions align expectations and bring about strategic complementarities in political activities. Therefore, GVC linkages can lead to collective political actions, especially among large and lead firms. In general, to understand trade politics, researchers should not only examine individual

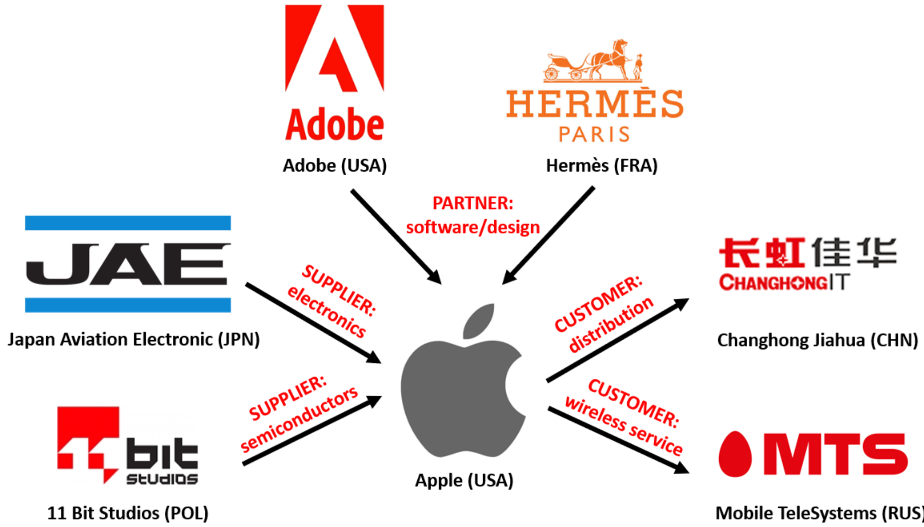


Figure 2: **Apple's Production Linkages:** This figure shows a subset of Apple's production partners based on the FactSet Supply Chain Relationship Database.

factors, industries, and firms, but the production networks they are embedded in.

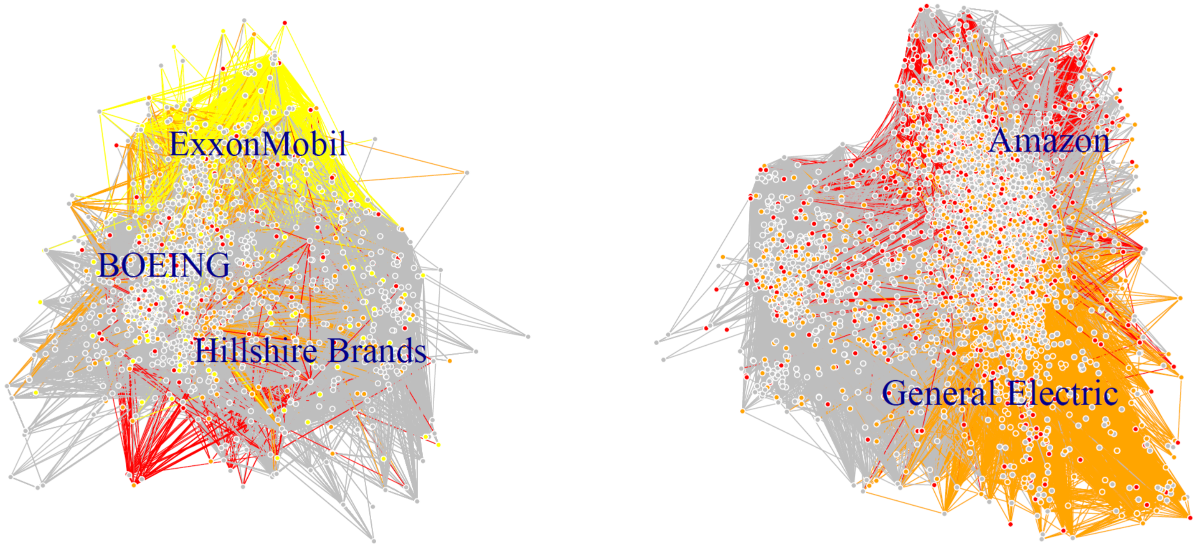
Measuring firms' GVC linkages and the overall GVC networks is very challenging due to the lack of firm-level supply chain datasets. Existing research on global production has come up with various but partial solutions. First, most papers utilize cross-country and -industry input-output tables to approximate firm-level production linkages (e.g., Osgood (2018)), but such a crude measure may mask important variation across firms as emphasized by the "new-new trade theory." Second, scholars have relied on fine-grained transaction data and specifically "related-party trade" (e.g., (Jensen et al., 2015)) or "processing trade" (e.g., Ludema et al. (2019)) as a proxy for supply chain relationships. However, these measures fail to identify foreign partners, not to mention the linkages between two *domestic* firms due to their integration into the same GVC. Finally, the most effective means to date of capturing firm-level GVC linkages have come from surveys. But not all of these surveys identify firm names, and most of them are limited to a fairly small sample (e.g., Johns and Wellhausen (2016)). As Kim and Rosendorff (2021) point out, "how to capture a firm's embeddedness in global production presents a challenge for scholarship." As a result, systematic tests of GVCs in trade politics have been rare until this day.

To overcome these challenges, I exploit a new and underutilized data source, FactSet Supply Chain Relationship Database (2003-2020). `FactSet` analysts systematically collect companies' relationship information exclusively from primary public sources such as SEC 10-K annual filings, investor presentations, and press releases, and document them through well-refined methodology.[11] Company information is fully reviewed annually, and changes based on corporate actions are monitored daily. The output is a comprehensive, detailed, and up-to-date dataset of over 3 million inter-company relationship records covering more than 31,000 publicly traded firms around the globe. Specifically, US firms covered by `FactSet` constitute over 91% of market value and 85% of total employment.[12] In addition, `FactSet` classifies all of business relationships into 4 main categories and 13 types, capturing a wide range of value-adding activities beyond physical transformation of the product. These activities include design, branding, marketing, and other service trade that are essential to my theoretical framework and the GVC literature in general. A simple example of Apple's supply chains is presented in Figure 2.

Based on `FactSet`, I create and visualize the GVC networks of US firms in Figure 3. The nodes represent US firms, and the edges denote common ties with a foreign firm (i.e., "GVC linkages" as I have defined). This is a direct measure of firms' embeddedness in the same GVC that would diffuse trade preferences and facilitate collective actions according to my theory. As a first step, I apply the Louvain Partition Algorithm to detect latent GVC coalitions. If lobbying has no network effect through GVC linkages, we should expect that the probability of lobbying should be homogeneous across these coalitions. However, I find that different GVC coalitions have significantly different tendency to lobby, varying from 3 to 10% with $p < 0.01$. I highlight those politically active GVC coalitions with their most important actor controlling the supply chains (measured by betweenness centrality). Due to the economic and political activism of these lead

[11] Please refer to the sample data and the methodology guide here.

[12] These coverage estimates are based on my comparison between `FactSet` and the comprehensive firm financial database, `Compustat`.



(a) **2004** (b) **2019**

Figure 3: **Politically Active GVC Coalitions:** This figure visualizes GVC coalitions based on Louvain Partition and identify top GVC coalitions that are most active in lobbying. The labels indicate the most important actor in these coalitions in terms of its control over supply chains.

firms, their GVC partners are more likely to lobby with them on trade issues.

The descriptive evidence motivates systematic analysis of my first hypothesis - Firms with GVC linkages tend to lobby together. To create my outcome of interest, I collect the universe of the reported lobbying activities over the issues of trade and tariff in the US. I leverage `LobbyView` (2004-2019) as my primary data source, which compiles all lobbying reports filed under the Lobbying Disclosure Act (1995) and identifies corporate clients with unique `gvkeys` widely used in other financial databases (e.g., `Compustats`). Most importantly, walking through the concordance between `gvkey`, `cusip`, and `isin` (all three standard firm identifiers), I can match firms' political activities with their supply chain relationships in `FactSet`. Joining `LobbyView`, `FactSet`, and `Compustats` offers the unique opportunity to examine GVCs and trade politics at the firm level.

Since firms' decision to lobby may be strategic complements to each other, I estimate a local aggregate network effect model with firm- and year-fixed effects. [13]

$$y_{it} = \rho \mathbf{W}_{it-1}\mathbf{y}_{t-1} + \mathbf{X}_{it-1}\beta + \alpha_i + \gamma_t + \epsilon_{it} \tag{3}$$

where y_{it} is a dummy variable indicating whether firm i lobbied in year t or a continuous variable measuring firm i's total lobbying expenditure in year t. In doing so, I am able to capture both the "extensive" and "intensive" margins of firms' political activities. On the right-hand side, $\mathbf{W}_{it-1}$ is the ith row of the lagged adjacency matrix that represents the GVC linkages among firms. To be specific, the ij entry of the $\mathbf{W}$ matrix denotes whether firm i and j are linked to a common foreign business partner in year $t-1$. To avoid self-loop/self-influence, the diagonal of the matrix with $i = j$ is set to 0.[14] Together, $\mathbf{W}_{it-1}\mathbf{y}_{t-1}$ measures the intensity of lobbying behaviors of firm i's GVC partners in the previous period. Row vector $\mathbf{X}_{it-1}$ includes a series of pre-treatment covariates as in Kim (2017), while α_i and γ_t are year and firm fixed effects. Therefore, I control for firm-level time-variant and -invariant heterogeneity and is arguably more demanding than previous analysis. Finally, I cluster the standard errors at the firm level to account for serial correlations. Based on this model specification, my quantity of interest is ρ, which can be interpreted as "peer effect" or "social influence" through GVC networks.

The estimated results are reported in Table 1. Model (1) is the baseline where I control for lobbying of direct supply chain partners and other firm characteristics. As expected, the coefficient ρ for `GVC Partner Lobby` is positive and significant at the conventional level, while the direct supply network does not have a meaningful effect. Model (2) further controls for the interaction term between `Productivity` and `Product differentiation`, the key explanation for firm-level lobbying in Kim (2017). The robust estimate of ρ indicates that even after controlling for

[13]See Advani and Malde (2018) and the Appendix for a formal theoretical foundation for this modeling choice.

[14]In doing so, I also avoid the inclusion of lagged dependent variable for a given firm, which would have caused Nickell bias along with the firm fixed effect.

large and monopolistic exporters, manufacturers are still under network influence of their GVC partners.[15] Model (3) and (4) estimate the network effects from horizontal and vertical GVC partners respectively and obtain similar and significant results.[16] From Model (5) to (8), I estimate the same model but with lobbying expenditure as my outcome. The results are very similar.

My empirical analysis confirms that the GVC network is an important and independent determinant of firms' lobbying activities over trade liberalization. Substantially, when the number of active GVC partners increases from 0 to 38 (the mean value of lobbying firms), firms become 3 percentage points more likely to lobby. Moreover, lobbying of one more GVC partners increases their lobbying expenditure by as much as 25%. Small as the effect size may seem, this will in fact translate into many hundreds more firms that engage in lobbying activities and many millions more investment in politics. In addition, these estimates are likely to be biased downwards, because the analysis is only considering the direct effect of the GVC network. In other words, since US firms tend to have longer and more complicated GVCs, the equilibrium network effect should propagate and aggregate to a larger size.

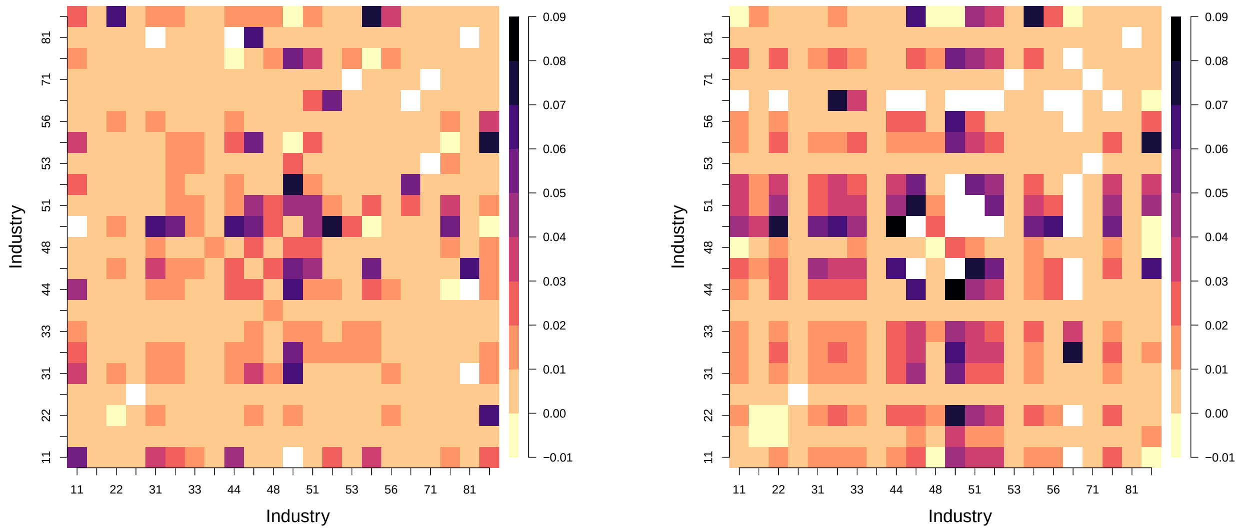
[15]Note that the sample size shrinks in Model (2), because the estimates of `Product differentiation` only exist for manufacturing industries. However, public traders come from all industries, from agriculture to service.

[16]In fact, `Horizontal Partner Lobby` and `Vertical Partner Lobby` are highly correlated with the Pearson R-squared as large as 91%. This may also suggest that interest convergence and collective actions take place along both dimensions.

Table 2: **GVC Network Effect on Firms' Lobbying Activities**

	Dependent variable:							
	Lobby				Lobbying Expenditure			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GVC Partner Lobby	**0.011*****	**0.017*****			**0.184*****	**0.252*****		
	(0.004)	**(0.006)**			**(0.050)**	**(0.078)**		
- Horizontal Partner Lobby			**0.008****				**0.118*****	
			(0.003)				**(0.044)**	
- Vertical Partner Lobby				**0.006****				**0.107*****
				(0.003)				**(0.040)**
Direct Partner Lobby	0.002	−0.001			0.041	0.010		
	(0.003)	(0.005)			(0.040)	(0.065)		
Productivity	−0.003*	−0.023***	−0.020***	−0.020***	−0.048**	−0.265***	−0.230***	−0.230***
	(0.002)	(0.007)	(0.006)	(0.006)	(0.024)	(0.088)	(0.080)	(0.080)
Productivity Squared	0.001**	0.002***	0.002**	0.002**	0.012**	0.026**	0.022**	0.022**
	(0.0004)	(0.001)	(0.001)	(0.001)	(0.005)	(0.011)	(0.010)	(0.010)
Productivity × Diff		0.029**	0.026**	0.025**		0.298**	0.258*	0.255*
		(0.011)	(0.011)	(0.011)		(0.141)	(0.135)	(0.136)
Firm Characteristics	✓	✓	✓	✓	✓	✓	✓	✓
Firm Fixed Effect	✓	✓	✓	✓	✓	✓	✓	✓
Year Fixed Effect	✓	✓	✓	✓	✓	✓	✓	✓
Observations	59,533	29,978	31,630	31,630	59,533	29,978	31,630	31,630
Adjusted R^2	0.668	0.685	0.681	0.681	0.724	0.741	0.736	0.736

Note: Cluster robust standard errors at the firm level. * p<0.1; ** p<0.05; *** p<0.01.



(a) **Hiring of the Same Lobbyist**

(b) **Lobbying on the Same Bill**

Figure 4: **Coordinated Lobbying among GVC Partners:** This figure shows the effects of GVC linkages on two firms' hiring of the same lobbyist (Panel a) and lobbying on the same bill (Panel b). The effects are heterogeneous across industries from which the two firms come from, but they are mostly positive. There are also darker colors in the middle, indicating the sectors of retail trade (44-45), transportation and warehousing (48-49), finance and insurance (52) are more likely to see GVC-based political coordinations and coalitions.

Furthermore, I estimate a series of dyadic regressions to offer more direct evidence about GVC linkages and firms' political coordination. Specifically, I use two firms' hiring of the same lobbyist and lobbying on the same bill as indicators of coordination. Recent evidence has shown that firms' lobbying schedule and even targeted politicians are affected by their counterparts with the same lobbyist.[17] On the other hand, lobbying on the same bill is also suggestive of similar interests and possible coordination, as most bills are lobbied by only a couple of lead firms (Kim and Kunisky, 2021). I visualize the effects of GVC linkages on two firms' hiring of the same lobbyist (Panel a) and lobbying on the same bill (Panel b) across industries to which these two firms belong (defined at NAICS 2-digit level).As expected, the effects are mostly positive.[18] Moreover, darker colors in

[17]See https://www.depts.ttu.edu/rawlsbusiness/about/finance/research-seminar/documents/2015/Lobbying_CEF_01Apr2015.pdf.

[18]In the Appendix, I report regression estimates with the same firm controls. More importantly, I account for possible homophily among firms' political actions, including sharing the same board member and headquarter locations (Mizruchi and Koenig, 1991). I also add industry-pair fixed effects to address memberships in the same trade associations (Kowal, 2018)

the middle suggest that GVC linkages with the sectors of retail trade (44-45), transportation and warehousing (48-49), finance and insurance (52) are more likely to lead to such coordination. This is consistent with the observation that retailers, supply chain managers, and service providers have played an important role in coalition formation. Overall, my analysis stresses that GVC networks can foster coordinated lobbying among producers which are often assumed to act independently.

3.2 GVCs and Collective Lobbying Through Trade Associations

The previous subsection demonstrates that GVC partners are more likely to lobby together. It is reasonable to expect that with the increase in GVC linkages between lead firms, they would exploit larger and more diverse platforms for their political causes. This is precisely the second hypothesis this subsection focuses on - Domestic lead firms with higher GVC interdependencies among each other tend to mobilize collective lobbying through trade associations. Most recent framework of trade politics centers on firms' individual lobbying and tries to extend the logic of concentrated benefits to explain collective actions (Osgood, 2021). However, it overlooks inter-firm relationships as a necessary mechanism for coalitional politics. My hypothesis highlights production linkages as an alternative explanation for the rise of collective lobbying - It is firms' complex GVCs, not their mere size and monopoly, that bring about collective actions.

To test this hypothesis, I first construct an industry-level measure for GVC interdependencies by aggregating the firm-level dataset from `FactSet`. Formally, I rely on the mean degree measure:

$$GVC\_Interdependence_{kt} = \frac{\sum_i^n d_{it}}{n} \tag{4}$$

where d_{it} is the degree (or number of edges) of firm i in year t, and n denotes the total number of firms in industry k and year t. Intuitively, this measure captures the number of GVC linkages a *typical* firm would have in a given industry-year. Higher value in this measure would mean that the given industry has greater GVC interdependencies among lead firms in the given year.

On the other hand, I closely examine lobbying clients in `LobbyView` to create my outcome variable. I first identify 4,056 unique clients that lobbied on the issue of trade and tariff from 2004 to 2019 and then manually label 891 trade associations among these clients. The left panel of Figure 5 presents descriptive statistics that the lobbying expenditure by trade associations has been rising steadily since 2011 and stabilized around 30%. In addition, collective lobbying has become more concentrated since 2016, as indicated by the sharply declining portion of lobbying reports. This may result from more contentious and targeted trade policies during the Trump Era. The right panel of Figure 5 reports the top 10 trade associations in terms of lobbying expenditure during this period. Careful research on each of these entities confirms that trade associations have become a major force for open trade rather than trade protection. These trade associations have also included a variety of globalized producers along the GVC, from design to customer support, and even invited international members directly. This serves as suggestive evidence that GVC interdependencies have played an important role in collective lobbying.

For statistical analysis, I first match each trade associations with their primary NAICS code based on the Infogroup Historical Business Data. This comprehensive database collects product information about trade organizations in the US through phone verification, web research, review news publications, and annual reports. I then join these data with my measure of GVC interdependencies at NAICS 4-digit level.[19] Therefore, my outcome is a binary response indicating whether collective lobbying is present in a given industry-year, while my treatment is the self-calculated `GVC interdependence`. Based on Bombardini and Trebbi (2012), I also include several important controls that may be related to both of my treatment and outcome - number of public firms and Herfindahl–Hirschman Concentration Index calculated from Compustats, average firm size and capital-labor ratio from US Bureau of Economic Analysis (BEA), and Product differentiation

[19]Defining industries at NAICS 4-digit level is consistent with previous research (e.g., Bombardini and Trebbi (2012)) and my own careful reading about the trade associations.

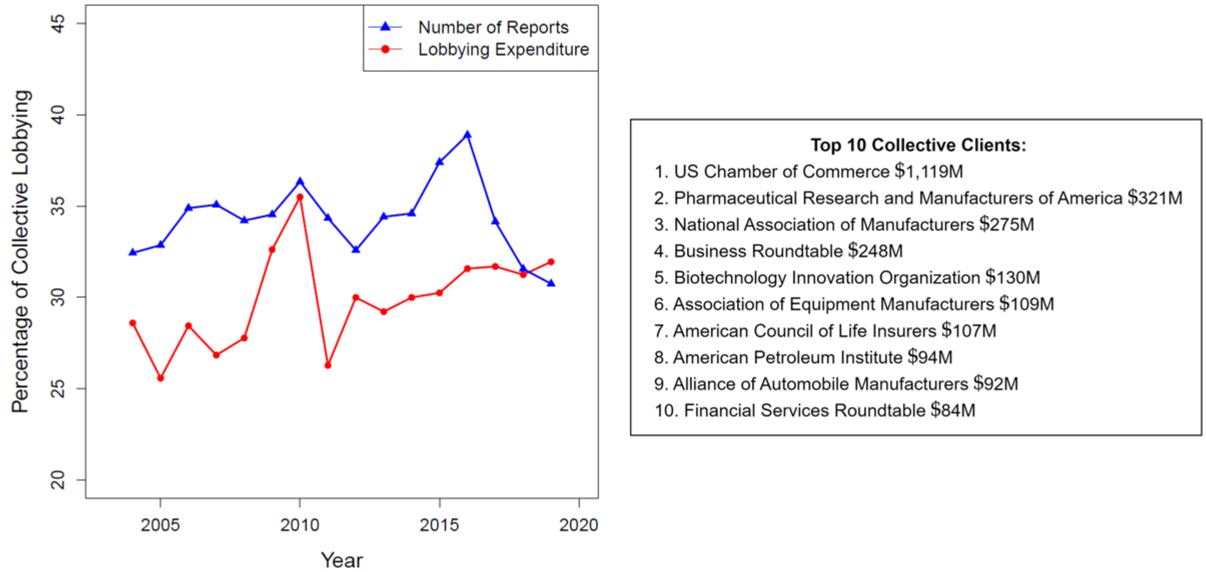


Figure 5: **Collective Lobbying by Trade Associations:** This figure summarizes lobbying activities by trade associations (2004-2019) and the top 10 trade associations in terms of lobbying expenditure. Collective lobbying through trade associations have consistently occupied about 30% of the total lobbying activities.

from Broda and Weinstein (2006). I estimate a logistic regression and simulate the effects of `GVC Interdependence` in Figure 6. In short, GVC networks increase the probability of collective lobbying from close to 0 to over 30%, holding other covariates at their mean.[20]

To sum up, this subsection shows that GVC interdependencies among lead firms have facilitated collective lobbying through trade associations. Therefore, my theoretical framework offers a convincing explanation for the long-standing puzzle about pro-trade collective actions. Broadly speaking, firms become much easier to mobilize when GVC linkages are considered.

3.3 GVCs and Preferential Trade Networks

The previous two subsections have shown that GVCs can give rise to distinct lobbying networks and broad-based trade associations that pressure for trade liberalization. This subsection aims to illustrate that GVC coalitions matter for trade policy outcomes and international economic

[20] I present regression estimates with various controls and fixed effects in the Appendix.

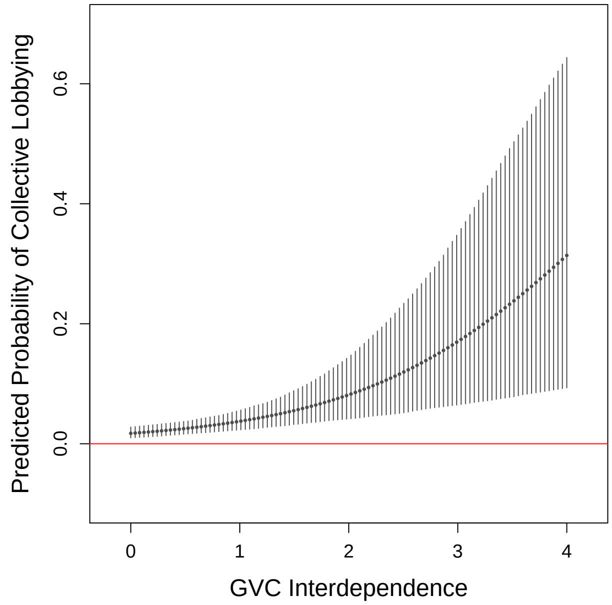


Figure 6: **GVC Interdependence and Collective Lobbying** This figure plots the predicted probability of collective lobbying as a function of GVC interdependencies within an industry, controlling for all other covariates in (Bombardini and Trebbi, 2012). Having more GVC linkages among lead firms increases the probability of collective lobbying from close to 0 to over 30%.

cooperation in general. To test this third hypothesis about GVCs and trade liberalization, I will revisit the important debate over the formation of PTAs in the fields of International Political Economy and International Economics.

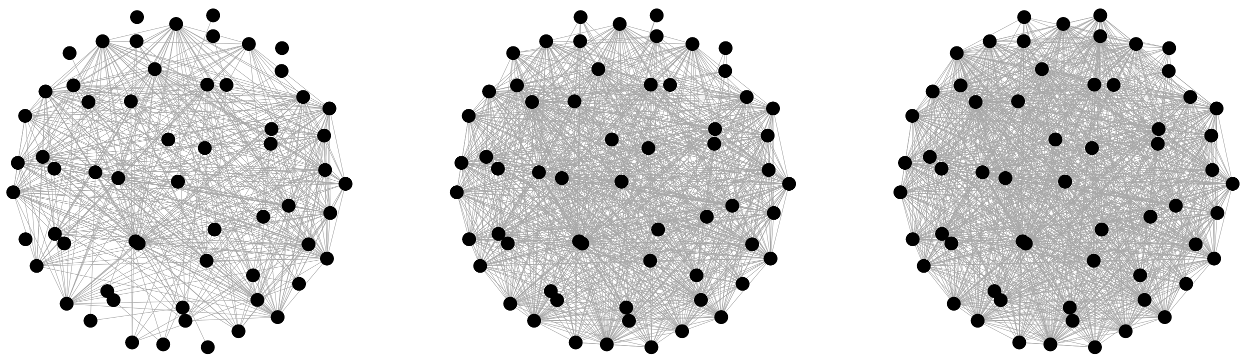
Existing explanations for the rise of PTAs have covered a wide range of factors, including but not limited to bilateral trade (Yarbrough and Yarbrough, 2014), economic growth (Mattli, 1999), and regime type (Milner and Mansfield, 2012; Mansfield and Milner, 2018). However, only recently have scholars started paying attention to the rapid expansion of GVCs (e.g., Zeng et al. (2020).) However, researchers have found it difficult to conceptualize and measure the force of GVCs. GVCs may represent themselves as bilateral division of labor and increasing interdependencies in production, but they may also operate as a structural factor. For example, when country A and country B enter a bilateral PTA and foster closer production linkages, and later on country B signs another PTA with country C that facilitates outsourcing and investment from B to C, there will be a reasonable expectation that A and C are more likely to become PTA partners as well. On the one hand, C can now better serve A due to production transfer from B to C under the PTA. Therefore, collective lobbying of upstream and downstream producers in A would push for preferential treatments between these two countries (Baldwin, 1997). On the other hand, increasing production-sharing activities and direct investment between A and C may create demand for institutionalized protection by GVC coalitions (Johns and Wellhausen, 2016). Consequently, PTA formation between A and C may follow the expansion of GVCs under the existing PTAs in the previous period(s).

To tackle this empirical challenge, I propose to model the coevolution of PTA and GVC networks where we simultaneously account for country characteristics, bilateral relationships, structural changes, and temporal dependencies. To do so, I first construct PTA "panel networks" (1995-2015) based on the Design of Trade Agreements (DESTA) Database. This comprehensive database documents all types of preferential trade cooperation and measures the "depth" of each PTA with a well-defined index. In Figure 7, I plot the preferential trade network at three points of time to visualize its evolution process. Each node represents one of 62 major countries in the world,[21] while each edge refers to the existence of any PTA. The layout of the network is kept the same to ensure comparability across the three years. It is easy to observe that the PTA networks have become denser over time - The network density has in fact risen from 24% to 56%, indicating more than half of the possible edges are present. Broadly speaking, this figure reflects the proliferation of PTAs well recognized in the existing literature.

To capture the expansion and influence of GVC coalitions, I leverage the Trade in Value-Added (TiVA) Database (2005-2015), which calculates `Forward linkage` and `Backward linkage` based on inter-country input-output tables across 65 major economies.[22] In my analysis, I exclude

[21]You can find the full list of country names in the Appendix. These are countries for which we have a GVC measure from the Trade in Value-Added Database.

[22]Similar to but more general than my definitions in the theory section, `Forward linkage` captures domestic value added in trade partners' exports and final demand, while `Backward linkage` captures the value added of intermediate imports embodied in exports (Kim and Rosendorff, 2021)



(a) 1995 (PTA = 447) **(b) 2005 (PTA = 888)** **(c) 2015 (PTA = 1058)**

Figure 7: **The Evolution of PTA Network:** This figure shows the evolution of the PTA network among 62 major countries in the year of 1995, 2005, and 2015.

Hong Kong, Macao, and Taiwan and retain 62 countries as the nodes of the PTA network. I also prepare a panel of country- and country dyad-level covariates based on the existing literature.

I model the evolution of the PTA network with the Temporal Exponential Random Graph Model (tERGM) (Leifeld et al., 2018; Cranmer and Desmarais, 2011). Intuitively, ERGM approximates the network generating process that accounts for specific node, edge, and structure attribute, whereas tERGM further conditions on the structure of temporal dependencies. Formally, the baseline ERGM is characterized as:

$$\Pr(N;\theta) = \frac{\exp(\theta^T h(N))}{\kappa(\theta)} \tag{5}$$

where the probability of observing a particular network N is a normalized exponential function. θ is the vector of model coefficients, $h(N)$ is a vector of statistics computed on N that include exogenous (e.g., node and edge attributes) and endogenous (e.g., transitivity) dependencies, and $\kappa(.)$ is the normalizing constant. Similarly, the temporal extension - tERGM - specifies the conditional probability on lagged networks:

$$\Pr(N^t|N^{t-1}, N^{t-2}, ..., N^1, \theta) = \frac{\exp(\theta^T h(N^t, N^{t-1}, N^{t-2}, ..., N^1))}{\kappa(N^{t-1}, N^{t-2}, ..., N^1, \theta)} \quad (6)$$

where the superscripts for N denote the time period from 1 to t.

In my statistical model, the key treatment of interest is the lagged GVC coalitions operationalized as `Forward linkage` and `Backward linkage` between any pair of countries. To characterize the structural process where my PTA partner's PTA partner is more likely to be my PTA partner due the expansion of GVCs, I include the inter-temporal transitivity statistics in the model. For instance, a single-period delayed transitivity term is defined as:

$$h(N^t, N^{t-1}) = \sum_{ijk} N_{ij}^{t-1} N_{jk}^{t-1} N_{ik}^{t} \quad (7)$$

where N_{ij}^{t-1}, for example, is the dummy variable indicating the presence of the edge between i and j in time $t-1$. If transitivity has been prevalent over time, we should expect highly-clustered structure in PTA networks due to this process, so I also include the number of triangles for each time period.[23] Finally, I experiment with a series of star terms to account for different degree that a node has, and the results mostly remain robust. As for node- and edge-level covariates, I follow the existing literature to control for economic and political factors. To deal with inter-temporal dependencies in general, I include network "memory terms" such as dyadic stability and linear time trend, whose formal definitions can be found in the Appendix.

Table 3 reports the model estimation results. I apply the maximum pseudo-likelihood (MPL) approach with bootstrapped confidence intervals.[24] Model (1) only includes exogenous node and edge characterises, and we find the two GVC measures are positive and statistically significant.

[23]Note that the extent of clustering is defined as the density of triangles.

[24]Leifeld et al. (2018) have introduced this procedure where MPL helps obtain a consistent estimator with reasonable computational power, while bootstrapping corrects the underestimation of uncertainty.

With two structural terms introduced in Model (2), the results are consistent. Substantially, one percentage point increase in either of the GVC measures is associated with about 49% increase in the odds of PTA formation. Moreover, as we expect, PTA networks display a significant level of transitivity and clustering over time.

In the Appendix, I compare the predictive performance of the tEGRM model and that of dyadic logistic regressions widely used in the literature. I find that tERGM achieves a much higher accuracy rate for both the in-sample and out-of-sample predictions. I also show the robustness of my results with different specifications of k-stars and time trends. Finally, I explore the impact of GVCs on the "depth" of PTA through a series of valued ERGM. The bottom line is that GVC networks also contribute to the "depth" of PTAs across years in a significant and substantial manner. In summary, GVC-based coalitions seem to be a key determinant of international trade cooperation since the new millennium.

4 Conclusion

In this paper, I introduce GVC linkages as a new determinant of trade coalitions and trade policy outcomes in this era of global production. Joining firm-level supply chain datasets and lobbying reports, I offer direct evidence for trade coalitions along the GVCs. To sum up, my theoretical analysis and empirical evidence suggest the necessity to rethink the role of coalitions in trade politics even in the firm-centered framework. It also highlights the need to update the literature on the political economy of trade - To discuss the trade policy over a particular product, researchers need to consider not only the factor intensity and exporters of the product, but also its production networks and value-added structure.

Table 3: GVC Linkages and Preferential Trade Agreements (tERGM)

	Dependent variable:	
	PTA Formation	
	(1)	(2)
Forward linkage	0.59 [0.21, 0.72]	0.38 [0.14, 0.50]
Backward linkage	0.35 [0.09, 0.70]	0.49 [0.31, 0.68]
Transitivities		0.64 [0.18, 1.05]
PTA clusters		0.30 [0.23, 0.36]
Population	−0.21 [−0.49, 0.20]	−0.05 [−0.25, 0.19]
GDP per capita	−0.12 [−0.62, 0.73]	−0.06 [−0.47, 0.66]
GDP disparity	0.37 [−0.08, 0.80]	0.13 [−0.18, 0.55]
GDP growth	−0.07 [−0.13, 0.12]	−0.05 [−0.09, 0.15]
Regime type	0.04 [−0.05, 0.23]	0.06 [−0.02, 0.19]
Regime type × Growth	0.00 [−0.01, 0.01]	0.00 [−0.02, 0.01]
Bilateral trade	1.23 [0.03, 15.85]	0.69 [−0.07, 14.80]
Total trade	−0.05 [−0.51, 0.42]	0.17 [−0.17, 0.55]
Military alliance	−0.86 [−16.70, 0.50]	−0.25 [−15.85, 1.10]
Same continent	−0.98 [−2.47, 0.15]	−0.41 [−1.99, 0.33]
Edges	9.94 [−7.91, 26.14]	8.77 [−6.75, 21.90]
K-Star	✓	✓
Temporal Stability	✓	✓
Linear Time Trend	✓	✓
Number of Nodes	62	62

Note: 95% bootstrapped confidence intervals in brackets.

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Commerce, Coalitions, and Global Value Chains: Evidence from Coordinated and Collective Lobbying Supporting Information

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Contents

A Theoretical Proofs

A.1 Formal Characterization of Setup

I analyze trade policy under the following scenario. There are two countries, home and foreign (denoted as superscripts H and F), and two consumption goods, a freely-traded numeraire good (q) and a downstream good (z) produced by three consecutive stages.[1] The representative home consumer has a quasi-linear utility function $U(z, q) = k(z)+q$, where $k(z)$ refers to some increasing function of the downstream good z, while q enters the utility function linearly. The quasi-linearity of the utility function is a common choice in stylized setups (see p.45 in Mas-Colell et al. (1995) and Appendix A.2). It also renders a quasi-linear indirect utility function (i.e., the value function of the utility function) that simplifies my analysis and illustration later on. Define the indirect utility function as $V(p^D, I) = v(p^D) + I$, where $v(p^D)$ corresponds to the utility from consuming the downstream good z with price p^D, and I denotes income.

Turning to the supply side, Home has established one production chain that involves the upstream, the midstream, and the downstream product denoted as x, y, and z respectively. The upstream producer takes in exogenously given factor (e.g., labor or/and capital) and outputs x, the midstream producer uses x to produce y, while the downstream producer processes y to obtain z.[2] Instead of assuming particular functional forms for these production functions,[3] I assume the existence of interior solution to the producer's problem and redefine x, y, and z as the optimal quantity of production. To simplify the algebra, we will define the production process by its profit function at each stage, namely $\pi^U(p^U)$, $\pi^M(p^U, p^M)$, and $\pi^D(p^M, p^D)$, where p^U, p^M, and p^D refer to the price of x, y, and z.

[1] The inclusion of the numeraire good is a standard practice to pin down the equilibrium of the model.

[2] There may be other factors of production necessary for the midstream and the downstream stage, but I do not model them explicitly as long as they satisfy the standard assumptions for production functions.

[3] For example, one can stick to the popular choice of Cob-Douglas function with constant return to scale (Mas-Colell et al., 1995).

To introduce simple production networks beyond national borders, we let a portion of midstream production shift abroad due to economic efficiency, i.e., home becomes the exporter of x and importer of y. For simplicity, I assume that the upstream producer at home customizes some products for export with a different and independent price at p^{U*}. This is consistent with the literature on global production (Antràs et al., 2017). Note that the profits of the upstream producer, π^U, will now depend on the price at home and abroad, p^U and p^{U*}. We also assume that for foreign and domestic midstream producers, there is "perfect" price pass-through from input to output (e.g., one percent increase in p^{U*} leads to one percent increase in p^{M*}). Note that "imperfect" price pass-through will only affect the magnitude of change. Finally, we let x flow freely (or we can think about p^{U*} as absorbing any exogenous tariff on x^F), while the import of y is subject to τ measured as one plus the ad valorem tariff rate, such that $p^M = p^{M*}\tau$. The environment is summarized in Figure 1 in the main text with the quantity of interest τ in red.

Lastly, we can specify the profit functions for domestic producers as $\pi^U = p^U x^H + p^{U*} x^F - c_1(x^H + x^F)$, $\pi^M = p^M y^H - p^U x^H - c_2 y^H$, and $\pi^D = p^D z - p^M(y^H + y^F) - c_3 z$, where c_1, c_2, and c_3 refer to the corresponding unit costs. Taking partial derivatives will lead us to the following:

$$\frac{\partial \pi^U(p^U, p^{U*})}{\partial p^U} = x^H; \quad \frac{\partial \pi^U(p^U, p^{U*})}{\partial p^{U*}} = x^F \tag{1}$$

$$\frac{\partial \pi^M(p^U, p^M)}{\partial p^M} = y^H; \quad \frac{\partial \pi^M(p^U, p^M)}{\partial p^U} = -x^H \tag{2}$$

$$\frac{\partial \pi^D(p^M, p^D)}{\partial p^D} = z; \quad \frac{\partial \pi^D(p^M, p^D)}{\partial p^M} = -(y^H + y^F) \tag{3}$$

A.2 Quasi-Linearity of Utility Function

This subsection derives the property of quasi-linear utility functions that will simplify our proofs later on. As specified in Mas-Colell et al. (1995), it is a common choice to simplify the algebra.

Recall that we start with the quasi-linear utility function as below:

$$U(z, q) = k(z) + q \tag{4}$$

where $k(z)$ refers to some increasing function of the downstream good z, while the numeraire good q enters the utility function linearly.

Applying the equality between the marginal rate of substitution and the price ratio (define the price as p^D and $p^Q = 1$ respectively), we can derive the following relationships:

$$\frac{MU_z}{MU_q} = \frac{p^D}{p^Q}$$

$$\Leftrightarrow \qquad k'(z) = p^D$$

$$\Leftrightarrow \qquad z = k'^{-1}(p^D)$$

Now we can solve for the expression of q using the budget constraint:

$$p^D z + p^Q q = I$$

$$\Leftrightarrow \qquad k'^{-1}(p^D)p^D + q = I$$

$$\Leftrightarrow \qquad q = I - k'^{-1}(p^D)p^D$$

Therefore, the indirect utility function (i.e., the value function of the utility function) is:

$$V(p^D, I) = k(k'^{-1}(p^D)) + I - k'^{-1}(p^D)p^D$$

$$\Leftrightarrow \qquad V(p^D, I) = k(k'^{-1}(p^D)) - k'^{-1}(p^D)p^D + I$$

$$\Leftrightarrow \qquad V(p^D, I) = v(p^D) + I$$

Note that the indirect utility is also quasi-linear, which gives us a very useful result via Roy's Identity:

$$z = -\frac{\frac{\partial V(p^D,I)}{\partial p^D}}{\frac{\partial V(p^D,I)}{\partial I}} = -\frac{\partial V(p^D, I)}{\partial p^D} = -v'(p^D) \tag{5}$$

A.3 Proof of Proposition 1

Note that our objective function is defined as in Equation (4) in the main text:

$$W = V(p^D, I) + \pi^U(p^U, p^{U*}) + \pi^M(p^U, p^M) + \pi^D(p^M, p^D) + (p^M - p^{M*})M \tag{6}$$

Differentiate the above equation with respect to tariff gives the following:

$$\frac{\partial W}{\partial \tau} = \frac{\partial V(p^D, I)}{\partial \tau} + \frac{\partial \pi^U(p^U, p^{U*})}{\partial \tau} + \frac{\partial \pi^M(p^U, p^M)}{\partial \tau} + \frac{\partial \pi^D(p^M, p^D)}{\partial \tau} + \frac{\partial (p^M - p^{M*})M}{\partial \tau} \tag{7}$$

Apply the chain rule with Equality (1) to (3) in the main text, as well as the result in Equation (2) and $M = y^F$, we can simplify the expression as follows:

$$
\begin{aligned}
\frac{\partial W}{\partial \tau} &= \frac{\partial V(p^D, I)}{\partial p^D}\frac{dp^D}{d\tau} + \frac{\partial \pi^U(p^U, p^{U*})}{\partial p^U}\frac{dp^U}{d\tau} + \frac{\partial \pi^U(p^U, p^{U*})}{\partial p^{U*}}\frac{dp^{U*}}{d\tau} + \frac{\partial \pi^M(p^U, p^M)}{\partial p^U}\frac{dp^U}{d\tau} \\
&+ \frac{\partial \pi^M(p^U, p^M)}{\partial p^M}\frac{dp^M}{d\tau} + \frac{\partial \pi^D(p^M, p^D)}{\partial p^M}\frac{dp^M}{d\tau} + \frac{\partial \pi^D(p^M, p^D)}{\partial p^D}\frac{dp^D}{d\tau} + \frac{\partial (p^M - p^{M*})M}{\partial \tau} \\
&= -z\frac{dp^D}{d\tau} + x^H\frac{dp^U}{\partial \tau} + x^F\frac{dp^{U*}}{d\tau} - x^H\frac{dp^U}{d\tau} + y^H\frac{dp^M}{d\tau} - (y^H + y^F)\frac{dp^M}{d\tau} + z\frac{dp^D}{d\tau} + \frac{\partial (p^M - p^{M*})y^F}{\partial \tau} \\
&= x^F\frac{dp^{U*}}{d\tau} - y^F\frac{dp^M}{d\tau} + \frac{\partial (p^M - p^{M*})M}{\partial \tau} \\
&= x^F\frac{dp^{U*}}{d\tau} - y^F\frac{dp^M}{d\tau} + M\frac{dp^M}{d\tau} - M\frac{dp^{M*}}{d\tau} + (p^M - p^{M*})\frac{dM}{dp^M}\frac{dp^M}{d\tau} \\
&= x^F\frac{dp^{U*}}{d\tau} - M\frac{dp^{M*}}{d\tau} + (p^M - p^{M*})\frac{dM}{dp^M}\frac{dp^M}{d\tau}
\end{aligned}
$$

As is clear in the steps, the production chains will allow the cancellation of multiple term-of-trade effects if the profit from each production stage enters into the welfare function additively and equally. To make further progress, we can totally differentiate the market clearing condition, $M(p^M) = E^*(p^{M*})$ and arrive at the following equality:

$$
-\mu\frac{dp^M}{p^M} = \xi^*\frac{dp^{M*}}{p^{M*}} \tag{8}
$$

where $\mu \equiv -\frac{dM}{dp^M}\frac{p^M}{M} > 0$ and $\xi^* \equiv \frac{dE^{M*}}{dp^{M*}}\frac{p^{M*}}{E^{M*}} > 0$ are the elasticity of home import demand and foreign export supply of the midstream goods with respect to their relative price. As usual, we can set the simplified expression of $\frac{\partial W}{\partial \tau}$ to zero, substitute in Equation (5), and solve for the optimal tariff:

$$
\begin{aligned}
\frac{\partial W}{\partial \tau} &= x^F\frac{dp^{U*}}{d\tau} - M\frac{dp^{M*}}{d\tau} + (p^M - p^{M*})\frac{dM}{dp^M}\frac{dp^M}{d\tau} = 0 \\
&\Leftrightarrow x^F\frac{dp^{U*}}{d\tau} - M\frac{dp^{M*}}{d\tau} + (\tau^o - 1)p^{M*}\frac{dM}{dp^M}\frac{dp^M}{d\tau} = 0 \\
&\Leftrightarrow x^F\frac{dp^{U*}}{d\tau} - M\frac{dp^{M*}}{d\tau} + (\tau^o - 1)p^{M*}\frac{dM}{dp^M}\frac{dp^M}{d\tau} = 0 \\
&\Leftrightarrow (\tau^o - 1)p^{M*}\frac{dM}{dp^M}\frac{dp^M}{d\tau} = M\frac{dp^{M*}}{d\tau} - x^F\frac{dp^{U*}}{d\tau}
\end{aligned}
$$

$$\Leftrightarrow \tau^o - 1 = \frac{1}{\xi^*}(1 - \frac{x^F dp^{U*}}{M dp^{M*}})$$

Under the assumption that the upstream producer customizes the exported goods, and that the price of these inputs moves in proportion to that of output abroad, we can set the elasticity of input price with respect to output price $\theta^* \equiv \frac{dp^{U*}/p^{U*}}{dp^{M*}/p^{M*}} = 1$. Therefore, substitute in the expression for θ will render the result in Proposition 1.

$$\tau^o - 1 = \frac{1}{\xi^*}(1 - \frac{x^F p^{U*}}{M p^{M*}}) \tag{9}$$

Notice that in general, θ^* may not necessarily be equal to 1, but it is reasonable to assume that θ^* should be positive. In this case, the effect of domestic value added $\frac{x^F p^{U*}}{M p^{M*}}$ will be moderated by the price elasticity. However, the optimal tariff will still be decreasing in domestic value added.

A.4 Proof of Proposition 2

We start with the new objective function below:

$$\Omega = W + \lambda^U \pi^U(p^U, p^{U*}) + \lambda^M \pi^M(p^U, p^M) + \lambda^D \pi^D(p^M, p^D) \tag{10}$$

Again, we take the derivative with respect to τ and solve for the politically optimal tariff.

$$\frac{\partial \Omega}{\partial \tau} = \frac{\partial W}{\partial \tau} + \lambda^U \frac{\partial \pi^U(p^U, p^{U*})}{\partial \tau} + \lambda^M \frac{\partial \pi^M(p^U, p^M)}{\partial \tau} + \lambda^D \frac{\partial \pi^D(p^M, p^D)}{\partial \tau} \tag{11}$$

We proceed to apply the chain rule as before.

$$
\begin{aligned}
\frac{\partial \Omega}{\partial \tau} &= \frac{\partial W}{\partial \tau} + \lambda^U \frac{\partial \pi^U(p^U, p^{U*})}{\partial \tau} + \lambda^M \frac{\partial \pi^M(p^U, p^M)}{\partial \tau} + \lambda^D \frac{\partial \pi^D(p^M, p^D)}{\partial \tau} = 0 \\
&\Leftrightarrow \frac{\partial W}{\partial \tau} + \lambda^U (\frac{\partial \pi^U(p^U, p^{U*})}{\partial p^U}\frac{dp^U}{d\tau} + \frac{\partial \pi^U(p^U, p^{U*})}{\partial p^{U*}}\frac{dp^{U*}}{d\tau}) \\
&+ \lambda^M (\frac{\partial \pi^M(p^U, p^M)}{\partial p^U}\frac{dp^U}{d\tau} + \frac{\partial \pi^M(p^U, p^M)}{\partial p^M}\frac{dp^M}{d\tau}) \\
&+ \lambda^D (\frac{\partial \pi^D(p^M, p^D)}{\partial p^M}\frac{dp^M}{d\tau} + \frac{\partial \pi^D(p^M, p^D)}{\partial p^D}\frac{dp^D}{d\tau}) = 0 \\
&\Leftrightarrow \frac{\partial W}{\partial \tau} + \lambda^U (x^H \frac{dp^U}{d\tau} + x^F \frac{dp^{U*}}{d\tau}) + \lambda^M (-x^H \frac{dp^U}{d\tau} + y^H \frac{dp^M}{d\tau}) \\
&+ \lambda^D [-(y^H + y^F)\frac{dp^M}{d\tau} + z\frac{dp^D}{d\tau}] = 0 \\
&\Leftrightarrow (\tau^{o'} - 1)p^{M*}\frac{dM}{dp^M}\frac{dp^M}{d\tau} - M\frac{dp^{M*}}{d\tau} + x^F\frac{dp^{U*}}{d\tau} + \lambda^U (x^H \frac{dp^U}{d\tau} + x^F \frac{dp^{U*}}{d\tau}) \\
&+ \lambda^M (-x^H \frac{dp^U}{d\tau} + y^H \frac{dp^M}{d\tau}) + \lambda^D [-(y^H + y^F)\frac{dp^M}{d\tau} + z\frac{dp^D}{d\tau}] = 0 \\
&\Leftrightarrow (\tau^{o'} - 1)p^{M*}\frac{dM}{dp^M}\frac{dp^M}{d\tau} = M\frac{dp^{M*}}{d\tau} - x^F\frac{dp^{U*}}{d\tau} - \lambda^U (x^H \frac{dp^U}{d\tau} + x^F \frac{dp^{U*}}{d\tau}) \\
&- \lambda^M (-x^H \frac{dp^U}{d\tau} + y^H \frac{dp^M}{d\tau}) - \lambda^D [-(y^H + y^F)\frac{dp^M}{d\tau} + z\frac{dp^D}{d\tau}] \\
&\Leftrightarrow \tau^{o'} - 1 = \tau^o - 1 - \lambda^U (x^H \frac{dp^U}{p^{M*}dM} + x^F \frac{dp^{U*}}{p^{M*}dM}) \\
&- \lambda^M (-x^H \frac{dp^U}{p^{M*}dM} + y^H \frac{dp^M}{p^{M*}dM}) - \lambda^D [-(y^H + y^F)\frac{dp^M}{p^{M*}dM} + z\frac{dp^D}{p^{M*}dM}] \\
&\Leftrightarrow \tau^{o'} = \tau^o - \underbrace{\frac{\lambda^U}{\xi^*}\frac{x^F p^{U*}}{M p^{M*}} - \frac{\lambda^U y^H}{p^{M*}\frac{dM}{dp^M}}\frac{x^H p^U}{y^H p^M}}_{\text{upstream producer}} - \underbrace{\frac{\lambda^M y^H}{p^{M*}\frac{dM}{dp^M}}(1 - \frac{x^H p^U}{y^H p^M})}_{\text{midstream producer}} \\
&\underbrace{- \frac{\lambda^D (y^H + y^F)}{p^{M*}\frac{dM}{dp^M}}[\frac{z p^D}{(y^H + y^F)p^M}\frac{dp^D/p^D}{dp^M/p^M} - 1]}_{\text{downstream producer}}
\end{aligned}
$$

Note that the last step relies on the assumption that the price elasticity of upstream product with respect to downstream product is equal to 1, i.e., $\frac{dp^U/p^U}{dp^M/p^M} = \frac{dp^{U*}/p^{U*}}{dp^{M*}/p^{M*}} = 1$. In general, perfect pass-through is replaced by positive pass-through, so that the corresponded value-added effect is moderated by the corresponding price elasticity.

B Empirical Analysis

This section is currently under construction. The complete version will be online soon. Feel free to follow up with me via email.

References for Supporting Information

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