How Globalization Unravels: A Ricardian Model of Endogenous Trade Policy*

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Abstract

We show how protectionism can arise endogenously in a Ricardian trade model when the gains from globalization are distributed unevenly. Our framework combines two countries, heterogeneous households that differ in labor income across sectors and in financial wealth within sectors, input–output linkages, and an endogenous trade policy shaped by voting and lobbying. Households vote according to their realized gains from trade, and even small distributional shifts can tilt political support toward protection as adversely affected groups gain influence. These forces interact with lobbying because protection in one sector alters costs in others through production networks, creating strategic complementarities that sustain protectionism. Calibrated to U.S.–China data on sectoral productivity and tariffs, the model generates a marked decline in support for globalization that mirrors the shifting distribution of gains across households and sectors.

JEL Classification: D57, D58, D63, D72, F1, F2, F4, F6

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1 Introduction

While many papers have documented the aggregate benefits of trade (e.g., Arkolakis et al., 2012, Costinot and Rodríguez-Clare, 2014, Melitz and Redding, 2015), a growing body of evidence highlights important downsides of globalization. Import competition has produced localized hardship and declining well-being (Pierce and Schott, 2020, Adda and Fawaz, 2020) and has contributed to rising populism (Autor et al., 2020, Pástor and Veronesi, 2021, Rodrik, 2021, Colantone et al., 2022, Guriev and Papaioannou, 2022). Perhaps not surprisingly, these developments have coincided with a broader turn toward protective trade measures across many countries, regardless of partisan control.

To understand these political developments, we develop a general equilibrium Ricardian model that links globalization's unequal effects to political mobilization and trade policy. The model features two countries (the United States and China), heterogeneous households that differ in sector-specific labor income and financial wealth, a multisector input-output structure, and endogenous tariffs shaped by political forces. Political outcomes arise through two channels: voting and lobbying. Households vote on trade liberalization versus protection according to their realized gains from trade. At the same time, affected sectors lobby for tariffs, seeking protection even when trade raises aggregate welfare, while the government weighs efficiency, inequality, and political contributions. Because protection in one sector alters production costs in others through input output linkages, lobbying becomes strategic and mutually reinforcing, creating a persistent cycle of rising protection.

We empirically substantiate this mechanism using new microdata that link economic exposure, attitudes toward globalization, and firm-level lobbying, extending the approach of Autor et al. (2013, 2020, 2021). First, using survey data, we show that individuals living in regions more exposed to import competition are significantly more likely to view trade as a threat—especially if they lack financial wealth. This suggests that distributional concerns, shaped by both labor and asset income, are central to anti-globalization sentiment. Second, using lobbying expenditure data from the Senate Office of Public Records, we find that firms in trade-affected industries substantially increase their lobbying activity in response to import shocks. These expenditures far exceed campaign contributions and offer a more targeted measure of firms' efforts to influence trade policy. These patterns provide direct empirical support for the two core channels in our model: unequal exposure shaping preferences, and lobbying transmitting economic discontent into policy.

We next outline the structure of a general equilibrium Ricardian model. On the production side, we build on Eaton and Kortum (2002) with sector-specific labor endowments à la Anderson (2011) and an input-output network of intermediate goods that transmits shocks

across sectors. On the household side, income heterogeneity arises from sector specific labor income across sectors and variation in financial wealth within sectors, generating two dimensions of heterogeneity: across households and within sectors. As in classical trade theory, wages fall in sectors exposed to import competition, but the extent of harm depends on household asset holdings. Financial wealth is invested in a single global asset that reflects the shadow value of intertemporal consumption smoothing in an integrated world economy, where the absence of country-specific bonds precludes intertemporal trade imbalances.

Building on this structure, the model integrates and extends the insights of Mayer (1984) on voting and Grossman and Helpman (1994) on lobbying, bringing both channels into a unified political economy framework. Households vote on trade liberalization versus protection based on their realized gains from globalization, allowing the voting outcome to diverge from the median household's preferences, as losses carry greater political weight. In parallel, sectors lobby the government to shape tariff decisions, capturing how trade policy evolves through both electoral mandates and continuous political pressure.[1] The policymaker's objective combines aggregate efficiency, inequality, and political contributions with varying weights, so shifts in political priorities can alter the distributional pattern of tariff outcomes, potentially amplified by strategic complementarities in production linkages.

To evaluate the model quantitatively, we construct a sectoral dataset for the U.S. and China (1991-2019) using data from the KLEMS project, the China Industrial Productivity (CIP) Database, and the U.S. Bureau of Economic Analysis (BEA). We harmonize sectoral classifications into 31 sectors (19 tradable, 12 nontradable), derive input-output matrices, and calibrate key model parameters. These include sectoral trade elasticities (Caliendo and Parro, 2015 and Baqaee and Farhi, 2024), household wealth shares (Survey of Consumer Finance), labor income, employment shares, risk aversion, and tariff rates sourced from WITS and Fajgelbaum et al. (2019). The calibrated model, informed by parameter values from the literature and sectoral data on inputs, productivity, and tariffs, does not target specific moments but instead translates established empirical estimates into an economic narrative showing how globalization's unequal effects shape macroeconomic, distributional, and political outcomes through voting and lobbying.

Our model replicates key empirical patterns: it predicts rising aggregate consumption alongside declining net exports as a share of GDP, consistent with observed trends. At the same time, it captures a rise in inequality and a shrinking share of households benefiting from

[1]Empirically, Bombardini et al. (2021) show that lobbying expenditures rose sharply in U.S. industries exposed to Chinese import competition, Bombardini and Trebbi (2020) review evidence on lobbying effectiveness, and Bown et al. (2021) and Zhang (2025) document coordinated lobbying driven by sectoral interdependence, consistent with the mechanism in our model.

globalization over the past decades, in line with Colantone et al. (2022) and Rodrik (2021). This erosion of support is shaped by three forces: (i) input-output linkages, (ii) changes in tariff policy, and (iii) financial income. Without (i), globalization's effects do not reach nontradable sectors, which account for the vast majority of U.S. employment (with tradable sectors comprising only 9% in 2023). (ii) Tariff changes, particularly those enacted during the 2018–2019 U.S.–China trade tensions, have reduced support for globalization by generating negative impacts on aggregate welfare. (iii) Financial income amplifies these dynamics, as the slowdown in Chinese growth lowers returns on invested wealth.

To understand how this decline in support translates into political pressure, we examine the sectoral and household level drivers of inequality. Tradable sectors are not uniformly affected: for example, electrical products contract under foreign competition, while transportation equipment benefits from cheaper inputs and faces limited foreign substitution due to low trade elasticities. Wealth heterogeneity reinforces these disparities: financial assets buffer some households from losses, while others, even within the same sector, experience falling labor incomes. This within sector variation generates uneven incentives for protection, laying the groundwork for political mobilization.

We relate the declining share of households that benefit from globalization to voting outcomes favoring trade protection or, more broadly, opposition to globalization. The distribution of gains from globalization has become increasingly dispersed, showing a bimodal pattern in recent years with a small group that is severely negatively affected. As a result, adversely affected households increasingly withdraw support for globalization, a trend especially pronounced since the mid-2000s. Allowing the median voter to diverge from the median household through salience weighting, where more negatively affected households exert greater influence, makes the shift toward protection even stronger. Quantitatively, the political momentum behind globalization has weakened so much that factors often left unmodeled, such as ideology or political sentiment, play a diminishing role in explaining rising support for protectionism, which now emerges directly from distributional forces in the model.

In our baseline setting, lobbying originates from sectors directly affected by trade policy. When the government assigns greater weight to inequality, tariffs rise, compressing the distribution of gains by benefiting households harmed by trade while hurting those that would otherwise gain, but lowering aggregate consumption. Consequently, the share of households better off under globalization becomes ambiguous, as improvements at the bottom are offset by losses at the top. This tradeoff aligns with the arguments of Pástor and Veronesi (2021) and Rodrik (2021), who note that societies averse to inequality may accept lower efficiency to contain the extremes of globalization. This mechanism helps explain why, as shown by

Grossman and Helpman (2020) and Guriev and Papaioannou (2022), populist leaders often pursue protectionist policies even at macroeconomic cost. It also mirrors the logic of costly redistribution discussed by Antràs et al. (2017) and Heathcote et al. (2017). Our framework helps explain why protectionism has risen in recent decades. In counterfactual scenarios resembling the United States in the 1950s, with faster growth, a broader tradable base, and smaller foreign economies, the model predicts lobbying for lower tariffs, illustrating how today's unequal exposure has reshaped the political equilibrium.

Finally, we assess the robustness of our quantitative results along two dimensions that may affect political outcomes. First, the baseline assumes sector specific labor, which influences the persistence of inequality and thus voting outcomes. While this captures medium term adjustment frictions documented by Artuç et al. (2010) and Dix-Carneiro and Kovak (2017), evidence from Autor et al. (2014) and Foschi et al. (2025) shows that workers eventually reallocate across sectors. Allowing such mobility leaves the main voting implications unchanged. Second, on the lobbying side, the baseline allows only own sector participation. Motivated by the idea of counter lobbying introduced by Bhagwati et al. (1992) and by recent evidence that global value chains create cross sector incentives to support openness (Alfaro et al., 2019; Antràs and Chor, 2022; Kim, 2017; Choi, 2025), we extend the model to permit cross sector lobbying under a loose participation constraint, requiring lobbying expenditures to exceed at least 10 percent of the economy wide average. The results remain nearly identical, as supportive lobbying by adversely affected sectors and counter lobbying by trade beneficiaries offset each other. Together, these exercises confirm that the main quantitative and political results are not driven by restrictive assumptions on factor mobility or lobbying scope.

We contribute to the literature studying the backlash against globalization, including Autor et al. (2013, 2020, 2021), Che et al. (2022), Choi et al. (2024), Colantone et al. (2022), Di Tella and Rodrik (2020), Dippel et al. (2022), Galle et al. (2022), Jensen et al. (2017), Margalit (2011), and Rodrik (2021).

The political economy of trade examines how distributional effects shape policy outcomes through voting and lobbying. Mayer (1984) develops a median-voter model in which tariffs reflect the aggregation of individual preferences over factor incomes. Dutt and Mitra (2002) relate trade protection to inequality and factor endowments. Méndez and Van Patten (2025) show that voting on trade agreements reflects firm-level exposure through production networks, and Dippel et al. (2021) identify trade-induced labor market adjustments as a key mechanism behind electoral responses to globalization. Heblich et al. (2024) document how trade shocks reshaped the distribution of income and production. On the lobbying side, Gawande et al. (2012) link sectors' political influence to their trade exposure. We contribute

to this literature by integrating both voting and lobbying into a unified general equilibrium framework that links distributional effects of trade to policy outcomes.

In the modeling context, we build on the international trade literature, e.g., Adão et al. (2020), Arkolakis et al. (2012), Arkolakis et al. (2019), Baqaee and Farhi (2024), Boehm et al. (2024), Caliendo and Parro (2015), Costinot and Rodríguez-Clare (2014), Eaton and Kortum (2002), Galle et al. (2022), Levchenko and Zhang (2014), Levchenko (2016), Melitz and Redding (2015), Ossa (2015), and Ramondo and Rodríguez-Clare (2013).

Our tariff analysis is in conjunction with the literature on optimal tariffs, which centers on importers' monopolistic power, among other factors, in shaping tariffs (e.g., Broda et al., 2008, Ossa, 2014, Irwin and Soderbery, 2021, Soderbery, 2018, Itskhoki and Mukhin, 2025) and that on distributional consequences of trade and globalization backlash mentioned above.

Our paper also relates to recent contributions on geopolitical fragmentation (e.g., Aiyar et al., 2023, Gopinath et al., 2025, Fernández-Villaverde et al., 2024, Mohr and Trebesch, 2024) and to the growing literature on geoeconomics, including Becko and O'Connor (2024), Broner et al. (2024), Clayton et al. (2024), Kleinman et al. (2024), Liu and Yang (2025), and Pflueger and Yared (2024). Our contribution links macro fragmentation to its micro foundations by showing how unequal gains from globalization generate political pressure (through voting and lobbying) that sustains fragmentation over time.

The rest of the paper is structured as follows. Section 2 establishes the causal link between economic discontent and policy shifts. Section 3 presents a Ricardian model of a two-country, multisector economy with tradable and nontradable goods and input-output linkages. Section 4 develops the political economy of trade policy, focusing on voting and sectoral lobbying dynamics. Section 5 examines the quantitative implications of the model for globalization, and Section 6 analyzes the endogenous formation of trade policy. Section 7 concludes. The Appendix provides additional details.

2 Empirical Evidence

Globalization and shifting public attitudes. In this section, we present empirical evidence on the effects of globalization—specifically, China's economic expansion and rising imports—on the U.S. economy and public attitudes toward globalization.

First, we assess how rising Chinese imports influenced individuals' attitudes toward globalization. Autor et al. (2020) provide an important contribution by leveraging the "China shock" of Autor et al. (2013), which measures regional import penetration of Chinese products instrumented by Chinese supply factors. Their findings indicate that regions more exposed

to Chinese imports increased support for Republican candidates in the 2008 and 2016 U.S. Presidential elections. We expand the analysis by examining the effect of wealth holdings, as financial income may mitigate the adverse effects of trade-induced labor income losses. To do so, we combine regional wealth estimates from Suss et al. (2024), derived from the Survey of Consumer Finances (SCF), with regional import penetration and voting data from Autor et al. (2020). To the best of our knowledge, this is the first paper that integrate the trade-induced globalization shock with financial data to examine heterogeneous impacts across wealth positions.

Table (1) presents the results. Columns (1)–(2) confirm that Chinese import penetration is associated with increased support for Republican candidate (Trump) in the 2016 election. Additionally, median household wealth level in 2000 (ln(Wealth)) is negatively associated with Republican vote share, consistent with our hypothesis that wealthier households are more likely to benefit from globalization. The result suggests that opposition to globalization—proxied by a vote for Trump—decreases with wealth. Columns (3)–(6) further explore the differential impacts of import penetration across wealth levels. Consistent with the hypothesis above, the result indicates that trade-related economic disruptions are more severe in lower-wealth regions. These findings remain robust to the inclusion of control variables.

To further investigate attitudes toward globalization, we use the Gallup Poll Social Series, which spans annually from 2000 to 2023 and includes survey responses on perceptions of foreign trade.[2] We merge these survey responses with regional import penetration and wealth at the commuting zone level using survey respondents' zip codes. A key advantage of the Gallup survey is that it provides a direct measure of individual attitudes toward globalization, whereas presidential voting behavior may reflect broader political factors. Additionally, the panel structure of the survey allows us to control for individual and year fixed effects, unlike the cross-sectional nature of the presidential election analysis. We differ from the empirical literature that investigates the relation between globalization-related attitudinal variables and voting behavior (see Rodrik (2021) for a review) in that we examine the causal link from globalization-induced economic shocks, measured by the import penetration from China, to the attitude toward globalization and how the impact differs across wealth distribution.

Table (2) confirms that individuals residing in regions with higher import penetration are more likely to perceive foreign trade as a threat, whereas wealthier individuals are more likely to view it as an opportunity. These are aligned with the findings in Table (1).

[2]Specifically, we use the question "What do you think foreign trade means for America? Do you see foreign trade more as an opportunity for economic growth through increased U.S. exports or a threat to the economy from foreign imports?" Respondents select either "opportunity for economic growth" or "threat to economy from foreign imports."

Table 1: 2016 Presidential election Republican vote share

	(1)	(2)	(3)	(4)	(5)	(6)
Import penetration	2.604***	1.834***				
	(0.843)	(0.614)				
ln(Wealth)	-6.706***	-15.945***				
	(1.794)	(3.051)				
Import penetration						
× 1(Wealth 1st quantile)			4.626***	2.557***	3.293***	1.710*
			(0.898)	(0.768)	(1.139)	(0.875)
× 1(Wealth 2nd quantile)			3.935***	2.654***	3.855***	1.503*
			(1.159)	(0.737)	(1.291)	(0.789)
× 1(Wealth 3rd quantile)			1.008	1.219**	0.881	1.523***
			(1.272)	(0.554)	(1.141)	(0.586)
× 1(Wealth 4th quantile)			0.664	-0.280	1.885	0.954
			(1.186)	(0.828)	(2.707)	(1.094)
N of obs.	3,077	3,077	3,077	3,077	3,077	3,077
Wealth quantile controls	—	—	No	No	Yes	Yes
Full controls	No	Yes	No	Yes	No	Yes

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: The dependent variable is the change in the Republican two-party vote share between the 2000 (Bush) and 2016 (Trump) presidential elections. Observations are counties, excluding Alaska and Hawaii. The main independent variables are the change in import penetration of Chinese products from 2000 to 2014 and the median net wealth in 2000 for each commuting zone (CZ). While Autor et al. (2020) use import penetration through 2008, we employ the updated series through 2014 from Autor et al. (2021). Net wealth data come from the Geographic Wealth Inequality Database of Suss et al. (2024). All regressions are estimated by 2SLS, using the supply-driven components of import penetration (and their interactions with wealth quantiles) as instruments. Observations are weighted by total votes cast in 2000, and standard errors are clustered by CZ. The top and bottom 0.5 percentiles of the dependent variable are excluded as outliers. In columns (5) and (6), controls include wealth-quantile dummies; in columns (2), (4), and (6), we use the full controls of Autor et al. (2020): the CZ manufacturing-employment share, the Autor and Dorn, 2013 routine-task share, the offshorability index of occupations, census-division dummies, and demographic variables (population shares by age group, and female, college-educated, foreign-born, white, Hispanic, and black shares), as well as the Republican vote share in 1992 and 1996. From the Geographic Wealth Inequality Database, we additionally include the logarithm of average income, average age and its square, the wealth Gini coefficient, and average household size.

Globalization's impact on politics and lobbying Similar to voting behavior, one can expect that campaign contributions are influenced by globalization. To empirically assess this link, we conduct an analysis analogous to the previous subsection, using campaign contribution data from the Database on Ideology, Money in Politics, and Elections (DIME), compiled by Bonica (2015). This dataset, which links campaign contributions to contributors' ideolog-

Table 2: Individuals' attitude toward foreign trade in the Gallup Poll Social Series

	(1)	(2)	(3)	(4)	(5)	(6)
Import penetration	-0.028***	-0.028***				
	(0.008)	(0.008)				
ln(Wealth)	0.106***	0.108***				
	(0.015)	(0.014)				
Import penetration						
× 1(Wealth 1st quantile)			-0.047***	-0.047***	-0.029**	-0.028**
			(0.009)	(0.009)	(0.014)	(0.014)
× 1(Wealth 2nd quantile)			-0.033***	-0.033***	-0.031**	-0.031**
			(0.011)	(0.011)	(0.013)	(0.012)
× 1(Wealth 3rd quantile)			-0.017	-0.017	-0.019	-0.018
			(0.019)	(0.018)	(0.024)	(0.024)
× 1(Wealth 4th quantile)			0.028**	0.028**	-0.014	-0.015
			(0.012)	(0.012)	(0.024)	(0.024)
N of obs.	17,716	17,679	17,716	17,679	17,716	17,679
Wealth quantile controls	—	—	No	No	Yes	Yes
Full controls	No	Yes	No	Yes	No	Yes
ID FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: The dependent variable is an indicator constructed from the survey question: "What do you think foreign trade means for America? Do you see foreign trade more as an opportunity for economic growth through increased U.S. exports or a threat to the economy from foreign imports?" It equals one if the respondent answers "opportunity for economic growth" and zero if the response is "threat to the economy from foreign imports." Observations are individuals, and the survey spans 2000 to 2023. The main independent variables are the change in the import penetration of Chinese products from 2000 to 2014 and the median net wealth in 2000 for each commuting zone (CZ), obtained from the Geographic Wealth Inequality Database of Suss et al. (2024). These CZ-level measures are linked to individual survey responses via zip codes. All regressions are estimated by 2SLS, using the supply-driven components of import penetration (and their interactions with wealth quantiles) as instruments. In columns (5) and (6), controls include wealth-quantile dummies. In columns (2), (4), and (6), full controls include age and age squared. Time and individual fixed effects are included in all specifications.

ical leanings, was also utilized by Autor et al. (2020).

Table (3) presents the results. Column (1) shows that regions with lower wealth exhibit higher elasticities with respect to Chinese import penetration. Since these regions experience larger economic losses from imports while benefiting less from globalization-induced asset returns, they contribute more financially to political campaigns aimed at reversing globalization trends. This finding remains robust across various specifications, as shown in columns (2)–(4). Notably, regions in the highest wealth quantile display the smallest coefficients,

Table 3: Campaign contributions to Republican relative to Democrat

	(1)	(2)	(3)	(4)
Import penetration				
× 1(Wealth 1st quantile)	0.612***	0.562***	0.325*	0.528***
	(0.157)	(0.174)	(0.186)	(0.186)
× 1(Wealth 2nd quantile)	0.443***	0.480***	0.504***	0.447***
	(0.120)	(0.155)	(0.136)	(0.167)
× 1(Wealth 3rd quantile)	0.265*	0.373**	0.382**	0.479**
	(0.139)	(0.152)	(0.172)	(0.202)
× 1(Wealth 4th quantile)	0.037	0.258	0.011	0.183
	(0.164)	(0.183)	(0.255)	(0.225)
N of obs.	2,319	2,315	2,319	2,315
Wealth quantile controls	No	No	Yes	Yes
Full controls	No	Yes	No	Yes

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: Dependent variable is the differential between Republican and Democrat candidates in terms of the campaign contribution growth from the 2002 to 2016 elections cycles. Observations are country-congressional district pairs, excluding Alaska and Hawaii. Main independent variables are the change in the import penetration of Chinese products from 2000 to 2014 and the median net wealth as of 2000 for each commuting zone (CZ), as in Table 1. Control variables include those in Table 1, as well as the share of campaign contributions received by Republican candidates and the CF scores of each of Republican and Democrat candidates in the 2002 election cycle at the congressional district-level compiled by the DIME dataset. Observations are weighted by a county-district cell's share in the total year-2002 voting age population of a district, and standard errors are twoway clustered by CZ and congressional districts.

which are consistently insignificant at the 10 percent level.

We further examine political lobbying in response to globalization. Under the Lobbying Disclosure Act of 1995, amended by the Honest Leadership and Open Government Act of 2007, lobbying activities—including expenditures and associated policy issues—must be publicly disclosed. Total lobbying spending hovered around 3 to 3.5 billion dollars per year in the 2010s, nearly doubling compared to the level in 1998, the earliest year for which data is available. The scale is far larger than campaign contributions by Political Action Committees (PAC)—most of which represent business, labor or ideological interests—which were around 200 to 250 million dollars per year during the same period (Bombardini and Trebbi, 2020). Further, the disclosure requires to identify policy issues involving lobbying activities, such as trade, tax, and labor issues, which enables us to specify the spending of our interest.

We compile firm-level lobbying expenditures from filings submitted to the Senate Office of Public Records (SOPR). Although these data have been used in political economy (e.g.,

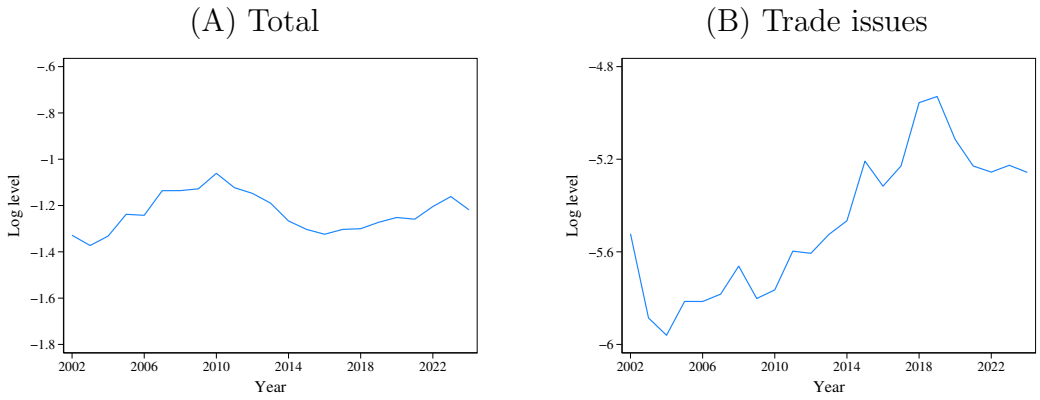


Figure 1: Lobbying expenditure-to-GDP ratio

Notes: Lobbying expenditure is denominated by nominal GDP. Lobbying expenditure data are collected from the Senate Office of Public Records (SOPR), which are linked to listed companies' names using the S&P Capital IQ data. Company fixed effects are removed.

Kang, 2015) and corporate finance research (e.g., Bertrand et al., 2014; Borisov et al., 2015), they remain largely unexplored in macroeconomics. Because filings are reported for individual legal entities, we consolidate them at the parent-company level to construct a firm-by-year dataset.[3] Figure 1 shows the rise in lobbying expenditures directed toward trade-related issues (e.g., trade and tariffs), which peaked in 2018–19. This contrasts with the relatively stable path of total lobbying expenditures once normalized by nominal GDP. Although the spike has moderated in recent years, lobbying on trade issues remains markedly higher than a decade ago.

Table (4) analyzes the impact of Chinese import exposure on firms' lobbying activities using annual lobbying expenditures from 2002 through 2024. Following Acemoglu et al. (2015), we account for both downstream and upstream effects through production networks. Specifically, we use shocks derived from input–output tables constructed by Acemoglu et al. (2016). The downstream shock captures the exposure of industries to import penetration shocks hitting their supplier industries, which then propagate downstream. The upstream shock reflects shocks to their customer industries that propagate upstream. Consistent with earlier findings, greater exposure to Chinese imports—measured at the SIC 4-digit industry level—in own sectors is associated with increased lobbying expenditures on trade issues (column (1)) and the likelihood of engaging in lobbying (column (3)). Moreover, the exposure propagates through the production network (columns (2) and (4)). Firms in upstream sectors react in the same direction, possibly due to intermediate demand shifts, as they will face decreased

[3]For example, entities such as 'Amazon Corporate,' 'Amazon.com Services,' and 'Amazon Web Services' are separately registered in the data. We aggregate these under 'Amazon.com, Inc.'

Table 4: Lobbying expenditure

Dependent var:	ln(lobbying expenditure on trade)		1 for lobbying on trade	
	(1)	(2)	(3)	(4)
Import penetration - own	0.268***	0.484***	0.053***	0.082***
	(0.063)	(0.075)	(0.010)	(0.012)
Import penetration - upstream		0.155***		0.040***
		(0.049)		(0.008)
Import penetration - downstream		-0.498**		-0.081***
		(0.065)		(0.010)
N of obs.	2,775	2,775	2,775	2,775
Full controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: Dependent variable is the logarithm of the lobbying expenditure on trade issues in columns (1)–(2) and an indicator variable that takes one if a firm spends a positive lobbying expenditure on trade issues in columns (3)–(4). Observations are firms by year. The independent variables are the change in the import penetration of Chinese products from 1999 to 2011 at SIC 4-digit level, and its upstream and downstream propagation, provided by Acemoglu et al. (2016). These are normalized so that the coefficients represent the impacts of a one standard deviation change in an independent variable. Controls include the logarithm of total revenue, that of total assets, profits before tax, the firm's age, and age squared. All regressions are estimated by 2SLS, using the supply-driven components of the import penetration as exogenous instruments. Time fixed effects are included in all regressions. Robust standard errors are reported.

demand as a result of higher import penetration in their customers' sectors. Downstream sectors' responses are the opposite, since they may benefit from low-cost imported goods as imports expand in their suppliers.

Discussion. The evidence in this section shows how Chinese economic growth has shaped the U.S. economy in substantial ways. On balance, the results point to rising competitive pressure from globalization as a force shifting public sentiment away from openness.

But the effects are complex. Cross-sectional regressions capture local labor-market disruptions yet miss economy-wide gains from trade. Wealth also matters: globalization influences both labor income and financial returns, shaping households' exposure in different ways. Political reactions extend beyond economic distress, as large firms and other organized interests actively shape trade policy. Sectoral propagation through production networks adds another layer, creating both winners and losers (e.g., the upstream and downstream patterns in Table 4).

A full assessment of the macroeconomic implications of Chinese growth must therefore account for all these channels. The next section develops a model that does so.

3 A Ricardian Model

Let us consider a discrete-time world economy with a home country (e.g., U.S.) and a foreign country (e.g., China). Each economy has n sectors and is more competitive in producing goods for which it has a comparative advantage.

In the next paragraphs, we describe only the home country because the foreign country has a symmetric structure, except that each variable carries a superscript f (for "foreign"). After introducing the environment and defining a competitive equilibrium, we examine various aspects of the model, including consumption dynamics and the impact of changes in the foreign country on the home country. We close with three simple two-sector examples that highlight the main intuition behind the results.

3.1 The environment

Households. Each sector in the home country is inhabited by a continuum of households with mass m_i, where $\sum_{i=1}^{n} m_i = 1$. At period t, each household in sector i is endowed with a fixed amount of sector-specific factor input X_{it}/m_i, which it provides inelastically for production in that sector in exchange for earnings E_{it}. We can think about X_{it} as sector-specific skills or capital. For simplicity, we assume this factor input is non-transferable across sectors. We can think about this situation as the limit case of low transferability of skills or capital among sectors.

The consumption basket. The consumption by household h in sector j at time t is given by aggregating the goods produced in each sector according to:

$$C_t^{hj} = \prod_{i=1}^{n} \left(C_{it}^{hj} \right)^{v_i}, \tag{1}$$

with $v_i > 0$ and $\sum_{i=1}^{n} v_i = 1$.

Each good C_{it}^{hj} is itself a CES bundle of a home H and a foreign F i good:

$$C_{it}^{hj} = \left(\xi_i (C_{it}^{Hhj})^{\frac{\theta_i - 1}{\theta_i}} + (1 - \xi_i)(C_{it}^{Fhj})^{\frac{\theta_i - 1}{\theta_i}} \right)^{\frac{\theta_i}{\theta_i - 1}}. \tag{2}$$

In this aggregator, θ_i is the elasticity of substitution and ξ_i governs the import share. This latter parameter may reflect differences in tastes, implicit barriers to trade, or other unmodelled mechanisms that bias consumption toward locally produced goods. Also, we assume that $\xi_i \in (0, 1)$ for $i \in T = \{1, 2, ..., n_T\}$ and $\xi_i = 1$ for $i \in N = \{n_{T+1}, ..., n\}$. That is, goods

in T are tradable, and the rest are non-tradable.

Given a tariff τ_{it} imposed on the imported good, the price of good i is

$$P_{it} = \left(\xi_i^{\theta_i}(P_{it}^H)^{1-\theta_i} + (1-\xi_i)^{\theta_i}(\tau_{it}P_{it}^F)^{1-\theta_i}\right)^{\frac{1}{1-\theta_i}}$$

where P_{it}^H and P_{it}^F are the prices of home- and foreign-produced i goods. Thus, the domestic price level is:

$$P_t = \prod_{i=1}^{n} (P_{it})^{v_i}.$$

We treat $P_t = 1$ as a numeraire.

Preferences. Households pick a sequence of $\{C_t^{hj}\}_{t=0}^{\infty}$ to maximize their utility:

$$U_0^{hj} = \sum_{t=0}^{\infty} \beta^t \frac{(C_t^{hj})^{1-\gamma} - 1}{1-\gamma} \tag{3}$$

$$\text{s.t.} \quad C_t^{hj} + W_{t+1}^{hj} = R_t W_t^{hj} + E_{jt}\frac{X_{jt}}{m_j}, \tag{4}$$

where W_t^{hj} is the net wealth at the beginning of the period and R_t is the gross nominal rate of return on wealth.

Here, wealth represents claims on other households' (domestic or foreign) future income flows. With complete markets, the specific assets through which these claims are implemented are irrelevant for our purposes. We also do not need to describe international financial flows. The key point is that the asset return is determined by the equilibrium consumption path.

Production. Gross output in sector i, Y_{it}, is produced by a representative firm with access to a constant-return-to-scale Cobb-Douglas technology:

$$Y_{it} = A_{it} X_{it}^{\alpha_i} \prod_{j=1}^{n} Y_{ijt}^{(1-\alpha_i)w_{ij}}, \tag{5}$$

that bundles the (exogenous) sector-specific factor input X_{it} and intermediate inputs Y_{ijt} produced by sector j and used in sector i, where $(1-\alpha_i) \in [0,1]$ is the intermediate input share and $\sum_{j=1}^{n} w_{ij} = 1$. Also, A_{it} denotes the sector's productivity, which is treated as exogenous and taken as given by agents.

Each intermediate is itself a CES aggregator of home- and foreign-produced goods:

$$Y_{ijt} = \left(\xi_j (Y_{ijt}^H)^{\frac{\theta_j - 1}{\theta_j}} + (1 - \xi_j)(Y_{ijt}^F)^{\frac{\theta_j - 1}{\theta_j}} \right)^{\frac{\theta_j}{\theta_j - 1}}.$$

For simplicity, the elasticity of substitution, θ_j, and the import share, ξ_j, are the same as in equation (2) for each sector j.

Gross output is used either for final consumption or as intermediate inputs.

Market clearing. Market clearing in each sector i is given by the sum of home and foreign demands, each of which is itself a composite of the demand for final consumption and for intermediate goods:

$$\underbrace{\underbrace{\sum_{j=1}^{n} \int_0^{m_j} C_{it}^{Hhj} dh}_{\text{Final goods}} + \underbrace{\sum_{j=1}^{n} Y_{jit}^H}_{\text{Intermediate goods}}}_{\text{Home demand}} + \underbrace{\underbrace{\sum_{j=1}^{n} \int_0^{m_j^f} C_{it}^{fHjh} dh}_{\text{Final goods}} + \underbrace{\sum_{j=1}^{n} Y_{jit}^{fH}}_{\text{Intermediate goods}}}_{\text{Foreign demand (=exports)}} = \underbrace{Y_{it}}_{\text{Supply}}.$$

Note that, in this definition, we assume that tariff revenue is dumped into the ocean. Since below we work with a first-order approximation of the model around a steady state calibrated to the early 1990s (when imports from China were small), this assumption is quantitatively negligible.[4]

GDP. The demand approach to national accounting yields the home country's nominal GDP:

$$GDP_t = C_t + \underbrace{\sum_{i=1}^{n} (1 - \xi_i^f)^{\theta_i} (\tau_{it}^f)^{-\theta_i} \left(\frac{P_{it}}{P_{it}^f} \right)^{-\theta_i + 1} D_{it}^f}_{=EX_t\text{: Exports}} - \underbrace{\sum_{i=1}^{n} (1 - \xi_i)^{\theta_i} \tau_{it}^{-\theta_i} \left(\frac{P_{it}^f}{P_{it}} \right)^{-\theta_i + 1} D_{it}}_{=IM_t\text{: Imports}}, \quad (6)$$

where D_{it} and D_{it}^f capture final and intermediate goods demand in the home and foreign economies, respectively.

The production approach to national accounting yields the alternative but equivalent

[4]The steady state is calibrated with data mostly from 1991. In that year, U.S. tariff revenue was \$16.8 billion. Using China's import share of 3.9% (tariff revenue is not available by country of origin), imputed tariff revenue from China was \$0.66 billion, roughly 0.01% of nominal GDP (\$6.2 trillion).

expression for GDP:

$$GDP_t = \sum_{i=1}^{n} \alpha_i S_{it}, \tag{7}$$

where $S_{it} = P_{it}Y_{it}$ denotes sectoral nominal output. We will use both equations (6) and (7) below.

Equilibrium. To define a competitive equilibrium for the home country, we will take home and foreign productivity, factor inputs, and tariffs as exogenously given.

Definition 1 *Given an exogenous sequence* $\{A_{it}, A_{it}^f, X_{it}, X_{it}^f, \tau_{it}, \tau_{it}^f\}_{t=0}^{\infty}$ *for all* $i = \{1, ..., n\}$, *a competitive equilibrium for the world economy is a sequence of prices* $\{P_{it}, P_{it}^f, R_t, , R_t^f\}_{t=0}^{\infty}$ *and allocations* $\{C_{it}^{hj}, C_{it}^{Fhj}, C_{it}^{hjf}, C_{it}^{Fhjf}, Y_{it}, Y_{it}^f\}_{t=0}^{\infty}$ *such that, given prices, households maximize their utility, firms minimize costs, markets clear, and the income identity and production feasibility of the home and foreign countries are satisfied.*

This competitive equilibrium is computed as a solution to a system of linear equations. The detail is provided in Appendix A.

A steady state is defined (and computed) analogously: it is just a competitive equilibrium where all variables are constant over time.

Notation. In what follows, we analyze the model dynamics using a first-order (log-linear) approximation. Specifically, we define:

$$d\ln x_t \equiv \ln x_t - \ln x \approx \frac{dx_t}{x} \equiv \frac{x_t - x}{x},$$

as the log deviation of variable x_t from its steady-state value x. For example, using the consumption Euler equation, the real rate of return $\tilde{R}_{t+1}$ on wealth is given by

$$d\ln \tilde{R}_{t+1} = \gamma \left(\mathbb{E}_t \left[d\ln C_{t+1} \right] - d\ln C_t \right).$$

Also, a boldface letter denotes a matrix or vector. For instance, $\boldsymbol{S}_t$ is a n-by-1 vector that collects each sector's nominal output S_{it} in the i-th element.

3.2 Consumption dynamics

The first-order approximation of the household's budget constraint around the steady-state wealth level yields

$$\underbrace{d\ln C_t^{hj}}_{\text{Individual consumption}} = \underbrace{\frac{\omega^{hj}}{1-\beta} d\ln R_t}_{\text{Financial income}} + \underbrace{(1-\omega^{hj}) d\ln S_{jt}}_{\text{Labor income}}, \tag{8}$$

where $\omega^{hj} = (1-\beta)W^{hj}/((1-\beta)W^{hj} + \frac{\alpha_j}{m_j}S_j)$ is the wealth share. Equation (8) highlights that the relative importance of each of the sources of income of a household, financial and sectoral labor income, is determined by the wealth share.

3.3 Impact of changes in the foreign country

Sectoral output. Before deriving a complete model solution, it is instructive to see the impacts of foreign economy on the domestic one using a few equilibrium conditions. Our primary focus is on sectoral output S_{it} since it is proportional to sectoral labor income $E_{it}X_{it}/m_i$ according to a firm's first-order condition with sector-specific input.

Lemma 1 *In the first-order approximation, the demand side of the economy is given by:*

$$\underbrace{d\boldsymbol{S}_t}_{\textit{Sectoral output}} = \underbrace{\tilde{\boldsymbol{V}}'}_{\textit{Network}} \Bigg\{ \underbrace{\tilde{\boldsymbol{v}} d(P_t C_t)}_{\textit{Home aggregate demand}} \underbrace{+\tilde{\boldsymbol{v}}^f d(P_t^f C_t^f)}_{\textit{Foreign aggregate demand}} \underbrace{-\tilde{\boldsymbol{\theta}}}_{\textit{Trade elasticity}} \underbrace{(d\ln \boldsymbol{P}_t - d\ln \boldsymbol{P}_t^f)}_{\textit{Relative price}} \underbrace{+\boldsymbol{\eta} d\ln \boldsymbol{\tau}_t - \boldsymbol{\eta}^f d\ln \boldsymbol{\tau}_t^f}_{\textit{Tariff}} \Bigg\}. \tag{9}$$

Here, $\tilde{\boldsymbol{V}}$ is the Leontief inverse induced by the technology (5) in each sector but adjusted with trade, $\tilde{\boldsymbol{v}}$ and $\tilde{\boldsymbol{v}}^f$ represent sectoral elasticity with respect to aggregate demand, $\tilde{\boldsymbol{\theta}}$ is a n-by-n diagonal matrix that collects demand elasticity $\tilde{\theta}_i$ in the (i,i) element, and the n-by-n matrices $\boldsymbol{\eta}$ and $\boldsymbol{\eta}^f$ govern the impact of tariffs. Appendix A shows how this lemma is derived from the first-order conditions of the households and firms as well as the market clearing conditions.

Equation (9) indicates that sectoral outputs are inversely related to the relative price between home and foreign goods, while positively affected by home and foreign aggregate demand. In other words, the foreign economy's productivity and factor input growth affects the domestic economy in two ways: a negative effect due to reduced price competitiveness as the foreign economy provides cheaper products; and a positive effect if foreign growth

increases aggregate demand. Equation (9) also illustrates how tariffs $d\ln\boldsymbol{\tau}_t$ create a wedge between domestic and foreign prices and benefit or harm domestic sectors depending on the sign of corresponding elements in $\boldsymbol{\eta}$, conditional on aggregate demand. These impacts are propagated through intermediate goods demand in the production network, captured by $\check{\boldsymbol{V}}'$.

Without trade, equation (9) collapses to $d\boldsymbol{S}_t = \boldsymbol{V}'\boldsymbol{v}d(P_tC_t)$ where fluctuations in aggregate demand P_tC_t impact sectoral output through the production network represented by the Leontief inverse $\boldsymbol{V}$.

Using the production function (i.e., the supply side of the economy), we can derive the following proposition (see Appendix A for details).

Proposition 1 *Sectoral output is related, to a first order, to exogenous productivity, factor inputs, and tariffs ($\boldsymbol{A}_t, \boldsymbol{A}_t^f, \boldsymbol{X}_t, \boldsymbol{X}_t^f, \boldsymbol{\eta}_t, \boldsymbol{\eta}_t^f$), as well as aggregate consumption P_tC_t and $P_t^fC_t^f$:*

$$\underbrace{d\boldsymbol{S}_t}_{\text{Sectoral output}} = \underbrace{\check{\boldsymbol{V}}'}_{\text{Network}}\Bigg[\underbrace{\check{\boldsymbol{v}}d(P_tC_t)}_{\text{Home aggregate demand}} \underbrace{+\check{\boldsymbol{v}}^f d(P_t^fC_t^f)}_{\text{Foreign aggregate demand}} + \underbrace{\check{\boldsymbol{\theta}}\left\{\boldsymbol{V}(d\ln\boldsymbol{A}_t + \boldsymbol{\alpha}d\ln\boldsymbol{X}_t) - \boldsymbol{V}^f(d\ln\boldsymbol{A}_t^f + \boldsymbol{\alpha}^f d\ln\boldsymbol{X}_t^f)\right\}}_{\text{Differential of home and foreign production}} \underbrace{+\check{\boldsymbol{\eta}}d\ln\boldsymbol{\tau}_t - \check{\boldsymbol{\eta}}^f d\ln\boldsymbol{\tau}_t^f}_{\text{Tariff}}\Bigg]. \tag{10}$$

The variables $\check{\boldsymbol{V}}'$, $\check{\boldsymbol{v}}$, $\check{\boldsymbol{v}}^f$, and $\check{\boldsymbol{\theta}}$ are analogues of their counterparts in Lemma 1, modified to incorporate supply-side effects arising from sectoral productivity, factor inputs, and tariffs. The third term in the square brackets represents the differential between home and foreign production, which affects the relative price between home and foreign goods and, in turn, sectoral outputs.

Note that the effect of the production network appears twice. First, the foreign economy's sectoral productivity and factor input growth propagate downstream through the supply chain represented by $\boldsymbol{V}^f$ in the third term. Second, it spillovers upstream in the home country's sectors through $\check{\boldsymbol{V}}'$.

3.4 Illustrative two-sector examples

We present three simple examples of a 2-sector economy to provide intuition for the model's behavior. For illustrative purposes, we set

$$d\ln\boldsymbol{A}_t = d\ln\boldsymbol{X}_t = d\ln\boldsymbol{X}_t^f = d\ln\boldsymbol{\eta}_t = d\ln\boldsymbol{\eta}_t^f = 0$$

and focus our attention on the effects of foreign productivity changes $d \ln \boldsymbol{A}_t^f$. Figure 2 illustrates these examples and further details are provided in Appendix A.

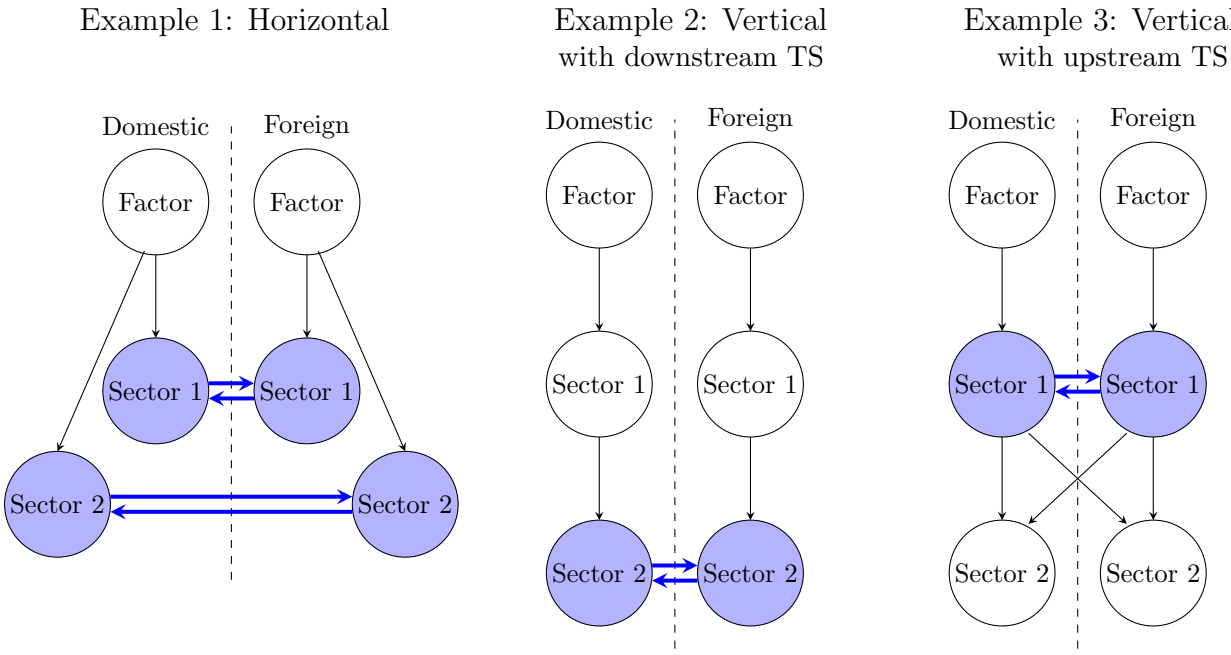


Figure 2: Examples of production network

Notes: Blue circles are tradable goods sectors and blue arrows indicate trade. Black arrows indicate input usage. TS denotes tradable sector.

Example 1: Horizontal network. As a starting point, suppose production is conducted horizontally without sectoral input-output linkages, i.e., $\boldsymbol{\alpha} = \boldsymbol{\alpha}^f = \boldsymbol{I}$. Then, according to equation (10), the impact of foreign productivity conditional on aggregate consumption is

$$\left[\begin{array}{cc} \frac{dS_{1t}}{d\ln A_{1t}^f} & \frac{dS_{1t}}{d\ln A_{2t}^f} \\ \frac{dS_{2t}}{d\ln A_{1t}^f} & \frac{dS_{2t}}{d\ln A_{2t}^f} \end{array}\right]\Bigg|_{P_tC_t,\, P_t^fC_t^f \text{ fixed}} = -\left[\begin{array}{cc} \frac{\tilde{\theta}_1}{1+\tilde{\theta}_1(S_1^{-1}+S_1^{f-1})} & 0 \\ 0 & \frac{\tilde{\theta}_2}{1+\tilde{\theta}_2(S_2^{-1}+S_2^{f-1})} \end{array}\right]. \tag{11}$$

Sectoral output is negatively affected, conditional on aggregate demand, by foreign productivity $d \ln A_{it}^f$ because higher foreign supply lowers relative prices. Without input-output linkages, sectoral shocks do not spill over to other sectors under fixed aggregate consumption.

If a good is non-tradable, equation (11) reduces to

$$\frac{dS_{it}}{d\ln A_{it}^f}\Bigg|_{P_tC_t,\, P_t^fC_t^f \text{ fixed}} = 0, \tag{12}$$

for $i = 1, 2$, which shows that non-tradable goods are not affected by the same sector abroad.

If a foreign productivity shock raises home aggregate consumption, non-tradable sectors may benefit even when the corresponding tradable sectors contract.

In sum, conditional on aggregate demand, foreign productivity lowers relative prices and reduces domestic output in the matching tradable sector, while non-tradable sectors remain unaffected when input-output linkages are absent.

Example 2: Downstream tradable sector. Now consider a nontrivial input-output linkage in a vertical network. Suppose good 1 is used as an input in both sectors 1 and 2, i.e., $\boldsymbol{W} = \boldsymbol{W}^f = \begin{bmatrix} 1 & 0 \\ 1 & 0 \end{bmatrix}$, while factor X is only used in sector 1, i.e., $\boldsymbol{\alpha} = \boldsymbol{\alpha}^f = \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}$.

Assume also that sector 1 is non-tradable whereas sector 2 is tradable (for example, non-manufacturing activities, such as transportation and construction, supplying inputs to tradable manufacturing). Then, we obtain:

$$\begin{bmatrix} \frac{dS_{1t}}{d\ln A^f_{1t}} & \frac{dS_{1t}}{d\ln A^f_{2t}} \\ \frac{dS_{2t}}{d\ln A^f_{1t}} & \frac{dS_{2t}}{d\ln A^f_{2t}} \end{bmatrix} \Bigg|_{P_tC_t,\, P^f_tC^f_t \text{ fixed}} = -\frac{\tilde{\theta}_2}{1+\tilde{\theta}_2(S_1^{-1}+S_1^{f-1})} \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix},$$

which shows that, conditional on aggregate consumption, foreign productivity shocks in either sector affect domestic output in both sectors through the shared use of good 1 as an input.

Consider first a foreign productivity shock in sector 2 (the downstream tradable sector), $d\ln A^f_{2t}$. As foreign sector 2 becomes more productive, it expands and puts competitive pressure on domestic sector 2, which contracts. This contraction lowers domestic sector 2's demand for inputs from sector 1 (the upstream non-tradable sector), causing sector 1 to contract as well.

Importantly, sector 1 is not directly exposed to foreign competition, but is affected indirectly through the fall in intermediate demand from sector 2. Since sector 1 is non-tradable, it cannot offset this decline through export markets. This result contrasts with Acemoglu et al. (2015), who show that supply shocks propagate only downstream under perfect competition.[5]

Now consider a shock to foreign sector 1 (the upstream non-tradable sector), $d\ln A^f_{1t}$. The productivity gain lowers input costs in the foreign economy, benefiting foreign sector 2. As the foreign sector 2 expands, the domestic sector 2 again contracts due to stronger competition, which reduces its demand for inputs from sector 1 and leads to a contraction in sector 1. Thus, even a foreign shock in a non-tradable upstream sector can propagate through

[5] Baqaee (2018) finds that a supply shock can have upstream effects under imperfect competition. Our result holds under perfect competition with trade. Baqaee and Farhi (2024) point out spillovers through households' demand complementarity among tradable and non-tradable goods, while our mechanism works through intermediate goods demand.

the foreign production network and spill back into the domestic economy via intermediate demand. In this way, non-tradable sectors are indirectly exposed to foreign productivity through global production linkages, even in the absence of direct trade exposure.

Example 3: Upstream tradable sector. Finally, consider the same vertical network as in Example 2, but now assume that sector 2 is non-tradable instead of sector 1. We obtain:

$$\left[\begin{array}{cc} \frac{dS_{1t}}{d\ln A_{1t}^f} & \frac{dS_{1t}}{d\ln A_{2t}^f} \\ \frac{dS_{2t}}{d\ln A_{1t}^f} & \frac{dS_{2t}}{d\ln A_{2t}^f} \end{array}\right]\Bigg|_{P_tC_t, P_t^fC_t^f \text{ fixed}} = c\left[\begin{array}{cc} -\left\{1+(1-\tilde{\xi}_1)\right\} & 0 \\ 2(1-\tilde{\xi}_1) & 0 \end{array}\right].$$

where $c = \tilde{\theta}_1\left[\left\{1+\tilde{\theta}_1(S_1^{-1}+S_1^{f-1})\right\}\left\{1+(1-\tilde{\xi}_1)\right\}+2(1-\tilde{\xi}_1)\right]^{-1}$.

In this case, a productivity shock in foreign sector 1 (upstream, tradable) affects domestic sectors through a different channel. The domestic sector 1 contracts due to direct import competition, as tradable goods from the foreign sector 1 become cheaper. In contrast, domestic sector 2 (downstream, non-tradable) benefits from lower input costs, since it relies on good 1 as an input but is insulated from direct foreign competition.

This example contrasts with Example 2, in which the non-tradable upstream sector contracts due to reduced domestic demand. Here, the non-tradable downstream sector gains through cost-side spillovers. The result highlights how tradability shapes both the sign and the strength of shock transmission within the production network.

4 Political Economy of Trade Policy

In modern democracies, political outcomes reflect both electoral majorities and the concentrated influence of lobbying. Voting captures households' preferences over globalization, such as openness to trade with foreign countries or autarky, which is broadly interpreted as anti-globalization. Households' choices depend on their individual gains from globalization. Lobbying represents the pressure exerted by sectors advocating for tariffs, while the government weighs aggregate efficiency, inequality, and lobbyists' political contributions. We will first explain how voting is incorporated into our model, and then move on to lobbying.

4.1 Voting

We consider a simple voting function that maps the gains from globalization $x = d \ln C_t^{jh}$ to the probability of voting for autarky $f(x)$:

$$f(x) = \frac{1}{1 + \exp\{-\theta_0 + \theta_1 x\}}. \tag{13}$$

The parameters θ_0 and θ_1 control the intercept and slope.

When $\theta_1 > 0$, $f'(x) < 0$, that is, households that gain more from globalization are less likely to vote for autarky. This captures the idea that voters weigh many motives (ideological, sociological, and others), but that economic incentives matter: those who benefit from globalization tend to support it more.

Building on the early insights of Kahneman and Tversky (1979) and following Gabaix (2019), Bordalo et al. (2020), and Bordalo et al. (2022), we introduce salience weights to capture the tendency of individuals to overreact to losses:

$$w(x) = \exp\{\alpha \max\{0, -x\}\},$$

where $\alpha > 0$ increases the weight placed on households experiencing losses from globalization ($x < 0$), while $\alpha = 0$ implies no salience adjustment. These weights formalize that losses loom larger than gains and therefore exert a stronger influence on political choices. Consequently, the median household by consumption or income need not coincide with the median voter, as salient losses can disproportionately shape aggregate political preferences.

The aggregate voting share for autarky is defined as

$$V = \frac{\mathbb{E}\left[w(x) f(x)\right]}{\mathbb{E}\left[w(x)\right]} = \frac{\int w(x) f(x) dG(x)}{\int w(x) dG(x)}, \tag{14}$$

where $G(x)$ denotes the distribution function of x.

4.2 Sectoral lobbying

We next describe how sectoral lobbying enters the model. Our framework is related to Grossman and Helpman (1994) (GH, henceforth), but differs in several important respects. GH develop a partial-equilibrium setting in which prices are fixed except for tariffs, sectors do not interact, and trade policy reflects a static trade-off between producers' gains and consumers' losses.

In contrast, our model operates in general equilibrium. As a result, lobbying by one sector

(and the trade restrictions it induces) alters the benefits and costs of globalization faced by all other sectors. Moreover, unlike GH's static environment, our setting allows the interaction between globalization and fragmentation to vary over time.

A politician's objective function U_t^{pj}, when choosing a sectoral tariff τ_{jt} after the changes in some of the driving forces of the economy, balances social welfare u_t and lobbying contributions Q_t^j:

$$\begin{aligned} U_t^{pj} &= (1-\eta)u_t + \eta Q_t^j, \\ u_t &= \underbrace{\overline{d\ln S_t}}_{\text{Average output}} \underbrace{-\frac{\sigma}{2}\sum_{j=1}^{n}\frac{S_j}{S}\left(d\ln S_{jt} - \overline{d\ln S_t}\right)^2}_{\text{Inequality}} + \underbrace{\sum_{j=1}^{n}\frac{IM_j}{S}(1+d\ln IM_{jt})d\ln\tau_{jt}}_{\text{Tariff revenue}}, \end{aligned} \tag{15}$$

where $\overline{d\ln S_t} = \sum_{j=1}^{n}(S_j/S)\,d\ln S_{jt}$ and $S = \sum_{j=1}^{n} S_j$. Both social welfare and lobbying contributions are measured in value terms, normalized by the domestic price index $P_t = 1$.

The parameter $\eta \in [0,1]$ captures the weight the politician assigns to contributions, with $\eta = 0$ representing a purely welfare-driven policy. The welfare component u_t contains three elements: (i) average sectoral output, which summarizes aggregate performance; (ii) a penalty for dispersion across sectors, scaled by the inequality aversion parameter σ; and (iii) tariff revenue, which reflects the fiscal return from trade restrictions relative to the size of the economy.

This formulation reflects a policymaker who values not only the variations in total output but also their distribution and fiscal capacity. Because sectoral output is determined in general equilibrium, lobbying by one sector affects its own tariff and generates feedback effects on other sectors' welfare and lobbying incentives.

The lobbying sector's payoff is:

$$\begin{aligned} U_t^j &= u_t^j - Q_t^j, \\ u_t^j &= \frac{S_j}{S}\left\{d\ln S_{jt} - \frac{\sigma}{2}\left(d\ln S_{jt} - \overline{d\ln S_t}\right)^2\right\}. \end{aligned} \tag{16}$$

The quadratic term in equation (16) captures workers' convex utility.

Nash bargaining. Following Goldberg and Maggi (1999), we assume Nash bargaining between the government and lobbyists, $(U_t^{pj})^{1-\phi}\left(U_t^j\right)^{\phi}$, where ϕ is the weight on lobbyists, which we will show shortly is irrelevant in equilibrium. We assume the government cannot commit to future policy, so lobbying and tariffs are determined each period.

The first-order condition with respect to Q_t^j implies

$$U_t^{pj} \propto U_t^j \propto (1-\eta)u_t + \eta u_t^j, \tag{17}$$

which shows that contributions are chosen so that the politician and the lobbyists act as if they maximize a common objective: the weighted sum of social welfare and lobbyists' welfare.

Endogenous tariff determination. The politician sets the changes in tariff rates $d\ln\tau_{jt}$ for $j \in T$ to maximize the common objective function (17). The first-order condition delivers the following proposition.

Proposition 2 *Changes in tariffs satisfy:*

$$\underbrace{\tilde{\boldsymbol{S}}^{j\prime}\frac{\partial \ln \boldsymbol{S}_t}{\partial \ln \tau_{jt}}}_{\textit{Average loss/gain}} + \underbrace{\frac{IM_j}{S}(1+d\ln IM_{jt}) + d\ln \boldsymbol{\tau}_t{}' \operatorname{diag}\left(\frac{\boldsymbol{IM}}{S}\right)\frac{\partial \ln \boldsymbol{IM}_t}{\partial \ln \tau_{jt}}}_{\textit{Tariff revenue increase/decrease}} \tag{18}$$

$$= \underbrace{\sigma}_{\textit{Inequality aversion}} \underbrace{\left(d\ln \boldsymbol{S}_t - \mathbf{1}\,\overline{d\ln S_t}\right)' \operatorname{diag}(\tilde{\boldsymbol{S}}^j)\left(\frac{\partial \ln \boldsymbol{S}_t}{\partial \ln \tau_{jt}} - \mathbf{1}\frac{\partial \overline{\ln S_t}}{\partial \ln \tau_{jt}}\right)}_{\textit{Equality gain/loss}},$$

where $\tilde{\boldsymbol{S}}^j$ *is an* n*-by-*1 *column vector whose* i*-th element equals* $(1-\eta)S_i/S$ *for* $i \neq j$ *and* S_j/S *for* $i = j$*.*

Equation (18) shows that changes in tariffs balance two forces: the average loss or gain in sectoral output and the gain or loss from changes in sectoral equality. Both components are weighted by $\tilde{\boldsymbol{S}}^j$, which embeds the lobbying distortion. Rearranging the first-order condition yields the following corollary.

Corollary 1 *The optimal response function of sectoral tariffs is given by:*

$$d\ln\tau_{jt} = F_j\left(d\ln \boldsymbol{A}_t^f, d\ln \boldsymbol{X}_t^f, d\ln \boldsymbol{A}_t, d\ln \boldsymbol{X}_t, d\ln \boldsymbol{\tau}_t^f, d\ln \boldsymbol{\tau}_{-jt}\right), \tag{19}$$

where $d\ln\boldsymbol{\tau}_{-jt}$ *collects other sectors' tariffs, i.e., the* i*-th element is* $d\ln\tau_{it}$ *for* $i \neq j$ *and 0 in the* j*-th element.*

The details of the derivation are presented in the Appendix. Sectoral tariffs depend on foreign and home economic conditions $(d\ln \boldsymbol{A}_t^f, d\ln \boldsymbol{X}_t^f, d\ln \boldsymbol{A}_t, d\ln \boldsymbol{X}_t)$, foreign tariffs $d\ln\boldsymbol{\tau}_t^f$, and other sectors' tariffs $d\ln\boldsymbol{\tau}_{-jt}$. These variables influence the vector $d\ln\boldsymbol{S}_t$ as well as tariff revenues and therefore shape the trade-off behind $d\ln\tau_{jt}$ described in equation (18). For

example, growth in $\boldsymbol{A}_t^f$ can raise domestic inequality, which creates an incentive to increase tariffs to offset the distributional impact.

Strategic complementarity and substitutability. Equation (19) also implies sectoral interactions. To see this point, it is convenient to define the response of sector j to sector i's tariff imposition:

$$\frac{d\ln\tau_{jt}}{d\ln\tau_{it}} = \boldsymbol{\Theta}(j,i). \tag{20}$$

A positive value of $d\ln\tau_{jt}/d\ln\tau_{it}$ indicates strategic complementarity, in the sense that sector i's tariff induces a higher tariff in sector j, while a negative value indicates strategic substitutability.

In the two-sector examples discussed earlier, a horizontal production structure (where sectors do not rely on each other for inputs) implies no interaction in tariff responses.

By contrast, when sectors are linked in a vertical network and both are tradable, the interaction becomes more complex and the sign of the tariff response is ambiguous. On the one hand, if the upstream sector (sector 1) raises its tariff, it increases input costs for the downstream sector (sector 2). This weakens sector 2's competitiveness and can strengthen its incentive to lobby for additional protection, suggesting strategic complementarity. On the other hand, if the downstream sector (sector 2) raises its tariff, it reduces foreign competition and supports domestic demand for upstream inputs, improving sector 1's position and reducing its incentive to seek protection, implying strategic substitutability.

The net effect depends on the strength of these opposing forces and on the relative lobbying power of each sector. Further theoretical details are presented in the Appendix.

In the quantitative analysis in the following section, we compute the full impact of an arbitrary change in tariffs $\boldsymbol{\Delta}$ through these sectoral interactions:

$$\boldsymbol{\Theta\Delta} + \boldsymbol{\Theta}^2\boldsymbol{\Delta} + \boldsymbol{\Theta}^3\boldsymbol{\Delta} + \cdots = \boldsymbol{\Theta}(\boldsymbol{I} - \boldsymbol{\Theta})^{-1}\boldsymbol{\Delta}. \tag{21}$$

5 Quantitative Results

Calibration. We construct a sectoral dataset for the U.S. and China at an annual frequency from 1991 to 2019. We start in 1991 because the necessary trade-related data become available then and because this predates China's emergence as a major factor in U.S. international trade. We end in 2019 to avoid the effects of the COVID-19 pandemic.

The primary data sources are the KLEMS project for sectoral TFP $\boldsymbol{A}_t^f$ and factor inputs

$\boldsymbol{X}_t^f$, which aggregate labor and capital inputs. Chinese data come from the China Industrial Productivity (CIP) 4.0 Database, compiled by the Research Institute of Economy, Trade and Industry (RIETI), Hitotsubashi University, and the Peking University Growth Lab. Since the CIP database spans 1988 to 2017, series after 2018 are interpolated using value added growth for the corresponding sectors from the National Bureau of Statistics of China. U.S. data come from the Bureau of Economic Analysis (BEA). We harmonize sectoral classifications by constructing 31 private sectors (19 tradable and 12 non tradable) that map 63 U.S. sectors and 34 Chinese sectors, as reported in Appendix B. The input output matrix $\boldsymbol{W}$ and intermediate share $(\boldsymbol{I} - \boldsymbol{\alpha})$ use 1997 data, the earliest available U.S. input output tables. Sectoral outputs in the steady state, $\boldsymbol{S}$ and $\boldsymbol{S}^f$, are taken directly from the KLEMS data.

The steady-state import shares $\boldsymbol{\xi}$ and $\boldsymbol{\xi}^f$ are calibrated using bilateral trade data from UN Comtrade and WTO OECD balanced trade in services. Comtrade's HS6-digit codes are converted to 4-digit NAICS codes using Pierce and Schott (2012) and then mapped to the 31 harmonized sectors. Final consumption shares $\boldsymbol{v}$ and $\boldsymbol{v}^f$ are computed to satisfy market clearing. Sectoral trade elasticities $\boldsymbol{\theta}$ follow Caliendo and Parro (2015) and Baqaee and Farhi (2024) and appear in Table (B.1). We calibrate tariff rates for individual tradable sectors, $\boldsymbol{\tau}_t$ and $\boldsymbol{\tau}_t^f$, using data from the World Integrated Trade Solution (WITS) and Fajgelbaum et al. (2019). We assume no tariffs in the steady state and capture actual tariffs with $d \ln \boldsymbol{\tau}_t$ and $d \ln \boldsymbol{\tau}_t^f$.

The wealth share ω^{hj} for U.S. households is calibrated using the Survey of Consumer Finance (SCF), compiled by the Federal Reserve Bank of New York. We use net worth and wage income as measures of W and S in the model. The SCF reports employment in 7 broad sectors. For each sector, we compute percentiles of household wealth share, defined as $\omega^{hj} = (1-\beta)W_h/((1-\beta)W_h + (\alpha_j/m_j)S_j)$, with a discount factor of $\beta = 0.96$, using the 1992 survey, the closest to our initial sample year (1991). These estimates are mapped to the corresponding KLEMS sectors. Sectoral labor income S_j and sectoral household employment shares m_j come from average hourly earnings and full time worker equivalent employment in 1991, compiled by the Bureau of Labor Statistics (BLS). The inverse of intertemporal substitution is set to $\gamma = 1.5$. We calibrate the salience weight parameter at $\alpha = 6$.

Assessing the U.S. economic impact of Chinese productivity growth. We examine the U.S. economic impact of Chinese economic growth by feeding the calibrated foreign TFP $\boldsymbol{A}_t^f$ and factor inputs $\boldsymbol{X}_t^f$, along with tariffs $\boldsymbol{\tau}_t$ and $\boldsymbol{\tau}_t^f$, into the model.

Figure 3 presents the model-implied outcomes and highlights the U.S. economic impact of Chinese growth, interpreted here as globalization. Panel (A) shows the share of households

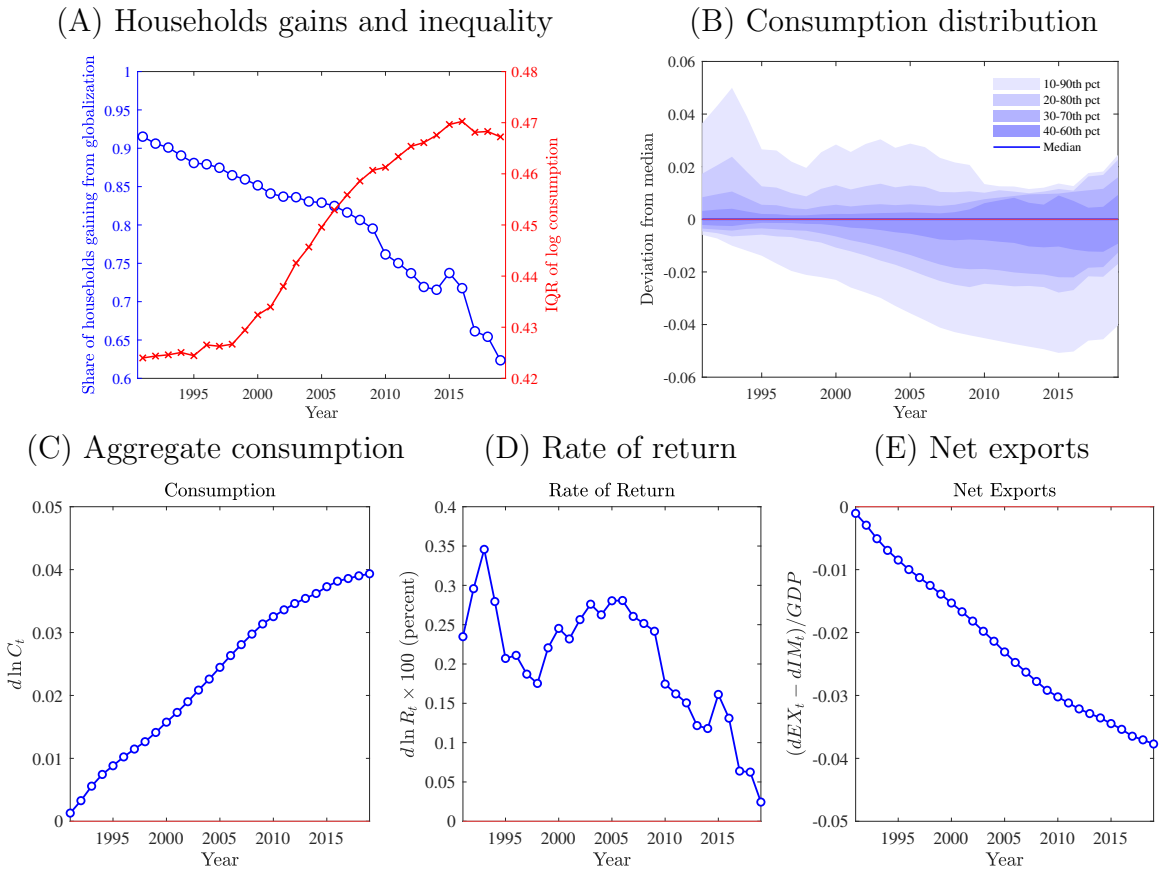


Figure 3: Effects of globalization: Gains, inequality, consumption, returns, and net exports

Notes: A 5-year centered moving average is shown. In Panel (A), the blue line displays the share of households who gain from globalization: $\frac{1}{n}\sum_{j=1}^{n}\int_0^{m_j} 1_{d\ln C_t^{hj}>0} dh$.

that benefit from globalization, that is, those with $d \ln C_t^{hj} > 0$. This share rose sharply in the early 1990s, peaked at 90%, and then declined to roughly 60% by the end of the sample. The same panel shows that this decline is accompanied by a widening interquartile range (IQR) of log consumption, which signals increasing inequality. Panel (B) confirms this pattern by illustrating a shift in the overall consumption distribution consistent with rising dispersion.

While the model is not calibrated to match these specific moments (including inequality), it nonetheless captures the main features of the observed increase in inequality in the United States. In particular, it reproduces the upward trend documented by Piketty and Saez (2003) and extended by Piketty et al. (2017), which accelerates after 2000.

In contrast to the declining trend in overall support, Panel (C) shows that aggregate consumption continues to grow as a result of globalization, although with a diminishing yet still positive effect on the rate of return, as displayed in Panel (D). The fall in asset returns after the Global Financial Crisis (GFC) likely reflects the slowdown in China's economic

growth. The model also replicates the observed deterioration in the trade balance as a share of GDP in Panel (E), which aligns with the empirical evidence. It is worth noting that, despite rising imports, domestic value-added production (measured as consumption minus net exports) remains slightly positive (this suggests that the gains in purchasing power from cheaper imports more than offset the displacement of domestic production).

The contrast between the sizable aggregate gains from globalization (Panel C) and the shrinking share of households that benefit (Panel A), together with the growing concentration of these gains among a smaller group (Panel B), highlights the importance of sectoral and household heterogeneity when studying political support for globalization or the forces driving economic fragmentation.

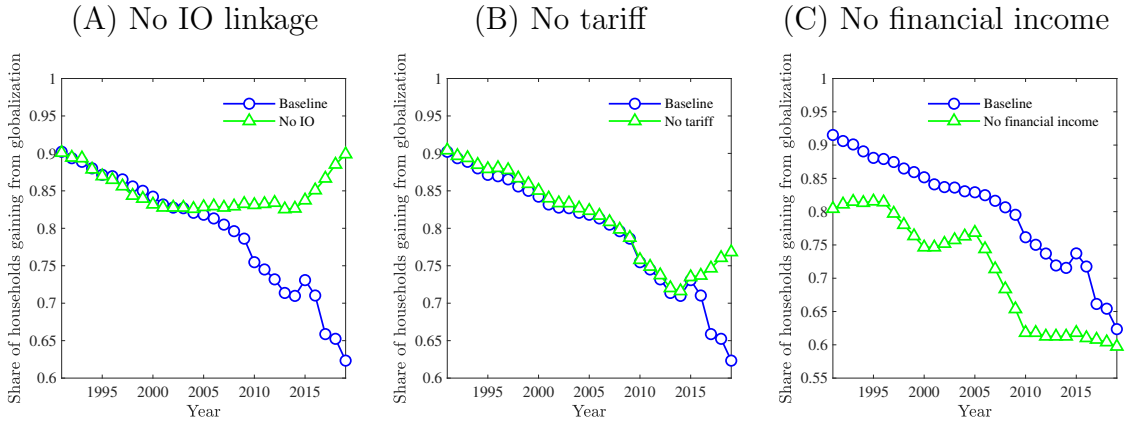


Figure 4: Effects of globalization: Contributions of model ingredients

Notes: A 5-year centered moving average is shown.

Figure 4 illustrates three key model features that drive the time-varying support for globalization: (i) input-output linkages, (ii) tariffs, and (iii) financial income. Without (i), as shown in Panel (A), rising imports from China do not necessarily harm non-tradable sectors, which employ the vast majority of U.S. workers (an important feature of the economy). As a result, support for globalization remains relatively stable over time. Regarding (ii), although the average effect is modest across the sample period, Panel (B) shows that tariff increases during the 2018–19 U.S.–China trade war reduced support for globalization. Finally, Panel (C) illustrates that (iii) financial income further amplifies the decline in support, since the benefits from higher returns have weakened in recent years (see Figure 3).

Sectoral impact. Figure 5 illustrates the consumption impacts of globalization across selected sectors, highlighting key mechanisms in the model. Full sectoral results are provided in Figure C.2 in the Appendix.

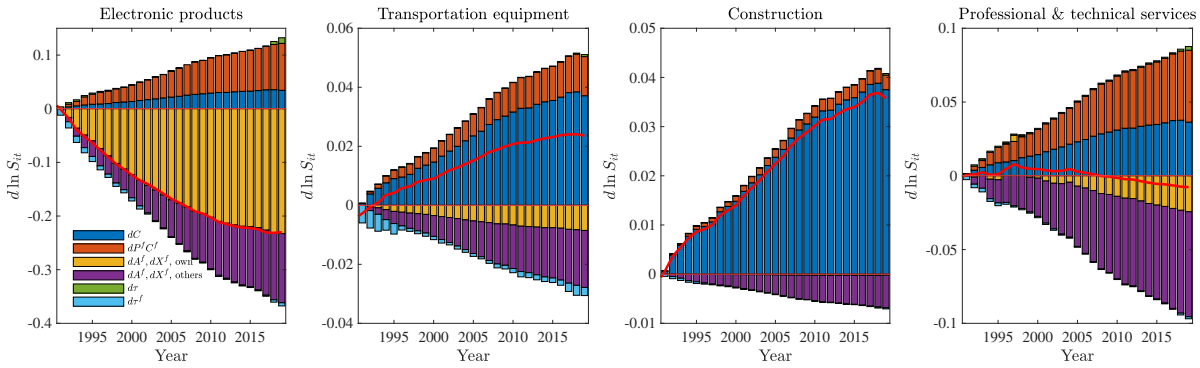


Figure 5: Effects of globalization: Sectoral output

Notes: The decomposition follows from Proposition 1 in equation (10). The red solid line indicates the total effect.

The adverse effects of foreign productivity and factor input growth on the domestic economy are particularly pronounced in tradable goods sectors. For instance, in the electronic sector (first panel), the rapid expansion of the Chinese industry since the 1990s led to significant displacement of U.S. domestic production. However, globalization can also benefit tradable goods sectors, since lower-cost imports that accompany foreign expansion raise the purchasing power of the home country. This effect is visible in the transportation equipment sector (second panel), where a relatively low trade elasticity further reinforces the gain.

In non-manufacturing sectors, which are not directly exposed to foreign competition, households generally benefit from globalization through two channels: lower intermediate input costs due to increased trade and more favorable sectoral output prices relative to tradables. The construction sector (third panel) provides a clear example. However, some non-tradable sectors may experience negative spillovers if they supply inputs to tradable sectors facing intensified foreign competition. As discussed in Example 2 of Section 3.4, the professional and technical services sector (fourth panel) is tightly linked to manufacturing. When manufacturing contracts under competitive pressures from globalization, the resulting decline in intermediate input demand reduces activity in this sector as well.

Moreover, Figure C.3 in the Appendix shows that differences in wealth holdings introduce further heterogeneity in the impact of globalization. Financial assets not only generate capital income but also cushion declines in labor income, producing within-sector disparities. In several tradable sectors, despite an overall negative effect of globalization, a subset of households with substantial financial assets experiences net positive gains.

6 Endogenous Trade Policy Formation

6.1 Voting support for trade protectionism

Given that the distribution of the gains from globalization, $g(x)$, is derived from model simulations, the voting share V can be linked to the underlying model parameters (θ_0, θ_1) in (13). We use an asterisk, (θ_0^*, θ_1^*), to denote the parameter values that deliver a 50% voting share ($V = 0.5$) for the trade protectionism regime, which corresponds to higher tariffs. We are particularly interested in the intercept parameter θ_0^*. A larger θ_0^* indicates that additional forces, orthogonal to the direct effects of globalization, are required to generate enough support for trade protectionism. We report two versions: one with the salience weight calibrated to $\alpha = 6$, and another where salience is turned off.

Panel (A) of Figure 6 illustrates the evolving distribution of the gains from globalization $g(x)$ by comparing three periods—1991–95, 2005–09, and 2015–19. It shows the widening distribution of gains from globalization: it was concentrated around modest positive gains in the 1990s (green), became more dispersed in both directions with a higher mean in the 2000s (red), and turned bimodal by the late 2010s (blue). The growing mass of households experiencing losses from globalization shifts aggregate voting behavior toward the trade protectionism regime, dominating the effect of those with positive gains and leading to a decline in the intercept θ_0^* to obtain the equal voting share. The voting functions overlaid in the panel indicate declining intercepts over time to ensure $V = 0.5$.

Panel (B) displays the evolution of θ_0^* over time. The baseline case with salience weights ($\alpha = 6$; the red solid line) exhibits a secular decline in θ_0 that guarantees equal voting shares. Even under the conservative case of no salience weights ($\alpha = 0$; the blue dashed line), θ_0^* begins to decline after the GFC, following a modest increase in the earlier period.

Panels (C) and (D) confirm the decline in θ_0^* in recent years across different slope parameters θ_1 and with and without salience weights.

6.2 Lobbying influence on trade policy formation

Beyond voting, how are trade policies determined? Historical episodes suggest that trade policies, most notably import tariffs, are often set outside of an electoral cycle. We further ask how lobbying influences trade policy formation and examine this question through the lens of sectoral lobbying in our model.

Tariff determinants in the model. Panel (A) of Figure 7 presents the model-implied tariff levels as functions of key parameters and initial conditions. Circles in each panel mark

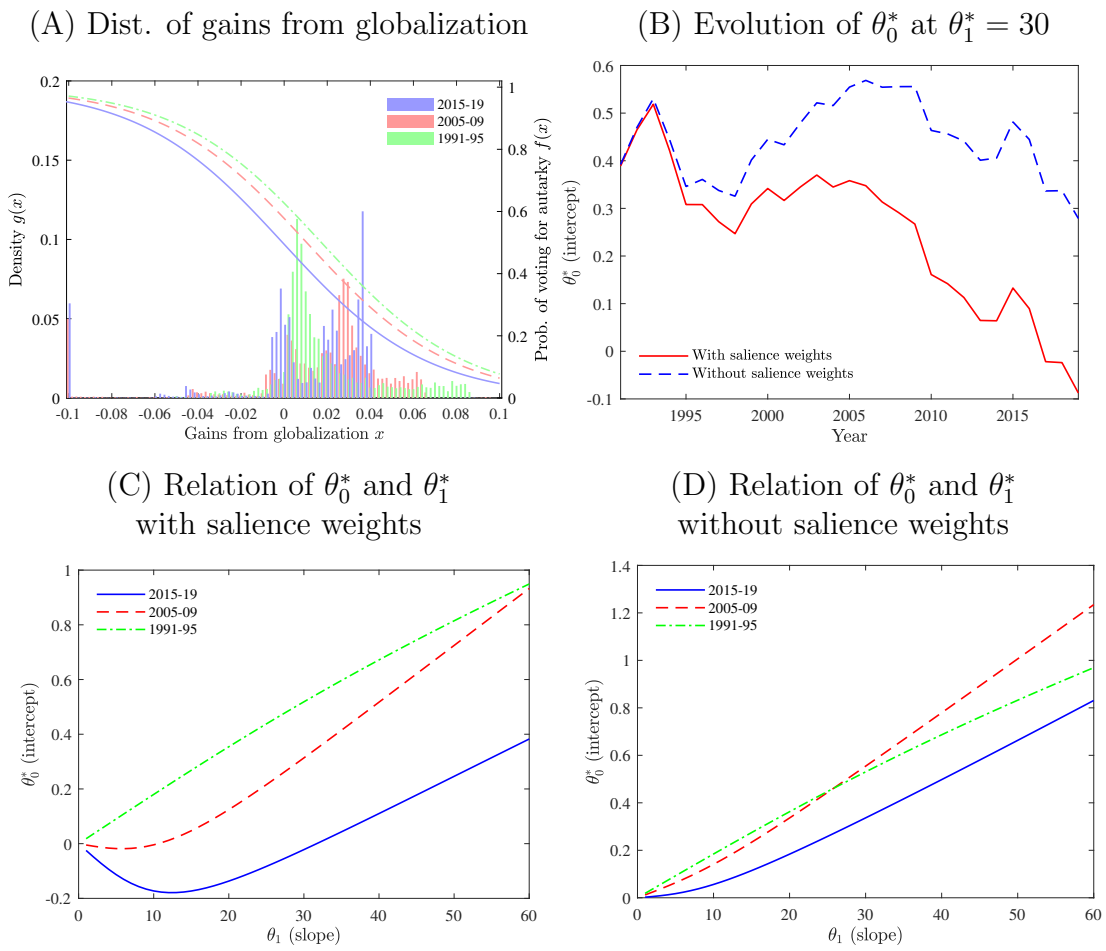


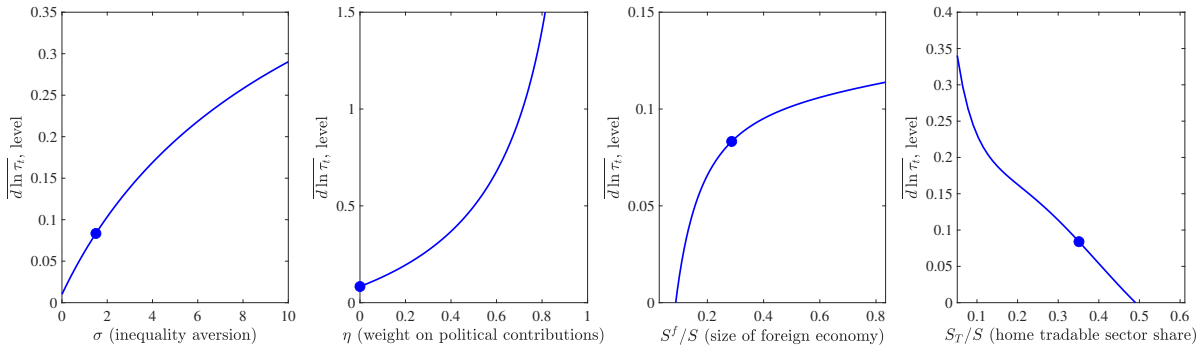
Figure 6: Voting outcomes

Notes: In Panel (A), the bars show the distribution of the gains from globalization, $x = d \ln C_t^{jh}$, where observations are pooled in each 5-year period. The voting function $f(x)$ is included as a reference with salient weights ($\alpha = 6$) and a calibrated slope ($\theta_1 = 30$). Panel (B) reports the evolution of θ_0^*, the intercept in the voting function that yields a 50% voting share for autarky ($V = 0.5$), with salience weights ($\alpha = 6$) in the red solid line and without them ($\alpha = 0$) in the blue dashed line. θ_1^* is set to 30 in both cases. Panels (C) and (D) present θ_0^* over time for different values of θ_1^*, with and without salient weights, respectively.

the reference values, which correspond to the case where $\sigma = 1.5$, equal to the coefficient of risk aversion γ, and $\eta = 0$, so that the social planner maximizes welfare without accounting for sector-specific contributions, see equation (15). This figure illustrates the strong nonlinearities implied by the model in how tariff levels respond to these parameters and initial conditions. The implied tariffs correspond to the year 2000.

The two figures on the left show that tariffs increase with higher values of σ (inequality aversion) and higher values of η (the weight on political contributions). These findings are intuitive: as the social planner (government) places more emphasis on reducing sectoral inequality or on the welfare of specific sectors, tariffs rise.

(A) Tariff levels as functions of key parameters and initial conditions



(B) Sectoral interactions of tariffs

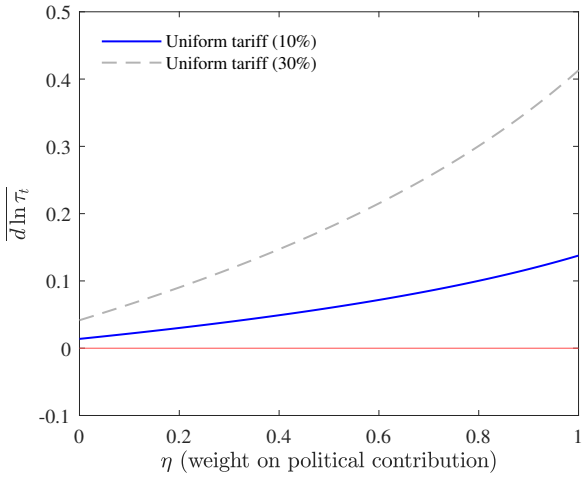


Figure 7: Tariff determinants in the model

Notes: Panel (A): Circles mark the reference values corresponding to the case where $\sigma = 1.5$ (equal to the coefficient of risk aversion γ) and $\eta = 0$, so that the social planner maximizes welfare without accounting for sector-specific contributions, see (15). The implied tariffs correspond to the year 2000. Panel (B): The figure displays the full responses of equations (20) and (21) evaluated at the reference values.

As shown in the third panel, the model also indicates that tariffs are influenced by the relative size of the economies involved. A larger foreign economy (measured by S^f/S) leads to higher tariffs, since greater import volumes exacerbate inequality in the domestic economy. The Chinese economy was substantially larger than earlier rapid growth episodes—such as those of Japan and Korea—when its growth took off, although the growth path of per capita income has been quite similar (Fernández-Villaverde et al., 2023). According to the Penn World Table 10.01, China's total GDP was 38% of that of the United States in PPP terms in 1993. This was roughly four times larger than Japan in 1950 (around 10%) and about 25 times larger than Korea in 1972 (around 1.6%), when per capita GDP was at a similar

level.[6] Counterfactually, if China's size had been comparable to Japan's—less than 10% of U.S. GDP at the start of our sample—the model would imply substantially smaller tariffs.

Finally, the size of the domestic tradable sector also plays a key role, as illustrated in the fourth panel. A larger tradable share (measured by S_T/S) spreads the negative effects of trade across a broader base, mitigating adverse distributional consequences. The tradable share has been in secular decline in the United States, a trend also observed in other advanced economies, making the domestic economy more vulnerable to foreign import competition.

Panel (B) of Figure 7 illustrates the sectoral interactions captured by equation (21). The moderately positive slopes indicate that strategic complementarity dominates substitutability, so higher protection in one sector raises incentives for others to seek similar protection. The strength of this complementarity depends on η: when lobbying motives dominate (high η), sectors reinforce each other's demands, amplifying overall protection. As shown later, higher values of η further strengthen these complementarities, leading to additional increases in equilibrium tariffs. While Panel (B) depicts a static relationship, in practice such complementarities can unfold dynamically, as protection in one sector triggers further lobbying elsewhere, creating a self-reinforcing cycle of rising tariffs.

Counterfactual tariff paths under alternative policy preferences. To better understand how the model generates endogenous tariffs over time, we examine a range of scenarios in which the policymaker places varying emphasis on inequality reduction (through higher σ), both with ($\eta > 0$) and without ($\eta = 0$) lobbying contributions, treating lobbying as a static decision each period while tracing the dynamic evolution of tariffs over time. Based on these five scenarios, we plot the simulated tariffs in Figure 8, as implied by equation (19).[7]

(C1)	Low σ (No inequality aversion),	No lobbying:	$\sigma = 0$,	$\eta = 0$
(C2)	Med σ (Moderate inequality aversion),	No lobbying:	$\sigma = 1.5$,	$\eta = 0$
(C3)	Med σ (Moderate inequality aversion),	With lobbying:	$\sigma = 1.5$,	$\eta = 0.3$
(C4)	High σ (Strong inequality aversion),	No lobbying:	$\sigma = 3$,	$\eta = 0$
(C5)	High σ (Strong inequality aversion),	With lobbying:	$\sigma = 3$,	$\eta = 0.3$

Echoing the patterns in Figure 7, Figure 8 shows that implied tariffs rise as inequality aversion (σ) and the weight on political contributions (η) increase, reflecting both the policymaker's effort to reduce sectoral inequality and the additional protectionist pressure generated

[6] China's per capita GDP in 1993 was 2,915 dollars in 2017 PPP-adjusted USD. Japan's was 2,879 dollars in 1950, the earliest year available in the Penn World Table 10.01. Korea's PPP GDP was 2,788 dollars in 1972.

[7] To isolate the role of inequality, we abstract the tariff term in ((18)); we verify in Appendix that including it does not alter our main findings.

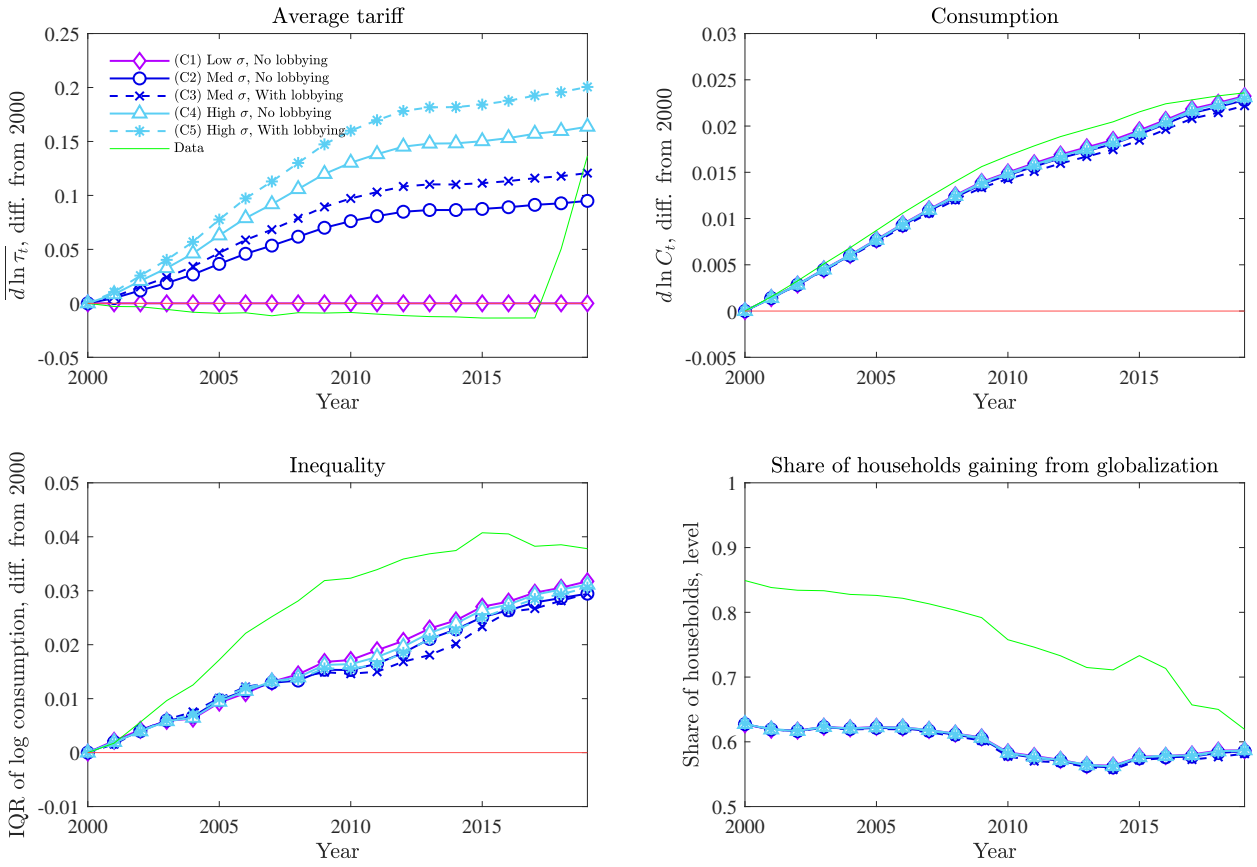


Figure 8: Implied tariffs, consumption, inequality, and globalization gains under alternative policy preferences

Notes: To isolate the role of inequality, we abstract the tariff term in ((18)). For all panels, we set $\gamma = 1.5$. The average tariff is computed as $\overline{d \ln \tau_t} = \sum_{i=1}^{n_T} w_{IMi} d \ln \tau_{it}$ where $w_{IMi} = IM_i/IM = D_i(1-\tilde{\xi}_i)/\sum_{i=1}^{n_T} D_i(1-\tilde{\xi}_i)$. Panel (A) sets parameter values as follows: (C1) No inequality aversion, no lobbying: $\sigma = 0$, $\eta = 0$; (C2) Moderate inequality aversion, no lobbying: $\sigma = 1.5$, $\eta = 0$; (C3) Moderate inequality aversion, with lobbying: $\sigma = 1.5$, $\eta = 0.3$; (C4) Strong inequality aversion, no lobbying: $\sigma = 3$, $\eta = 0$; (C5) Strong inequality aversion, with lobbying: $\sigma = 3$, $\eta = 0.3$.

by lobbying, as we move from C1 to C5. When inequality aversion is absent ($\sigma = 0$, C1), tariffs remain flat under our model. Holding σ fixed, increasing η (e.g., from C2 to C3 or from C4 to C5) leads to even higher tariffs, as stronger lobbying incentives amplify strategic complementarities across sectors. In the reference case (C2), tariffs rise moderately over time, reaching about 10 percentage points above the 2000 level by the end of the sample. The actual tariff increase during the 2018–19 U.S.–China trade war (green line) is of a similar magnitude.[8]

[8]According to the model, the social-welfare-maximizing policymaker in the reference case (C2) would have imposed more targeted protection, offering greater support to severely affected sectors while applying lower tariffs elsewhere. In contrast, the actual tariff increases during the 2018–19 U.S.–China trade war were concentrated around 15–20% across most sectors. This suggests that actual trade policy may have deviated from the socially optimal benchmark due to political distortions.

The implications of these policy scenarios for support for globalization are nuanced. Higher tariffs reduce aggregate consumption but also mitigate inequality, producing offsetting effects on household outcomes. As shown in the bottom-right panel of Figure (8), the share of households benefiting from globalization declines relative to the baseline but remains fairly stable—consistently above 50%—indicating that a majority of households continue to gain from trade even under more protective policies.

Note that we consider values of η equal to 0 and 0.3 to contrast cases in which the government does versus does not value political contributions—effectively capturing the strength of lobbying influence. The literature offers no consensus on the empirical magnitude of η. For example, Goldberg and Maggi (1999) and Gawande and Bandyopadhyay (2000) report values near 0 based on U.S. non-tariff barriers in 1983, while rejecting the null of pure welfare maximization ($\eta = 0$). Irwin and Soderbery (2021) estimate η between 0.73 and 0.85 outside trade agreements, and Ma and McLaren (2018) find values around 0.3 when swing state interests are involved. While precise estimation of η is beyond this paper's scope, we view values strictly above 0 as more realistic; otherwise, the scale of political spending in U.S. politics—as emphasized by Bombardini and Trebbi (2025)—would be difficult to rationalize. We further show that as lobbying influence increases (i.e., as η decreases), rich strategic interactions emerge—highlighting the core mechanism of our model.

Counterfactual tariff paths under alternative initial economic conditions

The analysis in the previous section suggests that protectionist pressures have intensified in recent years, driven by the distributional consequences of globalization. This trend follows several decades of global integration under free trade, during which other export-oriented economies—such as Japan and Korea—experienced rapid growth. Why, then, is the recent resurgence of protectionism more pronounced than in earlier episodes? While a detailed analysis of individual historical cases is beyond the scope of this paper, we address this question through the lens of our model, focusing on how initial economic conditions shape trade policy outcomes.

With these considerations in mind, we conduct a counterfactual simulation under the following alternative assumptions about the foreign economy:

(A1) Baseline
(A2) Smaller foreign size
(A3) Larger home tradables
(A4) Home growth
(A5) Higher home growth
(A6) Combining (A2), (A3), (A5)

Assumption (A1) defines the baseline scenario, with parameter values identical to those in case (C2) of Figure (7). Under (A2), foreign output S^f is reduced to one-quarter of its baseline level, reflecting the relative size of the Chinese and Japanese economies compared with the United States at the onset of their economic takeoffs (China in 1993 and Japan in 1950), as discussed above. Assumption (A3) increases output in the domestic tradable sectors, S_T, by 50 percent relative to the baseline. This adjustment is motivated by historical data indicating a secular decline in the tradable sector's share of the U.S. economy since World War II: the share in 1950 was about 1.5 times its level in 1993 (41.7 vs. 27.0 percent, respectively). Assumptions (A4) and (A5) incorporate the home economy's growth, which affects the relative size of the foreign economy over the period of analysis. In (A4), growth is set to the actual sectoral data reported in KLEMS, whereas in (A5) it is calibrated to the higher growth rates observed from 1950 onward. Importantly, U.S. sectoral growth in earlier decades was both faster and more concentrated in tradable sectors. Assumption (A6) considers a combination of these counterfactual scenarios.

Figure 9 plots the model-implied tariff trajectories under the alternative scenarios, highlighting heterogeneous outcomes across assumptions. Tariff increases are considerably more modest when the foreign economy is smaller (A2) or when the domestic tradable sector is larger (A3). In both cases, the lower relative weight of foreign imports dampens the distributional pressures that fuel protectionism, leading to nearly identical tariff paths.

Under assumption (A4), where actual home-economy growth is incorporated, tariff increases are slightly larger than in the baseline (A1). Two forces drive this result: stronger home growth sustains the domestic economy's relative size, but when growth is concentrated in non-tradable sectors, rising inequality generates upward pressure on tariffs to compensate tradable sectors. The trajectory suggests that these forces largely offset each other, though they push tariffs somewhat higher. By contrast, assumption (A5), which features faster and tradable-sector?biased domestic growth, produces only a muted rise in tariffs. In this case, both forces reduce the protectionist pressure created by foreign expansion, yielding much lower tariffs, close to zero.

Finally, assumption (A6), which combines these counterfactuals, yields a declining tariff

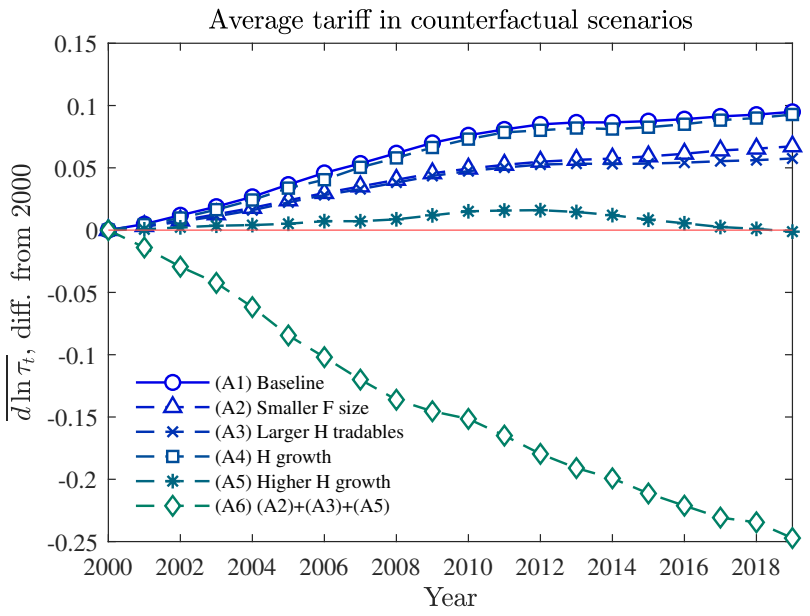


Figure 9: Implied tariffs under alternative initial economic conditions

Notes: Other than the parameter indicated in each line, model parameters are set to (C2) of Figure (7).

path that reaches 25% at the end of the sample, reflecting how the model interprets the historical shift toward more open trade in earlier decades. Figure C.5 in the Appendix confirms that the pace and composition of foreign growth, as a mirror image of the home economy, substantially affect the endogenous tariff outcomes.

Across assumptions (A1)-(A6), the model produces a wide range of tariff paths, underscoring its capacity to capture both rising and falling protectionist pressures. This flexibility illustrates the model's power in showing that the shifting nature of protectionist pressures arises endogenously from the underlying economic environment, rather than being imposed exogenously.

6.3 Extensions: mobility, cross-lobbying, and political feedback

We extend the model along three dimensions: labor mobility, cross-lobbying, and the interaction between voting and sectoral lobbying. Each of these elements can meaningfully influence the political outcomes generated by the model, but the main results remain robust to these modifications. We discuss each in turn below.

Labor mobility. Artuç et al. (2010) and Dix-Carneiro and Kovak (2017) document substantial labor mobility frictions, showing that workers adjust only slowly across sectors, which causes trade shocks to have persistent effects on regional employment and wages. In this re-

gard, our paper follows the approach of Caliendo et al. (2019) and Dix-Carneiro et al. (2023), which incorporate labor mobility frictions across sectors. At the same time, recent work by Autor et al. (2014) and Foschi et al. (2025) shows that workers can eventually reallocate across sectors, mitigating the long run persistence of globalization shocks. While our baseline assumption of no cross sector labor mobility is a useful abstraction that captures the medium term persistence of sectoral shocks, we examine whether our results, particularly those on voting outcomes, are driven by this assumption.

The baseline model assumes that factors are sector-specific and thus not transferable across sectors. We relax this assumption by allowing the mass of households in each sector, m_j, to vary exogenously over time, thereby incorporating the empirical evidence discussed above on labor reallocation following trade shocks. This provides a parsimonious way to capture labor reallocation across sectors. Specifically, we take the observed dynamics of sectoral employment shares from the BLS data and feed them into m_j in the model. To allow for the possibility that part of the observed variation reflects forces other than trade, we introduce a tuning parameter $\varepsilon \in [0, 1]$, which controls the fraction of the observed dynamics incorporated into the model:

$$m_{jt} = m_j^{obs} \left(\frac{m_{jt}^{obs}}{m_j^{obs}} \right)^{\varepsilon},$$

where m_{jt}^{obs} are observed sectoral employment shares, and m_j^{obs} denotes their steady state, which corresponds to the initial period of our sample, i.e., 1991.

It is important to note that the dynamics of m_{jt} affect factor incomes through altering labor supply in both the originating and destination sectors. Accordingly, the consumption dynamics in equation (8) are modified as follows:

$$\underbrace{d \ln C_t^{hj}}_{\text{Individual consumption}} = \underbrace{\frac{\omega^{hj}}{1-\beta} d \ln R_t}_{\text{Financial income}} + \underbrace{\left(1 - \omega^{hj}\right) \left(d \ln S_{jt} - d \ln m_{jt}\right)}_{\text{Labor income}}. \tag{22}$$

The intuition is straightforward: when $d \ln m_{jt} > 0$, an increase in labor supply lowers individual labor income, as total income is distributed across a larger number of workers.

Figure 10 shows θ_0^*, the intercept of the voting function that yields an equal split of votes ($V = 0.5$) for trade protectionism when labor mobility is introduced. Panel (A) includes salience weights, while Panel (B) omits them; both display broadly similar patterns. In the left panels, we shut down the labor-income effect in equation (22), removing the downward pressure on destination-sector wages from labor inflows as workers exit sectors harmed by trade. As a result, higher ε shifts θ_0^* upward, since mobility mitigates the negative income

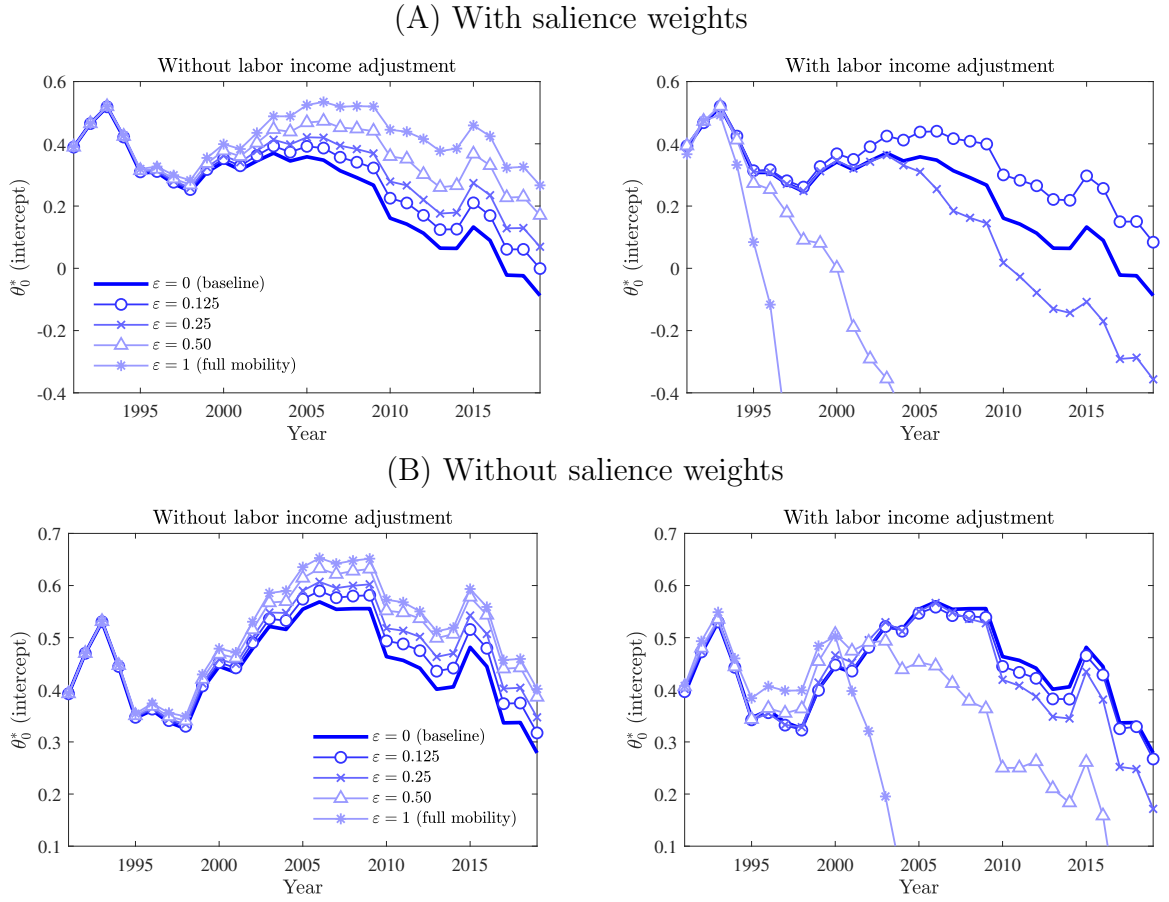


Figure 10: Evolution of θ_0^* in voting function: Labor mobility

Notes: The salience weight parameter is set to $\alpha = 6$ in Panel (A), while it is $\alpha = 0$ in Panel (B). In the right-hand charts, the cases with $\epsilon = 0.5$ and $\epsilon = 1.0$ (represented by lines with triangles and asterisks, respectively) fall outside the plot area, corresponding to values of –0.20 and –1.99 in Panel (A) and –2.20 and –6.48 in Panel (B) at the end of the sample period.

effect. Even so, since the great financial crisis, θ_0^* continues to drift downward, indicating persistent protectionist sentiment.

In the right panels, where labor income adjusts according to equation (22), mobility substantially lowers θ_0^*, especially at higher ε. For comparability, the y-axis limits are held fixed across left and right panels; thus the high-mobility cases ($\varepsilon = 0.5, 1.0$) fall outside the plotted range, reflecting their strong quantitative impact. In Panel (A), with salience weighting, a low value of $\varepsilon = 0.125$ slightly raises θ_0^*, suggesting that modest mobility may cushion shocks without amplifying inequality.

Overall, the results highlight the importance of labor-income adjustments. Labor inflows impose sizeable wage effects on destination sectors, and observed mobility patterns do not imply that reallocation offsets the gains and losses from globalization. Even with labor mobility, the model continues to imply rising support for trade protectionism.

Cross-sectoral lobbying. The idea of counter lobbying, or lobbying for less protection, is discussed in Bhagwati et al. (1992). While our model allows only for own sector lobbying, this assumption may be restrictive in the context of global value chains. In reality, as Alfaro et al. (2019) and Antràs and Chor (2022) argue, cross border production linkages generate complex political incentives, since firms that rely on imported intermediates or foreign affiliates often favor trade openness and create counter lobbying pressure against protection. Empirically, Kim (2017) shows that export-oriented and import-using firms lobby for liberalization, and Choi (2025) finds similar evidence among globally integrated firms.

Motivated by these observations, we next extend the model to allow for cross sector participation in lobbying in the determination of sectoral tariffs, whereas the baseline model assumed lobbying only by the directly affected sector. Our framework goes beyond earlier multi sector lobbying models, such as Gawande et al. (2012), by embedding lobbying behavior in a general equilibrium production network, where sectoral linkages endogenously shape trade policy outcomes.

We modify the politician's objective function in equation (15) to

$$U_t^p = (1-\eta) \underbrace{u_t}_{\text{Social welfare}} + \eta \underbrace{\sum_{i \in L} Q_t^i}_{\text{Lobbying contributions}}, \tag{23}$$

where L denotes the set of sectors engaged in lobbying. Nash bargaining between the government and lobbying sectors yields

$$U_t^p \propto U_t^j \propto (1-\eta) u_t + \eta \sum_{i \in L} u_t^i, \tag{24}$$

for all $j \in L$. The resulting objective function can be interpreted as a weighted average of social welfare and the utilities of all sectors engaged in lobbying. As a result, the tariff set for a given sector depends not only on that sector's own gains but also on how its policy affects the welfare of other lobbying sectors and overall social welfare.

This formulation gives rise to *counter-lobbying*, in which adversely affected sectors lobby to offset or reverse the protection granted to another sector. For instance, when a tariff is imposed on a tradable sector (e.g., automobiles), downstream sectors (e.g., car dealers) may experience higher input costs and thus lobby against the tariff. Conversely, *supportive-lobbying* may also arise when upstream sectors (e.g., steel producers) benefit from the protection. The overall impact of cross-sectoral lobbying in equilibrium is therefore ambiguous *a priori*, depending on the relative strength of counter- and supportive-lobbying forces.

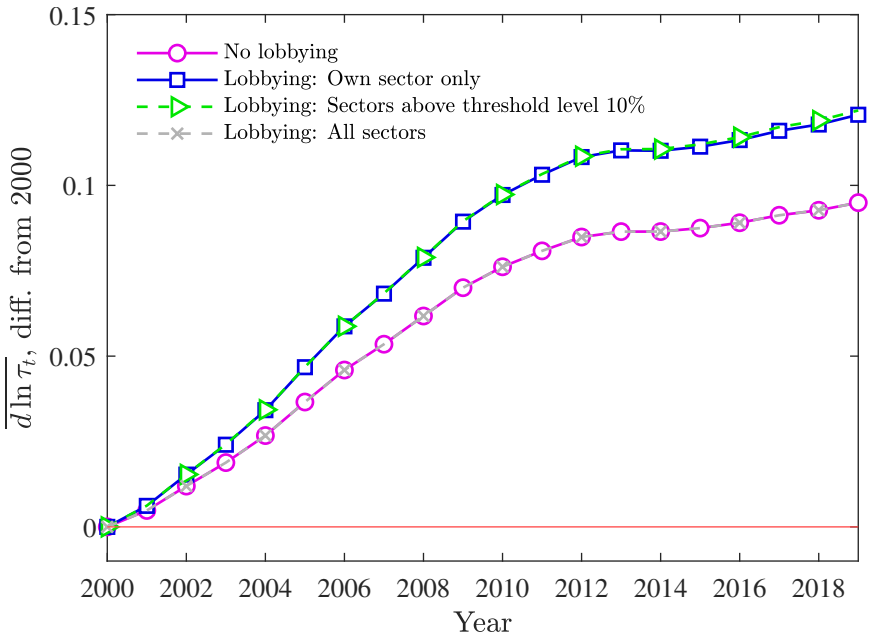


Figure 11: Implied tariffs under cross-sectoral lobbying

Notes: Model parameters are set to (C2) and (C3) of Figure (8), i.e., $\sigma = 1.5$ and $\eta = 0$ or 0.3. The solid lines with circles and squares are identical to (C2) and (C3) of Figure (8), respectively. The dashed lines with triangles and crosses represent cases in which lobbying is limited to sectors with intensity above 10% of the average, or in which all sectors are allowed to lobby, respectively.

To quantify these effects, we must specify the composition of the lobbying set L. Following Goldberg and Maggi (1999), we define lobbying sectors as those whose lobbying intensity exceeds a given threshold. Lobbying intensity is measured as sectoral lobbying expenditure on trade and tariff issues relative to sales, based on the dataset constructed in Section (2). We set a threshold of 10% of the average lobbying intensity to define the set of sectors allowed to participate in lobbying. This "restricted" group accounts for about 70% of total sales, reflecting the realistic notion that lobbying is concentrated in a subset of sectors rather than universal. For comparison, we also consider a "universal" case in which all sectors are allowed to lobby, serving as a counterfactual benchmark with full participation.[9]

Figure 11 presents the results. A few interesting observations emerge. First, under the 10% threshold that restricts lobbying participation, the results are virtually identical to those obtained when only own-sector lobbying is allowed. This occurs because counter-lobbying by sectors benefiting from trade, such as wholesale and retail trade, partly offsets protectionist pressures, while supportive lobbying by adversely affected tradable sectors, such as apparel, balances these effects. However, the 10% threshold also excludes many benefiting nontradable

[9]Appendix Figure (C.7) reports lobbying intensity. It is highest in primary metals, wholesale and retail trade, and agriculture, consistent with anecdotal evidence. Tradable sectors also tend to exhibit higher lobbying intensity than non-tradable sectors.

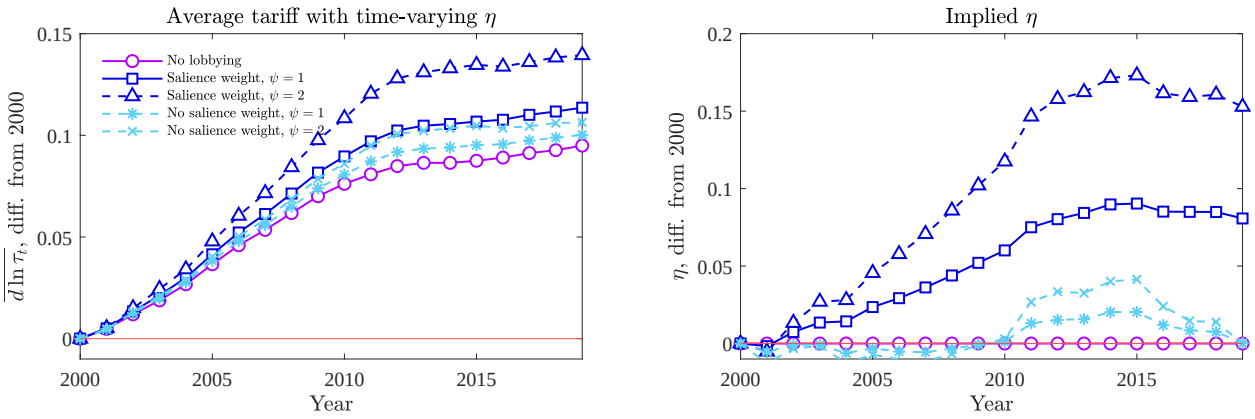


Figure 12: Implied tariffs under time-varying weight η on lobbying contribution

Notes: Lines with squares and triangles are with salience weights ($\alpha = 6$), whereas those with asterisks and crosses are without them ($\alpha = 0$). $\bar{V}$ is set to the voting share in 2000.

sectors—such as construction, education, healthcare, and hospitality—that would otherwise engage in counter-lobbying. With their exclusion, these opposing forces roughly cancel out, leaving aggregate tariffs largely unchanged.

Once lobbying participation becomes universal, these nontradable sectors are included, and the expanded counter-lobbying overwhelms the supportive lobbying of adversely affected sectors. As a result, tariffs decline toward the no-lobbying benchmark, which lies strictly below the outcome obtained when only own-sector lobbying is allowed. This pattern underscores the robustness of our baseline specification with own-sector lobbying, showing that the main results remain stable even when broader forms of cross-sectoral participation are allowed.

Interactions of voting and sectoral lobbying. The analysis thus far has treated voting and sectoral lobbying as orthogonal components of the political process that influence trade policy formation. In reality, however, these mechanisms may interact. We now consider a case in which the politician's objective function is influenced by voting behavior.

Specifically, we assume that η (the weight assigned to lobbying contributions) is a function of public support for globalization, $\eta_t = \psi(V_{t-1} - \bar{V})$, where V_{t-1} is the previous year's voting share favoring trade protectionism, as defined in equation (14), and $\bar{V}$ is the reference point, set to the voting share in 2000. The politician compares the previous period's voting share with this benchmark, and the resulting deviation affects the subsequent weight on sectoral lobbying. The parameter $\psi > 0$ governs the elasticity of η_t with respect to voting behavior. When voting shifts away from globalization, the politician places greater weight on sectoral interests, which reflect the distribution of gains from globalization across sectors.

Figure 12 reports the average tariff rates under the time-varying η, along with the implied values of η. As the voting share gradually shifts toward trade protectionism, η rises, leading tariffs to follow a higher path under endogenous η. The increase in tariffs is more pronounced when salience weights are introduced, since more adversely affected households are more likely to vote for trade protectionism. The response of η is also stronger for larger values of the parameter ψ.

7 Conclusion

This paper demonstrates how protectionism emerges endogenously from the unequal distribution of globalization's gains.

We make this point in two steps. First, our empirical analysis links economic discontent to policy change: households with lower wealth and greater exposure to trade competition are more likely to oppose globalization, while wealthier households (who benefit from financial integration) remain supportive. At the firm level, trade-affected industries lobby for protection, reinforcing these pressures.

Next, we develop a Ricardian trade model with input-output linkages, heterogeneous households, and endogenous sectoral lobbying. A central feature is dual-layer income heterogeneity, with households differing in labor income and financial wealth both across and within sectors. These differences generate asymmetric effects of globalization and distinct winners and losers. Workers in tradable sectors face wage pressure from imports, while wealthier households in the same sector may still gain through financial channels. This asymmetry widens consumption dispersion and concentrates inequality. The calibrated model reproduces the decline in public support for globalization, consistent with changes in foreign exposure, wealth distribution, and trade policy.

The model embeds a trade-off between aggregate efficiency and inequality. Trade policy balances these forces when used to address globalization's distributional effects. Data from recent decades show sizable aggregate gains but increasingly uneven distribution, creating pressures for protectionism through voting and sectoral lobbying.

Trade-affected sectors drive lobbying efforts, which may be strategic complements or substitutes depending on production linkages. These interactions generate a self-reinforcing cycle of lobbying-induced protectionism, even when globalization remains beneficial in the aggregate. A welfare implication is that while tariffs reduce sectoral disparities, they substantially lower aggregate consumption and efficiency. Protectionism can therefore escalate endogenously through lobbying dynamics, making the reversal of globalization an outcome

of underlying economic and political forces.

The results reinforce a standard policy view: rule-based open trade policies to secure efficiency gains, paired with domestic redistribution to address unequal outcomes. Multilateral institutions such as the WTO are essential in anchoring openness. The lobbying interdependencies highlighted by the model provide an additional rationale for international coordination, particularly to mitigate spillovers arising from domestic distributional concerns.

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Supplemental Appendices to

"How Globalization Unravels:

A Ricardian Model of Endogenous Trade Policy"

Jesús Fernández-Villaverde[†], *Tomohide Mineyama*[‡], *Dongho Song*[§]

A Model Solution

Households. The cost minimization over the consumption basket (1)–(2) in the main text yields:

$$
\begin{aligned}
C_{it}^{Hhj} &= \left(\frac{P_{it}}{P_{it}\xi_i}\right)^{-\theta_i} C_{it}^{hj}, \\
C_{it}^{Fhj} &= \left(\frac{\tau_{it}P_{it}^{f}}{P_{it}(1-\xi_i)}\right)^{-\theta_i} C_{it}^{hj}, \\
C_{it}^{hj} &= v_i \left(\frac{P_{it}}{P_t}\right)^{-1} C_t^{hj}, \\
P_t &= \prod_{i=1}^{n} (P_{it})^{v_i}, \\
P_{it} &= \left(\xi_i^{\theta_i} P_{it}^{1-\theta_i} + (1-\xi_i)^{\theta_i} (\tau_{it}P_{it}^{f})^{1-\theta_i}\right)^{\frac{1}{1-\theta_i}},
\end{aligned}
\tag{A.1}
$$

where τ_i is the tariff and P_{it} is a domestic price, which is a composite of home- and foreign-produced goods prices.

The first-order condition for the intertemporal decision (3)–(4) in the main text leads to the consumption Euler equation:

$$
1 = \mathbb{E}_t \left[\beta \left(\frac{C_{t+1}^{hj}}{C_t^{hj}} \right)^{-\gamma} \tilde{R}_{t+1} \right],
$$

where $\tilde{R}_{t+1} = R_{t+1}/(P_{t+1}/P_t)$ is the real rate of return.

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Firms. Profit maximization by firms leads to:

$$
\begin{aligned}
Y_{ijt}^{H} &= \left(\frac{P_{jt}}{P_{jt}\xi_j}\right)^{-\theta_j} Y_{ijt}, \\
Y_{ijt}^{F} &= \left(\frac{\tau_{jt}P_{jt}^{f}}{P_{jt}(1-\xi_j)}\right)^{-\theta_j} Y_{ijt}, \\
E_{it}X_{it} &= \alpha_i P_{it}Y_{it}, \\
P_{jt}Y_{ijt} &= (1-\alpha_i)w_{ij}P_{it}Y_{it},
\end{aligned}
\tag{A.2}
$$

Equation (A.2) indicates that sectoral earnings $E_{it}X_{it}$ are proportional to sales $P_{it}Y_{it}$.

Foreign households and firms. Given the symmetric structure, the first-order conditions are given by:

$$
\begin{aligned}
C_{it}^{fFjh} &= \left(\frac{P_{it}^{f}}{P_{it}^{f}\xi_i^{f}}\right)^{-\theta_i} C_{it}^{Fhj}, \\
C_{it}^{fHjh} &= \left(\frac{\tau_{it}^{f}P_{it}}{P_{it}^{f}(1-\xi_i^{f})}\right)^{-\theta_i} C_{it}^{Fhj}, \\
C_{it}^{Fhj} &= v_i^{f}\left(\frac{P_{it}^{f}}{P_{t}^{f}}\right)^{-1} C_{t}^{Fhj}, \\
P_{t}^{f} &= \prod_{i=1}^{n}\left(P_{it}^{f}\right)^{v_i^{f}}, \\
P_{it}^{f} &= \left((\xi_i^{f})^{\theta_i}(P_{it}^{f})^{1-\theta_i} + (1-\xi_i^{f})^{\theta_i}(\tau_{it}^{f}P_{it})^{1-\theta_i}\right)^{\frac{1}{1-\theta_i}}, \\
1 &= \mathbb{E}_t\left[\beta\left(\frac{C_{t+1}^{Fhj}}{C_{t}^{Fhj}}\right)^{-\gamma}\tilde{R}_{t+1}^{f}\right], \\
Y_{ijt}^{fF} &= \left(\frac{P_{jt}^{f}}{P_{jt}^{f}\xi_j^{f}}\right)^{-\theta_j} Y_{ijt}^{f}, \\
Y_{ijt}^{fH} &= \left(\frac{\tau_{jt}^{f}P_{jt}}{P_{jt}^{f}(1-\xi_j^{f})}\right)^{-\theta_j} Y_{ijt}^{f}, \\
E_{it}^{f}X_{it}^{f} &= \alpha_i^{f}P_{it}^{f}Y_{it}^{f}, \\
P_{jt}^{f}Y_{ijt}^{f} &= (1-\alpha_i^{f})w_{ij}^{f}P_{it}^{f}Y_{it}^{f},,
\end{aligned}
\tag{A.3}
$$

Market clearing. Substituting the first-order conditions into the market-clearing conditions yields:

$$\xi_i^{\theta_i}\left(\frac{P_{it}}{P_{it}}\right)^{-\theta_i+1} D_{it} + (1-\xi_i^f)^{\theta_i}(\tau_{it}^f)^{-\theta_i}\left(\frac{P_{it}}{P_{it}^f}\right)^{-\theta_i+1} D_{it}^f = S_{it}, \tag{A.4}$$

$$(1-\xi_i)^{\theta_i}\tau_{it}^{-\theta_i}\left(\frac{P_{it}^f}{P_{it}}\right)^{-\theta_i+1} D_{it} + (\xi_i^f)^{\theta_i}\left(\frac{P_{it}^f}{P_{it}^f}\right)^{-\theta_i+1} D_{it}^f = S_{it}^f, \tag{A.5}$$

$$\text{where} \quad D_{it} = v_i P_t C_t + \sum_{j=1}^{n}(1-\alpha_j) w_{ji} S_{jt}, \tag{A.6}$$

$$D_{it}^f = v_i^f P_t^f C_t^f + \sum_{j=1}^{n}(1-\alpha_j^f) w_{ji}^f S_{jt}^f. \tag{A.7}$$

Here $S_{it} = P_{it}Y_{it}$ is nominal output and D_{it} and D_{it}^f collect final and intermediate goods demand in the home and foreign economies, respectively.

The first-order approximation. Consider the first-order approximation around $P_i = P_i^f$. Variables without t subscript denote steady-state values.

Equations (A.4)–(A.7) lead to:

$$\begin{aligned}
&-\left\{\tilde{\xi}_i(1-\tilde{\xi}_i)D_i + \tilde{\xi}_i^f(1-\tilde{\xi}_i^f)(\tau_i^f)^{-1}D_i^f\right\}(\theta_i-1)(d\ln P_{it} - d\ln P_{it}^f) + \tilde{\xi}_i D_i d\ln D_{it} \\
&\quad +(1-\tilde{\xi}_i^f)(\tau_i^f)^{-1}D_i^f d\ln D_{it}^f + \tilde{\xi}_i(1-\tilde{\xi}_i)D_i(\theta_i-1)d\ln\tau_{it} \\
&\quad -\left\{-(1-\tilde{\xi}_i^f)(\theta_i-1)+\theta_i\right\}(1-\tilde{\xi}_i^f)(\tau_i^f)^{-1}D_i^f d\ln\tau_{it}^f = S_i d\ln S_{it}, \\
&\left\{\tilde{\xi}_i(1-\tilde{\xi}_i)\tau_i^{-1}D_i + \tilde{\xi}_i^f(1-\tilde{\xi}_i^f)D_i^f\right\}(\theta_i-1)(d\ln P_{it} - d\ln P_{it}^f) + (1-\tilde{\xi}_i)\tau_i^{-1}D_i d\ln D_{it} \\
&\quad +\tilde{\xi}_i^f D_i^f d\ln D_{it}^f + \tilde{\xi}_i^f(1-\tilde{\xi}_i^f)D_i^f(\theta_i-1)d\ln\tau_{it}^f \\
&\quad -\left\{-(1-\tilde{\xi}_i)(\theta_i-1)+\theta_i\right\}(1-\tilde{\xi}_i)\tau_i^{-1}D_i d\ln\tau_{it} = S_i^f d\ln S_{it}^f, \\
&\text{where} \quad D_i d\ln D_{it} = v_i d\ln(P_tC_t) + \sum_{j=1}^{n}(1-\alpha_j)w_{ji}S_j d\ln S_{jt}, \\
&D_i^f d\ln D_{it}^f = v_i^f P^f C^f d\ln(P_t^f C_t^f) + \sum_{j=1}^{n}(1-\alpha_j^f)w_{ji}^f S_j^f d\ln S_{jt}^f.
\end{aligned}$$

Here, $\tilde{\xi}_i = \xi_i^{\theta_i}/(\xi_i^{\theta_i} + (1-\xi_i)^{\theta_i}\tau_i^{1-\theta_i})$ and $\tilde{\xi}_i^f = (\xi_i^f)^{\theta_i}/((\xi_i^f)^{\theta_i} + (1-\xi_i^f)^{\theta_i}(\tau_i^f)^{1-\theta_i})$ are the steady-state share of domestic goods. The derivation used the first-order approximation of

equations (A.1) and (A.3) are:

$$d\ln P_{it} = \tilde{\xi}_i d\ln P_{it} + (1-\tilde{\xi}_i)(d\ln P_{it}^f + d\ln \tau_{it}),$$
$$d\ln P_{it}^f = \tilde{\xi}_i^f d\ln P_{it}^f + (1-\tilde{\xi}_i^f)(d\ln P_{it} + d\ln \tau_{it}^f).$$

We also assume $\tau_i = \tau_i^f = 1$ in the baseline case.

In a matrix form:

$$\begin{aligned}
&-\left\{\tilde{\boldsymbol{\xi}}(\boldsymbol{I}-\tilde{\boldsymbol{\xi}})\boldsymbol{D} + \tilde{\boldsymbol{\xi}}^f(\boldsymbol{I}-\tilde{\boldsymbol{\xi}}^f)\boldsymbol{D}^f\right\}(\boldsymbol{\theta} \\
&-\boldsymbol{I})(d\ln \boldsymbol{P}_t - d\ln \boldsymbol{P}_t^f) + \tilde{\boldsymbol{\xi}}\boldsymbol{D}d\ln \boldsymbol{D}_t + (\boldsymbol{I}-\tilde{\boldsymbol{\xi}}^f)\boldsymbol{D}^f d\ln \boldsymbol{D}_t^f + \tilde{\boldsymbol{\xi}}(\boldsymbol{I}-\tilde{\boldsymbol{\xi}})\boldsymbol{D}(\boldsymbol{\theta}-\boldsymbol{I})d\ln \boldsymbol{\tau}_t \\
&-\left\{-(\boldsymbol{I}-\tilde{\boldsymbol{\xi}}^f)(\boldsymbol{\theta}-\boldsymbol{I}) + \boldsymbol{\theta}\right\}(\boldsymbol{I}-\tilde{\boldsymbol{\xi}}^f)\boldsymbol{D}^f d\ln \boldsymbol{\tau}_t^f = \boldsymbol{S}d\ln \boldsymbol{S}_t, \qquad \text{(A.8)}\\
&\left\{\tilde{\boldsymbol{\xi}}(\boldsymbol{I}-\tilde{\boldsymbol{\xi}})\boldsymbol{D} + \tilde{\boldsymbol{\xi}}^f(\boldsymbol{I}-\tilde{\boldsymbol{\xi}}^f)\boldsymbol{D}^f\right\}(\boldsymbol{\theta}-\boldsymbol{I})(d\ln \boldsymbol{P}_t - d\ln \boldsymbol{P}_t^f) + (\boldsymbol{I}-\tilde{\boldsymbol{\xi}})\boldsymbol{D}d\ln \boldsymbol{D}_t \\
&+\tilde{\boldsymbol{\xi}}^f\boldsymbol{D}^f d\ln \boldsymbol{D}_t^f + \tilde{\boldsymbol{\xi}}^f(\boldsymbol{I}-\tilde{\boldsymbol{\xi}}^f)\boldsymbol{D}^f(\boldsymbol{\theta}-\boldsymbol{I})d\ln \boldsymbol{\tau}_t^f \\
&-\left\{-(\boldsymbol{I}-\tilde{\boldsymbol{\xi}})(\boldsymbol{\theta}-\boldsymbol{I}) + \boldsymbol{\theta}\right\}(\boldsymbol{I}-\tilde{\boldsymbol{\xi}})\boldsymbol{D}d\ln \boldsymbol{\tau}_t = \boldsymbol{S}^f d\ln \boldsymbol{S}_t^f, \qquad \text{(A.9)}\\
&\text{where} \quad \boldsymbol{D}d\ln \boldsymbol{D}_t = \boldsymbol{v}PCd\ln(P_tC_t) + (\boldsymbol{I}-\boldsymbol{\alpha})\boldsymbol{W}'\boldsymbol{S}d\ln \boldsymbol{S}_t, \\
&\boldsymbol{D}^f d\ln \boldsymbol{D}_t^f = \boldsymbol{v}^f P^f C^f d\ln(P_t^f C_t^f) + (\boldsymbol{I}-\boldsymbol{\alpha}^f)\boldsymbol{W}^{f\prime}\boldsymbol{S}^f d\ln \boldsymbol{S}_t^f.
\end{aligned}$$

Combining equations (A.8) and (A.9), we get:

$$\boldsymbol{D}d\ln \boldsymbol{D}_t + \boldsymbol{D}^f d\ln \boldsymbol{D}_t^f - (\boldsymbol{I}-\tilde{\boldsymbol{\xi}})\boldsymbol{D}d\ln \boldsymbol{\tau}_t - (\boldsymbol{I}-\tilde{\boldsymbol{\xi}}^f)\boldsymbol{D}^f d\ln \boldsymbol{\tau}_t^f = \boldsymbol{S}d\ln \boldsymbol{S}_t + \boldsymbol{S}^f d\ln \boldsymbol{S}_t^f,$$

or:

$$\begin{aligned}
&\boldsymbol{v}PCd\ln(P_tC_t) + \boldsymbol{v}^f P^f C^f d\ln(P_t^f C_t^f) - (\boldsymbol{I}-\tilde{\boldsymbol{\xi}})\boldsymbol{D}d\ln \boldsymbol{\tau}_t - (\boldsymbol{I}-\tilde{\boldsymbol{\xi}}^f)\boldsymbol{D}^f d\ln \boldsymbol{\tau}_t^f \\
&\qquad = \boldsymbol{V}'^{-1}\boldsymbol{S}d\ln \boldsymbol{S}_t + \boldsymbol{V}^{f\prime-1}\boldsymbol{S}^f d\ln \boldsymbol{S}_t^f, \qquad \text{(A.10)}
\end{aligned}$$

where $\boldsymbol{V} = \{\boldsymbol{I}-(\boldsymbol{I}-\boldsymbol{\alpha})\boldsymbol{W}\}^{-1}$ and $\boldsymbol{V}^f = \{\boldsymbol{I}-(\boldsymbol{I}-\boldsymbol{\alpha}^f)\boldsymbol{W}^f\}^{-1}$ are the Leontief inverse.

Substituting equation (A.10) back to condition (A.8) yields:

$$\begin{aligned}
\underbrace{\boldsymbol{S}d\ln \boldsymbol{S}_t}_{\text{Output}} = \underbrace{\tilde{\boldsymbol{V}}'}_{\text{Network}} \Bigg\{ &\underbrace{-\tilde{\boldsymbol{\theta}}}_{\text{Elasticity}} \underbrace{(d\ln \boldsymbol{P}_t - d\ln \boldsymbol{P}_t^f)}_{\text{Relative price}} \underbrace{+\tilde{\boldsymbol{v}}PCd\ln(P_tC_t)}_{\text{Home aggregate demand}} \underbrace{+\tilde{\boldsymbol{v}}^f P^f C^f d\ln(P_t^f C_t^f)}_{\text{Foreign aggregate demand}} \\
&\underbrace{+\boldsymbol{\eta}d\ln \boldsymbol{\tau}_t - \boldsymbol{\eta}^f d\ln \boldsymbol{\tau}_t^f}_{\text{Tariff}} \Bigg\}, \qquad \text{(A.11)}
\end{aligned}$$

where:

$$\tilde{\boldsymbol{V}}' = \underbrace{\boldsymbol{V}'}_{\text{Production network}} \underbrace{\left\{\boldsymbol{I} + (\boldsymbol{I} - \tilde{\boldsymbol{\xi}})(\boldsymbol{V}' - \boldsymbol{I}) + (\boldsymbol{I} - \tilde{\boldsymbol{\xi}}^f)(\boldsymbol{V}^{f\prime} - \boldsymbol{I})\right\}^{-1}}_{\text{Effect of trade}}$$

and

$$\tilde{\boldsymbol{\theta}} = \left\{ \underbrace{\tilde{\boldsymbol{\xi}}}_{\frac{\partial(d\ln \boldsymbol{P}_t - d\ln \boldsymbol{P}_t)}{\partial(d\ln \boldsymbol{P}_t - d\ln \boldsymbol{P}_t^f)}} \underbrace{(\boldsymbol{I} - \tilde{\boldsymbol{\xi}})\boldsymbol{D}}_{\text{Imports}} + \underbrace{\tilde{\boldsymbol{\xi}}^f}_{\frac{\partial(d\ln \boldsymbol{P}_t - d\ln \boldsymbol{P}_t^f)}{\partial(d\ln \boldsymbol{P}_t - d\ln \boldsymbol{P}_t^f)}} \underbrace{(\boldsymbol{I} - \tilde{\boldsymbol{\xi}}^f)\boldsymbol{D}^f}_{\text{Exports}} \right\} (\boldsymbol{\theta} - \boldsymbol{I})$$

are the Leontief inverse and demand elasticity, respectively, adjusted with trade.

The Leontief inverse $\tilde{\boldsymbol{V}}$ captures propagation through the domestic production network $\boldsymbol{V}$, but this propagation is attenuated because the imported goods component, $(\boldsymbol{I} - \tilde{\boldsymbol{\xi}})$, drops out of domestic linkages. The demand elasticity $\tilde{\boldsymbol{\theta}}$ is adjusted to account for imports and exports, $(\boldsymbol{I} - \tilde{\boldsymbol{\xi}})\boldsymbol{D}$ and $(\boldsymbol{I} - \tilde{\boldsymbol{\xi}}^f)\boldsymbol{D}^f$, and is rescaled by the home and foreign price differentials, $\tilde{\boldsymbol{\xi}}$ and $\tilde{\boldsymbol{\xi}}^f$.

The expressions $\tilde{\boldsymbol{v}} = \left\{\tilde{\boldsymbol{\xi}} + (\boldsymbol{I} - \tilde{\boldsymbol{\xi}}^f)(\boldsymbol{V}^{f\prime} - \boldsymbol{I})\right\}\boldsymbol{v}$ and $\tilde{\boldsymbol{v}}^f = (\boldsymbol{I} - \tilde{\boldsymbol{\xi}}^f)\boldsymbol{V}^{f\prime}\boldsymbol{v}^f$ represent sectoral elasticity with respect to aggregate demand. Similarly, we can define

$$\boldsymbol{\eta} = \left\{\tilde{\boldsymbol{\xi}}(\boldsymbol{\theta} - \boldsymbol{I}) - (\boldsymbol{I} - \tilde{\boldsymbol{\xi}})(\boldsymbol{V}^{f\prime} - \boldsymbol{I})\right\}(\boldsymbol{I} - \tilde{\boldsymbol{\xi}})\boldsymbol{D}$$

and

$$\boldsymbol{\eta}^f = \left\{\tilde{\boldsymbol{\xi}}^f(\boldsymbol{\theta} - \boldsymbol{I}) + (\boldsymbol{I} - \tilde{\boldsymbol{\xi}})(\boldsymbol{V}^{f\prime} - \boldsymbol{I}) + \boldsymbol{\theta}\right\}(\boldsymbol{I} - \tilde{\boldsymbol{\xi}}^f)\boldsymbol{D}^f.$$

Equation (A.11) shows that sectoral outputs fall when the relative price of home goods increases and rise with home and foreign aggregate demand, with these effects amplified by the production network. The sign of $\boldsymbol{\eta}$ is ambiguous because higher tariffs reduce foreign imports on one hand, but also depress domestic demand on the other. When trade is absent, that is, $\tilde{\boldsymbol{\xi}} = \boldsymbol{I}$, equation (A.11) simplifies to

$$\boldsymbol{S} d\ln \boldsymbol{S}_t = \boldsymbol{V}'\boldsymbol{v}\, PC\, d\ln(P_t C_t).$$

In another simplified example, without production network, i.e., $\boldsymbol{\alpha} = \boldsymbol{\alpha}^f = \boldsymbol{I}$, we can show $\tilde{\boldsymbol{V}} = \boldsymbol{V} = \boldsymbol{I}$, $\tilde{\boldsymbol{v}} = \tilde{\boldsymbol{\xi}}\boldsymbol{v}$, $\tilde{\boldsymbol{v}}^f = (\boldsymbol{I} - \tilde{\boldsymbol{\xi}}^f)\boldsymbol{v}^f$, $\boldsymbol{\eta} = \tilde{\boldsymbol{\xi}}(\boldsymbol{I} - \tilde{\boldsymbol{\xi}})(\boldsymbol{\theta} - \boldsymbol{I})\boldsymbol{D}$, $\boldsymbol{\eta}^f = \{\tilde{\boldsymbol{\xi}}^f(\boldsymbol{\theta} - \boldsymbol{I}) + \boldsymbol{\theta}\}(\boldsymbol{I} - \tilde{\boldsymbol{\xi}}^f)\boldsymbol{D}^f$, $\boldsymbol{D} = \boldsymbol{v}PC$, and $\boldsymbol{D}^f = \boldsymbol{v}^f P^f C^f$, implying that $\tilde{\boldsymbol{V}}$, $\boldsymbol{\eta}$, $\boldsymbol{\eta}^f$ are diagonal and, thus, there is no sectoral propagation.

National accounting. Recall that the home country's nominal GDP is given by:

$$GDP_t = P_t C_t + \underbrace{\sum_{i=1}^{n} (1-\xi_i^f)^{\theta_i} (\tau_{it}^f)^{-\theta_i} \left(\frac{P_{it}}{P_{it}^f}\right)^{-\theta_i+1} D_{it}^f}_{=EX_t:\text{Exports}} - \underbrace{\sum_{i=1}^{n} (1-\xi_i)^{\theta_i} \tau_{it}^{-\theta_i} \left(\frac{P_{it}^f}{P_{it}}\right)^{-\theta_i+1} D_{it}}_{=IM_t:\text{Imports}}.$$

Therefore, up to first-order, we have the approximation:

$$\begin{aligned} dGDP_t &= d(P_t C_t) + \sum_{i=1}^{n} (1-\tilde{\xi}_i^f) \left\{ -\theta_i D_i^f d\ln \tau_{it}^f - (\theta_i - 1) D_i^f (d\ln P_{it} - d\ln P_{it}^f) + dD_{it}^f \right\} \\ &\quad - \sum_{i=1}^{n} (1-\tilde{\xi}_i) \left\{ -\theta_i D_i d\ln \tau_{it} - (\theta_i - 1) D_i (d\ln P_{it}^f - d\ln P_{it}) + dD_{it} \right\} \\ &= d(P_t C_t) + \mathbf{1}'(\boldsymbol{I} - \tilde{\boldsymbol{\xi}}^f) d\boldsymbol{D}_t^f - \mathbf{1}'(\boldsymbol{I} - \tilde{\boldsymbol{\xi}}) d\boldsymbol{D}_t - \mathbf{1}'\tilde{\boldsymbol{\theta}}(d\ln \boldsymbol{P}_t - d\ln \boldsymbol{P}_t^f) \\ &\quad + \mathbf{1}'(\boldsymbol{I} + (\boldsymbol{\theta} - \boldsymbol{I})\tilde{\boldsymbol{\xi}})(\boldsymbol{I} - \tilde{\boldsymbol{\xi}}) \boldsymbol{D} d\ln \boldsymbol{\tau}_t - \mathbf{1}'(\boldsymbol{I} + (\boldsymbol{\theta} - \boldsymbol{I})\tilde{\boldsymbol{\xi}}^f)(\boldsymbol{I} - \tilde{\boldsymbol{\xi}}^f) \boldsymbol{D}^f d\ln \boldsymbol{\tau}_t^f. \end{aligned} \tag{A.12}$$

The production approach yields $GDP_t = \sum_{i=1}^{n} \alpha_i S_{it}$, and

$$dGDP_t = \mathbf{1}'\boldsymbol{\alpha} d\boldsymbol{S}_t. \tag{A.13}$$

Using the symmetry of home and foreign economies, equations (A.12) and (A.13) imply:

$$\mathbf{1}'\boldsymbol{\alpha} d\boldsymbol{S}_t + \mathbf{1}'\boldsymbol{\alpha}^f d\boldsymbol{S}_t^f = d(P_t C_t) + d(P_t^f C_t^f). \tag{A.14}$$

Production function. The production function, together with first-order conditions, determines the relation of sales with prices and factor inputs:

$$\begin{aligned} \boldsymbol{\alpha} d\ln \boldsymbol{S}_t &= d\ln \boldsymbol{A}_t + \boldsymbol{\alpha} d\ln \boldsymbol{X}_t + \boldsymbol{V}^{-1} d\ln \boldsymbol{P}_t \\ &\quad + (\boldsymbol{I} - \boldsymbol{\alpha}) \boldsymbol{W} (\boldsymbol{I} - \tilde{\boldsymbol{\xi}})(d\ln \boldsymbol{P}_t - d\ln \boldsymbol{P}_t^f - d\ln \boldsymbol{\tau}_t), \end{aligned} \tag{A.15}$$

$$\begin{aligned} \boldsymbol{\alpha}^f d\ln \boldsymbol{S}_t^f &= d\ln \boldsymbol{A}_t^f + \boldsymbol{\alpha}^f d\ln \boldsymbol{X}_t^f + \boldsymbol{V}^{f-1} d\ln \boldsymbol{P}_t^f \\ &\quad - (\boldsymbol{I} - \boldsymbol{\alpha}^f) \boldsymbol{W}^f (\boldsymbol{I} - \tilde{\boldsymbol{\xi}}^f)(d\ln \boldsymbol{P}_t + d\ln \boldsymbol{\tau}_t^f - d\ln \boldsymbol{P}_t^f). \end{aligned} \tag{A.16}$$

Combining equations (A.15) and (A.16), we obtain

$$\begin{aligned} d\ln \boldsymbol{P}_t - d\ln \boldsymbol{P}_t^f &= \left\{ \boldsymbol{I} + (\boldsymbol{V} - \boldsymbol{I})(\boldsymbol{I} - \tilde{\boldsymbol{\xi}}) + (\boldsymbol{V}^f - \boldsymbol{I})(\boldsymbol{I} - \tilde{\boldsymbol{\xi}}^f) \right\}^{-1} \\ &\quad \left\{ \boldsymbol{V}(\boldsymbol{\alpha} d\ln \boldsymbol{S}_t - d\ln \boldsymbol{A}_t - \boldsymbol{\alpha} d\ln \boldsymbol{X}_t) - \boldsymbol{V}^f(\boldsymbol{\alpha}^f d\ln \boldsymbol{S}_t^f - d\ln \boldsymbol{A}_t^f - \boldsymbol{\alpha}^f d\ln \boldsymbol{X}_t^f) \right. \\ &\quad \left. + (\boldsymbol{V} - \boldsymbol{I})(\boldsymbol{I} - \tilde{\boldsymbol{\xi}}) d\ln \boldsymbol{\tau}_t - (\boldsymbol{V}^f - \boldsymbol{I})(\boldsymbol{I} - \tilde{\boldsymbol{\xi}}^f) d\ln \boldsymbol{\tau}_t^f \right\}. \end{aligned} \tag{A.17}$$

Closed-form solution. We can use equations (A.8), (A.10), (A.12), (A.13), (A.14), (A.17) to solve for $\{d\ln \boldsymbol{S}_t, d\ln \boldsymbol{S}_t^f, d\ln(P_tC_t), d\ln(P_t^fC_t^f), d\ln \boldsymbol{P}_t - d\ln \boldsymbol{P}_t^f\}$, given:

$$\{d\ln \boldsymbol{A}, d\ln \boldsymbol{A}^f, d\ln \boldsymbol{X}, d\ln \boldsymbol{X}^f, d\ln \boldsymbol{\tau}, d\ln \boldsymbol{\tau}^f\}.$$

Substituting equation (A.10) into equation (A.17) eliminates $d\ln \boldsymbol{S}_t^f$:

$$\begin{aligned} d\ln \boldsymbol{P}_t - d\ln \boldsymbol{P}_t^f = \boldsymbol{c}_1^{-1}\Big\{&\boldsymbol{c}_2\boldsymbol{S}d\ln \boldsymbol{S}_t - \boldsymbol{c}_3(\boldsymbol{v}PCd\ln P_tC_t + \boldsymbol{v}^fP^fC^fd\ln P_t^fC_t^f) \\ &-\boldsymbol{V}(d\ln \boldsymbol{A}_t + \boldsymbol{\alpha}d\ln \boldsymbol{X}_t) + \boldsymbol{V}^f(d\ln \boldsymbol{A}_t^f + \boldsymbol{\alpha}^f d\ln \boldsymbol{X}_t^f) \\ &+\boldsymbol{c}_4 d\ln \boldsymbol{\tau}_t - \boldsymbol{c}_5 d\ln \boldsymbol{\tau}_t^f\Big\}, \end{aligned} \tag{A.18}$$

where $\boldsymbol{c}_1 = \boldsymbol{I} + (\boldsymbol{V}-\boldsymbol{I})(\boldsymbol{I}-\tilde{\boldsymbol{\xi}}) + (\boldsymbol{V}^f-\boldsymbol{I})(\boldsymbol{I}-\tilde{\boldsymbol{\xi}}^f)$, $\boldsymbol{c}_2 = \boldsymbol{V}\boldsymbol{\alpha}\boldsymbol{S}^{-1} + \boldsymbol{V}^f\boldsymbol{\alpha}^f\boldsymbol{S}^{f-1}\boldsymbol{V}^{f\prime}\boldsymbol{V}'^{-1}$, $\boldsymbol{c}_3 = \boldsymbol{V}^f\boldsymbol{\alpha}^f\boldsymbol{S}^{f-1}\boldsymbol{V}^{f\prime}$, $\boldsymbol{c}_4 = \{\boldsymbol{V}^f\boldsymbol{\alpha}^f\boldsymbol{S}^{f-1}\boldsymbol{V}^{f\prime}\boldsymbol{D} + (\boldsymbol{V}-\boldsymbol{I})\}(\boldsymbol{I}-\tilde{\boldsymbol{\xi}})$, and $\boldsymbol{c}_5 = \{\boldsymbol{V}^f\boldsymbol{\alpha}^f\boldsymbol{S}^{f-1}\boldsymbol{V}^{f\prime}\boldsymbol{D}^f + (\boldsymbol{V}^f-\boldsymbol{I})\}(\boldsymbol{I}-\tilde{\boldsymbol{\xi}}^f)$.

Combining equations (A.11) and (A.18) determines the relation between $\boldsymbol{S}_t$ and exogenous variables as well as aggregate demand, eliminating the relative price:

$$\begin{aligned} \boldsymbol{S}d\ln \boldsymbol{S}_t = \check{\boldsymbol{V}}'\Big[&\check{\boldsymbol{v}}PCd\ln(P_tC_t) + \check{\boldsymbol{v}}^fP^fC^fd\ln(P_t^fC_t^f) \\ &+\check{\boldsymbol{\theta}}\Big\{\boldsymbol{V}(d\ln \boldsymbol{A}_t + \boldsymbol{\alpha}d\ln \boldsymbol{X}_t) - \boldsymbol{V}^f(d\ln \boldsymbol{A}_t^f + \boldsymbol{\alpha}^f d\ln \boldsymbol{X}_t^f)\Big\} + \check{\boldsymbol{\eta}}d\ln \boldsymbol{\tau}_t - \check{\boldsymbol{\eta}}^f d\ln \boldsymbol{\tau}_t^f\Big] \end{aligned}$$

where:

$$\check{\boldsymbol{V}}' = \left\{\tilde{\boldsymbol{V}}'^{-1} + \underbrace{\tilde{\boldsymbol{\theta}}\boldsymbol{c}_1^{-1}\boldsymbol{c}_2}_{\text{Price effect}}\right\}^{-1},$$

and $\check{\boldsymbol{v}} = \tilde{\boldsymbol{v}} + \tilde{\boldsymbol{\theta}}\boldsymbol{c}_1^{-1}\boldsymbol{c}_3\boldsymbol{v}$, $\check{\boldsymbol{v}}^f = \tilde{\boldsymbol{v}}^f + \tilde{\boldsymbol{\theta}}\boldsymbol{c}_1^{-1}\boldsymbol{c}_3\boldsymbol{v}^f$, $\check{\boldsymbol{\theta}} = \tilde{\boldsymbol{\theta}}\boldsymbol{c}_1^{-1}$, $\check{\boldsymbol{\eta}} = \boldsymbol{\eta} - \tilde{\boldsymbol{\theta}}\boldsymbol{c}_1^{-1}\boldsymbol{c}_4$, $\check{\boldsymbol{\eta}}^f = \boldsymbol{\eta}^f + \tilde{\boldsymbol{\theta}}\boldsymbol{c}_1^{-1}\boldsymbol{c}_5$.

Note that the propagation through $\check{\boldsymbol{V}}'$ is mitigated, compared to $\tilde{\boldsymbol{V}}'$, due to the price impact of output fluctuations. That is, higher sectoral output leads to higher domestic prices in equation (A.18), thereby reducing demand.

A.1 Equilibrium computation

Conditions (A.8), (A.9), (A.12), (A.13), (A.14), (A.15), and (A.16) identify:

$$\begin{aligned} d\ln \boldsymbol{S}_t &= d\ln \boldsymbol{P}_t + d\ln \boldsymbol{Y}_t, \\ d\ln \boldsymbol{S}_t^f &= d\ln \boldsymbol{P}_t^f + d\ln \boldsymbol{Y}_t^f, \end{aligned}$$

which, given exogenous vectors $\{\boldsymbol{A}_t, \boldsymbol{A}_t^f, \boldsymbol{X}_t, \boldsymbol{X}_t^f, \boldsymbol{\tau}_t, \boldsymbol{\tau}_t^f\}$, provide us with eight sets of linear equations to solve for eight endogenous vectors $\{\boldsymbol{S}_t, \boldsymbol{S}_t^f, \boldsymbol{P}_t, \boldsymbol{P}_t^f, \boldsymbol{Y}_t, \boldsymbol{Y}_t^f, P_tC_t, P_t^fC_t^f\}$. Other variables are calculated accordingly using respective conditions.

A.2 Examples

We now develop the details of our examples in Subsection 3.3.

Example 1. We need $\check{\boldsymbol{V}}$ and $\check{\boldsymbol{\theta}}$ to obtain the derivative $d\ln \boldsymbol{S}_t / d\ln \boldsymbol{A}_t^f$ as

$$\left.\frac{d\ln \boldsymbol{S}_t}{d\ln \boldsymbol{A}_t^f}\right|_{P_tC_t, P_t^fC_t^f \text{ fixed}} = -\check{\boldsymbol{V}}\check{\boldsymbol{\theta}}\boldsymbol{V}^f.$$

In the horizontal network case, $\boldsymbol{V} = \tilde{\boldsymbol{V}} = \boldsymbol{I}$, $c_1 = \boldsymbol{I}$, and $c_2 = \boldsymbol{S}^{-1} + \boldsymbol{S}^{f-1}$. It follows $\check{\boldsymbol{V}} = \left(\boldsymbol{I} + \tilde{\boldsymbol{\theta}}(\boldsymbol{S}^{-1} + \boldsymbol{S}^{f-1})\right)^{-1}$ and $\check{\boldsymbol{\theta}} = \tilde{\boldsymbol{\theta}}$. Then, we obtain

$$\left[\begin{array}{cc} \frac{dS_{1t}}{d\ln A_{1t}^f} & \frac{dS_{1t}}{d\ln A_{2t}^f} \\ \frac{dS_{2t}}{d\ln A_{1t}^f} & \frac{dS_{2t}}{d\ln A_{2t}^f} \end{array}\right]\Bigg|_{P_tC_t, P_t^fC_t^f \text{ fixed}} = \left[\begin{array}{cc} -\frac{\tilde{\theta}_1}{1+\tilde{\theta}_1(S_1^{-1}+S_1^{f-1})} & 0 \\ 0 & -\frac{\tilde{\theta}_2}{1+\tilde{\theta}_2(S_2^{-1}+S_2^{f-1})} \end{array}\right].$$

Example 2. Since sector 1 is non-tradable, $\tilde{\xi}_1 = 1$ and $\tilde{\theta}_1 = 0$. Then,

$$\boldsymbol{V} = \left[\begin{array}{cc} 1 & 0 \\ 1 & 1 \end{array}\right],\ \tilde{\boldsymbol{V}} = \left[\begin{array}{cc} 1 & 0 \\ 1 & 1 \end{array}\right],\ c_1 = \left[\begin{array}{cc} 1 & 0 \\ 0 & 1 \end{array}\right],\ c_2 = \left[\begin{array}{cc} S^{-1}+S^{f-1} & 0 \\ S^{-1}+S^{f-1} & 0 \end{array}\right].$$

It follows that:

$$\check{\boldsymbol{V}} = \frac{1}{1+\tilde{\theta}_2(S_1^{-1}+S_1^{f-1})}\left[\begin{array}{cc} \tilde{\theta}_2(S_2^{-1}+S_2^{f-1}) & -\tilde{\theta}_2(S_1^{-1}+S_1^{f-1}) \\ 1 & 1 \end{array}\right],\ \check{\boldsymbol{\theta}} = \left[\begin{array}{cc} 0 & 0 \\ 0 & \tilde{\theta}_2 \end{array}\right],$$

and we obtain:

$$\left[\begin{array}{cc} \frac{dS_{1t}}{d\ln A_{1t}^f} & \frac{dS_{1t}}{d\ln A_{2t}^f} \\ \frac{dS_{2t}}{d\ln A_{1t}^f} & \frac{dS_{2t}}{d\ln A_{2t}^f} \end{array}\right]\Bigg|_{P_tC_t, P_t^fC_t^f \text{ fixed}} = -\frac{\tilde{\theta}_2}{1+\tilde{\theta}_2(S_1^{-1}+S_1^{f-1})}\left[\begin{array}{cc} 1 & 1 \\ 1 & 1 \end{array}\right].$$

Example 3. In this case, $\tilde{\xi}_2 = 1$ and $\tilde{\theta}_2 = 0$. Also,

$$\boldsymbol{V} = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}, \ \tilde{\boldsymbol{V}} = \begin{bmatrix} 1+2(1-\tilde{\xi}_1) & 2(1-\tilde{\xi}_1) \\ 1 & 1 \end{bmatrix},$$
$$c_1 = \begin{bmatrix} 1 & 0 \\ 2(1-\tilde{\xi}_1) & 1 \end{bmatrix}, \ c_2 = \begin{bmatrix} S^{-1}+S^{f-1} & 0 \\ S^{-1}+S^{f-1} & 0 \end{bmatrix},$$

which leads to:

$$\check{\boldsymbol{V}} = \frac{1}{\left(1+\tilde{\theta}_2(S_1^{-1}+S_1^{f-1})\right)\left(1+(1-\tilde{\xi}_1)\right)+2(1-\tilde{\xi}_1)} \begin{bmatrix} 1+(1-\tilde{\xi}_1) & -2(1-\tilde{\xi}_1) \\ 1 & 1+\tilde{\theta}_2(S_1^{-1}+S_1^{f-1}) \end{bmatrix},$$
$$\check{\boldsymbol{\theta}} = \begin{bmatrix} \tilde{\theta}_1 & 0 \\ 0 & 0 \end{bmatrix}.$$

Then:

$$\begin{bmatrix} \frac{dS_{1t}}{d\ln A_{1t}^f} & \frac{dS_{1t}}{d\ln A_{2t}^f} \\ \frac{dS_{2t}}{d\ln A_{1t}^f} & \frac{dS_{2t}}{d\ln A_{2t}^f} \end{bmatrix}\Bigg|_{P_tC_t, P_t^fC_t^f \text{ fixed}} = c \begin{bmatrix} -\left(1+(1-\tilde{\xi}_1)\right) & 0 \\ 2(1-\tilde{\xi}_1) & 0 \end{bmatrix},$$

where $c = \tilde{\theta}_1 \left[\left\{1+\tilde{\theta}_1(S_1^{-1}+S_1^{f-1})\right\}\left\{1+(1-\tilde{\xi}_1)\right\}+2(1-\tilde{\xi}_1)\right]^{-1}$.

A.3 Endogenous tariffs

The optimality condition for τ_{jt} is obtained from the first-order condition of equation (17) in the main text:

$$\underbrace{\tilde{\boldsymbol{S}}^{j\prime}\underbrace{\frac{\partial \ln \boldsymbol{S}_t}{\partial \ln \tau_{jt}}}_{\equiv \boldsymbol{C}_{S\tau j}}}_{\text{Average loss/gain}} + \eta \underbrace{\left\{ \frac{IM_j}{S}(1+d\ln IM_{jt}) + \underbrace{\left(\frac{\partial \ln \boldsymbol{IM}_t}{\partial \ln \tau_{jt}}\right)'}_{\equiv \boldsymbol{C}'_{IM\tau j}} \operatorname{diag}\left(\frac{\boldsymbol{IM}}{S}\right) d\ln \boldsymbol{\tau}_t \right\}}_{\text{Tariff revenue increase/decrease}}$$
$$= \underbrace{\sigma}_{\text{Inequality aversion}} \underbrace{\underbrace{\left(\frac{\partial \ln \boldsymbol{S}_t}{\partial \ln \tau_{jt}}\right)'}_{\equiv \boldsymbol{C}'_{S\tau j}} (\boldsymbol{I}-\boldsymbol{1}\boldsymbol{S}')' \operatorname{diag}(\tilde{\boldsymbol{S}}^j)(\boldsymbol{I}-\boldsymbol{1}\boldsymbol{S}')\, d\ln \boldsymbol{S}_t}_{\text{Equality gain/loss}},$$

where $\tilde{\boldsymbol{h}}^j$ is a n-by-1 column vector with the i-th element being $(1-\eta)S_i/S$ for $i \neq j$ and S_i/S for $i = j$. The coefficients $\boldsymbol{C}$ satisfy a linear solution:

$$
\begin{aligned}
d\ln \boldsymbol{S}_t = \boldsymbol{C}_{SA^f} d\ln \boldsymbol{A}_t^f + \boldsymbol{C}_{SX^f} d\ln \boldsymbol{X}_t^f + \boldsymbol{C}_{SA} d\ln \boldsymbol{A}_t \\
+\boldsymbol{C}_{SX} d\ln \boldsymbol{X}_t + \boldsymbol{C}_{S\tau} d\ln \boldsymbol{\tau}_t + \boldsymbol{C}_{S\tau^f} d\ln \boldsymbol{\tau}_t^f, \\
d\ln \boldsymbol{IM}_t = \boldsymbol{C}_{IMA^f} d\ln \boldsymbol{A}_t^f + \boldsymbol{C}_{IMX^f} d\ln \boldsymbol{X}_t^f + \boldsymbol{C}_{IMA} d\ln \boldsymbol{A}_t \\
+\boldsymbol{C}_{IMX} d\ln \boldsymbol{X}_t + \boldsymbol{C}_{IM\tau} d\ln \boldsymbol{\tau}_t + \boldsymbol{C}_{IM\tau^f} d\ln \boldsymbol{\tau}_t^f,
\end{aligned}
$$

and the subscript j indicates the j-th column vector.

Stacking the first-order condition for tradable sectors, we obtain:

$$
\begin{aligned}
&\underbrace{\tilde{\boldsymbol{C}}'_{S\tau T}\mathbf{1}}_{\text{Average loss/gain}} + \eta \left\{ \underbrace{\operatorname{diag}\left(\frac{\boldsymbol{IM}_T}{S}\right)(\mathbf{1} + d\ln \boldsymbol{IM}_{Tt}) + \boldsymbol{C}'_{IM\tau T}\operatorname{diag}\left(\frac{\boldsymbol{IM}}{S}\right) d\ln \boldsymbol{\tau}_t}_{\text{Tariff revenue increase/decrease}} \right\} \\
&= \underbrace{\sigma}_{\text{Inequality aversion}} \underbrace{\tilde{\tilde{\boldsymbol{C}}}'_{s\tau T} d\ln \boldsymbol{S}_t}_{\text{Equality gain/loss}},
\end{aligned}
$$

where $\tilde{\boldsymbol{C}}_{S\tau T}$ is a n-by-n_T matrix that collects $\operatorname{diag}(\tilde{\boldsymbol{S}}^j)\boldsymbol{C}_{S\tau j}$ as the j-th column, and $\tilde{\tilde{\boldsymbol{C}}}_{S\tau T}$ is a n-by-n_T matrix with $(\boldsymbol{I} - \mathbf{1}\boldsymbol{S}')' \operatorname{diag}(\tilde{\boldsymbol{S}}^j)(\boldsymbol{I} - \mathbf{1}\boldsymbol{S}')\boldsymbol{C}_{S\tau j}$ in the j-th column.

Then:

$$
\begin{aligned}
d\ln \boldsymbol{\tau}_{Tt} = &\underbrace{\left[\sigma \tilde{\tilde{\boldsymbol{C}}}'_{S\tau T}\boldsymbol{C}_{S\tau T} - \eta\left\{\boldsymbol{C}'_{IM\tau T}\operatorname{diag}\left(\frac{\boldsymbol{IM}_T}{S}\right) + \operatorname{diag}\left(\frac{\boldsymbol{IM}_T}{S}\right)\boldsymbol{C}_{IM\tau T}\right\}\right]^{-1}}_{\equiv \Omega^{-1}} \\
&\times \Bigg[\tilde{\boldsymbol{C}}'_{S\tau T}\mathbf{1} - \sigma\tilde{\tilde{\boldsymbol{C}}}'_{S\tau T}\left(\boldsymbol{C}_{SA^f} d\ln \boldsymbol{A}_t^f + \boldsymbol{C}_{SX^f} d\ln \boldsymbol{X}_t^f + \boldsymbol{C}_{SA} d\ln \boldsymbol{A}_t + \boldsymbol{C}_{SX} d\ln \boldsymbol{X}_t + \boldsymbol{C}_{S\tau^f} d\ln \boldsymbol{\tau}_t^f\right) \\
&\quad + \eta \operatorname{diag}\left(\frac{\boldsymbol{IM}_T}{S}\right)\Big(\mathbf{1} + \boldsymbol{C}^T_{IMA^f} d\ln \boldsymbol{A}_t^f + \boldsymbol{C}^T_{IMX^f} d\ln \boldsymbol{X}_t^f \\
&\qquad + \boldsymbol{C}^T_{IMA} d\ln \boldsymbol{A}_t + \boldsymbol{C}^T_{IMX} d\ln \boldsymbol{X}_t + \boldsymbol{C}^T_{IM\tau^f} d\ln \boldsymbol{\tau}_t^f\Big)\Bigg],
\end{aligned}
$$

where $\boldsymbol{C}^T_{\cdot}$ collects $j \in T$-th row of $\boldsymbol{C}_{\cdot}$.

We can also show that:

$$
\begin{aligned}
d\ln\tau_{jt} = \frac{1}{\Omega_{jj}}\Big[& -\Omega_j d\ln\boldsymbol{\tau}_{-jt} + \tilde{\boldsymbol{C}}'_{S\tau j}\mathbf{1} \\
& - \sigma\tilde{\tilde{\boldsymbol{C}}}'_{S\tau j}\left(\boldsymbol{C}_{SA^f} d\ln\boldsymbol{A}_t^f + \boldsymbol{C}_{SX^f} d\ln\boldsymbol{X}_t^f + \boldsymbol{C}_{SA} d\ln\boldsymbol{A}_t + \boldsymbol{C}_{SX} d\ln\boldsymbol{X}_t + \boldsymbol{C}_{S\tau^f} d\ln\boldsymbol{\tau}_t^f\right) \\
& + \eta\left(\frac{\boldsymbol{IM}_j}{S}\right)\Big(1 + \boldsymbol{C}^j_{IMA^f} d\ln\boldsymbol{A}_t^f + \boldsymbol{C}^j_{IMX^f} d\ln\boldsymbol{X}_t^f \\
& + \boldsymbol{C}^j_{IMA} d\ln\boldsymbol{A}_t + \boldsymbol{C}^j_{IMX} d\ln\boldsymbol{X}_t + \boldsymbol{C}^j_{IM\tau^f} d\ln\boldsymbol{\tau}_t^f\Big)\Big],
\end{aligned}
$$

where $d\ln\boldsymbol{\tau}_{-jt}$ has the i-th element of $d\ln\tau_{it}$ for $i \neq j$ and 0 for $i = j$.

$$
\frac{d\ln\tau_{jt}}{d\ln\tau_{it}} = \underbrace{-\frac{\Omega_{ji}}{\Omega_{jj}}}_{\equiv\Theta(j,i)}.
$$

B Supplementary Tables

Table B.1: Calibrated trade elasticities

	Harmonized sector	$\theta_i - 1$
1	Agriculture, forestry, & fishing	8.11
2	Oil & gas	15.72
3	Mining	15.72
4	Utility	5
5	Construction	5
6	Wood products & furniture	10.83
7	Nonmetallic mineral products	2.76
8	Primary metals	7.99
9	Fabricated metal products	7.99
10	Machinery	1.52
11	Electronic products	10.6
12	Electrical equipment	10.6
13	Transportation equipment	1.01
14	Miscellaneous manufacturing	5
15	Food, beverage & tobacco products	2.55
16	Textile	5.56
17	Apparel	5.56
18	Paper products, printing & publishing	9.07
19	Petroleum & coal products	51.08
20	Chemical products	4.75
21	Plastics & rubber products	4.75
22	Wholesale & retail trades	5
23	Transport, storage & post services	5
24	Information & computer services	5
25	Financial Intermediation	5
26	Real estate	5
27	Professional & technical services	5
28	Education	5
29	Healthcare & social security services	5
30	Cultural, entertainment, & other services	5
31	Hotels & restaurants	5

Notes: These values are taken from Caliendo and Parro (2015) and Baqaee and Farhi (2024). Their notation of trade elasticity corresponds to $\theta_i - 1$ in our model.

Table B.2: Harmonized sectors

	Harmonized sector	US KLEMS	Chinese KLEMS
1	Agriculture, forestry, & fishing	1 Farms, 2 Forestry, fishing, and related activities	1 Agriculture, forestry, animal husbandry & fishery
2	Oil & gas	3 Oil and gas extraction	2 Oil & gas excavation
3	Mining	4 Mining, except oil and gas, 5 Support activities for mining	3 Coal mining, 4 Metal mining, 5 Non-metallic minerals mining
4	Utility	6 Utilities & 25 Power, steam, gas and tap water supply, 52 Waste management and remediation services	25 Power, steam, gas and tap water supply
5	Construction	7 Construction	26 Construction
6	Wood products & furniture	8 Wood products, 17 Furniture and related products	11 Saw mill products, furniture, fixtures
7	Nonmetallic mineral products	9 Nonmetallic mineral products	16 Stone, clay, and glass products
8	Primary metals	10 Primary metals	17 Primary & fabricated metal industries
9	Fabricated metal products	11 Fabricated metal products	18 Metal products (excluding rolling products)
10	Machinery	12 Machinery	19 Industrial machinery and equipment
11	Electronic products	13 Computer and electronic products	21 Electronic and telecommunication equipment
12	Electrical equipment	14 Electrical equipment, appliances, and components	20 Electric equipment
13	Transportation equipment	15 Motor vehicles, bodies and trailers, and parts, 16 Other transportation equipment	23 Motor vehicles & other transportation equipment
14	Miscellaneous manufacturing	18 Miscellaneous manufacturing,	22 Instruments and office equipment, 24 Miscellaneous manufacturing industries
15	Food, beverage & tobacco products	19 Food and beverage and tobacco products	6 Food and kindred products, 7 Tobacco products
16	Textile	20 Textile mills and textile product mills	8 Textile mill products
17	Apparel	21 Apparel and leather and allied products	9 Apparel and other textile products, 10 Leather and leather products
18	Paper products, printing & publishing	22 Paper products, 23 Printing and related support activities, 37 Publishing industries, except internet (includes software)	12 Paper products, printing & publishing
19	Petroleum & coal products	24 Petroleum and coal products	13 Petroleum and coal products
20	Chemical products	25 Chemical products	14 Chemicals and allied products

Table B-6: Harmonized sectors (continued)

	Harmonized sector	US KLEMS	Chinese KLEMS
21	Plastics & rubber products	26 Plastics and rubber products	15 Rubber and plastics products
22	Wholesale & retail trades	27 Wholesale trade, 28 Retail trade	27 Wholesale and retail trades
23	Transport, storage & post services	29 Air transportation, 30 Rail transportation, 31 Water transportation, 32 Truck transportation, 33 Transit and ground passenger transportation, 34 Pipeline transportation, 35 Other transportation and support activities, 36 Warehousing and storage	29 Transport, storage & post services
24	Information & computer services	38 Motion picture and sound recording industries, 39 Broadcasting and telecommunications, 40 Data processing, internet publishing, and other information services, 48 Computer systems design and related services	30 Information & computer services
25	Financial Intermediation	41 Federal Reserve banks, credit intermediation, and related activities, 42 Securities, commodity contracts, and investments, 43 Insurance carriers and related activities, 44 Funds, trusts, and other financial vehicles	31 Financial Intermediation
26	Real estate	45 Real estate	32 Real estate services
27	Professional & technical services	46 Rental and leasing services and lessors of intangible assets, 47 Legal services, 49 Miscellaneous professional, scientific, and technical services, 50 Management of companies and enterprises, 51 Administrative and support services	33 Leasing, technical, science & business services
28	Education	53 Educational services	35 Education
29	Healthcare & social security services	54 Ambulatory health care services, 55 Hospitals and nursing and residential care facilities, 56 Social assistance	36 Healthcare and social security services
30	Cultural, entertainment, & other services	57 Performing arts, spectator sports, museums, and related activities, 58 Amusements, gambling, and recreation industries, 60 Other services, except government	37 Cultural, sports, entertainment services; residential and other services
31	Hotels & restaurants	59 Accommodation, 60 Food services and drinking places	28 Hotels and restaurants

Table B.3: Sectoral data

	Harmonized sector	SCF	BLS earnings	Chinese value added	Service trade
1	Agriculture, forestry, & fishing	1 Agriculture, Forestry, Fishing and Hunting	1 Total private	1 Agriculture, Forestry, Animal Husbandry and Fishery industries	n.a.
2	Oil & gas	2 Mining; Construction	4 Mining and logging	2 Industry	n.a.
3	Mining	2 Mining; Construction	4 Mining and logging	2 Industry	n.a.
4	Utility	7 Others	13 Utilities	9 Others	n.a.
5	Construction	2 Mining; Construction	5 Construction	3 Construction	E Construction
6	Wood products & furniture	3 Manufacturing etc.	7 Durable Goods	2 Industry	n.a.
7	Nonmetallic mineral products	3 Manufacturing et al.	7 Durable Goods	2 Industry	n.a.
8	Primary metals	3 Manufacturing et al.	7 Durable Goods	2 Industry	n.a.
9	Fabricated metal products	3 Manufacturing et al.	7 Durable Goods	2 Industry	n.a.
10	Machinery	3 Manufacturing et al.	7 Durable Goods	2 Industry	n.a.
11	Electronic products	3 Manufacturing et al.	7 Durable Goods	2 Industry	n.a.
12	Electrical equipment	3 Manufacturing et al.	7 Durable Goods	2 Industry	n.a.
13	Transportation equipment	3 Manufacturing et al.	7 Durable Goods	2 Industry	n.a.
14	Miscellaneous manufacturing	3 Manufacturing et al.	8 Nondurable Goods	2 Industry	n.a.
15	Food, beverage & tobacco products	3 Manufacturing et al.	8 Nondurable Goods	2 Industry	n.a.
16	Textile	3 Manufacturing et al.	8 Nondurable Goods	2 Industry	n.a.
17	Apparel	3 Manufacturing et al.	8 Nondurable Goods	2 Industry	n.a.
18	Paper products, printing & publishing	3 Manufacturing et al.	8 Nondurable Goods	2 Industry	n.a.
19	Petroleum & coal products	3 Manufacturing et al.	8 Nondurable Goods	2 Industry	n.a.
20	Chemical products	3 Manufacturing et al.	8 Nondurable Goods	2 Industry	n.a.

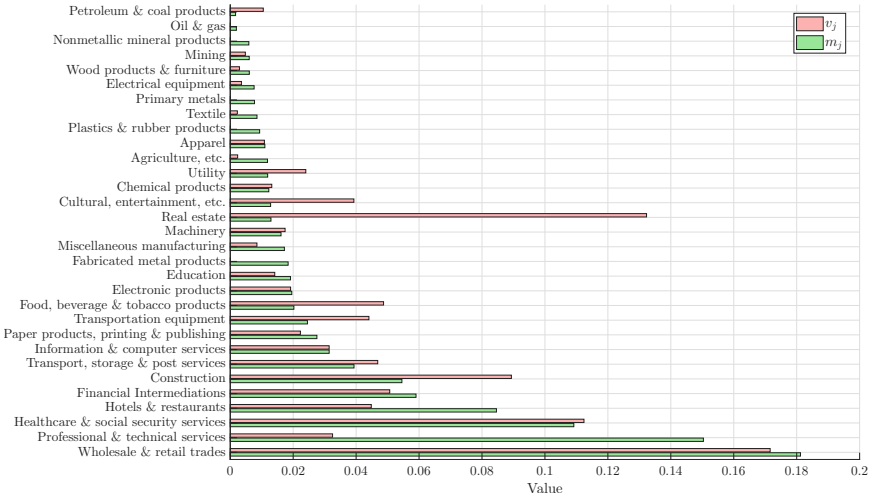
Table B-7: Sectoral data (continued)

	Harmonized sector	SCF	BLS earnings	Chinese value added	Service trade
21	Plastics & rubber products	3 Manufacturing et al.	8 Nondurable Goods	2 Industry	n.a.
22	Wholesale & retail trades	4 Wholesale and retail trade	11 Retail trade	4 Wholesale and Retail Trades	n.a.
23	Transport, storage & post services	6 Transportation et al.	12 Transportation and warehousing	5 Transport, Storage and Post	C Transport
24	Information & computer services	6 Transportation et al.	14 Information	9 Others	I Telecommunications, computer, and information services
25	Financial Intermediation	5 Publishing, finance, etc.	15 Financial activities	7 Financial Intermediation	F Insurance and pension services, G Financial services
26	Real estate	Publishing, finance, etc.	15 Financial activities	8 Ral estate	n.a.
27	Professional & technical services	6 Transportation et al.	16 Professional and business services	9 Others	A Manufacturing services on physical inputs owned by others, B Maintenance and repair services n.i.e., DA Business travel, H Charges for the use of intellectual property n.i.e., J Other business services
28	Education	7 Others	17 Private education and health services	9 Others	n.a.
29	Healthcare & social security services	6 Transportation et al.	17 Private education and health services	9 Others	n.a.
30	Cultural, entertainment, & other services	3 Manufacturing; Arts, Entertainment, and Recreation	18 Leisure and hospitality	9 Others	K Personal, cultural, and recreational services
31	Hotels & restaurants	7 Others	18 Leisure and hospitality	6 Hotels and Catering Services	DB Personal travel

Notes: Full descriptions of the SCF sectors are: 3 Manufacturing; Arts, Entertainment, and Recreation; 5 Publishing Industries; Finance and Insurance; Real Estate and Rental and Leasing; Management, Administrative, and Waste Services; Repair and Maintenance; 6 Transportation and Warehousing; Other Information Services; Professional and Technical Services; Management, Administrative, and Waste Services; Health Care.

C Supplementary Figures

(A) Final good share v_j and mass of households m_j



(B) Sales relative to mass of households S_j/m_j

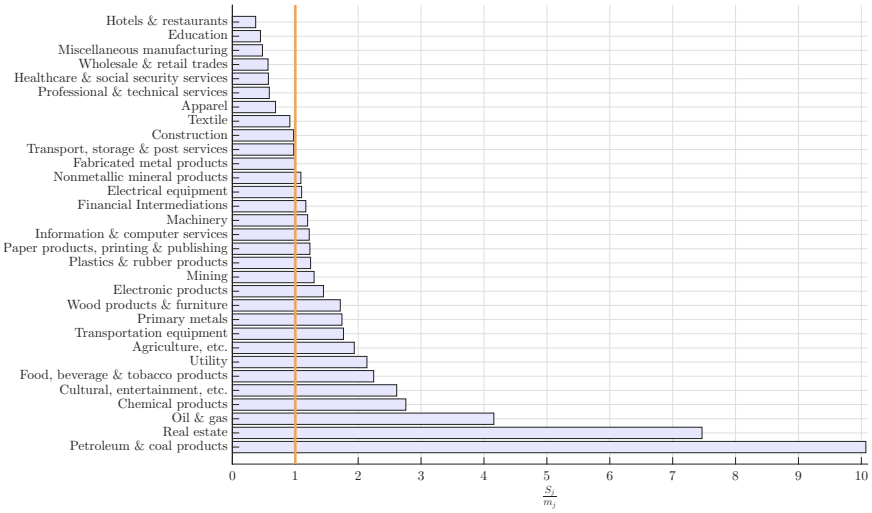


Figure C.1: Calibration of sectoral parameters

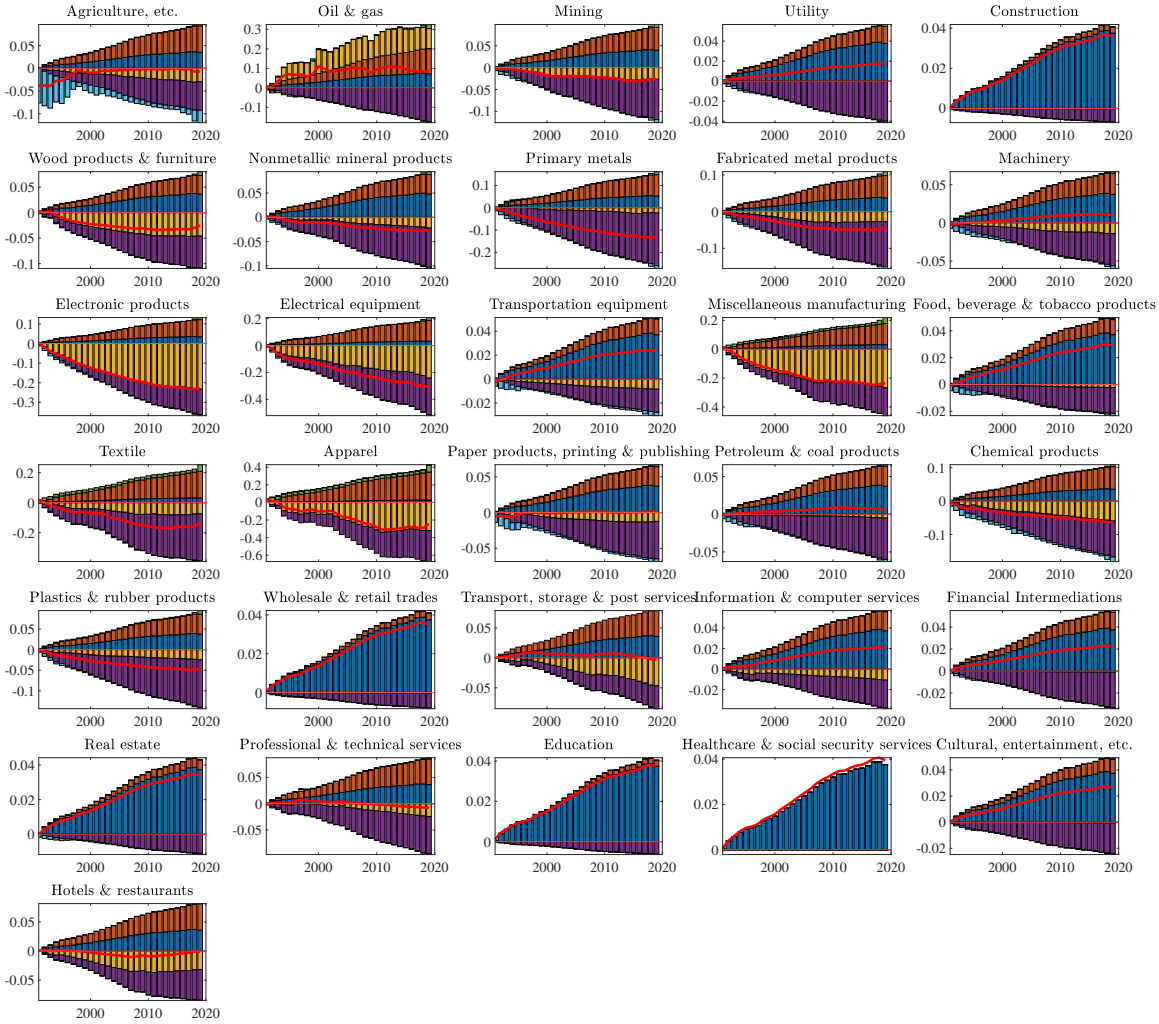


Figure C.2: Sectoral impact of globalization implied by the model

Notes: Red lines show the total impact $d \ln S_{jt}$. Bars display contributions from dC (blue), $dP^f C^f$ (orange), dA^f_j, dX^f_j (yellow), $dA^f_{j' \neq j}, dX^f_{j' \neq j}$ (purple), $d\tau$ (green), and $d\tau^f$ (light blue).

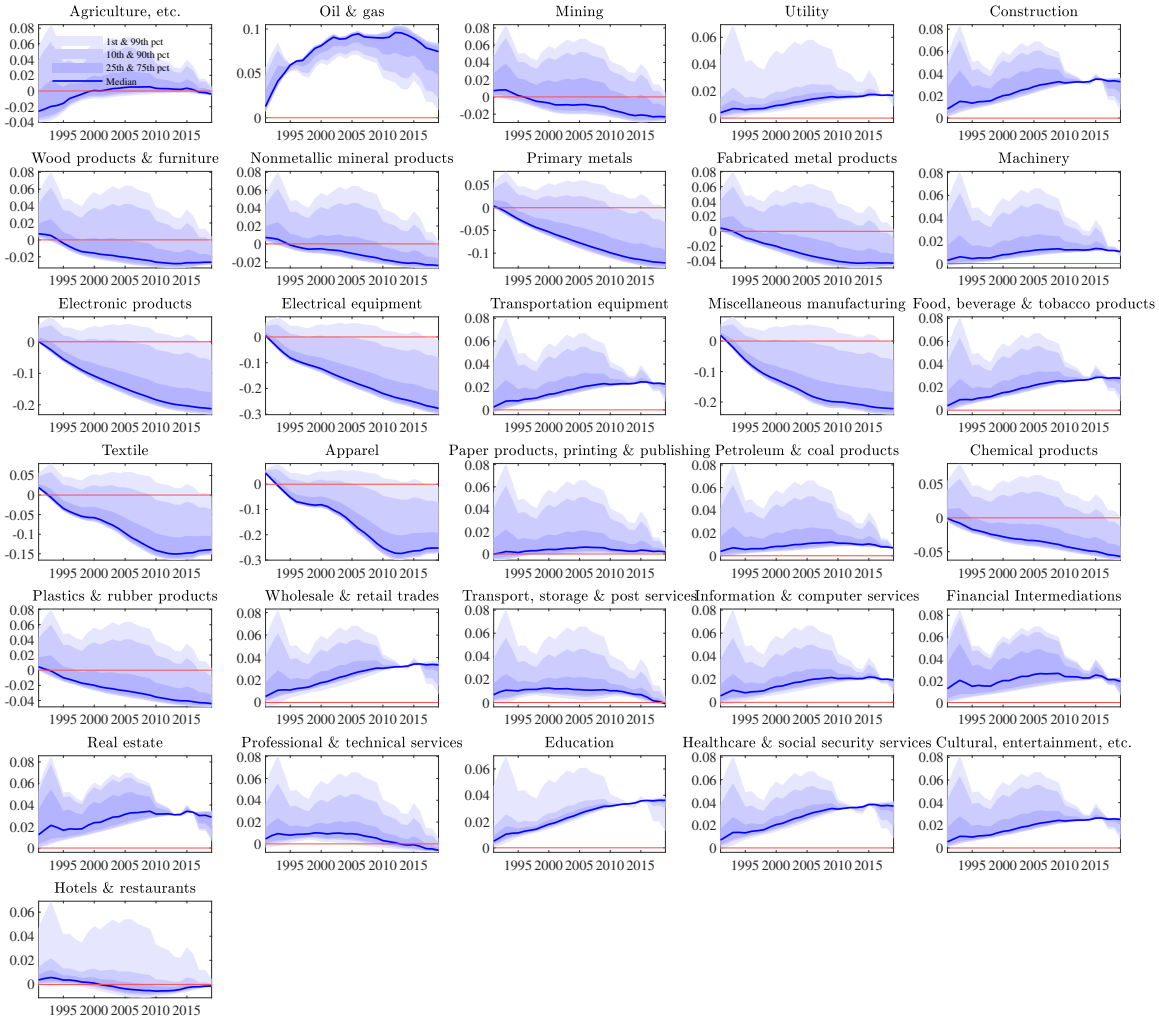


Figure C.3: Consumption impact of globalization by sector implied by the model

Notes: Consumption impact $d \ln C_t^{hj}$ among households in each sector is depicted. Blue lines display the median in each sector, while the shaded areas indicate the 1st-99th, 10th-90th, and 25th-75th percentiles, respectively.

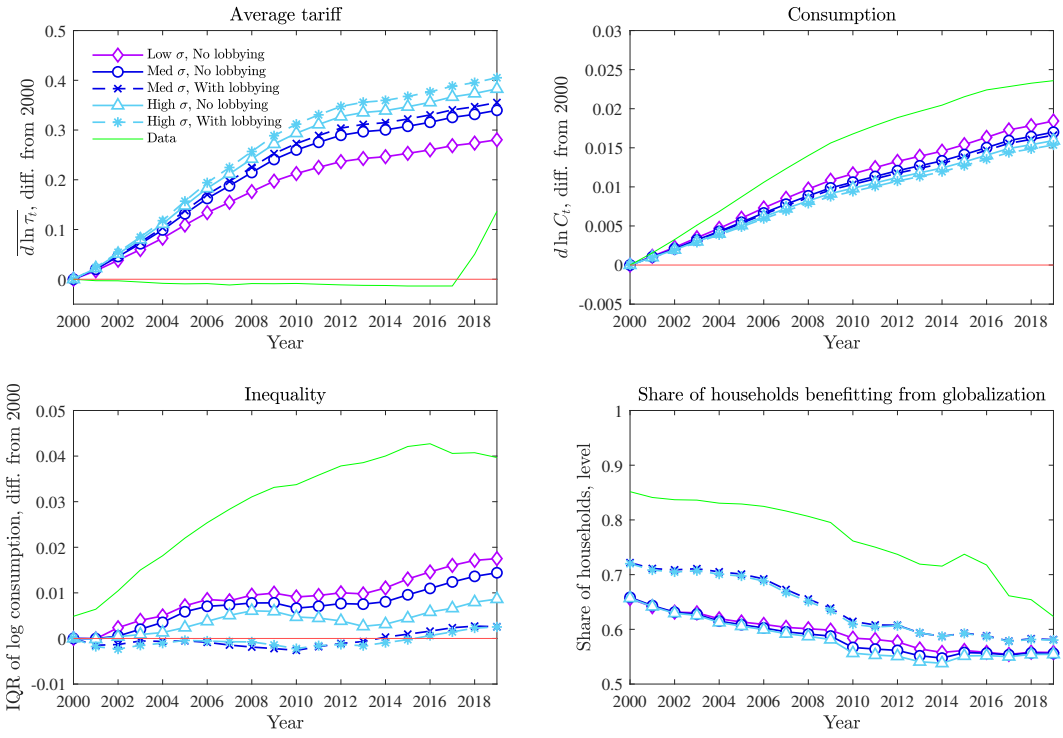


Figure C.4: Endogenous tariff determination: with tariff revenues

Notes: The average tariff is computed as $\overline{d\ln\tau_t} = \sum_{i=1}^{n_T} w_{IMi} d\ln\tau_{it}$ where $w_{IMi} = IM_i/IM = D_i(1-\tilde{\xi}_i)/\sum_{i=1}^{n_T} D_i(1-\tilde{\xi}_i)$. Parameter values are set as follows: (C1) No inequality aversion, no lobbying: $\sigma = 0$, $\eta = 0$; (C2) Moderate inequality aversion, no lobbying: $\sigma = 1.5$, $\eta = 0$; (C3) Moderate inequality aversion, with lobbying: $\sigma = 1.5$, $\eta = 0.3$; (C4) Strong inequality aversion, no lobbying: $\sigma = 3$, $\eta = 0$; (C5) Strong inequality aversion, with lobbying: $\sigma = 3$, $\eta = 0.3$.

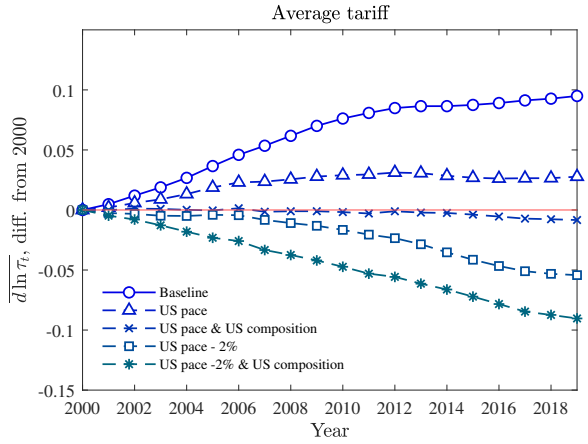


Figure C.5: Counterfactual analysis of tariff determination: Foreign growth

Notes: In the "US pace" scenario, the average growth rate in the foreign economy is reduced to that of the U.S. in the data. In the "US pace & US composition" scenario, sectoral composition is also adjusted to the U.S. one. In the last two scenarios, the average growth rate is further reduced by 2% per year so that the overall growth becomes close to zero. Other than the parameter indicated in each line, model parameters are set to (C2) of Figure 8.

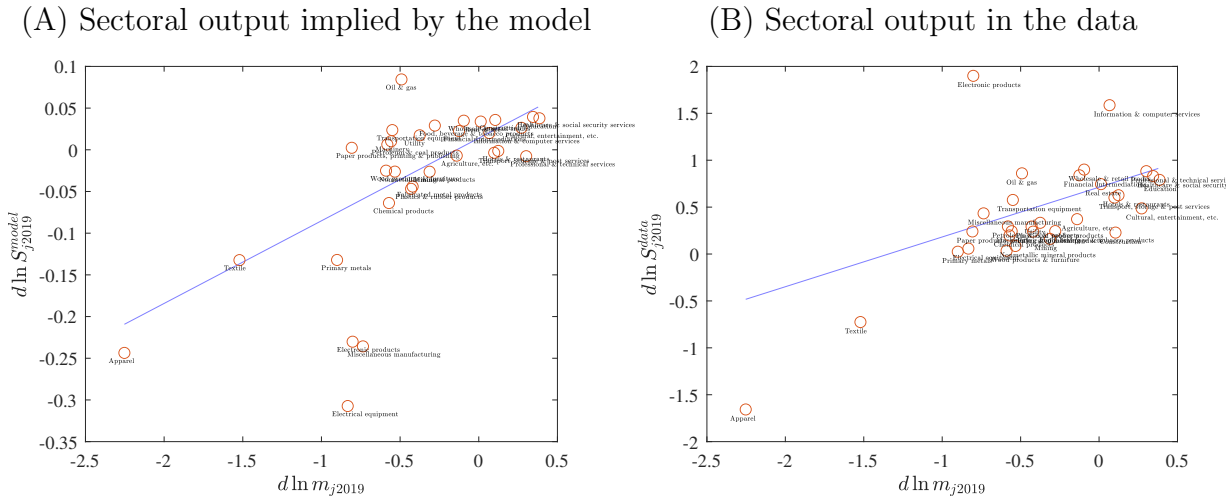


Figure C.6: Relation of labor mobility and sectoral output

Notes: The x-axis is the changes in the mass of households in each sector from 1991 to 2019, $d \ln m_{j2019}$. The y-axis is the changes in sectoral output implied in the model, $d \ln S^{model}_{j2019}$, and those in the data, $d \ln S^{data}_{j2019}$, respectively.

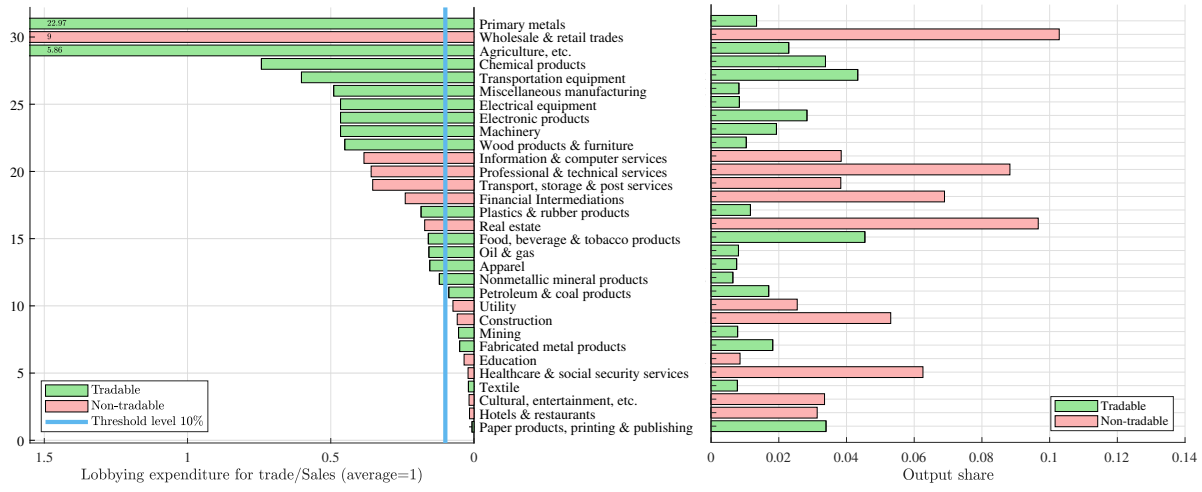


Figure C.7: Lobbying intensity and output share

Notes: Lobbying intensity is defined as lobbying expenditure as a share of sales. Thresholds are set to 10% of the average intensity.