NBER WORKING PAPER SERIES

THE UNCHARTED WATERS OF INTERNATIONAL TRADE

Pol Antràs

Working Paper 33312
http://www.nber.org/papers/w33312

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
December 2024

This article is based on my 2024 FBBVA Lecture of the European Economic Association given at the 2024 ASSA meeting in January and at FBBVA headquarters in Madrid in December 2024. I am grateful to Evgenii Fadeev, Teresa Fort, Elhanan Helpman, Adrian Kulesza, Marc Melitz, and Felix Tintelnot for feedback on the material covered in this paper. Jiaxuan Lu provided excellent research assistance. Three anonymous referees shared excellent suggestions that improved several aspects of the paper. I thank the BBVA Foundation and the Ferrante Fund at Harvard University for financial support. The views expressed herein are those of the author and do not necessarily reflect the views of the National Bureau of Economic Research.

The Uncharted Waters of International Trade
Pol Antràs
NBER Working Paper No. 33312
December 2024
JEL No. B27, D21, D22, F12, F14, F23, F52, L11, L13, L22

ABSTRACT

The field of international trade has undergone significant theoretical and empirical advancements over the last twenty-five years. A key breakthrough has been the emergence of firm-level approaches to studying exporting, importing, and global value chains. The field has also experienced a quantitative revolution, driven by medium-scale models that rapidly assess the implications of trade cost shocks on real income. Additionally, a branch of the empirical literature has unshackled itself from the discipline of theoretical frameworks and from traditional data sources. Yet, several underexplored areas, or `uncharted waters,' remain in international trade research. I outline new potential areas for theoretical research, including incorporating oligopolistic (strategic) behavior into core models, and fostering greater cross-disciplinary collaboration with other fields in economics and social sciences, such as behavioral economics or political science. I also discuss potential uncharted waters for empirical trade economists, while identifying potential new sources of data and ways in which official trade statistics could be improved. Finally, I explore how big data and artificial intelligence could reshape the design of international trade policy in coming years.

Pol Antràs
Department of Economics
Harvard University
1805 Cambridge Street
Littauer Center 210
Cambridge, MA 02138
and NBER
pantras@fas.harvard.edu

1 Introduction

International trade research occupies a pivotal place in the history of economic thought. Rooted in classical economics, its origins trace back to Adam Smith's critique of mercantilist policies and to David Ricardo's seminal concept of comparative advantage, which illuminated the benefits of specialization and trade. Building on these foundations, neoclassical trade theory provided a solid framework for analyzing the interplay of technological change, factor endowments, and trade policies in shaping economic prosperity. By the late 20th century, trade theory expanded beyond perfect competition to embrace the complexities of market imperfections, scale economies, and product differentiation, exemplified by the pioneering work of Paul Krugman and others in what is now known as *New Trade Theory*.

Despite this illustrious lineage, international trade research has undergone transformative developments over the past twenty-five years, fueled by breakthroughs in data, methodologies, and theory. Notably, the seminal work of Bernard and Jensen (1999) and Melitz (2003) revolutionized the field by shifting the focus from industries and products to firms as the central units of empirical and theoretical analyses of international trade flows. This firm-level perspective has significantly broadened the scope of organizational decisions examined in global firms. Researchers have highlighted that firms engage not only in exporting but also in importing (Antràs et al., 2017b), multinational activity (Helpman et al., 2004), and the organization of global value chains (Antràs and Chor, 2013). In the process, firms make key strategic organizational design decisions to manage cross-border connections with offshore production units efficiently (Antràs and Helpman, 2004).

Simultaneously, the field has witnessed a quantitative revolution, marked by the development of medium-scale models that allow for quick, back-of-the-envelope estimates of the implications of trade cost shocks on real income (Eaton and Kortum, 2002; Arkolakis et al., 2012). Additionally, a growing body of empirical work in international trade has been 'unshackled' from the constraints of traditional trade theory, leveraging new data sources and innovative methods to provide fresh insights into the nature of global trade, in many cases exploring topics that had not yet been developed theoretically (e.g., Autor et al., 2013; Atkin et al., 2017).

While the field's intellectual history over the past quarter-century is a resounding success, this surge of innovative work may inadvertently foster a perception among young scholars that many key questions in international trade have been settled. A starting premise of this paper is that we may be seeing the early signs of a research 'congestion' in the international trade field, somewhat reminiscent of the congestion in real-life international trade flows observed during the COVID-19 pandemic and in early 2024. Although I lack systematic evidence to substantiate this claim, anecdotal observations and interactions with my PhD students at Harvard suggest that many talented young researchers are gravitating toward other fields, such as spatial economics,

industrial organization, and macroeconomics, due to a perception of diminishing returns in international trade research.[1]

The primary goal of this paper is to highlight several underexplored areas—what I call 'uncharted waters'— for young researchers trying to leave an imprint in the international trade field. The paper is structured as follows. Section 2 reviews major advances in the field over the last twenty-five years, the 'charted waters' of international trade. Section 3 identifies gaps in the theoretical literature, including the need for research into oligopolistic competition, the intersection of trade and national security, and the implications of behavioral economics for trade policy. Section 4 discusses potential uncharted waters for empirical trade economists, while outlining potential new sources of data and ways in which official trade statistics could be improved. Finally, Section 5 highlights a few underexplored areas in the analysis of trade policy, with particular attention to the role of artificial intelligence (AI) and big data in reshaping trade policy.

Before proceeding, I offer four caveats. First, some of the uncharted waters identified in this paper have been previously explored, albeit with less advanced tools; revisiting them with modern 'vessels' may allow researchers to bring back hidden treasures that previous researchers missed. Second, because these areas remain largely uncharted, their navigability is uncertain. However, I have purposefully chosen routes that I believe offer relatively safe passage to abundant riches. Third, while this paper is primarily aimed at young researchers, parts of my discussion, particularly in Sections 4 and 5, are also directed at data gatekeepers and policy makers. Finally, though the focus throughout the paper is on topics related to international trade, some of the suggested avenues for cross-disciplinary collaboration may also interest researchers in other fields, especially those in our sister field of spatial economics.

2 The Charted Waters

The main goal of this paper is to outline potential uncharted waters for international trade researchers. As a mentor at Harvard pointed out to me, however, it would not be wise to describe what the field has failed to do without first briefly describing what the field has actually achieved over the past two and a half decades. This section thus covers the recently charted waters of international trade. Researchers in the trade field may find this section familiar and

[1]When I first presented this paper at the 2024 ASSA meetings in San Antonio, I provided some rough evidence documenting a significant decline in the number of job-market candidates in international trade compared to those in spatial economics during the period 2017–24. This was inferred from data collected by Jonathan Dingel's blog (tradediversion.net). But, as many later pointed out, this may just reflect the explosion of work in spatial economics, rather than a decline in interest in international trade. Jonathan Dingel has documented a modest decline in the number of trade candidates starting in 2017, but this is consistent with trends observed in other fields (see https://tradediversion.net/2024/08/19/the-surprisingly-small-decline-in-trade-jmps/).

choose to skip it, but the hope is that it may be of use to general-interest audiences.

In my view, the last twenty-five years have witnessed four major developments in international trade research: (i) the rise of firm-level approaches to exporting decisions, (ii) the study of global production decisions, (iii) advances in quantitative trade theory, and (iv) empirical work that has been 'unshackled' from theory constraints and from traditional data sources. Although these approaches are closely intertwined, it is useful to cover them one at a time.

2.1 Firm-Level Approach to Exporting

In recent years, international trade theory has experienced a transformative shift, echoing the paradigm shift that led to the rise of *New Trade Theory* during the late 1970s and early 1980s (Krugman, 1980; Helpman and Krugman, 1985). This development aligns with Kuhn's (1997) analysis of scientific revolutions, whereby the need for a fresh framework is driven by the discovery of empirical findings that contradict predictions of existing models. Central to understanding these discrepancies is recognizing that Krugman-style models treat all firms within a sector as fundamentally identical. While firms produce differentiated goods, they share a common cost structure, and preferences treat all product varieties symmetrically with a uniform elasticity of substitution. Consequently, firm behavior within industries turns out to be identical for all firms. Moreover, under the standard assumption of iceberg (or ad valorem) trade costs, these models predict that *every* firm in a differentiated-goods sector will export its products to *all* countries worldwide.

However, during the 1990s, a series of empirical studies utilizing newly available longitudinal plant- and firm-level data from various countries revealed a series of new facts that were inconsistent with the tenets of *New Trade Theory*. I next document five stylized facts that were particularly salient and formed the basis for theoretical work in subsequent years.

A. Five Stylized Facts on Exporting

First, instead of the universal exporting predicted by Krugman-style models, in the real world, only a small proportion of firms engage in exporting, with most exporting firms targeting just a few markets. This fact is illustrated for the United States in Table 1. As the last row indicates, only 35% of all manufacturing firms in the United States exported in 2007. Furthermore, this is not driven by universal exporting in some sectors and zero exporting in import-competing sectors: the share of firms that export is highest among firms in 'Computer and Electronic Products', reaching 75% export participation, but this share is positive and significantly lower than 50% in most sectors.

Second, the distribution of exporters is highly skewed. Despite accounting for only 0.03% of all US manufacturing firms (Bernard et al., 2009), Figure 1 shows that the top 1% of exporters

Table 1: Firm Participation in International Trade

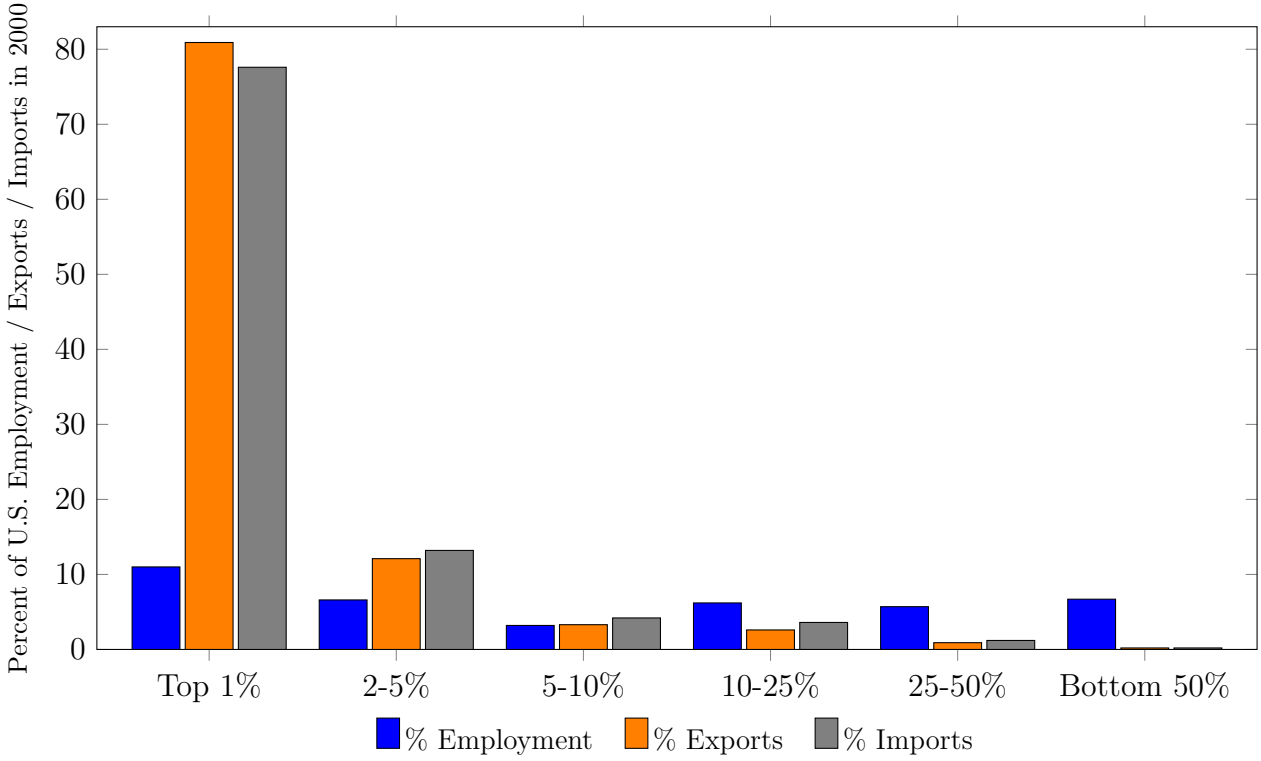
NAICS Industry	Percent of all firms (1)	Fraction of firms that export (2)	Fraction of firms that import (3)	Fraction of firms that import and export (4)
311 Food manufacturing	6.8	0.23	0.15	0.10
312 Beverage and tobacco product	0.9	0.30	0.18	0.11
313 Textile mills	0.8	0.57	0.44	0.37
314 Textile product mills	2.7	0.19	0.14	0.09
315 Apparel manufacturing	3.6	0.22	0.23	0.15
316 Leather and allied product	0.3	0.56	0.53	0.40
321 Wood product manufacturing	4.8	0.21	0.09	0.06
322 Paper manufacturing	1.5	0.48	0.25	0.21
323 Printing and related support	1.1	0.15	0.05	0.03
324 Petroleum and coal products	0.5	0.34	0.18	0.14
325 Chemical manufacturing	3.3	0.65	0.40	0.36
326 Plastics and rubber products	3.9	0.59	0.34	0.29
327 Nonmetallic mineral product	4.3	0.19	0.15	0.09
331 Primary metal manufacturing	1.5	0.58	0.32	0.29
332 Fabricated metal product	20.6	0.30	0.12	0.10
333 Machinery manufacturing	8.7	0.61	0.30	0.28
334 Computer and electronic products	3.9	0.75	0.50	0.47
335 Electrical equipment, appliance	1.7	0.70	0.46	0.41
336 Transportation equipment	3.4	0.57	0.35	0.31
337 Furniture and related product	6.5	0.16	0.12	0.07
339 Miscellaneous manufacturing	9.3	0.32	0.20	0.17
Aggregate manufacturing	100.0	0.35	0.20	0.16

Source: Bernard et al. (2018b). Data are for 2007 and are for firms that appear in both the US Census of Manufactures and the Linked-Longitudinal Firm Trade Transaction Database (LFTTD). Column 1 summarizes the distribution of manufacturing firms across three-digit NAICS industries. Remaining columns report the percent of firms in each industry that export, import, and do both.

accounted for a staggering 80.9% of US manufacturing exports. The top 2-5% and top 5-10% accounted for an additional 12.1% and 3.3%, respectively, leaving the contribution of the bottom 90% at a mere 3.7% of total US exports. This phenomenon is not special to the US. The top 1% of exporters accounted for 77% of exports in Hungary, 68% of exports in France, 59% of exports in Germany, 53% of exports in Norway, 51% of exports in China, 48% of exports in Belgium, 47% of exports in Denmark, 42% of exports in the United Kingdom, and 32% of exports in Italy (Mayer and Ottaviano, 2008; Manova and Zhang, 2012; Ciliberto and Jäkel, 2017).

Why are exporters often in the minority, even in an economy's most competitive sectors, and why are aggregate exports so concentrated among a small number of firms? The third stylized fact unveiled by empirical work in the late 1990s is that intraindustry heterogeneity in firm

Figure 1: Distribution of U.S. Exporters or Importers in 2000



Source: Bernard et al. (2009). Figure reports the percent of employment, exports and imports for US firms which are responsible for the top 1, 5, 10, 25, and 50 percentiles of the total export (blue and orange bars) and import (gray bar) distributions. See Bernard et al. (2009) for further details.

performance (scale, productivity, etc.) appears to be of first-order importance for explaining firm selection into exporting. This is both because within-sectoral heterogeneity in performance is very large – almost as large within sectors than across sectors (Bernard et al., 2003) – and because this heterogeneity is correlated with trade status. More specifically, exporters appear to be systematically different from non-exporters: they are larger, more productive, and operate at higher physical capital and skill intensities. As shown in Table 2, borrowed from Bernard et al. (2018b), these differences are very large. US exporters are on average 1.11 log points (or 203%) larger in terms of employment than non-exporters in the same sector, and even controlling for the number of employees, exporters feature substantially higher sales, labor productivity, TFP, wages, capital intensity and skill intensity. This suggests that some underlying differences in firm productivity or product appeal are key for understanding why some firms venture out into export markets, while other firms do not, something that trade economists refer to as the *extensive margin* of exports.[2]

A fourth stylized fact is that this extensive margin of trade is a key factor in explaining

[2]More recent work by Hottman et al. (2016) has documented that variation in firm appeal and product scope explains at least four fifths of the variation in firm sales.

Table 2: Exporter and Importer Premia

	Exporter premia (1)	Importer premia (2)	Exporter and importer premia (3)
log employment	1.11	1.20	1.39
log shipments	0.24	0.32	0.36
log value added per worker	0.21	0.25	0.28
log TFP	0.04	0.03	0.03
log wage	0.10	0.09	0.11
log capital per worker	0.20	0.28	0.34
log skill per worker	0.11	0.16	0.18

Source: Bernard et al. (2018b). Data are for 2007 and are for firms that appear in both the US Census of Manufactures and the LFTTD. All results are from bivariate OLS regressions of a given firm characteristic on the dummy variable noted at the top of each column as well as industry fixed effects. All specifications except for employment also include firm employment as an additional control. All results are significant at the 1 percent level. See Bernard et al. (2018b) for further details.

differences in aggregate exports across destinations. It is well known that the gravity equation of trade predicts that bilateral exports from one country to various other countries should increase in the GDP of the importing countries but should decline in their geographical distance (Head and Mayer, 2014). A less well-known fact is that, as Table 3 indicates, these patterns are largely driven by the fact that more firms from the exporting country select into selling to the importing country. More than 70% of the larger trade volumes to larger and less distant markets are driven by selection into exporting, rather than by firms selling higher amounts to those markets (see columns 1 and 2 of Panel A). When considering selection into exporting at the firm-product level, this narrower extensive margin accounts for more than 100% of the variation in exporting (see columns 3 and 4 of Panel A). These results indicate that even if one's goal is to understand *aggregate* bilateral trade flows, models with intraindustry heterogeneity in productivity have the potential to sharpen our understanding of how those aggregate flows are determined.

A fifth final stylized fact unveiled in the early 2000s relates to the intraindustry heterogeneity playing a crucial role in shaping the impacts of trade liberalization. As documented by Pavcnik (2002) and Trefler (2004) among others, these episodes often lead to a reallocation of market shares toward more productive firms, thereby boosting aggregate productivity even when firm-level productivity itself is not affected by such trade reforms.

Table 3: Gravity and Aggregate U.S. Exports and Imports, 2000

Panel A: Exports

	Log of total exports value (1)	**Log of number of exporting firms** (2)	**Log of number of exported products** (3)	**Log of export value per product per firm** (4)
Log of GDP	0.98	0.71	0.52	−0.25
	(0.04)	(0.04)	(0.03)	(0.04)
Log of Distance	−1.36	−1.14	−1.06	0.84
	(0.17)	(0.16)	(0.15)	(0.19)
Observations	175	175	175	175
R^2	0.82	0.74	0.64	0.25

Panel B: Imports

	Log of total import value (1)	**Log of number of importing firms** (2)	**Log of number of imported products** (3)	**Log of import value per product per firm** (4)
Log of GDP	1.14	0.82	0.71	−0.39
	(0.06)	(0.03)	(0.03)	(0.05)
Log of Distance	−0.73	−0.43	−0.61	0.31
	(0.27)	(0.15)	(0.15)	(0.24)
Observations	175	175	175	175
R^2	0.69	0.78	0.74	0.25

Source: Bernard et al. (2007a). Data are from the 2000 Linked-Longitudinal Firm Trade Transaction Database (LFTTD). Each column reports the results of a country-level ordinary least squares regression of the dependent variable noted at the top of each column on the covariates listed on the left. Regressions include a constant. Products are defined as ten-digit Harmonized System categories. All results are statistically significant at the 1 percent level.

B. Theoretical Developments

Inspired by these empirical advances, 21st century trade theory has evolved to incorporate intra-industry firm heterogeneity. A foundational contribution to this literature is the work of Melitz (2003), which builds on the structure of Krugman (1980) emphasizing the importance of increasing returns to scale, imperfect competition, and product differentiation in shaping bilateral trade flows. More specifically, in Krugman (1980), a continuum of firms in each country produce differentiated varieties of a sector's goods using technologies that feature economies of scale due the combination of a fixed overhead cost and a constant marginal cost of production, all expressed in terms of labor (the only factor of production in the model). Because firms produce differentiated goods, they have certain market power leading to imperfectly competitive markets. Krugman (1980) models product differentiation via a representative consumers in

each country having constant-elasticity-of-substitution (CES) preferences over the varieties produced by different firms (both domestic and foreign). Imperfect competition takes the form of monopolistic competition, whereby strategic effects are ignored (technically because of the existence of a continuum of firms), and free entry ensures that profits are zero in equilibrium.

The main innovations in Melitz (2003) relative to the prior work of Krugman (1980) are (i) the introduction of firm heterogeneity in the marginal cost of production, (ii) the existence of fixed costs of exporting, and (iii) an astute recasting of the free entry condition in *ex-ante* terms, which still permits the construction of a general-equilibrium model with firms obtaining zero expected profits. Melitz (2003) shows that these small deviations from Krugman (1980) generate a series of results that line up closely with the five stylized facts described above. Quite intuitively, the combination of heterogeneous productivity levels and fixed costs of exporting leads to selection into exporting by which only the most productive firms can overcome the overhead costs of exporting. Thus, exporters may well be in the minority (Fact #1), and if the distribution of productivity is sufficiently skewed, the distribution of exports will be skewed as well (Fact #2). Furthermore, selection into exporting naturally implies that exporters are better performers than non-exporters (Fact #3). With heterogeneous firms, aggregate trade flows are shaped by the combination of an extensive margin (which firms export to which markets) and an intensive margin (how much firms sell on average in each market in which they are active). Less trivially, for certain distributions of productivity, it can be shown that the extensive margin should be *the* dominant force shaping aggregate trade flows (Fact #4).[3] Finally, Melitz (2003) demonstrates that a process of trade liberalization (i.e., a reciprocal reduction in trade costs) leads to intra-industry reallocations that enhance aggregate productivity by shifting market shares from unproductive firms—forced to shrink or exit—toward highly productive firms that gain from the opportunity to export to foreign markets (Fact #5).

The seminal work on exporting of Melitz (2003) has been extended in a variety of fruitful ways. Some authors have explored variants of the model with alternative (non-CES) demand systems (Melitz and Ottaviano, 2008; Zhelobodko et al., 2012). Others have introduced Heckscher-Ohlin features (Bernard et al., 2007b), the possibility that firms are multi-product firms (Bernard et al., 2011; Mayer et al., 2014), or increasing marginal cost schedules (Almunia et al., 2021). Several other applications and extensions of the model are reviewed in Melitz and Redding (2014a).

[3]When the distribution of marginal costs is assumed to follow a Pareto distribution, as in Chaney (2008), Helpman et al. (2008), or Eaton et al. (2011), the extensive margin of trade is in fact predicted to explain one hundred percent of the variation in bilateral trade flows. Subsequent work by Head et al. (2014) and Fernandes et al. (2023), among others, shows that a positive but dominated role for the intensive margin of trade can be obtained by assuming that the distribution of productivity is log-normal rather than Pareto.

2.2 Global Sourcing, Multinational Firms and Global Value Chains

Although a large share of the trade literature continues to focus on models of exporting, a parallel literature originating also in the early 2000s pushed the view that selection into exporting is just one of the many decisions that global firms face in the modern world economy. When producing their goods, firms do not only use local factors of production, but often embody imported intermediate inputs and services into those exported goods. Thus, firms face nontrivial *importing* or *global sourcing* decisions. Furthermore, exports are not the only vehicle for firms to make their goods available to foreign consumers. In some cases, firms may want to assemble their goods in multiple locations, perhaps to be able to deliver their goods to foreign consumers while incurring lower transportation costs. In those circumstances, exporters become *multinational firms*.[4] More generally, modern manufacturing processes are highly complex and involve several distinct stages that are key for delivering a final consumer good: firms then face complicated decisions regarding how to organize these global value chains across countries. In sum, a body of work has pushed the view that when researchers aim to interpret international trade transactions, it can be fruitful to depart from models in which those transactions relate to non-multinational exporters selling finished products to foreign consumers, and instead consider these transactions as being specific slices of complex global value chains.

I next overview three related sub-branches of this literature focused on (i) importing and global sourcing; (ii) multinational firm activity; and (iii) global value chain activity.

A. Importing and Global Sourcing

Several pieces of evidence can be invoked to substantiate the need for richer conceptual frameworks than the workhorse model of Melitz (2003). Perhaps most notably, the vast majority of world trade is *not* in finished products: it has been estimated that trade in intermediate inputs accounts for as much as two-thirds of world trade (Johnson and Noguera, 2012). This implies that global firms not only export but also import. Indeed, in the tables and figures I invoked to motivate the need for models of selection into exporting, there are analogous facts that justify the need to study firms' selection into importing or global sourcing. More specifically, importers in the US are in the minority (Table 1, column 3), the distribution of US imports is as skewed as that for exports (Figure 1; gray bars), importers are larger, more productive, and more capital and skill intensive than non-importers (Table 2, column 2), and the cross-sectional variation in aggregate import volumes is largely driven by the extensive margin of imports (Table 3, columns 3 and 4 of Panel B). Antràs et al. (2017b) further document that US importers are not only larger than non-importers, but that their relative size advantage

[4]To be perfectly precise, these firms become multinationals only when they choose to control and manage those foreign assembly plants (see Antràs, 2015).

is also increasing in the number of countries from which they source.[5] These facts are jointly suggestive of sizable country-level fixed costs of sourcing, which limit the ability of small firms to select into importing from a large number of countries.

A variant of the Melitz (2003) model emphasizing trade in intermediate inputs and the relevance of fixed costs of importing was first proposed by Antràs and Helpman (2004). They presented a stylized two-country model in which heterogeneous final-good producers combine labor and inputs in production, and make decisions about whether to source inputs domestically or import them from abroad, while at the same time deciding whether to source these inputs through arm's-length contracts or within the boundaries of the firm. Their main focus was on studying how firms' sourcing decisions depend on productivity, trade costs, and contracting environments.[6]

A subsequent literature emphasized that global sourcing is not only shaped by firm-level productivity levels, but that firm performance and productivity are in turn enhanced by importing foreign inputs (Amiti and Konings, 2007; Goldberg et al., 2010; Halpern et al., 2015). Building on these insights, Antràs et al. (2017b) study the extensive and intensive margins of firms' global sourcing decisions in a multi-country sourcing model in which heterogeneous firms self-select into importing based on their productivity and country-specific variables. Unlike canonical models of exporting à la Melitz (2003), in which decisions across exporting markets are independent from each other, Antràs et al. (2017b) demonstrate that global sourcing decisions naturally interact through the firm's cost function, leading to complementarity or substitutability among source countries in reducing firms' marginal costs. The paper identifies key determinants of these decisions, such as firm core productivity, country-specific fixed and variable costs of sourcing, and illustrates the implications of global sourcing for firm behavior and aggregate trade patterns. Empirically, Antràs et al. (2017b) estimate the model using US customs data merged with US Census data and highlight that firms' sourcing decisions follow a hierarchical structure: more productive firms import from a broader set of countries.[7] The structural estimation identifies fixed costs of sourcing, revealing they vary significantly by

[5]More specifically, US firms that import from one country are more than twice the size of non-importers, firms that source from 13 countries are about four log points larger, and firms sourcing from 25 or more countries are over six log points bigger than non-importers (Antràs et al., 2017b).

[6]Other early contributions to the literature on offshoring and global sourcing include the work of Feenstra and Hanson (1997), Antràs (2003), Antràs et al. (2006), and Grossman and Rossi-Hansberg (2008), but none of these contributions emphasized intraindustry heterogeneity in firm-level decisions. Grossman and Rossi-Hansberg (2008) however studied interesting implications arising from heterogeneity in offshorability across tasks performed in production.

[7]To solve the computational challenges posed by these interdependencies, Antràs et al. (2017b) develop an iterative algorithm inspired by Jia (2008). This algorithm leverages lattice theory to iteratively refine sourcing strategies, reducing the dimensionality of the problem while maintaining accuracy. An active literature that includes the work of Arkolakis et al. (2023), Alfaro-Urena et al. (2023) and Kulesza (2024) has developed alternative algorithms to solve more complex combinatorial discrete choice problems than those envisioned by Antràs et al. (2017b).

country and depend on factors like distance and language.

B. Multinational Firms

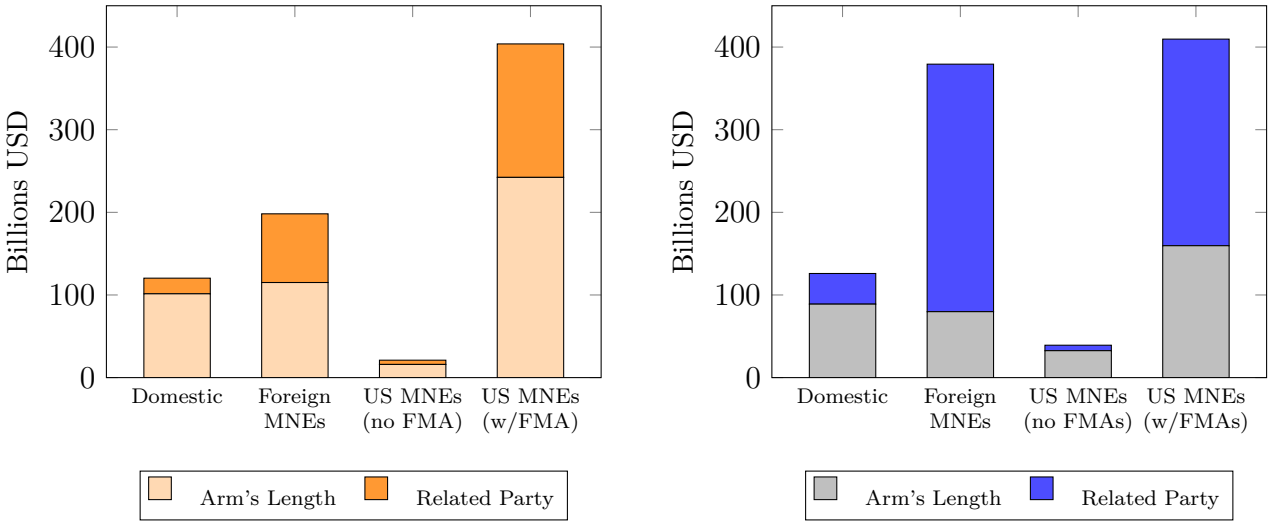
The same type of empirical studies utilizing longitudinal plant- and firm-level datasets that demonstrated the importance of selection into exporting and importing also underscored the importance of multinational firms (MNEs) in global trade. For instance, Bernard et al. (2009) identified trade transactions involving MNEs by flagging all firms with any related-party trade transactions, and found that roughly 90 percent of both U.S. exports and imports in their 2000 sample flowed through multinational firms. Using a newly merged data on US firms' exports and imports, and their global production locations in 2007, Antràs et al. (2024) estimate that around 80% of US exports and imports are accounted for by US firms that manufacture goods both in the US as well as in foreign countries. This is illustrated in Figure 2, which disaggregates these exports and imports into those carried out by Foreign-based MNEs and those carried out by US-based MNEs (with or without foreign manufacturing affiliates or FMAs). These trade flows are further disaggregated into those transacted at arm's-length and those transacted within the boundaries of MNEs. The figure confirms that exports and imports of non-MNEs constitute a very small share of aggregate exports and imports, and that the majority of MNE-mediated trade flows are intrafirm in nature, especially on the import side.[8]

MNEs may dominate aggregate trade flows simply because they are larger and more productive than domestic firms. Still, as shown by Antràs et al. (2024), US MNEs import and export more than domestic firms, even after controlling for a number of firm characteristics, including firm age, US sales, and total US establishments. This suggests that the fact that the production activities of MNEs are not solely centered in their home market leads them to be more trade-oriented than comparable domestic firms. Indeed, US exports and imports mediated by MNEs appear to be shaped by these firms' offshore production activities: MNEs are more likely to trade with countries in which they have affiliates and also with other countries within their affiliates' region (see Antràs et al., 2024).

The fact that US trade patterns are affected by what MNEs do abroad is not too surprising when one realizes the scale of these foreign operations. As shown in Figure 3, sales of foreign affiliates of US MNEs (with foreign manufacturing affiliates, or FMAs) are comparable in magnitude (about three-quarters) to the sales of US establishments of those firms. It can also be inferred from these figures that offshore-produced sales are about four times larger than US establishments' exports, thereby showing that most 'US-branded' products are made available to foreign consumers via offshore production rather than via exports from the US, in contrast

[8]The fact that some 'domestic' firms (i.e., non-MNEs) report positive values for related-party trade in their customs forms partly explains the difference between the estimates of MNE-mediated trade in Bernard et al. (2009) and in Antràs et al. (2024).

Figure 2: Manufacturing Firm Exports and Imports in 2007 by Firm and Transaction Types



(a) Manufacturing Firms' US Exports in 2007 **(b)** Manufacturing Firms' US Imports in 2007

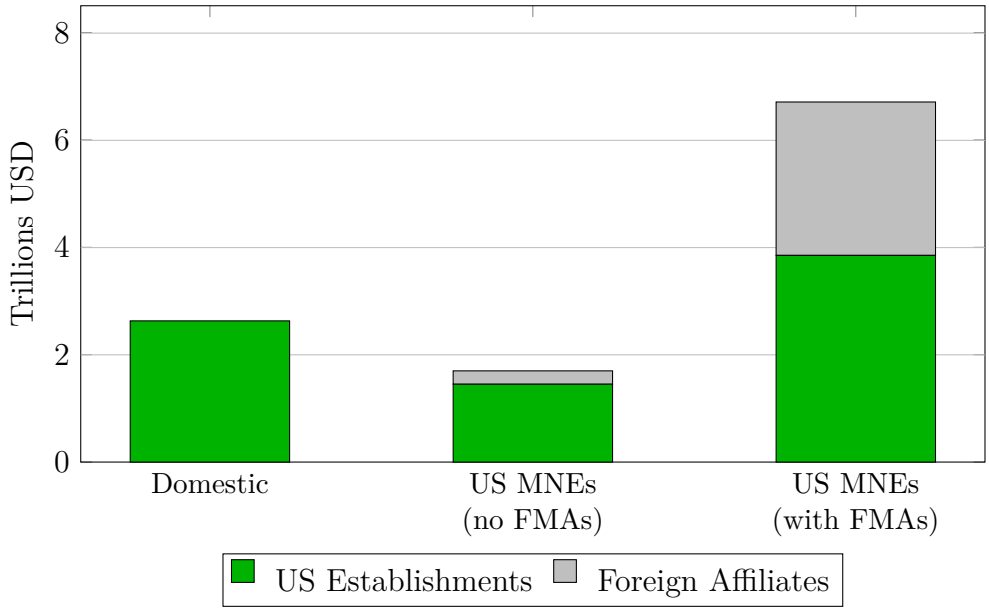
Source: Antràs et al. (2024). The data sources are the 2007 Longitudinal Business Database, Economic Censuses, Longitudinal Firm Trade Transactions Database, BEA inward and outward surveys. Table presents US imports and exports (both arm's-length or related party) by firm type. 'US MNEs (no FMAs)' refers to US-based MNEs that own no foreign manufacturing affiliates. Sample is all firms with US establishments in 2007. See Antràs et al. (2024) for more details.

with how those sales are modeled in workhorse models of firm-level exporting.

The quantitative importance of MNEs in the world economy has been acknowledged by trade economists for decades, but recent years have seen an explosion of firm-level approaches to the study of multinational activity.[9] Helpman et al. (2004) develop a stylized two-country framework explaining how heterogeneous firms decide between exporting and engaging in MNE activity to make their goods available to foreign consumers. Their model shows that only the most productive firms in an industry can overcome the high fixed costs of establishing foreign affiliates, while less productive ones export, and the least productive serve only the domestic market. Tintelnot (2017) and Arkolakis et al. (2018) both extend the analysis in Helpman et al. (2004) to a multi-country general equilibrium environment. In multi-country environments, firms face a combinatorial discrete choice problem associated with the choice of the set of locations in which to produce. This choice takes into account the fixed costs of activating those production locations, and the trade costs involved in shipping their goods from all active assembly locations to the markets in which those goods are sold. These two papers differ in how the various fixed costs of exporting or of assembly are modelled, and in the approach they follow to render tractable the estimation of their firm-level models of export-platform FDI.

[9]The voluminous 20th century literature on multinational activity is reviewed in Markusen (2004) and Antràs and Yeaple (2014).

Figure 3: Manufacturing Firms' Sales by Firm Type



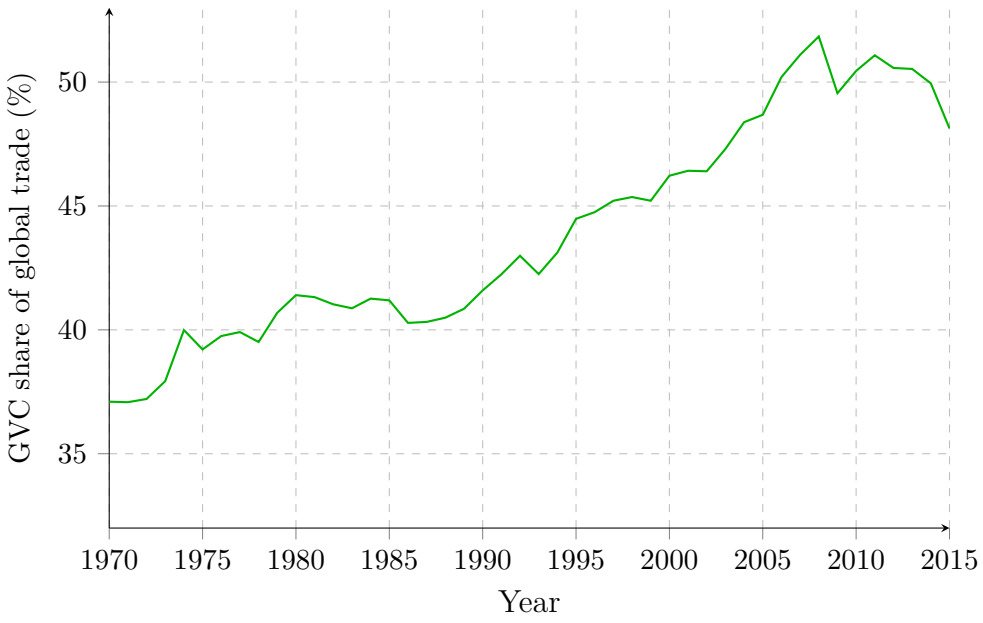
Source: Antràs et al. (2024). The data sources are the 2007 Longitudinal Business Database, Economic Censuses, Longitudinal Firm Trade Transactions Database, BEA inward and outward surveys. Table presents global sales by firm type and manufacturing plant locations. 'US MNEs (no FMAs)' refers to US-based MNEs that own no foreign manufacturing affiliates. Sample is all firms with US establishments in 2007. See Antràs et al. (2024) for more details.

C. Global Value Chains

The fragmentation of production processes across borders—what we now call global value chains or GVCs—has transformed international trade. GVCs are a defining feature of 21st-century trade, where products are no longer exchanged between two countries but are the result of complex supply chains spanning multiple nations. For instance, the production of semiconductors involves inputs from numerous countries before the final product is assembled and shipped (see Miller, 2022, for an excellent non-technical overview).

A burgeoning literature has explored the role of GVCs in shaping international trade and production. Following the organization of the literature in Antràs and Chor (2022), one can distinguish between macro-level and micro-level approaches to GVC analysis. Macro-level studies use tools such as the World Input-Output Tables to measure the use of foreign value added (embodied in materials, intermediate inputs, or 'tasks') in production, particularly for exports, thus capturing how production processes span multiple countries. The work of scholars like Hummels et al. (2001), Johnson and Noguera (2012), and Koopman et al. (2014) have helped quantify the importance of value-added trade. For instance, Figure 4 reports the percentage of world trade accounted for by transactions that are part of broader global value chains, as inferred from the methodology developed in Borin and Mancini (2019). Clearly, this share

Figure 4: Percent of GVC Trade in World Trade



Source: World Bank (2020). Based on the measure of GVC trade flows in Borin and Mancini (2019).

increased significantly in the 1990s and 2000s, and constitutes around 50% of world trade today.

On the theoretical front, macro models, such as those in Caliendo and Parro (2015) or Baqaee and Farhi (2024), emphasize intersectoral linkages and trade in intermediates, providing tools for quantitative assessments of trade policy impacts, an area that I will review in more detail in the next section. Multi-stage models such as those in Yi (2003) or Antràs and de Gortari (2020) expand this analysis by considering the sequential nature of production, which amplifies the gains from trade due to the compounding effects of trade costs along supply chains.[10]

Micro-level analyses of GVCs connect much more closely with the body of firm-level work on exporting, importing and MNE activity reviewed in previous sections. Researchers have developed frameworks in which firms select into GVC participation (Antràs et al., 2017b) and in which *lead firms* organize production processes across countries (Antràs and de Gortari, 2020). In those frameworks, country- and industry-level trade flows follow from the aggregation of a large number of firm-level decisions related to the destinations to which firms export their products, the source countries from which they procure intermediate inputs or in which they produce certain stages of production, and the 'platform' countries from which they assemble goods for distant destination countries. In other words, aggregate trade flows are the sum of all slices of all GVCs in the world. Theoretically, this 'micro' approach is largely concerned with developing tools to solve the complex problems that firms face when designing their optimal

[10]In fact, Melitz and Redding (2014b) show that gains from trade may become unboundedly large as production is sliced into more and more production stages (see Antràs and de Gortari, 2020, for a more detailed discussion).

global production decisions (see Antràs and Chor, 2022, for a review), and to show how the firm-level interdependencies that complicate such design have important implications for how economies respond to trade shocks.

This micro approach also encompasses a narrower definition of GVCs that emphasizes additional distinctive characteristics, namely that GVCs often entail the exchange of highly customized inputs on a repeated basis, with the contracts governing these relationships being incomplete and hard to enforce. These contractual aspects often lead to non-trivial firm-boundary decisions (see Antràs and Chor, 2013, for an example, and Antràs, 2015, for a textbook treatment).

2.3 Quantitative Trade Theory

Another significant development in the international trade field has been the rise of quantitative trade models, which allow economists to easily simulate the effects of trade policies on real incomes and welfare.

A. The Eaton-Kortum Revolution

In the 20th century, theoretical work in international trade was overwhelmingly stylized in nature. The leading theoretical scholars in the field devoted their career to the development of simple models that shed light on several aspects of international trade. For that purpose, it was often sufficient to work with two-country models, with a 'Home' country and a 'Foreign' country. In many cases, this was not just sufficient but also necessary because multi-country versions of many trade models were deemed to be intractable.

Take the example of the Ricardian model of trade. The insight that trade patterns are shaped by comparative rather than absolute advantage is something that can be easily illustrated (even to the undergraduate students) in a simple two-country, two-good model. It is also straightforward to illustrate the concept of a chain of comparative advantage (a ranking of goods in order of relative unit labor requirements) and its implied trade flows in a two-country model with many goods and trade costs. But how are bilateral trade flows determined in a world with many goods and many countries and in which bilateral trade costs may be different for different pairs of countries? Approaching the 200th anniversary of David Ricardo's 1817 *Principles of Political Economy and Taxation*, the trade field did not yet have a good handle on this problem (see Eaton and Kortum, 2012, for a nice discussion).

At the same time, there was growing demand for quantitative evaluations of trade policies. In the 20th century, that demand was satisfied via the use of applied (or computable) general equilibrium (AGE) models. These models feature multiple countries, multiple industries, and input–output linkages across industries, and researchers solve them numerically after calibrating

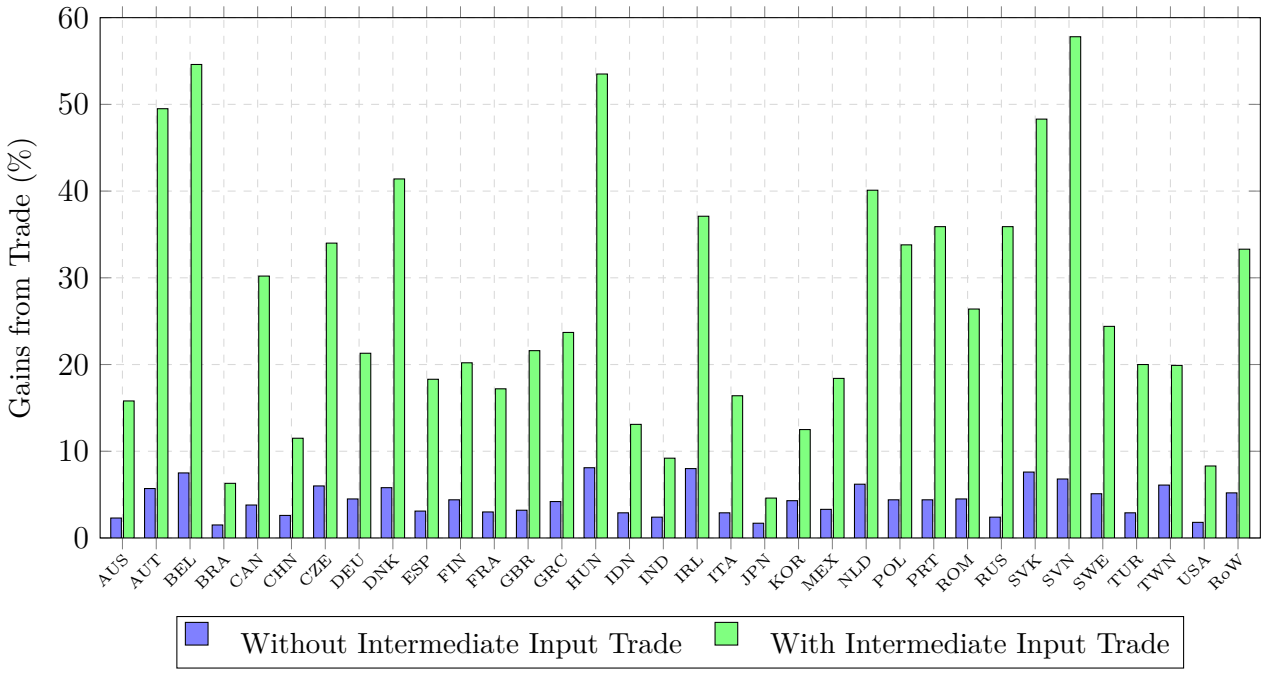
their parameters to data (see Kehoe et al., 2017, for an excellent recent review). Various extensions of these models were developed to incorporate realistic features (such as imperfect modes of competition) and to match certain salient features of the data (such as the fact that countries often export and import goods in the same industry). The main criticisms raised on applied general equilibrium models are that they are computationally intensive, rely too much on off-the-shelf elasticities, and are too complex to be able to easily interpret the key factors shaping a counterfactual response to a trade policy (see Costinot and Rodríguez-Clare, 2014).

The work of Eaton and Kortum (2002) launched a new approach to the quantitative evaluation of trade models. In the words of Costinot and Rodríguez-Clare (2014), the main goal of this agenda is "*to construct middle-sized models that are rich enough to speak to first-order features of the data, like the role of country size and geography, yet parsimonious enough so that one can credibly identify its key parameters and understand how their magnitude affects counterfactual analysis*."

The key conceptual insight of the original Eaton and Kortum (2002) paper – at least in my view – was the realization that there was a tight connection between a multi-country Ricardian model of trade and discrete-choice models of consumer choice, in which individuals choose one among a discrete number of options. As is well known since McFadden (1974), with a continuum of individuals making those choices and with an appropriate choice of an extreme-value distribution for other idiosyncratic factors that shape a consumer's preferences for different goods, one can aggregate the choices of the continuum of individuals and obtain a neat formula for the market share of each good. In Eaton and Kortum (2002), there is a single representative consumer in each country and the options are not different goods, but countries: the representative consumer in a country imports a given good from whichever country can provide this good most cheaply. Rather than a continuum of consumers, Eaton and Kortum (2002) introduce a continuum of goods, and they obtain a simple equation for the share of a country's spending on another country's goods by assuming that a good's efficiency of production in different countries is drawn from a Fréchet (Type II extreme value) distribution.

A particularly nice feature of this market-share equation is that it corresponds to a standard gravity equation of trade, which permits one to estimate a key parameter of the model – the so-called trade elasticity – using well-established empirical tools (see Head and Mayer, 2014). Indeed, in the single-sector model in Eaton and Kortum (2002), this trade elasticity, together with observable domestic trade shares, are sufficient to evaluate the consequences of changes in

Figure 5: Gains from Trade With and Without Intermediate Input Trade



Source: Costinot and Rodríguez-Clare (2014). The blue bars represent the gains from trade in the one-sector Ricardian model of Eaton and Kortum (2002). The green bars represent the gains from trade in the Caliendo and Parro (2015) multi-sector Ricardian model with interindustry linkages.

international trade costs for real income.[11] More specifically, the log-change in real income is

$$\widehat{GDP}_i = -\widehat{\lambda_{ii}}/\varepsilon, \tag{1}$$

where $\widehat{\lambda}_{ii}$ is the log-change in the share of expenditure on domestic goods and ε is the trade elasticity, which governs how the ratio of bilateral imports to domestic demand responds to changes in bilateral trade costs. This formula illustrates the key role of ε in shaping how reductions in trade openness (perhaps due to a trade war) translate into real income losses, with larger losses materializing when domestic goods are poor substitutes for foreign goods. For the special case of a trade war that would bring all countries back to autarky, the associated losses can be computed as $\widehat{GDP}_i = 1 - (\lambda_{ii})^{1/\varepsilon}$.

The blue bars in Figure 5 document these so-called 'gains from trade' for the set of countries included in the World Input-Output database and for a value of $\varepsilon = 5$. Strikingly, these gains from trade are below 3% for eleven of these countries, and they are estimated to be a mere 1.8% for the United States. The highest gains from trade are associated with smaller countries

[11] As Kehoe et al. (2017) write, a key innovation of modern quantitative models is that they "*deliver recognizable gravity-type equations and transparent mappings to welfare predictions, which helps circumvent the criticism that AGE models act like black boxes.*"

such as Ireland (8.0%) or Hungary (8.1%).

It is well understood that part of the reason why these estimated costs of reverting to autarky are small is because the framework in Eaton and Kortum (2002) is a single-sector model that assumes a relatively high level of substitutability across *any* two goods produced in different countries. When considering multi-sectoral models with a lower substitutability between the output of goods belonging to different sectors (Ossa, 2015) and when introducing input–output linkages across industries and countries (Caliendo and Parro, 2015), these same Ricardian models generate significantly larger gains from trade. As an illustration, the green bars in Figure 5 present the same gains from trade when computed in the Caliendo and Parro (2015) framework, which assumes a unit elasticity of substitution across sectors both in consumption but also in production. Clearly, those estimates are significantly larger: in fact, more than six times larger on average. Similarly, Antràs and de Gortari (2020) show that the implied gains from trade in models with multi-stage production are also significantly larger than in models with a single production stage.

Moving beyond these extreme autarky counterfactuals, research into quantitative models was bolstered by two other key contributions. First, Dekle et al. (2008) proposed a methodology – the *exact hat-algebra* approach – to quickly compute counterfactuals for a wider range of policy counterfactuals. These authors showed that an estimate of the trade elasticity and the initial equilibrium trade flows are sufficient to construct counterfactual predictions about the effect of *any* change in trade costs, not just a shift to autarky. Although they derived this result in the heavily parameterized Eaton and Kortum (2002) framework, similar results were obtained by Arkolakis et al. (2019) and Adão et al. (2017) in much more general environments. Second, the work of Arkolakis et al. (2012) demonstrated that the fact that the welfare gains from trade can be summarized by two key statistics— the share of domestic expenditure on goods and the trade elasticity – is not specific to the Ricardian model. The same result applies to one-sector Armington models and to one-sector Krugman-Melitz models featuring scale economies, monopolistic competition and firm heterogeneity. These advances showcased the strong potential of the exact hat-algebra approach for quantitative analyses.

B. Structural Approaches

The use of the Eaton-Kortum toolkit for quantitative analyses has raised some criticisms, both on methodological grounds (Dingel and Tintelnot, 2023; Sanders, 2023) and in terms of the predictive power of these models when evaluated against the observed response of trade flows to actual changes in trade costs (Kehoe et al., 2017). Apart from the valiant efforts to credibly estimate the key trade elasticities, the remaining parameters of the model are calibrated to ensure that the model fits the data perfectly. Indeed, this perfect fit seems at the core of the

Dekle et al. (2008) exact hat-algebra approach. Clearly, this approach is unbeatable in terms of model fit, but if the model is misspecified, or if there is measurement error in the data, there is the potential for these models to produce unreliable counterfactual predictions, a problem somewhat akin to 'overfitting' in regression analysis.[12]

Perhaps for this reason, a significant body of work in international trade has concerned itself with quantitative analyses that are much closer in spirit to empirical work in industrial organization. The goal of these contributions is to develop parsimonious models that do *not* necessarily fit the data, but that generate a structural interpretation of the properties of the divergence between model and data, or 'error term.' This allows researchers to develop econometric specifications that are particularly well suited to that error structure.[13]

The literature on structural estimation of trade models is too voluminous to be described here, but it includes work on (i) firm-level exporting decisions (Roberts and Tybout, 1997; Morales et al., 2019; Dickstein and Morales, 2018), (ii) the interactions between exporting or MNE activity and innovation and productivity (Aw et al., 2011; De Loecker, 2011; Bilir and Morales, 2020); (iii) global sourcing and multinational activity (Tintelnot, 2017; Antràs et al., 2017b); and (iv) the impact of trade on labor markets (Artuç et al., 2010; Helpman et al., 2010; Dix-Carneiro, 2014; Traiberman, 2019). Furthermore, many researchers have estimated models focused on a single industry, thus connecting even more intimately with the empirical industrial organization literature. Some of the global industries that have been studied in recent years include the car industry (Coşar et al., 2018; Head and Mayer, 2019), the hard disk industry (Igami, 2018), the pharmaceutical industry (Chaudhuri et al., 2006; Costinot et al., 2019), and the dry-bulk shipping industry (Brancaccio et al., 2020).

Naturally, these structural approaches to estimation and counterfactual analysis have their own limitations. Perhaps most obviously, they are orders of magnitude more complicated and time-consuming to implement than Eaton-Kortum style approaches. More substantively, these estimation approaches are overwhelmingly implemented in partial equilibrium settings, thus ignoring the type of general equilibrium interactions that constitute one of the intellectual pillars of the international trade field.

2.4 Empirical Work Unshackled

Most 20th-century empirical work in international trade was heavily disciplined by theory and used a relatively limited set of data sources. A canonical example of this is the literature

[12] Adão et al. (2024) have recently proposed an instrumental variable (IV)-based goodness-of-fit measure that provides a means to test whether a model provides reliable counterfactual predictions.

[13] Furthermore, Dingel and Tintelnot (2023) have recently shown that the useful exact hat-algebra approach to counterfactual analyses can also be used with the fitted values of a structural model, rather than observed values in the data, thus not requiring the model to fit the data exactly.

on the gravity equation of trade. Although log-linear regressions of bilateral trade flows on exporter GDP, importer GDP, and their distance have been run since the seminal work of Tinbergen (1962), these specifications only became widespread among academic international trade economists when researchers were able to provide microeconomic foundations for them (Anderson, 1979; Bergstrand, 1985). The 21st-century trade literature has extended the gravity equation's theoretical and empirical scope, incorporating theoretically-motivated features, such as multilateral resistance terms (Anderson and Van Wincoop, 2003) or econometric techniques to properly deal with the extensive margin of trade (Helpman et al., 2008). Furthermore, as discussed in the last section, modern quantitative Ricardian models of trade have provided an alternative foundation for the gravity equation (Eaton and Kortum, 2002).

Another example is the voluminous empirical Heckscher-Ohlin literature, which examined the extent to which the predictions of the Heckscher-Ohlin model aligned with real-world trade patterns. At its core, the model suggests that countries export goods that intensively use their abundant factors of production while importing goods that require their scarce factors. Empirical tests of this theory initially faced challenges, most notably in the seminal work of Leontief (1953), who found that US exports appeared to be less capital-intensive than US imports, seemingly in contradiction with the notion that the US was a relatively capital abundant country. This so-called 'Leontief paradox' spurred decades of research exploring theoretically consistent approaches to test the empirical validity of the model. Important contributions to that literature include the work of Ed Leamer and many of his students (Bowen et al., 1987; Trefler, 1993, 1995; Harrigan, 1997; Schott, 2003), as well as Davis and Weinstein (2001).

In contrast to these theoretically-driven literatures, much of the 21st century empirical research in international trade has been 'unshackled' from the chains of traditional trade theory, and in the process has explored new data sources and innovative methods.

A. Empirical Work 'Unshackled' From Theory

Much of the recent empirical research in international trade is not seeking to test specific theories, but is instead concerned with establishing a causal link between certain economic variables that are naturally of interest to trade economists. For instance, how trade participation affects firm performance is an issue of immense importance for businessmen, academics, and policy makers. Yet, the empirical research summarized in sections 2.1 and 2.2 makes it obvious that firm performance is itself a determinant of trade participation. To identify the causal link between exporting and firm performance, one needs to find settings with plausibly exogenous variation in trade participation. A notable example of this is the work of Atkin et al. (2017), who conducted a randomized control trial (RCT) that generated exogenous variation in the access to foreign markets for rug producers in Egypt. Atkin et al. (2017) found that treated

firms reported 16–26% higher profits and larger improvements in quality relative to control firms, with these improvements in technical efficiency being tied to learning-by-exporting. At a more macro level, researchers have revisited the links between trade openness and income per capita levels, while proposing instruments for trade openness that are more convincing than those that had been offered in the past. Notable examples include the work of Feyrer (2019), Feyrer (2021), and Pascali (2017), all of whom propose country *and* time-varying instruments for the ease with which countries can trade with other countries. Other researchers have sought to exploit plausibly exogenous variation in market integration in historical contexts, including the work of Donaldson (2018), Steinwender (2018), and Juhász (2018).[14]

Another active area of research concerns the study of the impact of import competition on labor markets. As described in the previous section, some researchers have tackled this question via the estimation of structural models of how labor markets respond to changes in trade costs. An immensely influential literature has instead exploited plausibly exogenous variation in the extent to which different regions in a country are affected by import competition, to tease out the causal link of increased imports on labor market outcomes (Autor et al., 2013; Dix-Carneiro and Kovak, 2017). The conceptual backbone of these approaches is the fact that national labor markets are often not fully integrated, and thus much can be learned from the differential exposure of different regional markets to the same trade shock. This work has propelled a growing theoretical literature in spatial economics aimed at incorporating imperfect labor mobility into standard quantitative models (Caliendo et al., 2019).

Another way in which the empirical trade research has unshackled itself from trade theory is by studying how exposure to trade affects various outcome variables that are not typically part of international trade models. To name just a few, economists have studied how trade participation affects child labor (Edmonds and Pavcnik, 2005), educational attainment (Atkin, 2016), or military conflicts (Martin et al., 2008), while also demonstrating a causal link between increased import competition and various negative social outcomes (see, for instance, Autor et al., 2019).

B. Empirical Work 'Unshackled' From Traditional Data Sources

Empirical work in international trade has not only been less disciplined by theory, but it also has become unshackled from traditional data sources, namely product-level trade data, industry-level sector characteristics, and Input-Output tables. As already summarized in sections 2.1 and 2.2, the empirical literature on firm-level trade participation already broke significant novel ground by relying on much more granular information on trade flows, sometimes even transaction-level

[14] A parallel literature has used plausibly exogenous trade shocks to shed light on other outcomes that are perhaps more relevant to researchers in fields other than international trade, such as the work on relational contracting by Macchiavello and Morjaria (2015) or the work by Dube and Vargas (2013) on civil conflict.

information. Still, since the pioneering work of Andrew Bernard and his collaborators, the trade field has incorporated many novel sources of data into empirical trade investigations.

Even when focusing on studies of firms' participation in trade, researchers have merged transaction-level trade flow data with additional datasets to shed light on how trade exposure affects other aspects of firm behavior and market equilibrium. For instance, state-of-the-art analyses of trade participation go well beyond the use of manufacturing censuses, by incorporating information on the wider operations of modern firms, which often are distinct in nature from manufacturing (Fort, 2017, 2023). This literature has illustrated how trade exposure leads to significant reorganization of firms in rich countries, away from manufacturing and onto other activities, such as product design or marketing (Bernard et al., 2017; Ding et al., 2022). Furthermore, as mentioned in section 2.2, census and customs level data have been merged with surveys of inward and outward MNE activity to provide a more complete picture of the global operations of firms (Antràs et al., 2024).

Other researchers have matched customs data with employer-employee datasets (Hummels et al., 2014; Adão et al., 2022), thereby leading to much sharper studies of how trade exposure at the *individual level* affects workers' wages. Relatedly, by merging customs data with value-added tax data providing information on domestic firm-to-firm links, researchers have been able to shed light of how exposure to trade affects firms that are only indirectly linked to global markets by buying inputs or selling goods to firms that directly export or import (Dhyne et al., 2021; Huneeus, 2018). Even when focusing attention on customs data, the use of transaction-level information has allowed some researchers to identify *international* buyer-seller relationships in trade (Bernard et al., 2018a). Finally, another active branch of the literature has employed banking data to link trading firms to their suppliers of credit, and shed light on the role of credit and trade finance in international trade (Amiti and Weinstein, 2011; Antràs and Foley, 2015; Paravisini et al., 2015; Federico et al., 2023).

Beyond these institutional data sources, researchers in international trade have leveraged highly creative sources of data, such as the use of satellite data to track shipping vessels (Brancaccio et al., 2020).[15] Many researchers have also resorted to barcode and product scanner data, which track consumer purchases for certain types of goods and allows one to study the impact of trade policies on product availability and prices (Borusyak and Jaravel, 2021). A growing body of work has also relied on newly digitized historical records, ranging from clay tables from the Bronze Age (Barjamovic et al., 2019) to archival loan records from mid-19th century England (Xu, 2022).

[15]Satellite data has also been used to proxy economic activity – and how it responds to tariffs – with high-frequency night lights data (Chor and Li, 2024).

2.5 Other Charted Waters

I have chosen to emphasize four main areas of progress in international trade research in the last twenty-five years, but admittedly this choice is subjective and may well alienate readers who have contributed to similarly dynamic branches of the trade literature. Indeed, the editors of the *Handbook of International Economics* commissioned surveys of many other areas of research that have boomed in recent years, such as: work on the institutional determinants of comparative advantage and multinational activity (Nunn and Trefler, 2014), novel contributions to the study of trade policy and trade agreements (Maggi, 2014; Caliendo and Parro, 2022), econometric advances in the estimation and interpretation of the gravity equation (Head and Mayer, 2014), studies on how trade shapes innovation (Akcigit and Melitz, 2022), the environment (Copeland et al., 2022), and economic development (Atkin and Donaldson, 2022), a growing literature on the interplay between trade and geography (Redding, 2022), and a recent body of work seeking to understand the recent backlash against globalization (Colantone et al., 2022).

I do not expect that this laundry list will assuage the disappointment of some readers who are heavily invested in these other recently charted waters, but in my defense, I myself have actively contributed to some of these other literatures, so clearly my choice of focus does not reflect a lack of excitement about work in other areas.

3 Uncharted Theoretical Waters

Having provided an overview of some main areas of international trade research in recent years, we are now ready to explore some of the uncharted waters of international trade. In this section, I will focus on uncharted theoretical waters, emphasizing three areas in which I think more progress is needed.

3.1 Oligopolistic Competition and Strategic Behavior

Much of the existing literature on international trade assumes monopolistic competition, by which firms are assumed to perceive a downward sloping demand for their products, but are assumed to be small enough not to engage in strategic interactions with their competitors. However, this assumption does not reflect the reality of many key industries, such as the aircraft or semiconductor industries, which are dominated by a few large firms. More generally, and as documented in section 2.1, the distribution of exporters and importers is highly skewed, with a very small number of firms accounting for a very significant share of trade in their countries. When inspecting the predominance of large firms at the industry level, the granularity of the data is even more striking. For instance, within four-digit industries, the largest French exporter

accounts on average for 28% of the industry exports (Gaubert and Itskhoki, 2021), while Freund and Pierola (2015) find that about one-third of the variation in the ratio of exports to GDP across countries and industries is due to *the* top firm in a sector, while the top five firms in a sector account for nearly 50% of the variation.[16] The literature on multinational firm activity has similarly demonstrated the existence of remarkable granularity in the data, with a small number of very large MNEs accounting for the bulk of MNE activity (see, for instance, Antràs et al., 2024).

A parallel empirical literature in industrial organization and macroeconomics has also documented a recent notable increase in the average markups charged by firms (De Loecker et al., 2020; Diez et al., 2018). Some authors have furthered linked these higher average markups to increased industry concentration (Autor et al., 2020) and to reduced business dynamism, i.e., depressed entry and exit rates (Decker et al., 2016). Admittedly, some of the micro-level results in this literature and their interpretation remain controversial, with certain studies finding conflicting evidence for some sectors (see, for instance, Grieco et al., 2024).

Still, recent empirical work casts some doubts on the realism of international trade models in which firms are too small to affect the behavior of their competitors and in which free entry drives profits to zero. Instead of being monopolistically competitive, market structure in many global markets appears to be oligopolistic.

A. Not So Uncharted Waters

Naturally, I am not the first to point out that strategic interactions between firms or that positive and large profit levels can have significant implications for trade flows and their welfare implications. In the early 1980s, when *New Trade Theory* was just taking off, some of its pioneers explored certain implications of oligopoly for trade and welfare. Most notably, Brander (1981) and Brander and Krugman (1983) introduced the concept of 'reciprocal dumping,' by which strategic interactions motivate firms from different countries to export to each other's markets despite the absence of comparative advantage or product-variety reasons for two-way trade (see also Brander and Spencer, 1985, and the literature on strategic trade policy it spun). A more recent literature largely stimulated by the work of Peter Neary – but an intellectual offspring of the pioneering work of Lerner (1934) – advocates the study of market-power distortions in general equilibrium settings (Neary, 2003; Leahy and Neary, 2013; Neary, 2016). This general equilibrium literature has shown that market power distortions are crucially affected by the dispersion of markups across sectors, rather than by their levels (see, for instance, Epifani and Gancia, 2011), and several authors have attempted to quantify the relevance of these distortions

[16] Ciliberto and Jäkel (2017) find that the top 5 firms in an industry accounted for 80% of Danish industry-level exports in 2007.

(Eaton et al., 2012; Edmond et al., 2015; Ding et al., 2024; Graziano, 2024).[17]

Still, and as also argued by Head and Spencer (2017), the modeling of oligopolistic competition remains somewhat on the fringes of our field. I will next outline a series of implications of modeling oligopolistic behavior that may be of interest to trade economists.

B. Strategic Interactions and the Extensive Margin of Trade

Although recent work has considered situations in which exporters are large enough to affect industry structure and internalize these effects in their pricing, the bulk of work in international has focused on strategic effects operating purely at the *intensive margin*, conditional on a fixed set exporters. Yet, in frameworks in which firms are 'non-atomistic', there is the possibility of strategic effects also operating at the *extensive margin*, thus shaping the entry decisions of exporters, importers, and multinational firms. More specifically, large firms understand that their pricing or entry decisions directly impact the entry decisions of other firms. As is well understood from the industrial organization literature, this gives rise to the possibility of multiple equilibria in industries populated by multiple large firms (Berry and Reiss, 2007). As a result, in otherwise standard models of firm-level export participation (Melitz, 2003), relatively productive firms may not be able to penetrate foreign markets if other less productive firms already sell in that market. In more technical terms, selection into exporting may not be strictly monotonic in productivity.

Existing work simply assumes that firms make entry decisions following a pecking order driven by productivity, with the most productive firms moving first (Atkeson and Burstein, 2008; Eaton et al., 2012; Gaubert and Itskhoki, 2021). But this is just one of many equilibrium selection criteria. In some settings, it may be more natural to consider alternative equilibrium selection criteria, such as letting 'incumbents' or domestic firms move first, thereby leading them to potentially deter entry via their choices of prices or quantities. How large are the real income gains from trade when trade liberalization is *not* associated with patterns of selection into exporting perfectly correlated with firm productivity? What are the implications for consumer surplus (i.e., prices and variety gains) and for firm profits? These are questions still in need for answers, and they are particularly relevant since the extensive margin of trade accounts for about two-thirds of the cross-sectional variation in trade flows (see Table 3).

The possibility of socially suboptimal selection into exporting is more than just a theoretical curiosity. Existing work has documented that although exporters are on average more productive than non-exporters, there is a significant overlap in those distributions, and firms do not enter

[17] Other recent work exploring the implications of oligopolistic competition for trade flows and its consequences includes Atkeson and Burstein (2008), Amiti et al. (2019), Breinlich et al. (2020), Alviarez et al. (2023), and Breinlich et al. (2024). Another important aspect of markups is that sometimes they are needed to foster innovation, so the distribution of markups may also shape the gains from trade via its effects on innovation, as studied in oligopolistic settings by Impullitti and Licandro (2018) and Impullitti et al. (2022).

markets according to an exact hierarchy (Eaton et al., 2011). Furthermore, in recent work, Ciliberto and Jäkel (2017) provide convincing evidence of the existence of what they refer to as 'competitive effects', which capture the negative effect that a firm's export decision has on its competitors' export decisions.

Strategic interactions are also relevant for the extensive margin of global sourcing. In situations in which a firm takes an action – such as selecting into importing from a low-cost source – that reduces its marginal costs, this may affect the incentives of other firms from the same country to follow this leader's entry. The sign of this dependence is not entirely obvious, however, and is likely to depend on how market structure is specified. Igami (2018) discusses these nuanced effects, and finds evidence of complementarities in offshoring decisions for the hard-disk industry.

The case of strategic interactions in the extensive margin of MNE activity is similar. When an MNE sets up a plant in a foreign country, thereby lowering the cost with which it can make its goods available to certain foreign consumers, this may well trigger a response by its competitors. This is what Knickerbocker (1973) defined as 'oligopolistic reaction' more than fifty years ago, but formal analyses of this phenomena are scant, with Head et al. (2002) being a notable exception.

The bottom line is that oligopolistic competition is likely to have important implications for the extensive margin of trade and MNE activity, a margin that trade economists now understand is key for understanding the structure of world trade.

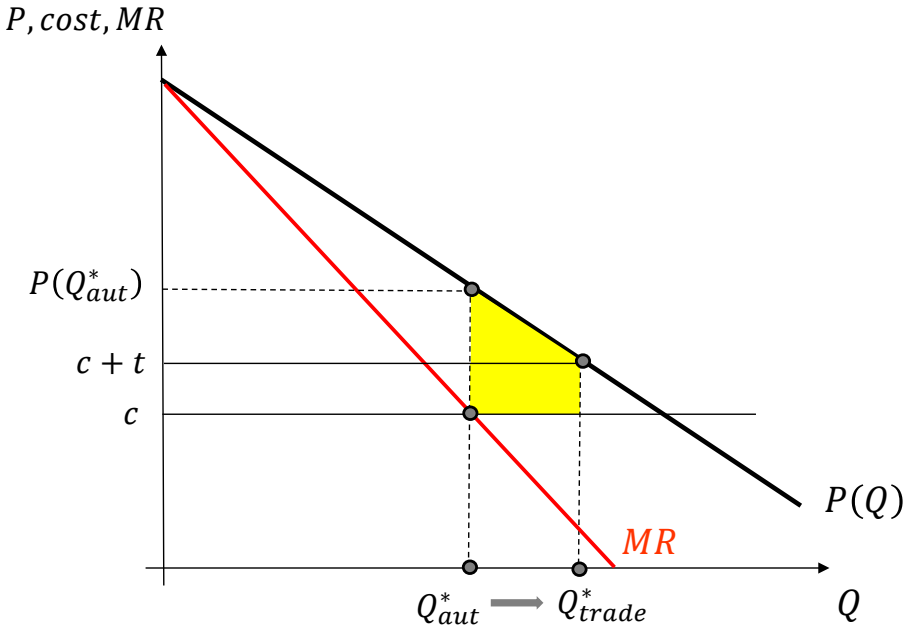
C. Some Implications for the Gains from Trade

Beyond its implications for the firm-level trade literature, the modeling of oligopolistic competition is also relevant for the quantitative trade literature focused on understanding the welfare consequences of trade liberalization. To motivate this point, consider two examples which are often taught in undergraduate courses.

Figure 6 depicts the partial-equilibrium welfare effects of trade liberalization in a homogeneous-good Bertrand duopoly, with a Home and a Foreign monopolists symmetric in all respects. Under autarky, the equilibrium at Home features a domestic monopolist which sets a quantity Q^*_{aut} equating its marginal revenue and its marginal cost c, with an associated markup $P\left(Q^*_{aut}\right) - c$. Under free trade, the standard Bertrand price war leads the Home monopolist to price at $c + \tau$, with an associated quantity Q^*_{trade}. Domestic profits shrink, but overall surplus goes up by the yellow-colored triangular area. Gains from trade are thus positive even when the domestic trade share λ_{HH} is unaffected by trade and equal to 1, seemingly contradicting the Arkolakis et al. (2012) formula in (1).[18]

[18]Note that when lowering τ, the 'trade elasticity' is 0, so the Arkolakis et al. (2012) formula is not well-defined

Figure 6: Trade Liberalization in a Symmetric Bertrand Duopoly



Notes: When moving from autarky to free trade, the equilibrium moves from that of a domestic monopolist with $MR = c$ to the standard marginal-cost pricing in a symmetric Bertrand game. The yellow colored area reflects the gains from trade, even if no trade flows materialize when $t > 0$.

Consider next the analogous case of a homogeneous-good Cournot duopoly, with a Home and a Foreign monopolists again symmetric in all respects. As shown by Brander and Krugman (1983), trade liberalization may well reduce welfare when starting from sufficiently high trade costs, even if such a liberalization necessarily reduces the share of spending on domestic goods. Intuitively, although trade liberalization expands production and decreases prices, this pro-competitive effect of trade is brought about by cross-hauling identical goods, which can be very ineffective when trade costs are high. Needless to say, the negative relationship between 'trade openness' and welfare is inconsistent with the Arkolakis et al. (2012) formula.

These are obviously two extreme examples, but they may be suggestive of the importance of certain mechanisms that the quantitative trade literature has largely ignored. For instance, the situation illustrated in Figure 6 is reminiscent of the empirical results of Jaravel and Sager (2019), who estimated a large negative impact of increased imports from China on U.S. consumer prices. As these authors discuss, for plausible parameter values, their estimates are consistent with models with strategic price setting, while these same estimates are too large to be rationalized by models featuring monopolistic competition, including models with variable elasticities of substitution, such as Arkolakis et al. (2019). Similarly, when studying evidence from Brazilian cement markets, Salvo (2010) points to an important role for imports in determining domestic

in this case.

cement prices, despite the near absence of imports.

In ongoing work, Antràs et al. (2025) explore the welfare consequences of reductions in trade costs in a general equilibrium model with oligopolistic competition *and* product differentiation, which generates bilateral trade flows and a well-defined trade elasticity for bounded trade costs. As they show, the losses-from-trade result in Brander and Krugman (1983) continues to apply when the elasticity of substitution across firms' goods is sufficiently large.

In sum, despite the existence of some quantitative work on trade models with oligopolistic competition (see, for instance, Edmond et al., 2015 or Ding et al., 2024), much more work on it is warranted, especially if it also seeks to tackle the determination of the crucial extensive margin of trade, as I have discussed above.

D. Trade, MNEs and the Distribution of Profits Across Countries

Models with oligopolistic competition and a fixed number of active firms also generate a distribution of profits across countries. In a world in which rising markups increase the profit share in national income, developing models that help pin down how profits are distributed across countries appears to be of first-order importance. Recent work by Ding et al. (2024) tackles this important topic but more work is needed.

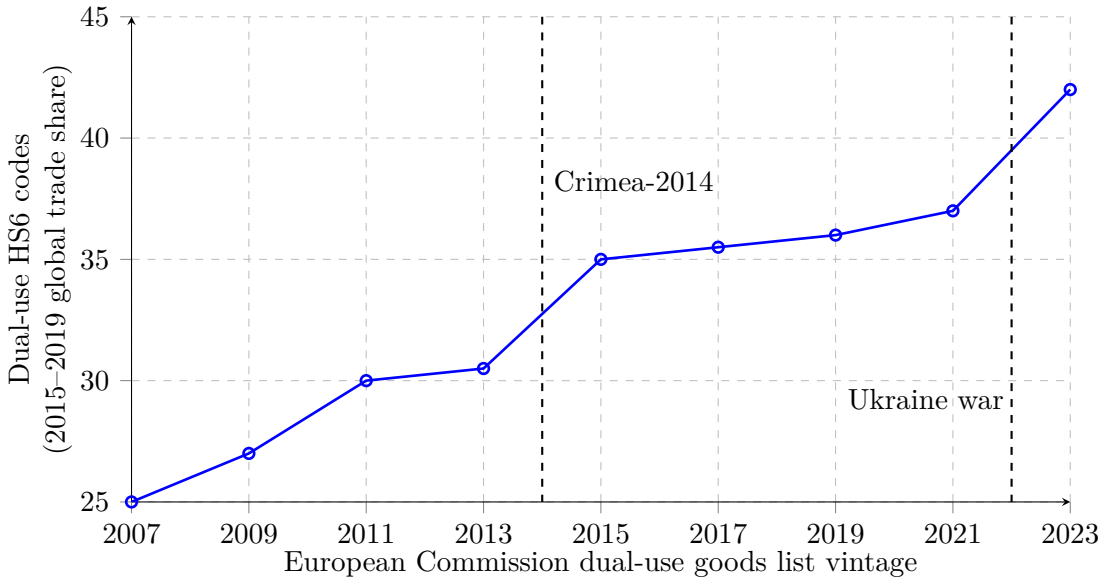
For the case of MNE activity, these frameworks should also facilitate the study of profit shifting practices, which relate to MNEs strategically reducing their overall tax liabilities by reallocating profits to jurisdictions with relatively lower tax rates. This is often achieved via practices like transfer pricing, allocating intangible assets, or financing structures that exploit tax treaty loopholes and differences in national tax laws. There is some neat recent empirical work on offshore profit-shifting practices (Guvenen et al., 2022; Tørsløv et al., 2023), but these aspects of how economies adjust to globalization need to be better integrated into our modern workhorse trade models.

3.2 Geoeconomics

Geopolitical tensions have flared up in recent years. The US-China trade war, Russia's invasion of Ukraine, and the recent turmoil in the Middle East are all clear examples of this. These tensions have had a clear impact on world trade. For instance, US merchandise imports from China fell by more than 20% in 2023, reverting back to their 2013 levels. More generally, trade flows between geopolitically aligned countries have grown disproportionately faster than trade flows between countries belonging to different geopolitical blocs (Gopinath et al., 2024).

The negative impact of geopolitical tensions on trade flows largely reflects changes in policy. Indeed, recent events have highlighted the importance of national security concerns in shaping trade policy. Certain goods—particularly in technology and defense—are increasingly seen as

Figure 7: Dual-use HS6 codes global trade share (2015–2019)



Source: Alekseev and Lin (2024). Data for dual-use categories are taken from the European Union's TARIC dual-use correlation tables. Data on trade flows from 2015 to 2019 are from the CEPII BACI (HS Rev. 4, 2012) dataset.

critical to national security, leading to restrictions on exports and investment. For instance, Figure 7, borrowed from the work of Alekseev and Lin (2024), documents a very significant rise in the percentage of world trade that the European Commission considers to be 'dual-use goods', i.e., items with both civilian and military applications.

It is clear that certain goods, such as nuclear warheads, are key for national security, and unfettered exports of those goods to geopolitical adversaries is something that governments should naturally try to restrict. The national security implications of trade in various other goods is much less clear-cut, however, particularly in a world in which a very significant percentage of global trade consists of slices of complex global supply chains, in which exporters may well not have a clear sense of how their goods will be used in foreign markets.

A. Some Waters Are Being Charted

Economists have kept a close eye on recent events and a burgeoning literature is emerging studying how national security concerns interact with trade policy and global supply chains. Indeed, the waters of geoeconomics are much more charted today than they were a year ago, when I first presented the material in this paper. Current events have sparked an interest in the optimal use of sanctions imposed on foreign countries (Becko, 2024; Itskhoki and Ribakova, 2024), and empirical studies have also sharpened our understanding of how trade flows organize along geopolitical fault lines (Gopinath et al., 2024; Iyoha et al., 2024; Liu and Yang, 2024;

Neri-Laine, 2024). On the theoretical front, many researchers have analyzed interesting ways in which geopolitics and economics interact (Clayton et al., 2023, 2024; Antràs and Padró-i Miquel, 2023; Alekseev and Lin, 2024; Becko and O'Connor, 2024; Broner et al., 2024; Leibovici and Santacreu, 2023; Traiberman and Rotemberg, 2023), while others have explored the quantitative interplay between trade, geopolitics and conflict (Couttenier et al., 2023; Kleinman et al., 2023).[19]

The purpose of this section is not to overview this growing literature: it is too early to take stock. Indeed, geopolitical tensions are not expected to disappear any time soon, so contributions to this literature are likely to grow exponentially in coming years. Instead of an overview of existing work, below I will offer some broader views on why I am excited about this research agenda, and why I think that it is likely to have a long half life.

B. What Do Governments Maximize?

The study of trade policy is intimately related to an understanding of what governments maximize when making policy choices. The useful benchmark of a benevolent social planner, seeking to maximize national income, has shed light on the role of terms-of-trade considerations in the optimal design of import tariffs and export taxes (Johnson, 1953). Borrowing from theories in political economy, economists have sharpened their understanding of trade policy by positing that politicians are often concerned with aspects other than social welfare, thereby leading to the implementation of policies that deviate from those that would be set by a benevolent social planner. For instance, work on the role of lobbying in political processes (Grossman and Helpman, 1994) has provided an explanation for why export tariffs are rarely observed in practice, while also delivering precise empirical predictions that have been tested with variation in import tariffs across sectors (Goldberg and Maggi, 1999). Other economists have studied the implications of behavioral biases and psychosocial components in shaping optimal trade policy (Freund and Özden, 2008; Tovar, 2009; Grossman and Helpman, 2021), an area that I will cover in more detail in the next section.

Recent events demonstrate, however, that national security is a fundamental factor that shapes policy, and trade policy in particular. Admittedly, this claim is not particularly original, as it is at the core of the field of International Relations (IR) in political science. It is hard to understand President Putin's decision to invade Ukraine or President Biden's embracing 'friendshoring' policies without considering national security concerns.

Still, until recent months, economists had largely ignored the role that national security plays in the design of policies. How does one incorporate national security into standard models of policy determination? Some authors incorporate extra terms in the government's objective

[19]Earlier theoretical and empirical work on geoconomics includes Hirschman (1945), McLaren (1997), Skaperdas and Syropoulos (2001), Antràs and Padró-i Miquel (2011), and Berger et al. (2013).

function, reflecting negative externalities that certain types of trade transactions can exert on a country's welfare (e.g., Clayton et al., 2023), while others relate those negative externalities to exports of certain type of dual-use goods that may enhance the military power of geopolitical adversaries (Alekseev and Lin, 2024). Nevertheless, current modeling choices are a bit too reduced form, which limits the ability of existing models to provide sharp predictions to guide empirical work or policy recommendations. I see a bit of an analogy with the work on the political-support protectionists motives, which in its reduced form had been around since the work of Findlay and Wellisz (1982) and Hillman (1982), but that did not spur an active empirical literature until the microfoundations provided in Grossman and Helpman (1994) delivered a tighter set of empirical predictions.

C. Some Areas in Need of Future Study

One aspect that I find particularly puzzling (and thus interesting) about the role of national security in shaping trade policy is that it seems to have both significant state-contingent and lexicographic characteristics. More specifically, the design of trade policies seems to be largely orthogonal to geopolitical considerations in times of peace, but geopolitics trumps any other consideration in times of conflict. For instance, in the current environment, it would appear that many governments are willing to give up a significant share of the efficiency gains from trade to redirect trade flows toward geopolitically aligned countries. If governments care so deeply about national security, why do they not take more active precautionary policies in times of peace? In a world in which trade structure reacts slowly to geopolitical shocks, this dichotomy is puzzling.

Another area in need of more work is the study of the interplay between optimal trade policy and the structure of international political alliances. On the one hand, it is well understood that trade flows are increasingly shaped by geopolitical alignment, which indicates that trade policy choices are motivated by more than a 'us against the world' view. Still, much of the recently crafted theoretical work is too reduced form to shed light on how optimal trade policy should be designed as a function of the structure of geopolitical alliances. On the other hand, economists often treat these political alliances as fixed, while in reality they are often dynamic, and potentially shaped by economic factors. Some of the United States' current geopolitical foes, such as Cuba or Venezuela, used to have very strong economic ties with the US economy. At the same time, China has grown to be the main trading partner for many of the United States' geopolitical 'friends', such as Japan, South Korea, Australia, South Africa, Brazil or Chile. In a potential decoupling scenario in coming years, will those countries fall in line with the US in isolating China from the rest of the world economy? Understanding how geopolitical alliances are formed and how they are shaped by the structure of world trade is a topic of great

and immediate relevance.

3.3 Behavioral Economics

Behavioral economics has made significant inroads into many areas of economics, but its application to international trade remains limited. Perhaps this is not entirely surprising given that trade theories largely focus on supply factors (firm behavior), and the tenet that firms seek to maximize profits for their shareholders seems to be a pretty good approximation to reality. This assumption seems particularly justifiable when focusing on the type of large and sophisticated firms that dominate global trade and multinational activity, as these firms stand to lose vasts amounts of money if they make systematic mistakes. Trade theories also assume that consumers are fully rational, and it is not entirely obvious that the type of behavioral biases that researchers have unveiled in the lab are of first-order importance for understanding international trade flows. Surely, consumers may favor 'local' goods over 'foreign' goods, more so than is justified by their relative quality and prices, but trade models typically capture this feature by incorporating a home bias term in preferences or by calibrating larger effective trade costs.

I would not discard that much can be learned from incorporating behavioral biases in the decisions of global firms or consumers. For instance, in certain static and especially dynamic models of international trade, the state space explodes very quickly, and modeling managerial decisions as following simple rules of thumb may prove to be a more realistic representation of how firms organize production in the world economy.[20] Furthermore, studying how rational firms interact with consumers who make systematic mistakes in evaluating products may well deliver interesting insights with broad implications for the gains from trade.

Be that as it may, in the remainder of this section I want to put forth the argument that, even if the field chooses to ignore behavioral biases when considering trade flows and MNE activity *conditional* on a policy environment, there is much scope for understanding how trade policies are shaped by behavioral biases, as individuals' perceptions of trade are often shaped by cognitive biases. Trade policies naturally respond to individuals' perceptions (e.g., through voting), so they are far from irrelevant for our field. I am of course not the first one to point this out, but these waters are largely uncharted, except for a small number of exceptions. For instance, Freund and Özden (2008) and Tovar (2009) both study how loss aversion à la Kahneman and Tversky (1979) – the observation that individuals place a larger welfare weight on the loss of a given amount of income than on a gain of the same amount – shapes the determination of trade policy, leading to a disproportionate amount of protection to be granted

[20] A recent body of work has explored models of exporting or of GVCs with incomplete or noisy information (Dickstein and Morales, 2018; Bui et al., 2022). In that work, however, authors maintain the assumption that agents are rational.

to declining industries. More recently, Grossman and Helpman (2021) incorporate insights from social identity theory, to demonstrate that trade-induced changes in inequality can significantly increase the public demands for protection.

Further work at the intersection of international trade and behavioral economics will be enhanced by a recent wave of large-scale surveys that have greatly expanded our understanding of individuals' perceptions of trade. This work builds on early contributions in the political science literature (Hiscox, 2006), but it has seen a revival in the economics literature in very recent years (Chatruc et al., 2021; Stantcheva, 2022; Alfaro et al., 2023). The very large scale of some of these surveys, together with the design of experiments embedded in them, have convincingly established that consumers' perceptions of the gains from trade are vague and unclear, while their perceptions of potential losses are relatively more salient. Stantcheva (2022) further finds that concerns about job risks outweigh the perceived benefits of lower consumer prices in shaping public opinion, with exposure to trade-related losses leading to opposition to free trade. Broader beliefs about the efficiency benefits of trade coupled with the feasibility of compensating those negatively affected by it are key predictors of support for free trade. These results underscore the importance of redistribution policies to maintain public backing for open trade. Furthermore, individual's perceptions are not just shaped by self-interest: survey respondents care about other's job losses and the extent to which these losers from trade are compensated.

The field of behavioral economics can offer useful tools for trade economists to gain a deeper conceptual understanding of how preferences for trade are formed. Why are perceptions of the gains from trade vague and unclear? Is it a manifestation of a more general economic illiteracy (e.g., lack of understanding of general equilibrium)? Might it reflect a form of money illusion à la Shafir et al. (1997) by which inflation masks the trade benefits to consumers by leading to higher absolute import prices despite their relative decline? Answers to these questions are key in better allowing economists to convey the benefits of trade to the public. Similarly, what explains that job losses feature so prominently in people's negative perceptions of trade? Is it simply loss aversion à la Kahneman and Tversky (1979)? Or is it perhaps related to the endowment effect in Thaler (1980)? Or does it perhaps reflect coarse thinking à la Bordalo et al. (2013) or sparse thinking à la Gabaix (2014)? And how should we interpret the other-regarding preferences demonstrated in large-scale surveys? Could these other-regarding preferences pose a challenge for the Hicks-Kaldor compensation criterion, which assumes rational and self-interested economic agents, and which is the intellectual foundation for many trade economists' enthusiastic defense of free trade? I do not have any good answers to these questions, nor do I think that other trade economists do, so this area strikes me as being of great need for further navigation.

3.4 A Confluence of Other Theoretical Uncharted Waters

In focusing my attention on oligopolistic competition, geoeconomics and behavioral economics, I would not want to convey that these are the only uncharted theoretical waters worth exploring. I next offer a more succinct overview of three other potentially fruitful areas for future research.

Redistributive Policies and Compensation Mechanisms While other areas of economics have deeply explored redistributive policies (e.g., welfare and tax systems), international trade research has focused less on the effectiveness and design of compensation mechanisms for those adversely affected by trade. How should compensation be optimally carried out in the absence of lump-sum transfers? Existing empirical evidence indicates that many governments may currently be relying on extremely inefficient ways to compensate the losers from trade integration. For instance, Autor et al. (2013) found that many US workers displaced by the 'China shock' turned to disability insurance as a form of income replacement, much more so than they relied on trade assistance programs. This suggests that disability insurance acted as a *de facto* safety net for those unable to find new employment. Quantitative trade models seeking to evaluate the welfare consequences of changes in trade barriers would thus benefit from a deeper integration of inefficient redistribution policies, which naturally erode some of the typically estimated welfare gains from trade, as argued by Antràs et al. (2017a).

The Data Economy The rise of the data economy (Baley and Veldkamp, 2025) may require a significant rethinking of some aspects of international trade theory. Unlike traditional goods or services, data exhibits unique properties: it is non-rivalrous, easily replicable, and inherently tied to network externalities. These features pose novel challenges for how we conceptualize its role in global trade. Data serves both as a critical input to production and as a traded output, and thus interacts with the concept of comparative advantage in interesting ways. The data economy also reshapes GVCs, with data-intensive industries leveraging analytics and artificial intelligence to drive innovation. Traditional trade policy tools, such as tariffs, are ill-suited to address the barriers that define the data economy, including data localization requirements, cross-border restrictions, and divergent privacy standards. Moreover, the geopolitical dimensions of the data economy (e.g., digital sovereignty or cybersecurity) introduce strategic considerations that clearly intersect with the geoeconomics literature outline in section 3.2. As I will further discuss in section 4, the growing importance of data and digital trade also raises measurement issues, as much of the value generated through data remains invisible in trade statistics. Relatedly, digital platforms play a transformative role in trade by facilitating the exchange of goods, services, and information across borders, often reducing transaction costs and connecting buyers and sellers at an unprecedented scale (Chen and Wu, 2021; Carballo et al., 2022). However, their dominance

in digital markets creates significant competition challenges, as platforms benefit from network effects, economies of scale, and data aggregation, often leading to market concentration and oligopolistic behavior that can crucially shape how the gains from trade are distributed across countries.

Trade and Culture Trade and culture intersect in ways that demand deeper theoretical exploration. Cultural differences can act as barriers to trade, influencing transaction costs and preferences, which are often treated as exogenous in traditional models (Melitz, 2008; Melitz and Toubal, 2014). Trade also induces cultural change, potentially fostering either homogenization or preserving diversity, and serves as a channel for transmitting values through goods and services with cultural connotations (Ferreira and Waldfogel, 2013). Some of these ideas are explored in the interesting theoretical work of Olivier et al. (2008), but much more work on this topic is warranted. The distinct nature of cultural goods, such as art and film, requires models that address their non-material value and unique trade implications, including intellectual property concerns and cultural protectionism. The interplay between cultural diversity, trade policy, and consumer welfare is another critical area, particularly as trade agreements often feature cultural exceptions. Migration and diaspora networks, which lower cultural and informational barriers, also deserve attention for their role in linking culture with trade, as suggested by the pioneering work of Rauch (1999). Finally, the rise of digital platforms for cultural products, such as streaming services, introduces new dynamics of cultural diffusion and trade, amplifying the need for models that integrate cultural preferences into the analysis of global trade patterns.

4 Uncharted Empirical Waters

Given the nature of my training and my work, I am at a bit more at ease speculating about theoretical avenues for future research than about empirical ones. Nevertheless, the international trade field, as well as my own research, have become increasingly empirical in nature. With that in mind, I will next turn to a discussion of uncharted empirical waters for international trade researchers and practitioners.

My approach will be however a bit distinct from the one I followed in discussing theoretical matters. I will focus less on topics in which more empirical work is needed, and more on the ways in which official statistics can be improved to facilitate work in the field, and on potentially untapped new sources of data. Part of the reason for deviating from the focus on themes in section 3 is that all six areas I identified as theoretically uncharted in that section would also greatly benefit from further empirical work, especially after theory provides some guidance on how to approach them with data. In sum, the material in this section will be a bit less thematic and arguably more directed to data keepers than to researchers. Still, it is worth stressing

that academics can (and should) play an active role in advocating for the improvements I will outline below.

4.1 Modest Improvements to Official Statistics

Let me first outline a series of modest improvements to official statistics. These improvements would not necessarily open the door for empirical work on new topics, but they would greatly facilitate work with existing datasets.

Focusing first on customs data, and despite the great improvements in recent years, our research field would benefit from a more systematic digitization of customs forms. In practice, researchers have access to fairly standardized datasets, especially when working with product-level data, but the nature of measurement error induced by the standardization process is not entirely clear to researchers. In addition, many researchers would greatly benefit from a more systematic reporting of information of both counterparties in a trade transaction, especially the industry to which they belong, so as to be able to construct more disaggregate global input-output tables (more on this below).

As described in section 2, much of the path-breaking theoretical work carried out in the early 21st century was motivated by access to datasets that merge customs forms with censuses of economic activity that go beyond narrow manufacturing censuses (Fort, 2023). This merge is currently available to researchers for some countries, but not for many others. In some cases, this is due to the lack of cross-agency collaboration within countries, while in other cases it is probably best explained by a lack of institutional arrangements that would make data gatekeepers comfortable with the use of this data. The exact same considerations apply to the merging of customs data with value-added tax (VAT) forms. Such type of combined datasets are currently available only for a far smaller number of countries (such as Belgium or Chile), but the vast majority of countries in the world (e.g., all OECD members except the United States) have a VAT.[21] Similarly, a more fluid collaboration across state agencies may facilitate a more expanded availability of merged customs-employer-employee datasets, which have proven enormously insightful in studies of the labor market effects of trade and offshoring (Hummels et al., 2014; Traiberman, 2019).

Finally, closer cross-agency collaborations between customs offices, export promotion agencies, and industry ministries could facilitate the evaluation of non-tariff policies shaping international trade, such as export promotion policies. What is the causal impact of large-scale export promotion or industrial policies on trade and welfare? Although some authors have provided suggestive evidence of the effects of such policies in some settings (Martincus and Carballo,

[21] As pointed out by a very helpful referee, in some countries, VAT information is consolidated by the declaring firm, thereby limiting the use of this data for certain purposes (e.g., when mapping domestic production networks).

2010; Atkin et al., 2017; Juhász, 2018; Lane, 2022), there is still much scope for randomized control trials or the use of quasi-experimental designs to shed further light on this topic.

4.2 More Significant Improvements to Official Statistics: Trade in Services

Aside from the issues raised above, I believe that most trade researchers would admit being satisfied with the level at which product-level trade flows are recorded. The six-digit Harmonized System (HS), which is a globally recognized standard for classifying traded goods, distinguishes between a few thousands different types of commodities. Furthermore, countries often produce even more disaggregated classifications, adding two to four additional digits with a further break up of goods. For instance, my younger daughter's favorite category is the EU's eight-digit HS code 995030041, which covers 'stuffed toys representing animals or non-human creatures.'

When it comes to trade in services, however, international trade researchers are much less excited about the nature of the data we currently have access to. There is an obvious reason for this. Unlike for trade in goods, for trade in services there is no package crossing the customs border with an internationally recognized commodity code (United Nations, 2010). In practice, data on trade in services comes primarily from International Transactions Reporting Systems (ITRS), which are designed by central banks and statistical agencies to monitor and record cross-border financial and economic transactions, with the ultimate goal of compiling Balance of Payments (BoP) statistics. Because the purpose of that data collection is largely macroeconomic in scope, it is perhaps not surprising that data on trade in services is not nearly as disaggregated as for goods. For instance, the 2010 US Extended Balance of Payments Services Classification includes services belonging to 12 broad categories, such as 'Telecommunications, Computer, and Information Services', 'Financial Services', or 'Other Business Services,' and then disaggregates these into around one hundred subcategories. Furthermore, because information on trade in services is based on the payments associated with them, the origin and destination of a flow are those of the payer and the recipient, respectively, not necessarily those of the flow's actual exporter and importer.

Although some researchers have carried out excellent work with the available data (Ariu, 2016; Ariu et al., 2019; Santacreu, 2023), the sparsity of this data is a serious limitation in our efforts to understand comparative advantage in service provision and in trying to delineate the implications of trade in services for the labor market.

At the same time, understanding international trade in services is of paramount importance. As services account for an increasing share of global trade, it is crucial to develop better tools for measuring and analyzing the flow of services across borders. Furthermore, certain forms of service trade (e.g., digital trade, trade in 'data') are likely to rise significantly in coming

years, so collecting more granular data on these transactions seems of great importance. Finally, cross-border transactions in 'royalties and license fees' are a key aspect of offshore profit-shifting practices of MNEs (Santacreu, 2023), so governmental agencies should be keen on investing to improve the quality of that data. Researchers seeking to understand how the geography of physical production shapes the creation and diffusion of knowledge could also greatly benefit from having access to more detailed information on these cross-border intellectual property transactions. In the current digital era, improving the collection of data on service trade appears both feasible and important.

4.3 Major Improvements to Official Statistics: Cross-Border Collaboration

Let me next turn to a few more ambitious suggestions, which I think would fundamentally change the landscape of empirical international trade research. As described in section 2, one of the most active areas of theoretical research in recent years consists of a reinterpretation of international trade transactions as being slices of global value chains. From a conceptual point of view, this indicates that these transactions cannot be studied in isolation, independently of other slices in those chains. Of course, the international trade field never treats transactions as being entirely independent from other transactions, but traditional and new trade theories focus on general equilibrium or industry equilibrium interdependencies. In GVC research, these interdependencies instead take place at the firm level or at the chain level.

For these reasons, the demand for datasets that provide an accurate portrait of the geography of GVCs has risen dramatically in recent years. Such increased demand is not coming only from academia. Calls for increased supply chain resilience after the COVID-19 pandemic, and recent national security concerns related to the opacity of some GVCs, have increased the demand by policy makers of information that allows them to monitor the GVC strategies of firms producing in their economies. Similarly, information on production processes that occur offshore is an important element in the implementation of carbon border adjustment mechanisms. How granular is the structure of GVCs and how important is that for shock transmission or for national security? How far does value added embodied in consumer goods travel on average and what is the carbon footprint of these sequential flows across countries? These are questions of great relevance but for which accurate answers require accurate data, which unfortunately we currently lack.

The monumental efforts that go into the construction of world input-output tables should be applauded, and these tables have greatly spurred research on GVCs. But their construction relies on a significant amount of imputation, which makes one treat quantitative analyses based

on them with a grain of salt (see Antràs and Chor, 2022).[22] There are currently a few ongoing projects using AI and machine learning techniques to construct more disaggregated global input-output tables based on detailed product-level information trade flows (Karbevska and Hidalgo, 2023; Fetzer et al., 2024), but only time will tell how accurately these techniques approximate actual global value chains.

An alternative approach to delineating global value chains, and one that would preserve the high quality of data currently being used by trade economists, would involve cross-border agreements that would lead to a global merge of all (or at least a significant share of all) available customs-level trade transactions, and ideally, also any available data on intranational firm-to-firm transactions (from value-added tax forms or enterprise surveys). With standardized product classifications and firm identifiers, merging those cross-border datasets might not be an insurmountable task.[23]

Obviously, such an undertaking would raise concerns about the governance of these merged datasets. International organizations (such as the WTO, the IMF, and the World Bank) could play a leading role in such an initiative, but this honestly feels a bit hopeless in the current geopolitical environment. Still, recent concerns about national security may prove to be an eye opener for many policy makers, so perhaps a silver lining of the current treacherous geopolitical situation is that it may fuel a more concerted push to make this initiative materialize in the future. If a more propitious time arises, increased collaboration between academic and government researchers is likely to raise the odds of such an ambitious project coming to fruition.

4.4 New Data Sources

Leaving aside data collected by government agencies, researchers should continue to use their ingenuity and (research budgets) to uncover new sources of data that can shed light on aspects of the global economy. I have reviewed some examples of this toward the end of section 2.4, when reviewing work that has 'unshackled' itself from traditional data sources. I expect to continue to witness in awe how researchers bring to the field previously untapped resources.

Exploiting new sources of data may be particularly relevant for the area of research I am most familiar with, seeking to provide a more accurate and granular map of global value chains. A number of recent papers have shed light on the global geography of production relying on the WorldBase dataset of Dun and Bradstreet (D&B), an establishment-level database covering public and private companies in more than 100 countries. This data, however, has its limitation, most notably it only has basic operational data for a subset of companies in the sample, and it

[22] As I jokingly tell my students, world input-output tables are a bit like sausages: tasty, but you don't want to know how they are made.

[23] The EU Regulation number 2019/2152 on European business statistics constitutes a step in this direction, acknowledging the necessity of harmonizing and exchanging micro-data within the European Union.

contains no information on the transactions carried out by these firms (not even aggregated at the destination or source market level).

Given the current buzz about big data and the demand for information on global value chains from both the private sector and government agencies, it is not surprising that some private companies are investing in collecting such data, with the goal of making it available to users for a fee. An example is Altana.ai, which relies on a federated learning architecture (i.e., a decentralized machine learning framework that allows multiple entities to collaboratively train a shared machine learning model while keeping their data local and private) to construct a global network of supply chains across the public and private sectors. I expect that researchers and government agencies will be using more and more of these novel 'non-official' datasets in future years. This will obviously continue to raise concerns about data quality, sample selection, and perhaps cost, but I am hopeful that these data-collecting private companies will prove to be a game changer for our field.

5 Uncharted Policy Waters

In the recent intellectual history of the international trade field, theoretical research has tended to lag empirical research by a few years, and research on policy aspects has tended to lag theoretical research also by a few years. For the case of *New Trade Theory*, empirical studies in the 1960s and 1970s (e.g., Grubel and Lloyd, 1971) were fundamental in motivating the theoretical work in the late 1970s and early 1980s, which in turn lead to a wave of work on strategic trade policy in the mid and late 1980s (see Helpman and Krugman, 1989, for an overview). More recently, the advent of firm-level approaches to trade participation followed a similar trajectory, starting with empirical work in the mid and late 1990s, theoretical work in the early 2000s, and work on trade policy and firm heterogeneity starting in the late 2000s (e.g., Demidova and Rodríguez-Clare, 2009).

If recent history provides any guidance, the type of new theoretical and empirical developments that I have outlined in previous sections, if brought to fruition, should lay the groundwork for future work on international trade policy. How should a country manage the participation of its agents in GVCs in the face of geopolitical risks? How should governments reign on the market power of the superstar lead firms managing GVCs? Should countries subsidize firms that feature high degrees of diversification in their sourcing strategies or tax those that feature low levels of diversification? What is the optimal design of Trade Adjustment Assistance (TAA) programs? Should we *actually* have TAA programs in addition to standard unemployment benefits? How should one design industrial policies or carbon border adjustment mechanisms so they stand the highest chance of succeeding? These are just a few questions which can be (and, in some cases, have been) partly answered with available

models, methods, and data, but for which research in coming years is likely to produce novel insights for policy makers.

Rather than providing speculative answers to these questions, I want to conclude with some thoughts on a broader topic, which relates to how artificial intelligence, big data and machine learning might impact the design of policies, and of trade and industrial policies more narrowly. Some argue that big data and computational power may permit a more 'surgical' approach to policy allowing governments to design more targeted and effective policies. Consider the following quote from Jack Ma, founder of Alibaba (cited in Boettke and Candela, 2023):

> "Over the past 100 years, we have come to believe that the market economy is the best system, but in my opinion, there will be a significant change in the next three decades, and the planned economy will become increasingly big. Why? Because with access to all kinds of data, we may be able to find the invisible hand of the market. [...] In the era of big data, the abilities of human beings in obtaining and processing data are greater than you can imagine. With the help of artificial intelligence or multiple intelligence, our perception of the world will be elevated to a new level. As such, big data will make the market smarter and make it possible to plan and predict market forces so as to allow us to finally achieve a planned economy."

The implication of Jack Ma's quote is that 'market socialism' à la Oskar Lange (Lange, 1936, 1937) is more feasible today with our current access to AI than in Lange's times. I am much less optimistic than Ma is about AI allowing governments to efficiently replace the market mechanism. Conceptually, Hayek already demonstrated eighty years ago that the pitfalls of market socialism were unrelated to computing power; instead, socialism cannot efficiently allocate resources due to the absence of market-driven price signals (Hayek, 1945). In other words, AI does not eliminate Hayek's 'knowledge problem.' On the empirical front, my sense is that big data and machine learning may greatly improve the accuracy of forecasts, but when it comes to causal inference, I am less sure that big data will serve as a replacement for experimental and quasi-experimental approaches to teasing out how specific policies exactly shape the workings of the global economy. In any case, it seems safe to expect that AI and big data will alter the pros and cons of government intervention in certain economic spheres, including in areas related to international trade.

6 Conclusion

While defending his mathematical approach to general equilibrium theory in the *Journal of Political Economy*, Vilfredo Pareto (1897) stated:

> "Is it not a most remarkable fact that a system of equations should thus be able to express not only the general character of economic phenomena, but every single detail as far as we may have any knowledge of them. The entire body of economic theory is henceforth bound together in this way and knitted into an integral whole. If our equations are constructed each for a homogeneous group, and groups are considered, we get [...] an effectively complete theory of international trade, together with an adequate scientific interpretation of the theory of comparative cost." (Vilfredo Pareto, *Journal of Political Economy*, 1897)

It is hard to overstate the importance of Pareto's mathematical approach to general equilibrium for the development of economics, but one hundred and twenty-eight years later, his claimed of having achieved an "*effectively complete theory of international trade*" capturing "*every single detail*" does not seem particularly prescient. I think most economists understand that economics is both a relatively young and a relatively complex type of science, so there is little presumption that the type of economic models that are in vogue today will continue to reign dominant in the near future. We economists can only hope that, by contributing to a growing body of knowledge, we will facilitate the work of future generations, who will probably have better tools to help policy makers address the key economic problems faced by society.

Putting this in terms of the metaphor that I have used throughout this article, the seas of international trade research are unbounded, and there will always remain uncharted waters to explore. Navigational maps may serve the useful role of indicating safe passages to uncharted waters, but a large availability of these maps should not deceive young sailors into thinking that all seas have been charted. There are many hidden treasures to uncover.

References

Adão, Rodrigo, Arnaud Costinot, and Dave Donaldson, "Nonparametric counterfactual predictions in neoclassical models of international trade," *American Economic Review*, 2017, *107* (3), 633–689.

_ , _ , and _ , "Putting Quantitative Trade Models to the Test: Evidence from the Trump Tariffs," forthcoming, *Quarterly Journal of Economics*, 2024.

_ , Paul Carrillo, Arnaud Costinot, Dave Donaldson, and Dina Pomeranz, "Imports, exports, and earnings inequality: Measures of exposure and estimates of incidence," *The Quarterly Journal of Economics*, 2022, *137* (3), 1553–1614.

Akcigit, Ufuk and Marc Melitz, "International trade and innovation," in Gita Gopinath, Elhanan Helpman, and Kenneth Rogoff, eds., *Handbook of International Economics: International Trade, Volume 5*, Vol. 5 of *Handbook of International Economics*, Elsevier, 2022, pp. 377–404.

Alekseev, Maxim and Xinyue Lin, "Trade policy in the shadow of conflict: the case of dual-use goods," 2024.

Alfaro, Laura, Maggie Chen, and Davin Chor, "Can evidence-based information shift preferences towards trade policy?," Working Paper 31240, National Bureau of Economic Research 2023.

Alfaro-Urena, Alonso, Juanma Castro-Vincenzi, Sebastián Fanelli, and Eduardo Morales, "Firm export dynamics in interdependent markets," Working Paper 31610, National Bureau of Economic Research 2023.

Almunia, Miguel, Pol Antràs, David Lopez-Rodriguez, and Eduardo Morales, "Venting out: Exports during a domestic slump," *American Economic Review*, 2021, *111* (11), 3611–3662.

Alviarez, Vanessa I, Michele Fioretti, Ken Kikkawa, and Monica Morlacco, "Two-sided market power in firm-to-firm trade," Working Paper 31253, National Bureau of Economic Research 2023.

Amiti, Mary and David E Weinstein, "Exports and financial shocks," *Quarterly Journal of Economics*, 2011, *126* (4), 1841–1877.

_ and Jozef Konings, "Trade liberalization, intermediate inputs, and productivity: Evidence from Indonesia," *American Economic Review*, 2007, *97* (5), 1611–1638.

_ , Oleg Itskhoki, and Jozef Konings, "International shocks, variable markups, and domestic prices," *Review of Economic Studies*, 2019, *86* (6), 2356–2402.

Anderson, James E, "A theoretical foundation for the gravity equation," *American Economic Review*, 1979, *69* (1), 106–116.

_ and Eric Van Wincoop, "Gravity with gravitas: A solution to the border puzzle," *American Economic Review*, 2003, *93* (1), 170–192.

Antràs, Pol, "Firms, Contracts, and Trade Structure," *Quarterly Journal of Economics*, 2003, *118* (4), 1375–1418.

_ , *Global production: Firms, contracts, and trade structure*, Princeton University Press, 2015.

_ , **Alonso de Gortari, and Oleg Itskhoki**, "Globalization, inequality and welfare," *Journal of International Economics*, 2017, *108*, 387–412.

_ **and** _ , "On the geography of global value chains," *Econometrica*, 2020, *88* (4), 1553–1598.

_ **and C Fritz Foley**, "Poultry in motion: a study of international trade finance practices," *Journal of Political Economy*, 2015, *123* (4), 853–901.

_ **and Davin Chor**, "Organizing the global value chain," *Econometrica*, 2013, *81* (6), 2127–2204.

Antràs, Pol and Davin Chor, "Global Value Chains," in Gita Gopinath, Elhanan Helpman, and Kenneth Rogoff, eds., *Handbook of International Economics*, Elsevier, 2022, chapter 5, pp. 297 – 376.

Antràs, Pol and Elhanan Helpman, "Global sourcing," *Journal of Political Economy*, 2004, *112* (3), 552–580.

_ **and Gerard Padró i Miquel**, "Foreign influence and welfare," *Journal of International Economics*, 2011, *84* (2), 135–148.

_ **and** _ , "Exporting Ideology: The Right and Left of Foreign Influence," Working Paper 31399, National Bureau of Economic Research 2023.

_ **and Stephen R Yeaple**, "Multinational firms and the structure of international trade," *Handbook of International Economics*, 2014, *4*, 55–130.

_ **, David Ramos-Menchelli, and Eduardo Morales**, "Reciprocal Dumping or Pro-Competitive Effects from Trade? Trade and Welfare under Oligopolistic Competition," 2025.

_ **, Evgenii Fadeev, Teresa C. Fort, and Felix Tintelnot**, "Exporting, Global Sourcing, and Multinational Activity: Theory and Evidence from the United States," *Review of Economics and Statistics*, 04 2024, pp. 1–48.

_ **, Luis Garicano, and Esteban Rossi-Hansberg**, "Offshoring in a knowledge economy," *Quarterly Journal of Economics*, 2006, *121* (1), 31–77.

_ **, Teresa C Fort, and Felix Tintelnot**, "The margins of global sourcing: Theory and evidence from us firms," *American Economic Review*, 2017, *107* (9), 2514–64.

Ariu, Andrea, "Services versus goods trade: a firm-level comparison," *Review of World Economics*, 2016, *152* (1), 19–41.

_ **, Holger Breinlich, Gregory Corcos, and Giordano Mion**, "The interconnections between services and goods trade at the firm-level," *Journal of International Economics*, 2019, *116*, 173–188.

Arkolakis, Costas, Arnaud Costinot, and Andrés Rodríguez-Clare, "New Trade Models, Same Old Gains?," *American Economic Review*, 2012, *102* (1), 94–130.

_ , _ , **Dave Donaldson, and Andrés Rodríguez-Clare**, "The elusive pro-competitive effects of trade," *Review of Economic Studies*, 2019, *86* (1), 46–80.

_ **, Fabian Eckert, and Rowan Shi**, "Combinatorial discrete choice: A quantitative model of multinational location decisions," Working Paper 31877, National Bureau of Economic Research 2023.

_ , **Natalia Ramondo, Andrés Rodríguez-Clare, and Stephen Yeaple**, "Innovation and production in the global economy," *American Economic Review*, 2018, *108* (8), 2128–2173.

Artuç, Erhan, Shubham Chaudhuri, and John McLaren, "Trade shocks and labor adjustment: A structural empirical approach," *American Economic Review*, 2010, *100* (3), 1008–1045.

Atkeson, Andrew and Ariel Burstein, "Pricing-to-market, trade costs, and international relative prices," *American Economic Review*, 2008, *98* (5), 1998–2031.

Atkin, David, "Endogenous skill acquisition and export manufacturing in Mexico," *American Economic Review*, 2016, *106* (8), 2046–2085.

_ , **Amit K Khandelwal, and Adam Osman**, "Exporting and firm performance: Evidence from a randomized experiment," *Quarterly Journal of Economics*, 2017, *132* (2), 551–615.

_ **and Dave Donaldson**, "The role of trade in economic development," in "Handbook of International Economics," Vol. 5, Elsevier, 2022, pp. 1–59.

Autor, David, David Dorn, and Gordon Hanson, "When work disappears: Manufacturing decline and the falling marriage market value of young men," *American Economic Review: Insights*, 2019, *1* (2), 161–178.

_ , _ , **Lawrence F Katz, Christina Patterson, and John Van Reenen**, "The fall of the labor share and the rise of superstar firms," *Quarterly Journal of Economics*, 2020, *135* (2), 645–709.

Autor, David H, David Dorn, and Gordon H Hanson, "The China syndrome: Local labor market effects of import competition in the United States," *American Economic Review*, 2013, *103* (6), 2121–2168.

Aw, Bee Yan, Mark J Roberts, and Daniel Yi Xu, "R&D investment, exporting, and productivity dynamics," *American Economic Review*, 2011, *101* (4), 1312–1344.

Baley, Isaac and Laura L Veldkamp, *The Data Economy: Tools and Applications*, Princeton University Press, 2025.

Baqaee, David Rezza and Emmanuel Farhi, "Networks, barriers, and trade," *Econometrica*, 2024, *92* (2), 505–541.

Barjamovic, Gojko, Thomas Chaney, Kerem Coşar, and Ali Hortaçsu, "Trade, merchants, and the lost cities of the bronze age," *Quarterly Journal of Economics*, 2019, *134* (3), 1455–1503.

Becko, John Sturm, "A theory of economic sanctions as terms-of-trade manipulation," *Journal of International Economics*, 2024, *150*, 103898.

_ **and Daniel G. O'Connor**, "Strategic (Dis) Integration," 2024.

Berger, Daniel, William Easterly, Nathan Nunn, and Shanker Satyanath, "Commercial Imperialism? Political Influence and Trade during the Cold War," *American Economic Review*, April 2013, *103* (2), 863–896.

Bergstrand, Jeffrey H, "The gravity equation in international trade: some microeconomic foundations and empirical evidence," *Review of Economics and Statistics*, 1985, pp. 474–481.

Bernard, Andrew B and J Bradford Jensen, "Exceptional exporter performance: cause, effect, or both?," *Journal of International Economics*, 1999, *47* (1), 1–25.

Bernard, Andrew B., Andreas Moxnes, and Karen Helene Ulltveit-Moe, "Two-Sided Heterogeneity and Trade," *Review of Economics and Statistics*, 2018, *100* (3), 424–439.

_ , J. Bradford Jensen, and Peter K. Schott, "Importers, Exporters, and Multinationals: A Portrait of Firms in the U.S. that Trade Goods," in T. Dunne, J.B. Jensen, and M.J. Roberts, eds., *Producer Dynamics: New Evidence from Micro Data*, University of Chicago Press, 2009.

_ , _ , Stephen J. Redding, and Peter K. Schott, "Firms in International Trade," *Journal of Economic Perspectives*, 2007, *21* (3), 105–130.

Bernard, Andrew B, J Bradford Jensen, Stephen J Redding, and Peter K Schott, "Global firms," *Journal of Economic Literature*, 2018, *56* (2), 565–619.

_ , Jonathan Eaton, J Bradford Jensen, and Samuel Kortum, "Plants and productivity in international trade," *American Economic Review*, 2003, *93* (4), 1268–1290.

_ , Stephen J Redding, and Peter K Schott, "Comparative advantage and heterogeneous firms," *Review of Economic Studies*, 2007, *74* (1), 31–66.

_ , _ , and _ , "Multiproduct firms and trade liberalization," *Quarterly Journal of Economics*, 2011, *126* (3), 1271–1318.

_ , Valerie Smeets, and Frederic Warzynski, "Rethinking deindustrialization," *Economic Policy*, 2017, *32* (89), 5–38.

Berry, Steven and Peter Reiss, "Empirical models of entry and market structure," *Handbook of Industrial Organization*, 2007, *3*, 1845–1886.

Bilir, L Kamran and Eduardo Morales, "Innovation in the global firm," *Journal of Political Economy*, 2020, *128* (4), 1566–1625.

Boettke, Peter J and Rosolino A Candela, "On the feasibility of technosocialism," *Journal of Economic Behavior & Organization*, 2023, *205*, 44–54.

Bordalo, Pedro, Nicola Gennaioli, and Andrei Shleifer, "Salience and Consumer Choice," *Journal of Political Economy*, 2013, *121* (5), 803–843.

Borin, Alessandro and Michele Mancini, "Measuring what matters in global value chains and value-added trade," *World Bank Policy Research Working Paper*, 2019, (8804).

Borusyak, Kirill and Xavier Jaravel, "The distributional effects of trade: Theory and evidence from the United States," Working Paper 28957, National Bureau of Economic Research 2021.

Bowen, Harry P, Edward E Leamer, and Leo Sveikauskas, "Multicountry, Multifactor Tests of the Factor Abundance Theory," *American Economic Review*, 1987, *77* (5), 791–809.

Brancaccio, Giulia, Myrto Kalouptsidi, and Theodore Papageorgiou, "Geography, transportation, and endogenous trade costs," *Econometrica*, 2020, *88* (2), 657–691.

Brander, James A, "Intra-industry trade in identical commodities," *Journal of International Economics*, 1981, *11* (1), 1–14.

_ **and Barbara J Spencer**, "Export subsidies and international market share rivalry," *Journal of International Economics*, 1985, *18* (1-2), 83–100.

Brander, James and Paul Krugman, "A 'reciprocal dumping' model of international trade," *Journal of International Economics*, 1983, *15* (3-4), 313–321.

Breinlich, Holger, Harald Fadinger, Volker Nocke, and Nicolas Schutz, "Gravity with granularity," 2024.

_ **, Volker Nocke, and Nicolas Schutz**, "Merger policy in a quantitative model of international trade," *The Economic Journal*, 2020, *130* (626), 393–421.

Broner, Fernando, Alberto Martin, Josefin Meyer, and Christoph Trebesch, "Hegemonic Globalization," 2024.

Bui, Ha, Zhen Huo, Andrei A Levchenko, and Nitya Pandalai-Nayar, "Noisy Global Value Chains," Technical Report, National Bureau of Economic Research 2022.

Caliendo, Lorenzo and Fernando Parro, "Estimates of the Trade and Welfare Effects of NAFTA," *Review of Economic Studies*, 2015, *82* (1), 1–44.

_ **and** _ , "Trade policy," *Handbook of International Economics*, 2022, *5*, 219–295.

_ **, Maximiliano Dvorkin, and Fernando Parro**, "Trade and labor market dynamics: General equilibrium analysis of the china trade shock," *Econometrica*, 2019, *87* (3), 741–835.

Carballo, Jerónimo, Marisol Rodriguez Chatruc, Catalina Salas Santa, and Christian Volpe Martincus, "Online business platforms and international trade," *Journal of International Economics*, 2022, *137*, 103599.

Chaney, Thomas, "Distorted gravity: the intensive and extensive margins of international trade," *American Economic Review*, 2008, *98* (4), 1707–21.

Chatruc, Marisol Rodriguez, Ernesto Stein, and Razvan Vlaicu, "How issue framing shapes trade attitudes: Evidence from a multi-country survey experiment," *Journal of International Economics*, 2021, *129*, 103428.

Chaudhuri, Shubham, Pinelopi K Goldberg, and Panle Jia, "Estimating the effects of global patent protection in pharmaceuticals: a case study of quinolones in India," *American Economic Review*, 2006, *96* (5), 1477–1514.

Chen, Maggie X and Min Wu, "The value of reputation in trade: Evidence from Alibaba," *Review of Economics and Statistics*, 2021, *103* (5), 857–873.

Chor, Davin and Bingjing Li, "Illuminating the effects of the US-China tariff war on China's economy," *Journal of International Economics*, 2024, *150*, 103926.

Ciliberto, Federico and Ina Charlotte Jäkel, "Superstar Exporters: An Empirical Investigation of Strategic Interactions in Danish Export Markets," *Available at SSRN 3037145*, 2017.

Clayton, Christopher, Matteo Maggiori, and Jesse Schreger, "A Framework for Geopolitics and Economics," June 2023.

_ , _ , and _ , "A Theory of Economic Coercion and Fragmentation," *SocArXiv*, March 2024. Number: j8wgx Publisher: Center for Open Science.

Colantone, Italo, Gianmarco Ottaviano, and Piero Stanig, "The backlash of globalization," in "Handbook of International Economics," Vol. 5, Elsevier, 2022, pp. 405–477.

Copeland, Brian R., Joseph S. Shapiro, and M. Scott Taylor, "Globalization and the environment," in Gita Gopinath, Elhanan Helpman, and Kenneth Rogoff, eds., *Handbook of International Economics: International Trade, Volume 5*, Vol. 5 of *Handbook of International Economics*, Elsevier, 2022, pp. 61–146.

Coşar, A Kerem, Paul LE Grieco, Shengyu Li, and Felix Tintelnot, "What drives home market advantage?," *Journal of International Economics*, 2018, *110*, 135–150.

Costinot, Arnaud and Andrés Rodríguez-Clare, "Trade Theory with Numbers: Quantifying the Consequences of Globalization," in Gita Gopinath, Elhanan Helpman, and Kenneth Rogoff, eds., *Handbook of International Economics*, Vol. 4, Amsterdam: Elsevier, 2014, chapter 4.

_ , **Dave Donaldson, Margaret Kyle, and Heidi Williams**, "The more we die, the more we sell? a simple test of the home-market effect," *Quarterly Journal of Economics*, 2019, *134* (2), 843–894.

Couttenier, Mathieu, Julian Marcoux, Thierry Mayer, and Mathias Thoenig, "The Gravity of Violence," 2023.

Davis, Donald R. and David E. Weinstein, "An Account of Global Factor Trade," *American Economic Review*, 2001, *91*, 1423–1453.

Decker, Ryan A, John Haltiwanger, Ron S Jarmin, and Javier Miranda, "Where has all the skewness gone? The decline in high-growth (young) firms in the US," *European Economic Review*, 2016, *86*, 4–23.

Dekle, Robert, Jonathan Eaton, and Samuel Kortum, "Global Rebalancing with Gravity: Measuring the Burden of Adjustment," *Robert Flood Editor and Committee Chair Ayhan Kose Co-Editor*, 2008, *55* (3), 511–540.

Demidova, Svetlana and Andrés Rodríguez-Clare, "Trade policy under firm-level heterogeneity in a small economy," *Journal of International Economics*, 2009, *78* (1), 100–112.

Dhyne, Emmanuel, Ayumu Ken Kikkawa, Magne Mogstad, and Felix Tintelnot, "Trade and domestic production networks," *Review of Economic Studies*, 2021, *88* (2), 643–668.

Dickstein, Michael J and Eduardo Morales, "What do exporters know?," *Quarterly Journal of Economics*, 2018, *133* (4), 1753–1801.

Diez, Mr Federico, Mr Daniel Leigh, and Suchanan Tambunlertchai, "Global market power and its macroeconomic implications," 2018.

Ding, Siying, Ahmad Lashkaripour, and Volodymyr Lugovskyy, "A Global Perspective on the Incidence of Monopoly Distortions," 2024.

Ding, Xiang, Teresa C Fort, Stephen J Redding, and Peter K Schott, "Structural change within versus across firms: Evidence from the United States," Working Paper 30127, National Bureau of Economic Research 2022.

Dingel, Jonathan I and Felix Tintelnot, "Spatial economics for granular settings," Working Paper 27287, National Bureau of Economic Research 2023.

Dix-Carneiro, Rafael, "Trade liberalization and labor market dynamics," *Econometrica*, 2014, *82* (3), 825–885.

_ and Brian K Kovak, "Trade liberalization and regional dynamics," *American Economic Review*, 2017, *107* (10), 2908–2946.

Donaldson, Dave, "Railroads of the Raj: Estimating the impact of transportation infrastructure," *American Economic Review*, 2018, *108* (4-5), 899–934.

Dube, Oeindrila and Juan F Vargas, "Commodity price shocks and civil conflict: Evidence from Colombia," *Review of Economic Studies*, 2013, *80* (4), 1384–1421.

Eaton, Jonathan and Samuel Kortum, "Technology, geography, and trade," *Econometrica*, 2002, *70* (5), 1741–1779.

_ and _ , "Putting Ricardo to work," *Journal of Economic Perspectives*, 2012, *26* (2), 65–90.

_ , _ , and Francis Kramarz, "An anatomy of international trade: Evidence from French firms," *Econometrica*, 2011, *79* (5), 1453–1498.

_ , Samuel S Kortum, and Sebastian Sotelo, "International trade: Linking micro and macro," 2012.

Edmond, Chris, Virgiliu Midrigan, and Daniel Yi Xu, "Competition, markups, and the gains from international trade," *American Economic Review*, 2015, *105* (10), 3183–3221.

Edmonds, Eric V and Nina Pavcnik, "The effect of trade liberalization on child labor," *Journal of International Economics*, 2005, *65* (2), 401–419.

Epifani, Paolo and Gino Gancia, "Trade, markup heterogeneity and misallocations," *Journal of International Economics*, 2011, *83* (1), 1–13.

European Commission, International Monetary Fund-Organisation for Economic Co-operation and Development United Nations Conference on Trade and Development World Trade Organization United Nations, *Manual on Statistics of International Trade in Services 2010*, New York: United Nations, 2010. Accessed: 2024-11-30.

Federico, Stefano, Fadi Hassan, and Veronica Rappoport, "Trade shocks and credit reallocation," Working Paper 31111, National Bureau of Economic Research 2023.

Feenstra, Robert C and Gordon H Hanson, "Foreign direct investment and relative wages: Evidence from Mexico's maquiladoras," *Journal of International Economics*, 1997, *42* (3-4), 371–393.

Fernandes, Ana M, Peter J Klenow, Sergii Meleshchuk, Martha Denisse Pierola, and Andrés Rodríguez-Clare, "The intensive margin in trade: How big and how important?," *American Economic Journal: Macroeconomics*, 2023, *15* (3), 320–354.

Ferreira, Fernando and Joel Waldfogel, "Pop internationalism: Has half a century of world music trade displaced local culture?," *The economic journal*, 2013, *123* (569), 634–664.

Fetzer, Thiemo, Peter John Lambert, Bennet Feld, and Prashant Garg, "AI-generated production networks: Measurement and applications to global trade," 2024.

Feyrer, James, "Trade and income - exploiting time series in geography," *American Economic Journal: Applied Economics*, 2019, *11* (4), 1–35.

_ , "Distance, trade, and income - The 1967 to 1975 closing of the Suez Canal as a natural experiment," *Journal of Development Economics*, 2021, *153*, 102708.

Findlay, Ronald and Stanislaw Wellisz, "Endogenous tariffs, the political economy of trade restrictions, and welfare," in "Import competition and response," University of Chicago Press, 1982, pp. 223–244.

Fort, Teresa C, "Technology and production fragmentation: Domestic versus foreign sourcing," *Review of Economic Studies*, 2017, *84* (2), 650–687.

_ , "The changing firm and country boundaries of US manufacturers in global value chains," *Journal of Economic Perspectives*, 2023, *37* (3), 31–58.

Freund, Caroline and Çağlar Özden, "Trade policy and loss aversion," *American Economic Review*, 2008, *98* (4), 1675–1691.

_ **and Martha Denisse Pierola**, "Export superstars," *Review of Economics and Statistics*, 2015, *97* (5), 1023–1032.

Gabaix, Xavier, "A Sparsity-Based Model of Bounded Rationality," *Quarterly Journal of Economics*, 2014, *129* (4), 1661–1710.

Gaubert, Cecile and Oleg Itskhoki, "Granular comparative advantage," *Journal of Political Economy*, 2021, *129* (3), 871–939.

Goldberg, Pinelopi Koujianou, Amit Kumar Khandelwal, Nina Pavcnik, and Petia Topalova, "Imported intermediate inputs and domestic product growth: Evidence from India," *Quarterly Journal of Economics*, 2010, *125* (4), 1727–1767.

_ **and Giovanni Maggi**, "Protection for sale: An empirical investigation," *American Economic Review*, 1999, *89* (5), 1135–1155.

Gopinath, Gita, Pierre-Olivier Gourinchas, Andrea Presbitero, Mr Andrea F Presbitero, and Petia Topalova, *Changing global linkages: A new Cold War?*, International Monetary Fund, 2024.

Graziano, Alejandro G, "International Trade, Market Concentration and Welfare," 2024.

Grieco, Paul LE, Charles Murry, and Ali Yurukoglu, "The evolution of market power in the us automobile industry," *The Quarterly Journal of Economics*, 2024, *139* (2), 1201–1253.

Grossman, Gene M and Elhanan Helpman, "Protection for sale," *American Economic Review*, 1994, *84* (4), 833.

Grossman, Gene M. and Elhanan Helpman, "Identity Politics and Trade Policy," *Review of Economic Studies*, 2021, *88* (3), 1101–1126.

Grossman, Gene M and Esteban Rossi-Hansberg, "Trading tasks: A simple theory of offshoring," *American Economic Review*, 2008, *98* (5), 1978–1997.

Grubel, Herbert G and Peter J Lloyd, "The Empirical Measurement of Intra-Industry Trade.," *Economic Record*, 1971, *47* (120).

Guvenen, Fatih, Raymond J Mataloni Jr, Dylan G Rassier, and Kim J Ruhl, "Offshore profit shifting and aggregate measurement: Balance of payments, foreign investment, productivity, and the labor share," *American Economic Review*, 2022, *112* (6), 1848–1884.

Halpern, László, Miklós Koren, and Adam Szeidl, "Imported inputs and productivity," *American Economic Review*, 2015, *105* (12), 3660–3703.

Harrigan, James, "Technology, Factor Supplies, and International Specialization: Estimating the Neoclassical Model," *American Economic Review*, 1997, *87* (4), 475–494.

Hayek, FA, "The Use of Knowledge in Society," *American Economic Review*, 1945, *35* (4).

Head, Keith and Barbara J Spencer, "Oligopoly in international trade: Rise, fall and resurgence," *Canadian Journal of Economics/Revue Canadienne d'Économique*, 2017, *50* (5), 1414–1444.

_ and Thierry Mayer, "Gravity equations: Workhorse, toolkit, and cookbook," in "Handbook of International Economics," Vol. 4, Elsevier, 2014, pp. 131–195.

_ and _ , "Brands in motion: How frictions shape multinational production," *American Economic Review*, 2019, *109* (9), 3073–3124.

_ , _ , and John Ries, "Revisiting oligopolistic reaction: are decisions on foreign direct investment strategic complements?," *Journal of Economics & Management Strategy*, 2002, *11* (3), 453–472.

_ , _ , and Mathias Thoenig, "Welfare and trade without Pareto," *American Economic Review*, 2014, *104* (5), 310–316.

Helpman, Elhanan and Paul Krugman, *Market structure and foreign trade: Increasing returns, imperfect competition, and the international economy* 1985.

_ and _ , "Trade policy and market," *Structure, The MIT Press*, 1989.

_ , Marc J Melitz, and Stephen R Yeaple, "Export versus FDI with heterogeneous firms," *American Economic Review*, 2004, *94* (1), 300–316.

_ , Marc Melitz, and Yona Rubinstein, "Estimating trade flows: Trading partners and trading volumes," *Quarterly Journal of Economics*, 2008, *123* (2), 441–487.

_ , Oleg Itskhoki, and Stephen Redding, "Inequality and unemployment in a global economy," *Econometrica*, 2010, *78* (4), 1239–1283.

Hillman, Arye L, "Declining industries and political-support protectionist motives," *American Economic Review*, 1982, *72* (5).

Hirschman, Albert O., *National Power and the Structure of Foreign Trade, by Albert O. Hirschman*, University of California Press, 1945. Google-Books-ID: l9ywwgEACAAJ.

Hiscox, Michael J., "Through a Glass and Darkly: Attitudes Toward International Trade and the Curious Effects of Issue Framing," *International Organization*, 2006, *60* (3), 755–780.

Hottman, Colin J, Stephen J Redding, and David E Weinstein, "Quantifying the sources of firm heterogeneity," *Quarterly Journal of Economics*, 2016, *131* (3), 1291–1364.

Hummels, David, Jun Ishii, and Kei-Mu Yi, "The Nature and Growth of Vertical Specialization in World Trade," *Journal of International Economics*, 2001, *54* (1), 75–96.

_ , Rasmus Jørgensen, Jakob Munch, and Chong Xiang, "The wage effects of offshoring: Evidence from Danish matched worker-firm data," *American Economic Review*, 2014, *104* (6), 1597–1629.

Huneeus, Federico, "Production network dynamics and the propagation of shocks," 2018.

Igami, Mitsuru, "Industry dynamics of offshoring: The case of hard disk drives," *American Economic Journal: Microeconomics*, 2018, *10* (1), 67–101.

Impullitti, Giammario and Omar Licandro, "Trade, firm selection and innovation: The competition channel," *The Economic Journal*, 2018, *128* (608), 189–229.

_ , _ , and Pontus Rendahl, "Technology, market structure and the gains from trade," *Journal of International Economics*, 2022, *135*, 103557.

Itskhoki, Oleg and Elina Ribakova, "The economics of sanctions: From theory into practice," 2024.

Iyoha, Ebehi, Edmund J. Malesky, Jaya Wen, Sung-Ju Wu, and Bo Feng, "Exports in Disguise: Trade Re-Routing During the U.S.-China Trade War," 2024.

Jaravel, Xavier and Erick Sager, "What are the Price Effects of Trade? Evidence from the US and Implications for Quantitative Trade Models," 2019.

Jia, Panle, "What happens when Wal-Mart comes to town: An empirical analysis of the discount retailing industry," *Econometrica*, 2008, *76* (6), 1263–1316.

Johnson, Harry G, "Optimum tariffs and retaliation," *Review of Economic Studies*, 1953, *21* (2), 142–153.

Johnson, Robert C. and Guillermo Noguera, "Accounting for Intermediates: Production Sharing and Trade in Value Added," *Journal of International Economics*, 2012, *86* (2), 224–236.

Juhász, Réka, "Temporary protection and technology adoption: Evidence from the napoleonic blockade," *American Economic Review*, 2018, *108* (11), 3339–3376.

Kahneman, Daniel and Amos Tversky, "Prospect Theory: An Analysis of Decision under Risk," *Econometrica*, 1979, *47* (2), 263–292.

Karbevska, Lea and César A Hidalgo, "Mapping global value chains at the product level," *arXiv preprint arXiv:2308.02491*, 2023.

Kehoe, Timothy J, Pau S Pujolas, and Jack Rossbach, "Quantitative trade models: Developments and challenges," *Annual Review of Economics*, 2017, *9*, 295–325.

Kleinman, Benny, Ernest Liu, and Stephen J. Redding, "International Friends and Enemies," *American Economic Journal: Macroeconomics*, 2023.

Knickerbocker, Frederick T, *Oligopolistic reaction and multinational enterprise*, Harvard University Press, Cambridg MA, 1973.

Koopman, Robert, Zhi Wang, and Shang-Jin Wei, "Tracing Value-Added and Double Counting in Gross Exports," *American Economic Review*, 2014, *104* (2), 459–494.

Krugman, Paul, "Scale economies, product differentiation, and the pattern of trade," *American Economic Review*, 1980, *70* (5), 950–959.

Kuhn, Thomas S, *The structure of scientific revolutions*, Vol. 962, University of Chicago Press Chicago, 1997.

Kulesza, Adrian, "Combinatorial Discrete Choice with Deep Reinforcement Learning," 2024.

Lane, Nathan, "Manufacturing revolutions: Industrial policy and industrialization in South Korea," *Available at SSRN 3890311*, 2022.

Lange, Oskar, "On the Economic Theory of Socialism," *Review of Economic Studies*, 1936, *4* (1), 53–71.

_ , "On the economic theory of socialism: part two," *Review of Economic Studies*, 1937, *4* (2), 123–142.

Leahy, Dermot and J Peter Neary, "Oligopoly and trade," in "Palgrave Handbook of International Trade," Springer, 2013, pp. 197–235.

Leibovici, Fernando and Ana Maria Santacreu, "Shortages of critical goods in a global economy: Optimal trade and industrial policy," *FRB St. Louis Working Paper*, 2023, (2020-10).

Leontief, Wassily, "Domestic production and foreign trade; the American capital position re-examined," *Proceedings of the American Philosophical Society*, 1953, *97* (4), 332–349.

Lerner, A. P., "The Concept of Monopoly and the Measurement of Monopoly Power1," *Review of Economic Studies*, 06 1934, *1* (3), 157–175.

Liu, Ernest and David Yang, "International Power," 2024.

Loecker, Jan De, "Product differentiation, multiproduct firms, and estimating the impact of trade liberalization on productivity," *Econometrica*, 2011, *79* (5), 1407–1451.

_ **, Jan Eeckhout, and Gabriel Unger**, "The rise of market power and the macroeconomic implications," *Quarterly Journal of Economics*, 2020, *135* (2), 561–644.

Macchiavello, Rocco and Ameet Morjaria, "The value of relationships: evidence from a supply shock to Kenyan rose exports," *American Economic Review*, 2015, *105* (9), 2911–2945.

Maggi, Giovanni, "International trade agreements," in "Handbook of International Economics," Vol. 4, Elsevier, 2014, pp. 317–390.

Manova, Kalina and Zhiwei Zhang, "Export prices across firms and destinations," *Quarterly Journal of Economics*, 2012, *127* (1), 379–436.

Markusen, James R., *Multinational Firms and the Theory of International Trade*, Vol. 1 of *MIT Press Books*, The MIT Press, April 2004.

Martin, Philippe, Thierry Mayer, and Mathias Thoenig, "Make trade not war?," *Review of Economic Studies*, 2008, *75* (3), 865–900.

Martincus, Christian Volpe and Jerónimo Carballo, "Beyond the average effects: The distributional impacts of export promotion programs in developing countries," *Journal of Development Economics*, 2010, *92* (2), 201–214.

Mayer, Thierry and Gianmarco IP Ottaviano, "The happy few: the internationalisation of European firms: new facts based on firm-level evidence," *Intereconomics*, 2008, *43* (3), 135–148.

_ , Marc J Melitz, and Gianmarco IP Ottaviano, "Market size, competition, and the product mix of exporters," *American Economic Review*, 2014, *104* (2), 495–536.

McFadden, Daniel, "The measurement of urban travel demand," *Journal of Public Economics*, 1974, *3* (4), 303–328.

McLaren, John, "Size, sunk costs, and Judge Bowker's objection to free trade," *The American Economic Review*, 1997, pp. 400–420.

Melitz, Jacques, "Language and foreign trade," *European Economic Review*, 2008, *52* (4), 667–699.

_ and Farid Toubal, "Native language, spoken language, translation and trade," *Journal of International Economics*, 2014, *93* (2), 351–363.

Melitz, Marc J, "The impact of trade on intra-industry reallocations and aggregate industry productivity," *Econometrica*, 2003, *71* (6), 1695–1725.

_ and Gianmarco IP Ottaviano, "Market size, trade, and productivity," *Review of Economic Studies*, 2008, *75* (1), 295–316.

_ and Stephen J Redding, "Heterogeneous firms and trade," in "Handbook of International Economics," Vol. 4, Elsevier, 2014, pp. 1–54.

_ and _ , "Missing gains from trade?," *American Economic Review*, 2014, *104* (5), 317–321.

Miller, Chris, *Chip war: The fight for the world's most critical technology*, Simon and Schuster, 2022.

Morales, Eduardo, Gloria Sheu, and Andrés Zahler, "Extended gravity," *Review of Economic Studies*, 2019, *86* (6), 2668–2712.

Neary, J Peter, "Globalization and market structure," *Journal of the European Economic Association*, 2003, *1* (2-3), 245–271.

_ , "International trade in general oligopolistic equilibrium," *Review of International Economics*, 2016, *24* (4), 669–698.

Neri-Laine, Matteo, "Sovereign Gravity: The Military Alliances' Effect on Trade," 2024.

Nunn, Nathan and Daniel Trefler, "Domestic institutions as a source of comparative advantage," *Handbook of International Economics*, 2014, *4*, 263–315.

Olivier, Jacques, Mathias Thoenig, and Thierry Verdier, "Globalization and the dynamics of cultural identity," *Journal of International Economics*, 2008, *76* (2), 356–370.

Ossa, Ralph, "Why trade matters after all," *Journal of International Economics*, 2015, *97* (2), 266–277.

Paravisini, Daniel, Veronica Rappoport, Philipp Schnabl, and Daniel Wolfenzon, "Dissecting the effect of credit supply on trade: Evidence from matched credit-export data," *Review of Economic Studies*, 2015, *82* (1), 333–359.

Pareto, Vilfredo, "The New Theories of Economics," *Journal of Political Economy*, 1897, *5* (4), 485–502.

Pascali, Luigi, "The wind of change: Maritime technology, trade, and economic development," *American Economic Review*, 2017, *107* (9), 2821–2854.

Pavcnik, Nina, "Trade liberalization, exit, and productivity improvements: Evidence from Chilean plants," *Review of Economic Studies*, 2002, *69* (1), 245–276.

Rauch, James E, "Networks versus markets in international trade," *Journal of International Economics*, 1999, *48* (1), 7–35.

Redding, Stephen J, "Trade and geography," *Handbook of International Economics*, 2022, *5*, 147–217.

Roberts, Mark J and James R Tybout, "The decision to export in Colombia: An empirical model of entry with sunk costs," *American Economic Review*, 1997, pp. 545–564.

Salvo, Alberto, "Inferring market power under the threat of entry: The case of the Brazilian cement industry," *RAND Journal of Economics*, 2010, *41* (2), 326–350.

Sanders, Bas, "Counterfactual Sensitivity in Quantitative Trade and Spatial Models," *arXiv preprint arXiv:2311.14032*, 2023.

Santacreu, Ana Maria, "International technology licensing, intellectual property rights, and tax havens," *Review of Economics and Statistics*, 2023, pp. 1–45.

Schott, Peter K, "One size fits all? Heckscher-Ohlin specialization in global production," *American Economic Review*, 2003, *93* (3), 686–708.

Shafir, Eldar, Peter Diamond, and Amos Tversky, "Money Illusion," *Quarterly Journal of Economics*, 1997, *112* (2), 341–374.

Skaperdas, Stergios and Constantinos Syropoulos, "Guns, Butter, and Openness: On the Relationship between Security and Trade," *American Economic Review*, May 2001, *91* (2), 353–357.

Stantcheva, Stefanie, "Understanding of trade," Working Paper 30040, National Bureau of Economic Research 2022.

Steinwender, Claudia, "Real effects of information frictions: When the states and the kingdom became united," *American Economic Review*, 2018, *108* (3), 657–696.

Thaler, Richard H., "Toward a Positive Theory of Consumer Choice," *Journal of Economic Behavior and Organization*, 1980, *1* (1), 39–60.

Tinbergen, Jan, "Shaping the World Economy: Suggestions for an International Economic Policy," *The Twentieth Century Fund*, 1962.

Tintelnot, Felix, "Global production with export platforms," *Quarterly Journal of Economics*, 2017, *132* (1), 157–209.

Tørsløv, Thomas, Ludvig Wier, and Gabriel Zucman, "The missing profits of nations," *Review of Economic Studies*, 2023, *90* (3), 1499–1534.

Tovar, Patricia, "The Effects of Loss Aversion on Trade Policy: Theory and Evidence," *Journal of International Economics*, 2009, *78* (1), 154–167.

Traiberman, Sharon, "Occupations and import competition: Evidence from Denmark," *American Economic Review*, 2019, *109* (12), 4260–4301.

_ **and Martin Rotemberg**, "Precautionary protectionism," *Journal of International Economics*, 2023, *145*, 103836.

Trefler, Daniel, "International factor price differences: Leontief was right!," *Journal of Political Economy*, 1993, *101* (6), 961–987.

_ , "The case of the missing trade and other mysteries," *American Economic Review*, 1995, pp. 1029–1046.

_ , "The long and short of the Canada-US free trade agreement," *American Economic Review*, 2004, *94* (4), 870–895.

World Bank, *World development report 2020: Trading for development in the age of global value chains*, The World Bank, 2020.

Xu, Chenzi, "Reshaping global trade: the immediate and long-run effects of bank failures," *Quarterly Journal of Economics*, 2022, *137* (4), 2107–2161.

Yi, Kei-Mu, "Can Vertical Specialization Explain the Growth of World Trade?," *Journal of Political Economy*, 2003, *111* (1), 52–102.

Zhelobodko, Evgeny, Sergey Kokovin, Mathieu Parenti, and Jacques-François Thisse, "Monopolistic competition: Beyond the constant elasticity of substitution," *Econometrica*, 2012, *80* (6), 2765–2784.