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Ludovic Panon

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Institut d'études politiques de Paris
ÉCOLE DOCTORALE DE SCIENCES PO
Programme doctoral en Economie
Département d'Economie
Doctorat en Sciences économiques

Essays in International Trade and Industrial Organization

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Defended on June 25, 2020

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Note to the Reader

The three chapters of this dissertation are self-contained research articles and can be read separately. They are preceded by an introduction (Chapter 1) which summarizes the research presented in this dissertation. The terms “paper” or “article” are used to refer to chapters. Chapters 3 and 4 are co-authored, which explains the use of the “we” pronoun. Chapters 2, 3 and 4 are referred to as the “first”, “second” and “third” chapter, respectively. Part of this work (Chapters 2 and 3) is supported by a public grant overseen by the French National Research Agency (ANR) as part of the “Investissements d’avenir” program (reference : ANR-10-EQPX-17 – Centre d’accès sécurisé aux données - CASD)

Abstract

This dissertation is a collection of three essays in the fields of international trade and industrial organization. The first two chapters study the macroeconomic implications of firm heterogeneity. In the first chapter, I use data on the universe of French manufacturing exporters from 1994-2001 to study the relationship between international trade and the manufacturing labor share. In particular, I investigate how and to what extent changes in demand conditions on foreign markets impact the labor share. This chapter aims to shed light on whether international trade may affect the labor share through channels other than changes in import exposure. In the second chapter, which is joint work with Flavien Moreau, we study the cost of distortions to competition on aggregate productivity. To do so, we have assembled a database on the identity of colluding firms that have been fined by the French competition regulator. We document novel stylized facts on cartels and anticompetitive firms. We use a static macroeconomic model to study the economic cost of cartels and help answer the following questions: is it large? If so, why does it differ from what Arnold Harberger obtained in his 1954 paper? Finally, the last chapter co-authored with Florin Cucu studies the link between asylum policies and foreign policy concerns using panel data on asylum applications in the European Union from 1999 to 2017. We then study what this relationship implies for international trade flows in a gravity regression framework.

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I am also extremely grateful for Thierry Mayer's support. His advice helped me tremendously throughout the PhD and Job Market. Thierry's own research has been a great source of inspiration. Importantly, our discussions encouraged me not only to delve into the macroeconomic implications of firm heterogeneity but also to develop my interest in issues related to competition.

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The PhD is a challenging yet stimulating experience. I learned a lot by interacting with the Sciences Po faculty and being challenged by them during seminars. They have helped me grow as a young economist and I am really thankful for that. In particular, I would like to thank Philippe Martin for his help on the Job Market, Johannes Boehm,

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Chapter 1

Introduction

The fields of international trade and industrial organization (IO) are now intrinsically linked. The relationship between the two fields is best illustrated by the 2008 Nobel prize winner Paul Krugman:¹ “The rapid growth in the application of industrial organization concepts to international trade seems to be remaking trade theory in IO’s image” (Krugman, 1989). These theoretical advances paved the way for firms to become the main unit of interest in international trade, rather than countries. More recently, the availability of microeconomic data has made it possible to study firms and narrowly defined industries, and document new stylized facts (Bernard et al., 2007).

The first two chapters of this dissertation build on two distinct facts in the macroeconomics and IO literature. However, they both study the macroeconomic implications of firm heterogeneity with an emphasis on international trade in the first chapter. The third chapter pertains to refugee migration and international trade. I first contextualize each chapter separately. A detailed description of the chapters is then provided.

The first motivating fact is that the labor share of income has experienced a decline across industries and developed economies since the 1980s (Karabarbounis and Neiman, 2013). The role played by international trade and exporting firms in affecting the labor share has been, however, overlooked. The seminal paper of Marc Melitz (Melitz, 2003) provides the tools to understand how international trade affects macroeconomic aggregates when firms are heterogeneous.² More specifically, a crucial insight of the Melitz model is that firm heterogeneity shapes aggregate productivity. When a country

¹Two early and influential contributions in the field of international trade that build on IO tools can be found in Krugman (1979) and Krugman (1980).

²The model is consistent with the observation that productivity differs widely across firms, “even within narrowly defined industries” (Syverson, 2004). Syverson (2011) provides an extensive survey of the determinants of productivity.

opens to trade (or further liberalizes its economy), the least productive firms within the industry *exit* and the most productive firms grow. This margin of adjustment increases aggregate productivity within the industry. In other words, productivity gains operate through reallocations of market shares towards more productive firms.³ Changes in aggregate productivity are only driven, however, by the exit of firms (the *extensive* margin). Can changes *across* existing firms (the *intensive* margin) caused by increased market competition affect the labor share?⁴ If so, are they important?

Economists have recently shed light on how reallocations of market shares across incumbent firms affect the aggregate labor share (Autor et al., 2020) and markups (De Loecker et al., 2020). Autor et al. (2020) show that the labor share decline across sectors can be attributed to the rise of extremely productive firms with a low labor share (“superstar firms”), rather than to a decrease in the labor share within firms. De Loecker et al. (2020) and De Loecker and Eeckhout (2018) provide evidence that market power as measured by markups has increased since the 1980s, both in the US and globally, respectively. Importantly, this rise is driven by the growth of high-markup firms. Given that our economies are inter-connected, it seems natural to think that trade globalization could contribute to this reallocation effect and drive down the labor share. Trade opportunities lead to an increase in the size of the market served by exporting firms. At the same time, the market size increase also drives up competition that exporting firms face on international markets, thereby reducing their profits. Which effect dominates? The most productive firms benefit from the increase in market size without being hurt by the concomitant increase in competition, while the least productive firms shrink. Chapter 1 shows that international trade construed through the lens of an increase in foreign demand decreases the manufacturing labor share in France through *intensive* margin reallocations. These are quantitatively significant. This shows that the role played by international trade in shaping the labor share is more subtle and quantitatively relevant than previously thought.

A second motivating fact for the second chapter of this thesis is that misallocation of factors of production across firms reduces aggregate productivity (Restuccia and Rogerson, 2008; Hsieh and Klenow, 2009). How does market power relate to misallocation?⁵ In general, having market power means that the firm is producing less than it would

³Exporting firms are larger and more productive than non-exporters (Bernard et al., 1995, 2007). These international firms pay higher wages, are more capital-intensive, more productive. Subsequent work has shown that these differences are partly the *cause* of exporting (Bernard and Jensen, 1999), although exporting also leads to increased productivity gains at the firm level through learning-by-exporting, as shown in De Loecker (2007).

⁴Melitz (2018) provides a clear exposition of how extensive and intensive margin reallocations shape aggregate productivity.

⁵A firm has market power if it can price above its marginal cost of production. The marginal cost of production of a firm is the change in its total cost when it produces one additional unit of a good.

if it did not have the ability to price above its marginal cost. If the most productive firms are the ones with the highest degree of market power, this reallocates demand towards relatively less productive firms, thereby reducing aggregate productivity. In other words, high-markup firms may be too small compared to what they *could* be. Is it an issue for the economy? In the 1950s, Arnold Harberger estimated the cost of monopoly distortions to be rather small: “Elimination of resource misallocations in American manufacturing in the late twenties would bring with it an improvement in consumer welfare of just a little more than a tenth of a per cent.” (Harberger, 1954). This influential result suggests that there are no reasons to worry about monopoly distortions since their estimated cost is negligible.

In Chapter 2, Flavien Moreau and I study how anticompetitive behaviors and cartels impact aggregate productivity through changes in resource misallocation. Indeed, there are growing concerns that the increase in concentration experienced in the EU and the US arises from a *decline* in competition (Gutiérrez and Philippon, 2018). To this end, we assemble novel micro data on the identity of anticompetitive firms fined by the French competition regulator. We document that anticompetitive firms are widely spread across sectors and are, on average, extremely large firms. Theoretically, they have the potential to reduce aggregate productivity by redirecting resources away from very productive firms and at the same time lead to an increase in aggregate markups. Our quantitative findings suggest that the cost of oligopoly distortions caused by cartels is much higher than previously found by Harberger (1954) and that the reasons to worry about competition distortions are in fact well founded. More generally, these results are reminiscent of the idea also studied in Chapter 1 that microeconomic heterogeneity shapes aggregate outcomes.

Finally, the third chapter, which is joint work with Florin Cucu, pertains to international trade. The recent inflow of asylum seekers in Europe highlighted the lack of cooperation in asylum policies across European countries. Could it be the case that asylum policies reflect something more than humanitarian concerns? If so, how do they relate to trade flows? We show that asylum policies reflect both pure humanitarian concerns *and* foreign policy concerns. Asylum policies are also used as a foreign policy tool to discredit adversary states. This relationship between asylum policies and international tensions helps explain the negative correlation we document between asylum policies and European imports from the rest of the world. These results further suggest that using refugees as an instrument to measure the causal impact of migrants on international trade may be ill-advised, to the extent that asylum policies and international tensions are correlated.

All in all, the three chapters rely extensively on the use of data. Theoretical tools are

also used to help understand the implications or origins of the empirical results. I now turn to a more detailed description of each chapter.

Chapter 1 - Labor Share, Foreign Demand and Superstar Exporters

The labor share decline has been documented in the recent macroeconomics literature across different OECD countries and sectors (Karabarbounis and Neiman, 2013; Autor et al., 2020). Economists have highlighted several competing explanations to rationalize its evolution and international trade's role has been put forward. The specific role of *import* exposure is usually stressed (Elsby et al., 2013). They find that the American industries that were the most heavily exposed to imports are also the ones that have experienced the larger drops in their labor share. It is extremely likely, however, that the *export* side of trade plays a role in driving the evolution of the labor share, at least in manufacturing.

This export side of trade refers to changes in demand conditions on foreign markets, caused by wars, political turmoil, demographic changes, economic shocks etc. These changes in foreign demand are likely to affect the labor share of individual firms serving export markets by influencing their wage structure. For instance, an increase in foreign demand might drive up the average wage of that firm, pushing up the labor share of that firm (holding its total value-added constant). It is also possible, however, that the growth rate of *incumbent* firms might be differentially affected by a change in foreign demand. If firms with a lower labor share than average benefit relatively more from an increase in foreign demand and grow relatively more as a result, this can impact the aggregate manufacturing labor share through market share reallocations at the intensive margin.

The contributions of the paper can be summarized as follows. The first one is to estimate the *causal* effect of changes in foreign demand on the manufacturing labor share. I find that an increase in the foreign demand that French exporters face *decreases* the *aggregate manufacturing* labor share.⁶ The second one is to give a number to assess the importance of this trade mechanism. I find that foreign demand is important in accounting for the manufacturing labor share decline over the period I study (1994-2001). All in all, this paper shows that the role played by international trade in shaping the labor share is more important and complex than previously thought.

This chapter makes use of French administrative and customs data on the universe of exporters over 1994-2001. I start by showing that the decline in the manufacturing labor

⁶The change in the manufacturing labor share is determined by the change in both the labor share and the value-added growth rate of manufacturing *firms*.

share over that period is correlated with the rise of exports occurring over the same period. I then show that this decrease is not due to firms experiencing a decrease in their labor share but to the growth of low-labor share firms, which also happen to be extremely large firms on international markets, or “superstar exporters”.⁷

Empirically, I study the effect of foreign demand on both the labor share of firms and their growth rate, as measured by their value-added growth rate. Changes in these two dependent variables of interest translate into changes in the aggregate labor share. To estimate a causal effect, I rely on a measure of foreign demand changes defined for each firm at a given point in time and used in the fields of international trade and labor economics (Hummels et al., 2014; Mayer et al., 2016). This measure allows me to attribute changes in the growth rate of firms and in their labor share to foreign demand without being confounded by automation, outsourcing, and offshoring, which can be correlated with changes in demand abroad. I find that an increase in foreign demand does two things. First, it allows *larger* exporting firms to grow *faster*. Small exporters, on the other hand, *shrink*. Second, these intensive margin reallocations also affect the labor share of firms: the labor share of larger exporters decreases relatively more than that of smaller exporters. I do find evidence, however, that average wages increase more within superstar exporters: although labor compensation within superstar exporters goes up with foreign demand, the labor share drops because the increase in value-added is stronger. This effect is heterogeneous across firms and stronger for superstar exporters.

How big are these two effects in explaining *observed* changes in the manufacturing labor share? I find that these two effects jointly account for 14% of the observed labor share decline. I further show that this number is essentially driven by superstar exporters and by output reallocations towards these firms.

The fact that superstar exporters are the firms that benefit from a rise in foreign demand can be simply rationalized by building on recent advances in the trade literature (Zhelobodko et al., 2012; Mayer et al., 2016; Mrázová and Neary, 2017). The idea is that a rise in foreign demand has two opposite effects on the growth rate of firms. An increase in foreign demand allows all firms to benefit from the increase in market size abroad, boosting their export sales and allowing them to grow. However, this increase in market size also leads to an *increase* in competition on that foreign market, which is going to reduce the profits of the least productive firms.⁸ These smaller firms, as a result, will be badly penalized by the rise in competition and will not benefit from the

⁷These firms are top sellers in terms of export sales, are export intensive, sell many different products and serve many different destination countries.

⁸This occurs when less productive firms face a higher demand elasticity, which is assumed in the model.

positive market size effect. More productive and larger firms will be shielded from the competition effect and grow.

Understanding the mechanisms through which foreign demand may shape the aggregate labor share is crucial. Indeed, several authors have shown that industries with the largest increases in product market concentration are the ones that have experienced the largest declines in their labor share (Barkai, 2019; Autor et al., 2020). An increase in market concentration is consistent with either an increase *or* a decrease in market competition.⁹ My paper suggests that although the manufacturing labor share decreases with foreign demand, these changes are consistent with *fiercer* competition on international markets that favor larger firms that are also more productive. As a consequence, these changes that occur between firms are also a source of aggregate productivity gains through greater allocative efficiency.

Chapter 2 - Macroeconomic Effects of Market Structure Distortions

In the second paper of this dissertation, Flavien Moreau and I investigate the impact of competition distortions on aggregate productivity.

Recent papers have estimated that the effect of market power on aggregate productivity might be much larger than previously found by Harberger (1954) (Edmond et al., 2018; Baqaee and Farhi, 2020). In this chapter, we take an explicit stance on the cause of misallocation, namely the existence of cartels, and document it with the use of novel micro data on the identity of anticompetitive firms and cartels fined by the French competition authority.

We start by showing that, on average, cartels are made up of six firms. These firms are widely spread in the economy, in the sense that they operate in all two-digit sectors in France. These colluding firms are, on average, much larger and more productive than non-colluders. They sell more, create more value-added, are more capital intensive, are more likely to serve international markets, have a higher market share etc. These firms also seem to be relatively homogeneous within a given cartel. These facts suggest that the presence of cartels made up of extremely large and productive firms is likely to reduce the demand they face and reallocate output towards less productive firms, thereby decreasing aggregate productivity. This motivates the use of a macroeconomic model.

To assess the quantitative impact of cartels on aggregate total factor productivity (TFP), we embed cartels in a general equilibrium model in which firms compete oligopolisti-

⁹See for instance Syverson (2019) for a recent discussion.

cally and in which markups vary across firms, depending on their market share. More specifically, a given number of firms is assumed to collude in each sector and maximizes its own profits, as well as the profits of the other coalition members. Cartels create a distortion to competition that is very similar to the distortions that arise in models of cross-ownership (O'Brien and Salop, 1999). In the absence of cartels, the equilibrium of the model boils down to the competitive Nash-Cournot equilibrium studied in Atkeson and Burstein (2008). In the model, aggregate productivity is determined by the amount of markup dispersion. In the absence of cartels, the equilibrium of the model features markup dispersion: very productive firms have a higher market share, which allows them to charge higher markups.¹⁰ The existence of a cartel allows cartel members to increase their markups, redirecting demand towards less productive non-cartel members.

Quantitatively, we show that firm heterogeneity and the demand elasticity faced by firms determine the cost of cartels on aggregate TFP. If firms are homogeneous, there is no markup dispersion and so cartels have no effect on resource misallocation. Moreover, in the model, the extent to which the dispersion in market shares translates into markup dispersion is pinned down by the gap between the elasticity of substitution within and across sectors. In the case where demand can be easily redirected across sectors, the impact of a cartel on TFP is dampened because high productivity firms in other sectors can grow. These two differences help explain why we find that the cost of competition distortions arising from cartels are likely to be at least one order of magnitude higher compared to Harberger (1954). Importantly, this cost varies depending on the intensity of collusion. If cartel members only assign a small weight to each other's profits, they will increase their markups by a smaller amount, which will lead to less misallocation.

The cost of cartels is important. These results are consistent with Edmond et al. (2018) and Baqaee and Farhi (2020) who study the cost of size-related and total markup dispersion, where the counterfactual is the efficient allocation that does *not* feature any markup dispersion. Our results finally suggest that competition policy has an important role to play. Eliminating the extra markup dispersion brought about by cartels is likely to be a source of aggregate productivity gains.

Chapter 3 - Asylum Policies, International Tensions and Trade Flows

The third chapter of this dissertation investigates the relationship between asylum policies, international tensions, and international trade. It is based on a joint paper with

¹⁰This allocation is not efficient because eliminating markups would allow more productive firms to produce more.

Florin Cucu.

The recent refugee crisis and the inflow of asylum seekers coming from various origin countries emphasized the lack of cooperation across European countries. If humanitarian conditions were the only determinant of asylum policies, different European countries would arguably equally grant the refugee status to individuals coming from war-torn countries. However, for a similar number of Turkish asylum seekers in France and Germany, we observe that recognition rates are much higher in Germany than in France. This example illustrates that foreign policy considerations are likely to play a role in shaping asylum policies. Our paper uses data on the number of filed, processed, and positive applications of asylum seekers in European countries from 1999 to 2017 to first investigate the relationship between asylum policies and international tensions. We then test how this relationship may affect the relationship between refugees and international trade flows.

We first show that while humanitarian conditions are positively correlated with recognition rates, European countries are more likely to grant asylum to individuals coming from rival states.¹¹ Indeed, recognition rates are negatively correlated with an index of voting similarity in the UN General Assembly and the presence of a free trade agreement. We also show that international disputes are associated with higher recognition rates, while episodes of cooperation are associated with lower recognition rates. We show that these regressions control for country-pair fixed effects, such that all bilateral, time-invariant factors such as history or cultural proximity are controlled for. In sum, we show that previous results in the political science research survive a more rigorous quantitative assessment.

Several studies have documented a causal effect of migrants on trade flows using refugees as an instrumental variable to take care of the concern that the link between immigration and trade might be reversed (Parsons and Vézina, 2018; Steingress, 2018): trade opportunities might cause people to migrate. The fact that asylum policies are correlated with international tensions suggests that using refugees as an instrument for migrants might be ill-advised given that this link is confounded by tensions. We then investigate the relationship between asylum policies and international trade flows using a gravity regression model.¹² We take into account the fact that the relationship between asylum policies and trade flows may be confounded by humanitarian conditions in sending countries, general policies towards refugees in receiving countries, and all geographic, cultural, historical and political bilateral factors that are time-invariant by

¹¹This is consistent with the finding of Neumayer (2005) who finds that asylum recognition rates do not converge across European countries over 1980 to 1999.

¹²See Head and Mayer (2014).

including appropriate fixed effects in the econometric specifications. We find that an increase in recognition rates or in the number of refugees is negatively correlated with European imports from the rest of the world. This effect, however, does not seem to be persistent as an increase in the number of refugees in the past few years does not affect contemporaneous imports (both economically and statistically). The effect is mostly driven by imports of homogeneous goods for which it is easier to find a different trade partner. These results confirm the fact that the relationship between refugees and trade may be confounded by international tensions.

While our results cannot be interpreted as causal, this chapter highlights the complexity of the link between international trade and asylum policies. The paper cautions against using refugees as an instrumental variable to assess the impact of migrants on trade in situations where asylum policies are guided by foreign policy concerns.

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Chapter 2

Labor Share, Foreign Demand and Superstar Exporters

Abstract

This paper uses French micro-data on the universe of exporters over 1994-2001 to shed light on a new determinant of labor share changes in the manufacturing sector: foreign demand changes. Using an exogenous measure of changes in demand conditions abroad, I document two channels through which foreign demand growth contributes to driving down the labor share. First, I find evidence of a between-exporter effect: low-labor share, highly internationalized “superstar” exporters grow disproportionately more when their foreign demand increases. Second, foreign demand growth also decreases the labor share within exporters and the effect is exacerbated for superstar exporters. Changes in demand conditions abroad explain 4% of the observed reallocation effect towards superstar exporters. Both between and within-between firm effects generated by changes in demand conditions on foreign markets account for 14% of the labor share decline. These findings suggest that foreign demand growth unambiguously pulls down the labor share and that international trade affects the labor share through channels other than changes in import exposure.

2.1 Introduction

The manufacturing value-added labor share has experienced changes in several OECD countries in recent decades.¹ This phenomenon casts doubt on both the future of work and its value.² The causes of its evolution, however, remain uncertain and international trade has been put forward as a cause of labor share changes.³ The trade-related mechanism highlighted in the literature is increased *import* exposure (Elsby et al., 2013). It is likely, however, that the *export* side of trade, which refers to changes in demand conditions on foreign markets, also causes changes in the manufacturing labor share.⁴ Trade integration has increased in the past few decades and up until the Great Recession at least. As a consequence, it has been made easier to serve and access foreign markets. For these reasons, it is important to understand the various ways in which international trade may shape the share of the value-added pie going back to workers. In this article, I use detailed micro-data on the universe of French exporters over 1994-2001 to highlight a new determinant of changes in the manufacturing labor share: foreign demand changes. I further study the quantitative relevance of this trade-induced mechanism.

The contribution of the article is twofold. First, I provide causal empirical evidence that an increase in foreign demand decreases the labor share at home through two channels. Foreign demand growth generates intensive margin reallocations towards low-labor share, more internationalized “superstar” exporters (*between-exporter* effect). Foreign

¹The value-added labor share or labor share is the ratio of total labor compensation to total value-added. It represents the share of value-added that goes back to workers in the form of wages and social contributions. The decline over the period 1994-2007 for most OECD countries in the EU KLEMS sample is documented in Figure 2.G.1.

²The labor share decrease also invalidates the well-known stability of factor shares observed by Kaldor (1957) and has important implications for macroeconomic modeling.

³A vast literature has highlighted the labor share decline across several different developed economies. Karabarbounis and Neiman (2013) show that it can be caused by a decrease in the relative price of investment goods and a more intensive use of capital. While appealing, this is theoretically hard to reconcile with micro-evidence that the elasticity of substitution between capital and labor is less than unity (Oberfield and Raval, 2014; Moreau, 2019). Other studies highlight the role of a global productivity slowdown (Grossman et al., 2017), privatization (Azmat et al., 2012), automation (Acemoglu and Restrepo, 2018; Bergholt et al., 2019), labor market deregulation (Blanchard and Giavazzi, 2003), plant restructuring (Böckerman and Maliranta, 2011), openness to trade (Guscina, 2006; Harrison, 2005; Jaumotte and Tytell, 2007), global value chains (Reshef and Santoni, 2019), expenditures on intangible capital (Koh et al., 2016), Information and Communication Technology (Lashkari et al., 2019; Aghion et al., 2019), compositional changes driven by the rise of the housing sector (Gutiérrez and Piton, 2019), market concentration (Barkai, 2016), granular market power (Jarosch et al., 2019), common ownership (Azar and Vives, 2018) and rising firms’ labor market power and changing production processes (Mertens, 2020) in driving down the labor share.

⁴On the one hand, an increase in foreign demand could increase the labor share of firms as the boost in foreign demand would drive up wages through an increase in labor demand. The increase in wages would lead to an increase in labor compensation, leading to an increase in the labor share of individual firms, *everything else equal*. On the other hand, it is possible that an increase in foreign demand could favor firms with a low labor share, decreasing the aggregate labor share through compositional changes.

demand growth also drives down exporters' labor share and the effect is *stronger* for superstar exporters (*within-between* exporter effect). Importantly, my framework makes it possible to disentangle the effect of foreign demand shocks from other firm-level changes affecting a firm's growth rate and its labor share, such as automation, outsourcing and offshoring. Second, I provide some back-of-the-envelope calculation to assess the magnitude of both between and within-between firm effects. This exercise sheds quantitative light on the effect of export demand on the labor share. Using French balance-sheet and customs data over 1994-2001,⁵ I document three facts for the manufacturing sector. The labor share decline over that period is driven by exporting firms. Focusing on manufacturing exporters is sufficient to understand the labor share decline in that sector as these are the largest firms, a fact well-established in the trade literature (Bernard et al., 2007). In addition, the labor share decline is accompanied by a strong rise in exports, arguably caused by a rise in foreign demand. Second, decomposing the change in the labor share into a within-firm, between-firm and entry-exit margin,⁶ I find that the reallocation of output towards low labor share firms is the key driver of the decline, consistent with recent evidence for the US (Autor et al., 2017; Kehrig and Vincent, 2017). Third, I show that more internationalized firms have a lower labor share. Taken jointly, these facts suggest that a reallocation of value-added towards superstar exporters generated by foreign demand has the potential to partly rationalize the drop in the labor share. Moreover, the use of good-quality micro data for France provides additional external validity to the existence of a reallocation effect towards low-labor share firms.

Empirically, I study whether foreign demand growth impacts the value-added growth rate of firms and their labor share differently depending on their degree of internationalization.⁷ To do so, I rely on a shift-share identification strategy. The foreign demand measure uses the fact that firms initially have a different export basket and export different goods to different countries. Changes in imports from the rest of the world *excluding* France affect firms differently, depending on their initial exposure to foreign markets. This firm-level foreign demand measure is plausibly exogenous to firm-level decisions that could impact their growth rate or labor share, such as the decision to

⁵My results are unchanged when focusing on the whole 1994-2007 period and 2001-2007 period. I focus on the 1994-2001 period of time to circumvent several data issues. Most important are changes in the number and identity of firms arising from the decision to consolidate the financial statements of firms, thereby mechanically affecting the calculation of labor shares. Other data issues include changes in product classifications and in reporting thresholds from the customs. Focusing on this period allows me to keep a highly consistent sample of firms over time.

⁶The within-firm effect refers to a shift in the distribution of firm-level labor shares while the between-firm, or reallocation effect is caused by a reallocation of value-added shares towards low-(or high) labor share firms.

⁷The labor share can be expressed as a *value-added* weighted average of individual firms' labor share. Studying how foreign demand shapes the labor share entails looking at its impact on the value-added growth rate of firms and their labor share.

offshore, outsource or automate. The most important empirical finding is that the effect of foreign demand growth on firms' value-added growth rate and labor share is heterogeneous across firms. More specifically, I find that more internationalized exporters grow more and that less internationalized exporters shrink, following an increase in foreign demand. I also find that exporters experience a decrease in their labor share following an increase in their foreign demand, and this negative effect is magnified for top exporters. Although labor compensation increases through an increase in average wages, the labor share goes down because of the disproportionate rise of value-added triggered by foreign demand growth. These results highlight the existence of intensive margin reallocations towards superstar exporters. The results do not appear to be driven by confounding factors such as automation, offshoring, outsourcing, by the choice of sample and specification, or by the existence of pre-trends.

I make use of my estimates to quantify the importance of foreign demand growth in explaining both the observed reallocation effect towards low-labor share firms and the overall change in the manufacturing labor share. I estimate that about 4% of the observed reallocation effect is driven by foreign demand growth over 1994-2001. Jointly taking into account both predicted between and within-between firm effects, I find that 14% of the manufacturing labor share decline is accounted for by foreign demand growth over that time period. In further sensitivity tests, I show that superstar exporters drive the results and that intensive margin reallocations towards large players are key to understanding the role played by foreign demand in shaping the labor share, both through its impact on the growth rate of firms and their labor share.

Finally, I rely on a monopolistic competition model with additively separable preferences to provide an explanation for the existence of such reallocations towards low-labor share firms. Intensive margin reallocations hinge on the price elasticity of demand decreasing with consumption, a case long recognized to be the most plausible by [Marshall \(1890\)](#) and [Krugman \(1979\)](#). This case is commonly referred to as Marshall's Second Law of Demand (MSLD). This condition is important as it generates a positive relationship between firm size and markups. More productive firms produce more, face a lower demand elasticity and are able to charge higher markups. In the cross-section, this leads to highly productive firms having a low labor share resulting from high markups. A foreign demand increase generates two counteracting forces on firms' profits: the positive effect arising from the increase in market size is counterbalanced by a negative effect caused by the concomitant increase in competition on the foreign market. When preferences are additively separable, this indeterminacy breaks down and the market size effect dominates for firms with a lower than average demand elasticity. This favors the largest firms if MSLD holds. This is due to the fact that firms with a low(er than

average) demand elasticity will not be too penalized by the increase in competition on the foreign market and will mostly benefit from the increase in market size brought about by the increase in foreign demand. In return, larger firms expand with respect to smaller firms that squeeze, consistent with my empirical findings. This result cannot be obtained with constant elasticity of substitution (CES) preferences in monopolistic competition models, as the two effects cancel each other out.

Related Literature. My paper relates to a recent literature that identifies different causes for the labor share decline. [Autor et al. \(2017\)](#) attribute most of the decline in the labor share to the rise of low-labor share superstar firms and emphasize the role of market concentration in driving down the labor share in several US sectors. My paper instead highlights the empirical role of foreign demand growth in affecting the labor share through reallocations towards low-labor share firms using firm-level data for the French manufacturing sector. For these reasons, I view my findings as complementary to theirs to the extent that I show that part of the rise of superstar firms is caused by foreign demand growth. My identification strategy also allows me to circumvent the issue of using market concentration measures to proxy for changes in competition ([Bresnahan, 1989](#); [Berry et al., 2019](#)). [Lashkari et al. \(2019\)](#) show that the fall in the price of IT can explain roughly 50% of both the increase in the labor share of individual firms and the reallocation effect towards low-labor share firms. Their quantification exercise helps to understand the evolution of the French aggregate labor share. Indeed, their model can quantitatively explain the positive within-firm component, which could help explain the rising labor share in French manufacturing post-2000 (see [Figure 2.G.1](#)). While my findings cannot rationalize the observed positive within-firm effect, my paper does not aim to explain the aggregate trend in the manufacturing labor share. Instead, I show that regardless of the time period considered, foreign demand growth unambiguously decreases the manufacturing labor share both through changes across and within firms.⁸ [Elsby et al. \(2013\)](#) find that offshoring the labor-intensive part of production is a good candidate explanation for the labor share decline in the US. My paper differs from theirs in that I instead focus on the role of export demand and emphasize the importance of the reallocation effect in driving down the manufacturing labor share using micro-data. Furthermore, my empirical framework allows me to disentangle the effect of export demand from that of technology. Finally, in a series of papers, [De Loecker and Eeckhout \(2017\)](#) and [De Loecker and Eeckhout \(2018\)](#) show that rising aggregate markups help account for the decrease in the labor share. My findings are consistent with this interpretation as superstar exporters have higher markups and grow more.

⁸The results carry to the 2001-2007 period and to the whole 1994-2007 period.

Recent papers have revived the idea that the demand elasticity is not constant across firms and more specifically, that it decreases with consumption, a case deemed “plausible” by [Krugman \(1979\)](#). This has important consequences as an increase in market size generates intensive margin reallocation effects favoring larger firms ([Zhelobodko et al., 2012](#); [Mrázová and Neary, 2017](#)). I build on these papers for the theoretical framework. My paper is closely related to [Mayer et al. \(2016\)](#). They find evidence of reallocations of export sales towards the best products produced by French exporters following an increase in foreign demand, fact they also attribute to MSLD. Their focus, however, is on how reallocations of export sales across *products* within multi-product firms generate aggregate productivity growth. I am instead interested in how foreign demand shocks generate reallocations across *firms* and highlight the heterogeneous response of firms’ growth rate and labor share to foreign demand changes. I further quantify the importance of both effects in generating aggregate labor share changes. My results are also consistent with aggregate productivity gains, as superstar exporters are larger and more productive.

In a recent work, [Parenti et al. \(2017\)](#) argue that “it is time to pay more attention to the demand side”. Recent evidence by [Hottman et al. \(2016\)](#) stress the importance of demand in determining firm size. They find that 80% of firm growth is caused by firm “appeal” which loosely refers to demand (differences in tastes or quality). My paper also highlights the importance of foreign demand growth in generating value-added growth favoring more internationalized firms. [Aghion et al. \(2018\)](#) document the role of foreign demand growth on patenting at the firm level and show that initially more productive firms patent more. My paper differs from theirs is that my focus is on providing an alternative mechanism for the labor share decline through between-firm and within-firm changes. My results, if anything, are short-term effects while innovation is a longer-run phenomenon. Their findings, however, could reinforce my key finding. Foreign demand growth might also contribute to reallocating value-added shares towards low-labor share firms through innovation, as superstar exporters might be more likely to innovate.

The rest of the article is organized as follows. Section [2.2](#) describes the data sources and the stylized facts. Section [2.3](#) describes the empirical framework and identification strategy. Section [2.4](#) presents the results and robustness tests. Section [2.5](#) lays out the theoretical framework and Section [2.6](#) concludes.

2.2 Data and Stylized Facts

2.2.1 Data Sources and Sample

I use two main sources of micro data: balance-sheet and customs data. Each firm in France is assigned a unique identifier (“SIREN” code) which facilitates keeping track of them over time and matching firm-level datasets.

The balance-sheet data contain the universe of French firms. I keep both large and small firms. This classification is based on a firm’s tax regime: the Regime of Normal Real Profits (BRN) applies to large firms while the Simplified Regime for the Self-Employed (RSI) applies to smaller companies. BRN contains firms with annual sales above 763K euros (230K euros for services) whereas smaller firms included in RSI sell at least 76.3K euros (but less than 763K euros) a year and more than 27K euros for services. This dataset has been used in previous studies, for instance in [Di Giovanni et al. \(2014\)](#) and I refer to their paper for more details. Given the focus of the paper, I only keep firms that operate in the manufacturing sector (sector 15 to 37 in NAF Rev. 1). This exhaustive database allow me to build a firm’s labor share and all other relevant variables that will be used in the empirical framework. More information on the way I treat my dataset and on the variables I use is provided in Appendix [2.A](#). I also rely on customs data. They contain information on a firm’s export sales and export quantities of each product defined at the 8-digit level towards each destination country in a given year. I use this additional data source to recover information on the number of products exported by each firm in a given year, the number of foreign countries served, the total amount of expenditures spent on imports and total export sales.

My sample of French manufacturing exporters spans the period 1994-2001. The period of analysis is shorter than usual in the literature that aims to identify a cause for labor share changes. For example, the sample of [Elsby et al. \(2013\)](#) roughly covers twenty years of (macro) data, while that of [Autor et al. \(2017\)](#) spans thirty years. The reason for focusing on this period of time is data-driven. First, I do not have access to both datasets before 1994. Second, the definition of a firm according to the French National Institute of Statistics changes in 2001. As of that date, a firm is no longer defined as a statistical unit but as an economic unit that can make relevant economic decisions. Companies belonging to and depending on a parent company are not considered as firms anymore. The value of their sales, labor expenditures etc. is consolidated at the level of the unit capable of making independent decisions. This can also mechanically generate exit as a firm owned by another company might exit the sample for purely statistical reasons. Ending my sample in 2001 allows me to keep a sample of firms that

do not experience drastic changes in terms of their growth rate or labor share due to exogenous statistical changes. Finally, focusing on this period of time allows me to circumvent regulatory changes that affect the reporting thresholds of French exporters after the ending date of my sample, as well as changes in the product nomenclature.⁹ I provide a robustness check where I extend the sample to the whole 1994-2007 period and to the 2001-2007 period and show that the results are robust to considering these alternative time periods.

Focusing on the 1994-2001 period is particularly well-suited to highlight the role of the *export-side* of trade on reallocation towards international firms while abstracting from import competition. The sample period ends in 2001, year when China joins the World Trade Organization (WTO) allowing it to considerably increase its exports abroad.¹⁰ Moreover, the rise of imports from low-wage countries (Auer et al., 2013) and Eastern-Europe following the 2004 European enlargement are also unlikely to have strong reallocation effects given that their import shares are relatively stable over the period of time considered (Figure 2.G.2) compared to the whole 1994-2007 period.¹¹

2.2.2 Stylized Facts

Using the data described in the previous subsection, I provide evidence that the labor share in French manufacturing declines over the mid-1990s up to 2001. I then decompose this change into different margins and document the fact that larger exporters and more internationalized firms have a lower labor share.

Labor share and trade flows. The labor share is defined as the ratio of total labor compensation to gross value-added. Figure 2.1 highlights the evolution of the labor share in the French manufacturing sector over 1994-2001 for the sample of exporting firms. It experiences a four percentage point decline.^{12 13} The pattern is very similar

⁹More details can be found in Bergounhon et al. (2018).

¹⁰The seminal paper by Autor et al. (2013) studies the effect of Chinese import competition on employment and finds large, negative effects on manufacturing employment in the US. Malgouyres (2017) studies the effect of import competition in both manufacturing and non-manufacturing employment in France and also finds sizable negative effects.

¹¹Dauth et al. (2014) highlight the importance of Eastern-European countries' exports to Germany for changes in employment.

¹²The labor share decline has been widely documented in the Macroeconomic literature for a wide range of developed countries, for instance in Karabarbounis and Neiman (2013) or Elsby et al. (2013) for the US.

¹³Defining labor as "equipped labor" and therefore the labor share as the ratio of total value-added to total sales as in Alvarez and Lucas Jr (2007), I also find that this alternative measure exhibits a strong and significant decline. The figure is available upon request.

Figure 2.1: Manufacturing Labor Share

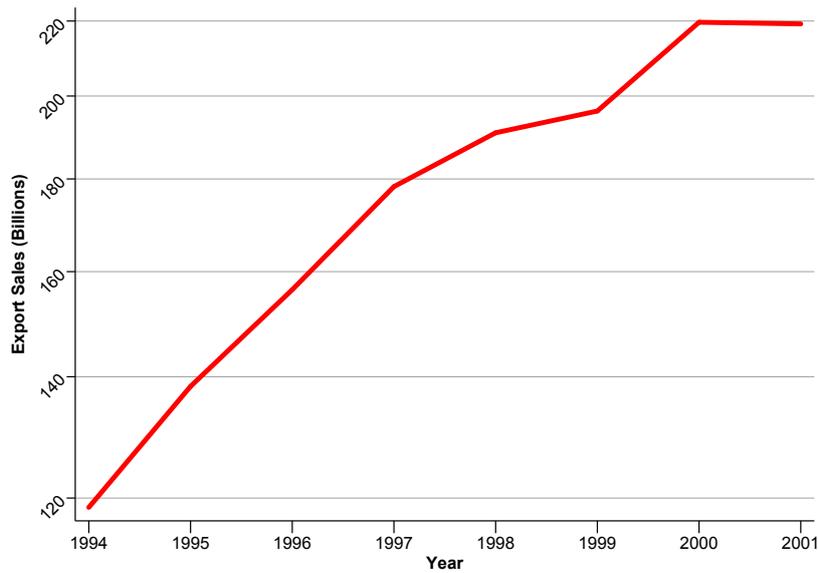
using macro data from EU KLEMS, as displayed in Figure 2.G.3.¹⁴ 11 out of 12 OECD countries experience a slight or drastic decrease in their manufacturing labor share over the whole 1994-2007 period with the exception of the UK (Figure 2.G.1). Interestingly, the French manufacturing labor share experiences an *increase* after 2001. It is important to note that the objective of the paper is to study how foreign demand shapes the aggregate labor share. I will show that my results are not affected by including the post-2001 period when the French manufacturing labor share increases: foreign demand growth also drives the labor share down after 2001. Figure 2.G.4 shows that the labor share of domestic firms (firms that do not export at a given point in time) is constant over the period and experiences a decrease after 2000, likely caused by the statistical change that took place in 2001 and mentioned in the previous subsection. I will therefore restrict my attention to the sample of French exporters. This is because exporting firms are the largest ones and represent 74% of the sector's total value-added.¹⁵ Exporters are representative of overall changes in manufacturing. Finally, I note that the drop in the manufacturing labor share is a within-industry phenomenon. As shown in Figure 2.G.5 in the Appendix, the decline occurs in all industries within manufacturing and is not due to a reallocation towards low labor share industries.

On the trade side, Figure 2.2 displays the evolution of export sales over the period 1994-2001.¹⁶ Exports have considerably increased over the period averaging 8% annually over 1994-2001. This sharp increase in exports is plausibly caused by an increase in

¹⁴The numbers in the macro data are higher as self-employment is accounted for.

¹⁵I will therefore use the term "firm" or "exporter" interchangeably, unless explicitly stated.

¹⁶The pattern is virtually the same when considering export sales from the customs data instead. The figure is available upon request.

Figure 2.2: Evolution of Exports


foreign demand and I will later use a direct measure of foreign demand to study how foreign demand growth affects the aggregate labor share. Figure 2.G.6 shows the exports of goods and services in percentage of GDP. This ratio steadily increases up to 2001.¹⁷ These trade patterns make clear that focusing on the 1994-2001 period is ideal to study the role of the export side of trade on the labor share decline.

Fact 1: *The manufacturing labor share has declined by 4 percentage points over 1994-2001.*

Decomposition of labor share changes. I now provide evidence that a reallocation towards firms with a low labor share can explain most of the decrease in the French manufacturing labor share.

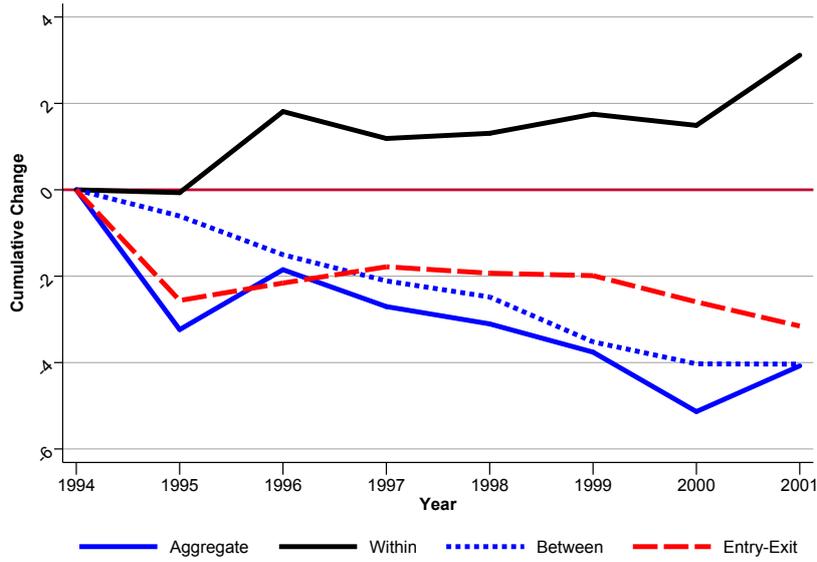
The labor share LS is the ratio of total labor compensation (including employers' contributions to social security etc.) to total value-added. Denoting the numerator by wL and value-added by VA , the labor share also writes as a weighted average of firms' labor share, weighted by their share in total value-added

$$LS_t = \frac{\sum_i wL_{it}}{VA_t} = \sum_i \omega_{it} LS_{it} \quad (2.2.1)$$

where ω_{it} is firm i 's value-added share in total manufacturing value-added at time t .

I decompose the change in the labor share from one year to the next into the contribution

¹⁷The patterns almost match perfectly when considering merchandise trade only.

Figure 2.3: Cumulative Change in Labor Share Components

of surviving firms, new entrants and exiters. To do so, I use a decomposition method initially developed by [Baily et al. \(1992\)](#) and refined in [Foster et al. \(2001\)](#) (FHK). For sake of simplicity, the labor share or aggregate labor share will refer to the *manufacturing* labor share, not the economy-wide labor share. The manufacturing labor share change between any two time periods is given by:

$$\begin{aligned}
 \Delta LS_t = & \sum_{i \in S} \omega_{it-1} (LS_{it} - LS_{it-1}) + \sum_{i \in S} (\omega_{it} - \omega_{it-1}) (LS_{it-1} - LS_{t-1}) \\
 & + \sum_{i \in S} (\omega_{it} - \omega_{it-1}) (LS_{it} - LS_{it-1}) + \sum_{i \in ENT} \omega_{it} (LS_{it} - LS_{t-1}) \\
 & - \sum_{i \in EXT} \omega_{it-1} (LS_{it-1} - LS_{t-1})
 \end{aligned} \tag{2.2.2}$$

where LS_{t-1} is the aggregate labor share in the previous year, also called the reference labor share level. The first term of (2.2.2) is the within-firm effect, the second and third terms are the between-firm (reallocation) component while the last two terms are the contribution of entry and exit, respectively.¹⁸ Equation (2.2.2) states that the manufacturing labor share can decrease for several reasons. A negative within-firm effect means that surviving firms experience a decrease in their labor share. A negative between-firm effect means that output is reallocated towards low-labor share survivors so that these firms become larger. Crucially, output corresponds to value-added from the definition of the labor share given in (2.2.1) so that the value-added growth of low-labor share firms can drive down the labor share. The contribution of entrants and exiters is allowed to be positive or negative. This depends on whether their labor share

¹⁸The third term is the cross effect. The whole reallocation term effect is the sum of the second component and the cross effect.

Table 2.1: FHK Decomposition of Labor Share Changes (Exporters)

	Total Change (1)	Within (2)	Between (3)	Entry-Exit (4)
1994-1995	-3.24	-0.07	-0.61	-2.56
1995-1996	1.39	1.88	-0.9	0.40
1996-1997	-0.85	-0.62	-0.61	0.38
1997-1998	-0.40	0.12	-0.37	-0.15
1998-1999	-0.65	0.44	-1.04	-0.06
1999-2000	-1.38	-0.26	-0.51	-0.61
2000-2001	1.06	1.63	-0.007	-0.56
1994-2001	-4.08	3.12	-4.04	-3.15
1994-2000	-5.14	1.49	-4.03	-2.60

Notes: This decomposition is done for the sample of manufacturing exporters using the Foster et al. (2001) decomposition. Column 1 is the change in the aggregate labor share for the sample of exporting firms. Column 2 is the within-firm margin. Column 3 is the sum of the between and the cross effect. Column 4 is the sum of the entry and exit components and refers to entry and exit into exporting.

is higher than the reference labor share level.

I make use of the FHK decomposition to study which margin drives the change in the labor share over the period of interest. To do so, I apply (2.2.2) to each year interval, namely 1994-1995, 1995-1996 etc. Figure 2.3 presents the result of this decomposition and shows the cumulative change in each component over time. The blue line represents the aggregate change while the blue dotted line represents the contribution of the between-firm component. The black full line and the red dashed line represent the contribution of the within-firm component and entry-exit, respectively. The blue dotted line is always negative and keeps decreasing over time with the exception of the period 2000-2001 when it is flat. It closely tracks the aggregate change line. The contribution of entry and exit is aggregated and is quite stable over the period. The within firm effect is positive and contributes to *increasing* the manufacturing labor share. This is consistent with Table 2.8 that shows that firms, on average, experience an increase in their labor share. Interestingly, in the US over 1982-2012, Autor et al. (2017) document that the within-firm component is *negative* and that the reallocation term is larger in magnitude than the within-firm one.

The results for each year interval are displayed in Table 2.1. The four percentage point decrease in the labor share is explained by a reallocation towards low labor share firms, suggesting that the key message of Autor et al. (2017) also holds for French manufacturing over 1994-2001. More generally, this finding is confirmed when focusing

Table 2.2: Statistics on Internationalization and Labor Shares

Statistic Internationalization Measure	Labor Share			
	Above Median (1)	Top 25 % (2)	Top 10 % (3)	Top 1 % (4)
Export intensity	70.7	69.4	67.4	63.9
ln Export sales	70	67.8	64.8	58.7
ln # Products exported	70.4	69.5	68.5	65.5
ln # Destinations served	70	69	67.5	63.4
# Firms	29,687	14,844	5,938	594

Notes: The results are obtained by taking the mean of each variable (labor share, export intensity, export sales, number of products exported and number of countries served) over time for each firm and calculating the labor share of firms that belong to the top 50, 25, 10 and 1% in terms of export intensity, number of products exported and number of countries served.

on the whole sample of manufacturing firms that includes domestic and exporting firms. Table 2.10 shows that the entry-exit component is less important in the whole manufacturing sample. This is due to the fact that Table 2.1 only includes exporting firms. Entry and exit do not capture the entry and the death of a firm but rather, whether it starts or stops exporting from one year to the next. The qualitative result of this decomposition is unaltered when considering the Melitz and Polanec (2015) decomposition method as shown in Table 2.11 and Table 2.12. The description of that method is relegated to Appendix 2.B.

Fact 2: *The manufacturing labor share decline is caused by a reallocation of value-added shares towards low-labor share firms.*

Internationalization and labor share. I now document that more internationalized, “superstar” exporting firms have a lower labor share.

Table 2.2 displays the labor share of firms whose export intensity, log export sales, log number of products exported and log number of destinations served is above the median, in the top 25%, 10% and 1% of each corresponding distribution. The figures in the table show that more internationalized exporters have a lower labor share. For example, firms in the top 1% of the export intensity distribution have a labor share that is almost 7 percentage points lower than firms in the top 50%. This pattern is true regardless the measure of internationalization used,¹⁹ but is particularly exacerbated for firms in the top of the export sales distribution. I will therefore use this measure as the key measure of internationalization for my baseline results and will show that

¹⁹These four internationalization measures are all positively correlated with each other.

the results are qualitatively unchanged when considering other internationalization measures. I also show in Table 2.13 that defining labor as “labor-plus-capital” (Alvarez and Lucas Jr, 2007; di Giovanni et al., 2018) and computing the labor share as the ratio of value-added to total sales yields very similar results. This alternative measure, which reflects all primary factors of production, also decreases with the degree of internationalization of firms. Table 2.14 tests the difference in mean between the labor share of firms with an internationalization measure above and below a certain threshold and confirms the finding that more internationalized exporters have a lower labor share. Finally, in columns 1 to 4 of Table 2.15, I regress a firm’s labor share on the four internationalization measures, controlling for the industry composition and supply and demand shocks occurring at the 2-digit industry level. I further control for firm-specific, time-invariant characteristics. This shows that an increase in openness compared to the firm mean leads to a lower labor share. Column 5 shows that export intensity and log export sales remain negatively correlated with the labor share at the firm-level when including all these predictors. Column 6 shows that this result survives the inclusion of total firm sales.

These pieces of evidence lead to the same conclusion. There exists a strong negative relationship between a firm’s degree of internationalization and its labor share, and this is particularly true for firms at the top of the export sales distribution.

Fact 3: *More internationalized exporters have a lower labor share.*

2.3 Empirical Framework

This section presents the empirical framework and identification strategy I rely on to study the effect of foreign demand changes on the manufacturing labor share.

2.3.1 Econometric Specifications

To study how foreign demand affects the manufacturing labor share, I make use of the fact that the labor share can be rewritten as a *value-added* weighted average of individual firms’ labor shares from Equation (2.2.1). I will therefore study how foreign demand affects the *value-added* growth rate of firms and their labor share. The analysis is restricted to firms that survive over at least two periods of time and I do not study how foreign demand shapes the decision of firms to enter or exit the export market, *i.e.*

the entry-exit margin highlighted in Section 2.2.2.

Section 2.2.2 shows that a reallocation of value-added shares towards low-labor share firms is the main driver of the labor share decline in French manufacturing over 1994-2001 and that low-labor share firms are highly internationalized, superstar exporters. To determine whether foreign demand changes can empirically generate this between-firm effect and contribute to decreasing the aggregate labor share, I test whether these changes benefit disproportionately more to superstar exporters (between-exporter specification). To do so, I estimate the following specification where i is an exporter and t is a year:

$$\begin{aligned} \Delta \ln VA_{it} = & \alpha^{\text{Rank}} \tilde{\Delta} \text{ForeignDemand}_{it} + \beta^{\text{Rank}} \tilde{\Delta} \text{ForeignDemand}_{it} \times \text{Superstar}_{it_0} \\ & + \gamma^{\text{Rank}} \text{Superstar}_{it_0} + \Delta \delta_{kt} + \Delta \psi_{it} \end{aligned} \quad (2.3.1)$$

The dependent variable is the growth rate of value-added between $t - 1$ and t . The growth rate of foreign demand from one year to the next is explained in detail below and is denoted by $\tilde{\Delta} \text{ForeignDemand}_{it}$. The important term is the interaction term that interacts a firm's measure of foreign demand with its degree of internationalization, Superstar_{it_0} , which is defined in the first year in which that firm appears in the sample to avoid endogeneity issues. Finally, $\Delta \delta_{kt}$ are 2-digit industry by year fixed effects and will absorb changes in business cycles conditions or competition shocks occurring at the industry level. Because the specification is expressed in first-differences, all unobserved drivers of a firm's value-added that are time invariant and that are correlated with that firm's foreign demand (high-quality firm, good management practices etc.) will be wiped out. Other identification threats are discussed in Section 2.3.2.

The total effect of changes in foreign demand on firm growth is $\frac{\partial \Delta \ln VA_{it}}{\partial \tilde{\Delta} \text{ForeignDemand}_{it}} = \alpha^{\text{Rank}} + \beta^{\text{Rank}} \times \text{Superstar}_{it_0}$. Absent the interaction term, one can expect $\alpha^{\text{Rank}} > 0$ as an increase in foreign demand should increase a firm's value-added. The main test is whether $\beta^{\text{Rank}} > 0$. If this is the case, highly internationalized exporters grow relatively more when hit by foreign demand shocks. This reallocates value-added shares towards these low labor share firms (Fact 3), thereby contributing to the observed labor share decline. Note that this elasticity varies across firms, depending on the rank of the firm in the initial superstar distribution (Superstar_{it_0}).²⁰

Given Equation (2.2.1), I also study how an increase in foreign demand at the firm level

²⁰The main measure of internationalization used is the log of the export sales distribution for the reason mentioned in the previous section. Results using alternative and time varying (lagged) measures are provided in the Appendix and yield very similar results.

impacts the labor share of exporters and how the effect might vary depending on their degree of internationalization (within-between exporter specification). The dependent variable is the labor share change in percentage points of each firm i in between two time periods, where the independent variables are the same as in Equation (2.3.1):

$$\begin{aligned} \Delta LS_{it} = & \zeta^{\text{Rank}} \tilde{\Delta} \text{ForeignDemand}_{it} + \chi^{\text{Rank}} \tilde{\Delta} \text{ForeignDemand}_{it} \times \text{Superstar}_{it_0} \\ & + \rho^{\text{Rank}} \text{Superstar}_{it_0} + \Delta \delta_{kt} + \Delta v_{it} \end{aligned} \quad (2.3.2)$$

The effect of foreign demand growth on the firms' labor share is allowed to vary across firms, depending on their degree of internationalization, as in the between-exporter specification described in Equation (2.3.1). Given that the labor share is the ratio of total labor compensation to value-added, an increase in foreign demand can increase or decrease this ratio, depending on which effect is strongest. On the one hand, we can expect a rise in foreign demand to increase labor compensation through an increase in the number of workers or in wages. To meet the increase in foreign demand, firms might need to hire more workers. Similarly, an increase in foreign demand might lead firms to raise wages in order to incentivize workers to meet the increase in demand. On the other hand, given that the firm might also sell more and experience an increase in its value-added as argued above, its labor share could go down if this effect dominates the increase in labor compensation. It is therefore not clear how foreign demand can impact a firm's labor share and what the effect might be for superstar exporters.

2.3.2 Identification Strategy

In order to identify the coefficients of interest α^{Rank} , β^{Rank} , ζ^{Rank} and χ^{Rank} , Equations (2.3.1) and (2.3.2) are estimated using OLS. Several concerns must be addressed regarding the identification of these parameters. The variable $\tilde{\Delta} \text{ForeignDemand}_{it}$ reflects changes in demand abroad. One could consider export sales as a proxy for foreign demand. The issue with the use of export sales as a proxy variable is that the estimation would likely be plagued by simultaneity bias. I show in Appendix 2.C that, under some plausible assumptions, the coefficients of interest will be upward biased.

An alternative to using export sales as a measure of foreign demand consists of using world import demand shocks as a source of exogenous changes to a firm's foreign demand as in [Hummels et al. \(2014\)](#) and [Mayer et al. \(2016\)](#).²¹ This measure will be

²¹[Hummels et al. \(2014\)](#) use world import demand and world export supply changes as exogenous sources of variation for exports and imports, respectively. I focus on the effect of foreign demand on firms' growth and on their labor share, and instead use this measure in reduced-form. [Mayer et al.](#)

exogenous to other firm-level determinants of a firm's growth rate and labor share, such as outsourcing, automation, offshoring. More specifically, I interact a foreign country's imports of a particular product with each firm's export share of that product to that country in its total export sales. Averaging across products and countries gives a firm-level measure of changes in demand conditions on foreign markets. More specifically, the intuition of the measure is the following. Imagine a French firm i exporting a single product, "grape wines, sparkling" (code 220410 in the 1992 HS6 classification), to a single destination country, Brazil, in 1996. Demand changes for that firm in that market are measured by Brazil's change in total imports of "grape wines, sparkling" from the rest of the world *excluding* France in between 1996 and 1997. Indeed, the fact that the value of total imports (excluding France) of Brazil varies is likely to affect that French exporter's demand and the degree of competition it faces in that market. For a multi-product firm serving several markets, the growth rate of each country's imports of each product is weighted by that firm's share of exports of each product towards each destination country in its total export sales.

More formally, let us denote by X_{ljpt} the value of exports of a particular product p from country l to country j at time t . The total value of imports of product p by country j in t is defined as

$$M_{jpt} = \sum_{l \in L \setminus \{\text{France}\}} X_{ljpt} \quad (2.3.3)$$

where M_{jpt} are destination country j 's total imports of product p from the rest of the world excluding France. The firm-level foreign demand shock in first-differences is given by:²²

$$\tilde{\Delta}\text{ForeignDemand}_{it} = \sum_{j,p} \frac{X_{ijpt_0}}{X_{it_0}} \frac{M_{jpt} - M_{jpt-1}}{\frac{1}{2}(M_{jpt} + M_{jpt-1})} \quad (2.3.4)$$

Changes in j 's imports of p (the second component of the sum) are weighted by the relative importance of firm i 's exports of that product in the initial year, $\frac{X_{ijpt_0}}{X_{it_0}}$.²³

(2016) study how foreign foreign demand shocks lead to reallocations of export sales across products within French multi-product firms and affect aggregate productivity in manufacturing.

²²The growth rate of imports is expressed in this manner so that it is well defined even if countries stop importing a particular product in a given year. If imports switch from zero to a positive value, this growth rate equals the value 2 while the growth rate will equal -2 if imports go from a positive number to zero. One could also use the alternative specification of the shock in first-differences: $\Delta\text{ForeignDemand}_{it} = \sum_{j,p} \frac{X_{ijpt_0}}{X_{it_0}} \ln \frac{M_{jpt}}{M_{jpt-1}}$. The results are robust to using this functional form and are available upon request.

²³In order to build these firm-level demand shocks, I use French customs data and the BACI database (Gaulier and Zignago, 2010). A product is defined at the HS6 level as this is the lowest level of disaggregation in BACI. The customs data allow me to map each firm's exports into this product classification as the NC8 category's six first digits exactly correspond to the HS6 classification. Therefore, the world import demand component comes from BACI while the weights are built using the customs data.

The exogeneity of the measure hinges on the fact that $\tilde{\Delta}\text{ForeignDemand}_{it}$ is uncorrelated with $\Delta\psi_{it}$ and Δv_{it} in Equations (2.3.1) and (2.3.2), conditional on the set of fixed effects and potential firm-specific controls. This in turn hinges on two conditions. First, it must be the case that the growth rate of M_{jpt} does not reflect any supply-side shocks arising in France, which would lead to a rise of French exports to foreign countries and would boost their imports. The fact that aggregate imports of country j have been purged from French exports in (2.3.3) arguably rules out this channel. The only source of time series variation I exploit comes from this purged growth rate of imports.²⁴

The second important condition is that the firm-level weights are exogenous. A recent literature aims to identify the conditions under which a shift-share instrument such as the one described in (2.3.4) is exogenous. Goldsmith-Pinkham et al. (2018) show that the exogeneity of the shift-share hinges on the exogeneity of the weights. The idea is that a firm's initial composition of export sales across products and destinations could have a direct effect on its growth rate or on the evolution of its labor share. In order for the shock not to reflect self-selection of French firms into exporting to booming markets (or conversely, exporting less or not exporting at all to markets experiencing a bust in demand), the weights are defined in the initial year the firm appears in the customs data so that this concern is less likely than the case where they would be defined in the previous period. Second, I show that the results are robust to including firm fixed effects in the first-differences specification. These firm trends plausibly absorb the variation in the growth rate of value-added or labor share caused by the initial export structure of the firms. Third, I show that *future* demand shocks do not predict contemporaneous outcomes, which provides reassuring evidence that the measure is not picking up pre-trends affecting the dependent variables of interest.

Although it is unlikely given the structure of the firm's foreign demand shock detailed above, I will also provide robustness checks to control for the possibility that other time-varying and firm-specific determinants of a firm's growth rate and its labor share might be correlated with changes in that firm's measure of foreign demand. First, changes in a foreign country's demand are associated with changes in wages or quality improvements. These changes might incentivize firms to offshore more, thereby affecting their growth rate and their labor share. I will control for this possibility by including total firm-level imports to control for offshoring.²⁵ Second, foreign demand

²⁴Another potential confounding factor is that of French firms that have a large market share in the foreign markets they serve. Their market power abroad might impact foreign firms serving these markets and could affect aggregate imports from the rest of the world excluding France. To address this concern, I have experimented by dropping all the firms that have a market share higher than 10% for a given product p in a given destination country t at time t . The results are robust to this test and are available upon request.

²⁵Biscourp and Kramarz (2007), Mion and Zhu (2013), Hummels et al. (2014) distinguish between broad

Table 2.3: Baseline Results

Internationalization Measure (Superstar _{<i>it</i>0}) Dependent variable	In Export Sales				
	$\Delta \ln VA_{it}$ (1)	$\Delta \text{Labor Share}_{it}$ (2)	$\Delta \ln \text{Labor Compensation}_{it}$ (3)	$\Delta \ln \text{Wages}_{it}$ (4)	$\Delta \ln \text{Workers}_{it}$ (5)
$\Delta \text{ForeignDemand}_{it}$	-0.0161*** (0.0041)	0.1935 (0.1784)	-0.0123*** (0.0037)	-0.0116*** (0.0039)	-0.0007 (0.0042)
$\Delta \text{ForeignDemand}_{it} \times \text{Superstar}_{it0}$	0.0067*** (0.0010)	-0.1439*** (0.0459)	0.0039*** (0.0008)	0.0033*** (0.0008)	0.0006 (0.0009)
Superstar _{<i>it</i>0}	-0.0062*** (0.0002)	0.0217*** (0.0080)	-0.0062*** (0.0002)	-0.0016*** (0.0002)	-0.0046*** (0.0002)
Two-digit Sector \times Year FE	✓	✓	✓	✓	✓
# Observations	166,323	166,323	166,323	166,323	166,323

Notes: Standard errors clustered at the firm level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The coefficients from the regression models are estimated over 1994-2001 using OLS. All columns include industry by year fixed effects. $\Delta \ln VA_{it}$ is the change in a firm's value-added. $\Delta \text{ForeignDemand}_{it}$ is the change in a firm's foreign demand. Superstar_{*it*0} is a measure of the degree of internationalization of the firm and is the log of the export sales of the firm in the first year in which it appears in the sample.

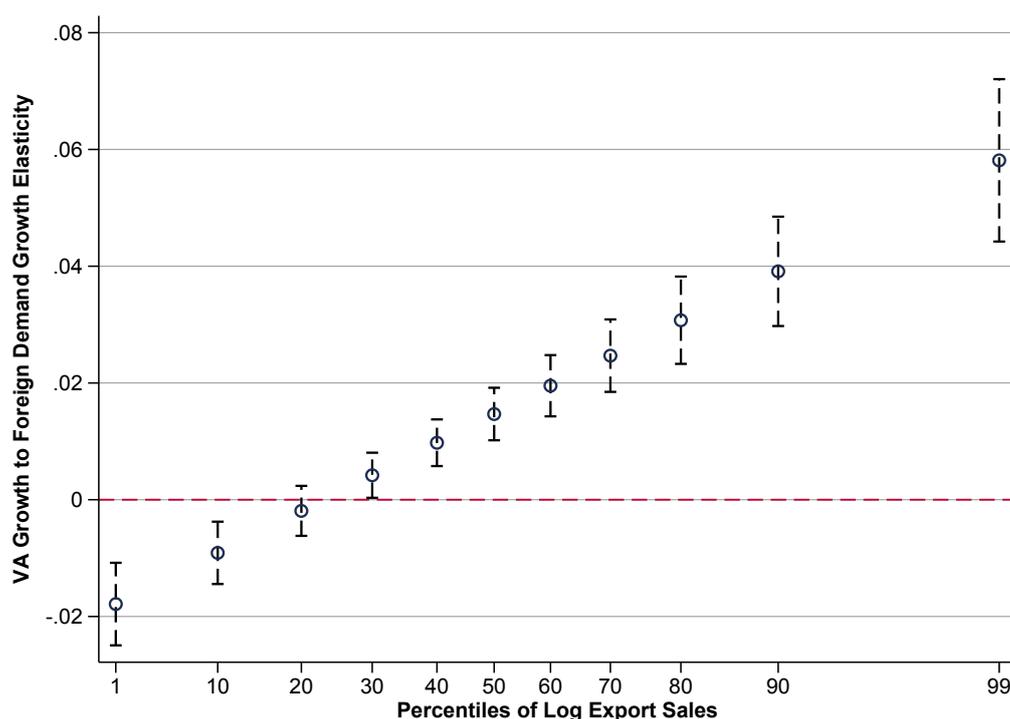
changes could be correlated with technological improvements occurring at the firm-level. I will control for the growth rate of capital intensity of firms to control for the fact that firms might automate part of their activity in response to changes in foreign demand, which could affect their growth rate and labor share. I will therefore add a vector of controls X_{it} , which includes the firm's growth rate of imports, growth rate of capital intensity and firm-specific fixed effects, to Equations (2.3.1) and (2.3.2). These additional results along with alternative robustness checks are provided in Section 2.4.3.

2.4 Results

2.4.1 Foreign Demand Growth and Reallocation

How does a foreign demand increase affect the value-added growth rate of heterogeneous exporters? Figure 2.4 highlights the first main empirical result. The coefficients used are reported in the first column of Table 2.3. A clear picture emerges: foreign demand growth allows some firms to grow while others shrink. More specifically, highly internationalized exporters grow following an increase in foreign demand while firms in the bottom 1% to 20% of the initial export sales distribution squeeze. Figure 2.4 points to the existence of intensive margin reallocations favoring more internationalized exporters. Indeed, the elasticity of value-added growth to foreign demand growth displayed in the Figure means that firms that are in the top 1% of the initial export sales distribution are going to experience a 0.6% increase in their value-added

and narrow offshoring by using firm-level imports that correspond or not to the main activity of the firm as indicated in the balance sheet data. Because I am not interested in separating the effect of broad versus narrow offshoring, I include *total* firm-level imports.

Figure 2.4: Between-Exporter Effect

Notes: This Figure is obtained by estimating Equation (2.3.1). This Figure reports the elasticity of value-added growth to foreign demand growth evaluated at different percentiles of the (log) export sales distribution (at time t_0). The coefficients used to compute these elasticities are reported in column 1 of Table 2.3. The percentiles of the initial export sales distribution are reported in Table 2.9.

following a 10% increase in their foreign demand. This elasticity goes down to -0.2% for firms in the bottom 1% of the export sales distribution. Changes in value-added are driven by changes in total sales as shown in Figure 2.G.9a. As shown below, the results are robust to using alternative internationalization measures, alternative firm size measures, controlling for offshoring and other determinants of a firm's growth rate and the results are not driven by firm specific pre-trends. All the robustness tests are reported in Section 2.4.3. The magnitude of the effect is relegated to Section 2.4.4.

As a case study, Figure 2.G.7 provides illustrative evidence that the effect of a negative demand shock such as a financial crisis has a heterogeneous impact on firms' value-added growth.²⁶ Two quasi-experiments occurred in the 1990s. The first one is the Asian financial crisis that occurred in 1997 and 1998 and the second one is the Russian financial crisis that took place in 1998. These two crises are exogenous from the perspective of French exporters. I assign French exporters surviving over the whole 1994-2001

²⁶This exercise is similar to that carried out in Berman et al. (2015) who provide evidence that the Asian financial crisis had a negative effect on the domestic sales of French exporters serving the Asian market prior to the crisis. They document a positive causal effect of export sales on domestic sales for French manufacturing exporters.

period into three groups. The first group consists of firms that never exported to the relevant market prior to the crisis.²⁷ The second group consists of firms whose ratio of export sales to the affected countries to total exports is larger than 10% prior to the crisis.²⁸ These should be the firms affected by the crisis. The third group is made out of firms with a larger degree of exposure to the relevant market pre-crisis (ratio of export sales to Asian countries or Russia to total exports larger than 20%). I then aggregate the value-added of firms belonging to each group and show the evolution of value-added compared to the pre-crisis level. Panel 2.G.7a and 2.G.7b of Figure 2.G.7 show that firms with a higher degree of exposure to these foreign markets were the most penalized by the financial disruption. While firms not exposed to the crisis keep growing over the period, firms with a degree of exposure larger than 20% shrink compared to the pre-crisis level, and this negative effect is stronger than for firms with a degree of exposure larger than 10%. This confirms that changes in demand conditions abroad affect firms' value-added growth differently, and that the effect is stronger for more internationalized exporters.

Foreign demand shocks therefore have a heterogeneous effect on value-added growth and favor superstar exporters with a low-labor share. These firms grow disproportionately more. This finding complements the findings of Autor et al. (2017) who show that the growth of superstar firms explains the decline of the labor share across sectors in the US and in several other OECD countries. Figure 2.4 shows that foreign demand growth can rationalize part of the rise of superstar firms/exporters, at least in the manufacturing sector.²⁹ These results corroborate the existence of a “winner take most” phenomenon in manufacturing. Foreign demand favors more internationalized exporters and contributes to the observed between-firm effect documented in Section 2.2.

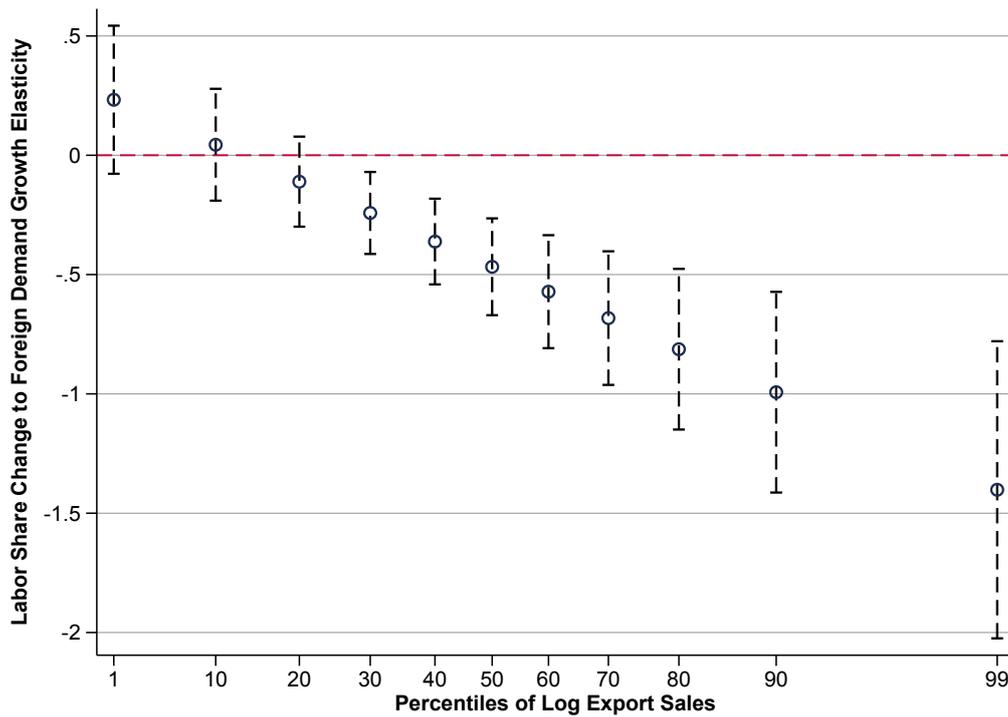
2.4.2 Foreign Demand Growth and Labor Shares

What is the effect of foreign demand shocks on firm-level labor shares? The results from estimating Equation (2.3.2) are displayed in Column 2 of Table 2.3. The elasticity of labor share changes to foreign demand growth is displayed in Figure 2.5. It shows that exporters that are not highly internationalized experience an increase in their labor share following an increase in foreign demand. More internationalized exporters, on

²⁷The five most affected countries by the Asian financial crisis were Indonesia, Malaysia, the Philippines, South Korea and Thailand.

²⁸I average this ratio over the pre-crisis years for each firm.

²⁹Other explanations are also likely to be causing this phenomenon, such as mergers and acquisitions and technological advances, for instance.

Figure 2.5: Within-Between Exporter Effect


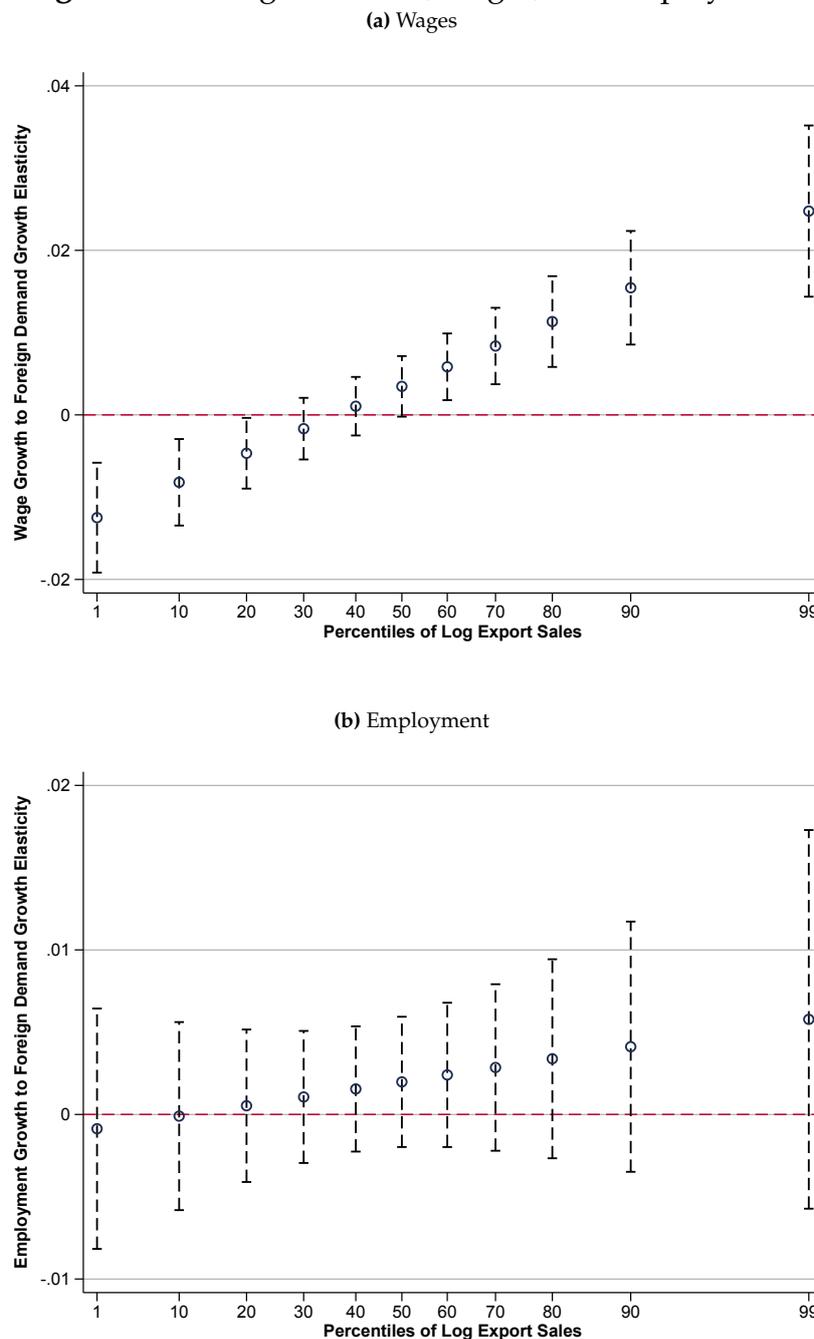
Notes: This Figure is obtained by estimating Equation (2.3.2). This Figure reports the elasticity of the change in a firm’s labor share to its foreign demand growth evaluated at different percentiles of the (log) export sales distribution (at time t_0). The coefficients used to compute these elasticities are reported in column 2 of Table 2.3. The percentiles of the initial export sales distribution are reported in Table 2.9.

the other hand, experience a drop in their labor share while the labor share of top exporters exhibit an even larger decrease.

The use of micro-data allows me to study how the numerator of a firm’s labor share, total labor compensation, varies with foreign demand shocks. Because changes in labor compensation can be driven by changes in the number of workers or in wages, I further study the evolution of these two margins separately. The estimated parameters are reported in the last three columns of Table 2.3. To meet the increase in foreign demand, firms might need to hire more workers. Similarly, an increase in foreign demand might lead firms to raise wages in order to incentivize workers to meet the increase in demand.³⁰ Column 4 of Table 2.3 and Figure 2.6a suggest that individuals working in superstar exporters experience wage gains. The last column of the table as well as Figure 2.6b show that superstars do not hire disproportionately more workers following an increase in foreign demand.³¹ As labor supply is arguably inelastic in the

³⁰Garin et al. (2018) study the causal effect of changes in demand conditions abroad on wages in Portugal before and after the Great Recession of 2008 and find positive significant effects.

³¹Higher hours worked could also be a way for firms to meet the increase in demand on the output market. Unfortunately, the data do not allow me to test this hypothesis.

Figure 2.6: Foreign Demand, Wages, and Employment

Notes: This Figure is obtained by estimating Equation (2.3.2) but where the dependent variable is the change in average wages for Panel 2.6a and in the number of employees for Panel 2.6b. This Figure reports the elasticity of the change in a firm's wages and number of workers to its foreign demand growth evaluated at different percentiles of the (log) export sales distribution (at time t_0). The coefficients used to compute these elasticities are reported in columns 4 and 5 of Table 2.3. The percentiles of the initial export sales distribution are reported in Table 2.9.

short-run, the increase in labor demand brought about by foreign demand growth leads to higher wages, thereby driving up total labor compensation (column 3 of Table 2.3). Moreover, the finding that the number of workers does not react and that superstar exporters grow disproportionately more suggests that their labor productivity is going to increase. I also note that the effect on wages depicted in Figure 2.6a likely masks a lot of heterogeneity across skill types. Foreign demand growth might favor more skilled workers, for instance. This issue is left for future research.

Empirically, the fact that the labor share of superstar exporters decreases relatively more is explained by the reallocation effect depicted in Figure 2.4. Top exporters grow disproportionately more, pushing down their labor share. Conversely, firms in the bottom 1% of the export sales distribution experience an increase in their labor share, driven by the fact that their value-added is going down, though the coefficient is not statistically significant.

The increase in foreign demand improves the condition of individuals working in superstar exporters, as suggested by Figure 2.6a. In relative terms, however, changes in demand conditions abroad shrink the share of the pie going back to workers. This within-between exporter effect points to the importance of the pure between-exporter, or reallocation, effect displayed in the previous subsection in driving changes in the labor share of firms.

2.4.3 Robustness Tests

I show that both the intensive margin reallocation of value-added towards superstar exporters and the stronger decrease in the labor share they experience are not driven by the choice of sample, variables or specification.

Additional controls and firm-specific trends. Table 2.4 confirms the findings of Table 2.3 when addressing the concern that offshoring may affect a firm's foreign demand by including the growth rate of each firm's total imports. The point estimates remain statistically significant at the 1% level in column 1 and 4. In column 2 and 5, I control for the fact that foreign demand shocks may also incentivize firms to automate part of the production process through the inclusion of the growth rate of capital intensity. The main effect on the interaction term is largely stable. Finally, in column 3 and 6, I control for firm-specific trends by adding firm fixed-effects. The point estimates on the interaction term survive this tough test test and remain significant. The number of observations is smaller in this table because of the presence of a few singletons.

Table 2.4: Robustness: Controls and Pre-Trends

Internationalization Measure (Superstar _{it0}) Dependent variable	Δ ln VA _{it}			ln Export Sales		
				Δ Labor Share _{it}		
	(1)	(2)	(3)	(4)	(5)	(6)
$\tilde{\Delta}$ ForeignDemand _{it}	-0.0177*** (0.0042)	-0.0177*** (0.0042)	-0.014*** (0.0046)	0.1650 (0.1925)	0.1529 (0.1923)	0.0288 (0.2226)
$\tilde{\Delta}$ ForeignDemand _{it} × Superstar _{it0}	0.0067*** (0.0011)	0.0067*** (0.0011)	0.0047*** (0.0012)	-0.1436*** (0.0486)	-0.1398*** (0.0486)	-0.1065* (0.0554)
Superstar _{it0}	-0.0058*** (0.0002)	-0.0058*** (0.0002)		0.0196** (0.0079)	0.0200*** (0.0078)	
Δ ln Imports _{it}	0.0209*** (0.0008)	0.0209*** (0.0008)	0.0136*** (0.0007)	-0.2007*** (0.0271)	-0.1918*** (0.0272)	-0.1815*** (0.0295)
Δ Capital Intensity _{it}		-0.0025 (0.0024)	-0.0131*** (0.0024)		-0.7123*** (0.0829)	-0.3387*** (0.0927)
Two-digit Sector × Year FE	✓	✓	✓	✓	✓	✓
Firm FE			✓			✓
# Observations	152,713	152,713	152,713	152,713	152,713	152,713

Notes: Standard errors clustered at the firm level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The coefficients from the regression models are estimated over 1994-2001 using OLS. All columns include industry by year fixed effects. $\Delta \ln VA_{it}$ is the change in a firm's value-added. $\tilde{\Delta}$ ForeignDemand_{it} is the change in a firm's foreign demand. Superstar_{it0} is a measure of the degree of internationalization of the firm and is the log of the export sales of the firm in the first year in which it appears in the sample. $\Delta \ln$ Imports_{it} is the change in a firm's total imports from the rest of the world, $\Delta \ln (1 + \text{Imports})_{it}$, and is a measure of offshoring. Δ Capital Intensity_{it} is the change in a firm's capital intensity as measured by the log of its capital-labor ratio. Columns 3 and 6 controls for firm-specific trends through the inclusion of firm fixed effects.

Future demand shocks. Table 2.16 further tests whether the initial export composition of firms can be responsible for the growth of value-added and changes in the firms' labor share. If pre-trends are responsible for these changes, we should expect future demand shocks to have a statistically significant impact on contemporaneous outcomes. Reassuringly, column 2 and 4 show that the effect is never significant while the coefficient on the interaction term between contemporaneous demand shocks and the superstar measure are precisely estimated as in Table 2.3. Though the coefficient in the third column is not significant at the 10% level (but is significant at the 14% level), the estimates are all significant at the 5% level for firms above the 30th percentile of the initial export sales distribution. This confirms that firm-specific trends are unlikely to drive the results.

Alternative time period. I provide evidence that both between and within-between exporter effects operate when I extend the sample to the whole 1994-2007 period. This is shown in the first two columns of Table 2.17. The main results are not affected and all the estimates are significant at the 1% level. To show that the results in the first two columns are not driven by the period 1994-2001, I focus on the sample of firms that operate over the 2001-2007 period. This does not alter the point estimates, which are even stronger over that time period. Foreign demand growth drives down

the manufacturing labor share through the reallocation effect mentioned before, and through a decrease in the labor share of firms which is strongest for top exporters. Even though the aggregate labor share experiences an increase after 2001, this test shows that the results are not driven by the time period and that foreign demand growth unambiguously pulls the labor share *down*.

Alternative internationalization measures. Table 2.18 uses the other internationalization measures described in Table 2.2, namely the export intensity of a firm, its number of products exported and the number of destination countries served. The interaction term is positive (negative) and significant in the first (last) three columns. The finding that superstar exporters grow relatively more than less internationalized firms and experience a stronger decrease in their labor share does not depend on the choice of internationalization measure.

Alternative labor share measure. Panel 2.G.9a of Figure 2.G.9 displays the elasticity of sales growth to foreign demand growth, while Panel 2.G.9b shows how the equipped labor share evolves with foreign demand growth. The top panel shows that the elasticity of sales growth to foreign demand growth closely corresponds to that of value-added growth reported in Figure 2.4, meaning that the results are driven by an increase in sales. The bottom panel displays a downward sloping elasticity with a firm's degree of internationalization. This shows that *all* the primary factors of production (capital and labor) of a firm are receiving a lower share of that firm's sales and that the effect is exacerbated for superstar exporters.

Exclusion of extreme years. As shown in Figure 2.1, the labor share declines sharply in 1994 while it increases in 2001. Without these two years, the labor share dropped by 2 percentage points over 1995-2000 (Table 2.1). To test the sensitivity of the result to the inclusion of these years, I exclude 1994 and 2001 of the sample and re-estimate Equations (2.3.1) and (2.3.2). Table 2.19 shows that the reallocation towards superstar exporters and the within-between effect survive the exclusion of these two years.

Exclusion of key industries. The different industries within manufacturing experienced a different growth rate of exports over the period as shown in Figure 2.G.8. Firms' value-added and labor share can evolve differently within different industries and be driven by industry-specific trends. I further exclude the industries whose growth rate of exports was particularly high to test whether the results are driven by these

industries. More specifically, I exclude the chemical, rubber, plastics and fuel, electrical and optical equipment, and transport equipment industries from my sample. Table 2.20 shows that the results survive this restriction and are not driven by a few key industries.

Alternative firm size measures. Fact 3 shows that more internationalized exporters have a lower labor share. I test whether the results hold when considering other “superstar” firm characteristics instead of these internationalization measures. I instead use capital intensity and revenue productivity as alternative measures of firm size/heterogeneity, as shown in Figure 2.G.10 and Figure 2.G.11, respectively. The elasticities displayed in all four panels leave the key results reported in Figure 2.4 and Figure 2.5 unchanged, though the coefficients are smaller in magnitude and less precisely estimated.

Alternative lag structure. Internationalized exporters are defined in the first year in which they appear in the sample to avoid simultaneity issues. This choice, however, prevents firms from becoming large players on international markets. I assess the robustness of the main results to lagging the internationalization measures, in order to allow exporters to move along the export sales distribution. This test is reported in Table 2.21. The results are robust to lagging the superstar variable once (column 1 and 2) or twice (column 3 and 4).

Sample of survivors. Table 2.3 contains firms that appear in at least two time periods (survivors) but it also contains entrants and exiters. Table 2.22 tests whether the subsample of exporters surviving the entire 1994-2001 period yields similar results. The estimated coefficients of interest (β^{Rank} and χ^{Rank}) have the same sign as the baseline estimates that contain entrants and exiters and are statistically significant. This test shows that entrants and exiters over the period do not drive the results.

Outsourcing. An alternative mechanism that could explain the reallocation of value-added shares towards large exporters and the decline in their labor share is outsourcing. Over the last decades, several industries such as the automobile industry have transferred part of their activity to business partners to focus on their core activity. Two observable consequences of outsourcing could be a sudden increase in investment as the firm narrows its activity to its core competency and large changes in employment. I therefore remove firm-year observations for which the growth rate of total investments

and the growth rate of employment is lower than the bottom or higher than the top 10% percent of each growth rate distribution within each 2-digit industry. This allows me to keep a sample of firms that have arguably not experienced any restructuring which would affect their value-added growth rate or their labor share. The point estimates reported in Table 2.23 are very similar to those in Table 2.3 and are estimated precisely.

2.4.4 Magnitude

How large is the effect of a surge in foreign demand on the manufacturing labor share? I make use of the Foster et al. (2001) decomposition method and the point estimates obtained in Section 2.4.1 and 2.4.2 to get a sense of the magnitude of the effects. I focus on the effect of foreign demand shocks on firms that survive over at least two years and do not study the entry-exit margins. Although the following results are partial equilibrium in nature, they provide interesting evidence on the magnitude of the effect of foreign demand growth in generating changes in the manufacturing labor share.

From Equation (2.2.2), the reallocation margin is given by:

$$\Delta LS_t^{\text{Between}} := \sum_{i \in S} (\omega_{it} - \omega_{it-1}) (LS_{it-1} - LS_{t-1}) + \sum_{i \in S} (\omega_{it} - \omega_{it-1}) (LS_{it} - LS_{it-1})$$

while the within-firm effect is given by:

$$\Delta LS_t^{\text{Within}} := \sum_{i \in S} \omega_{it-1} (LS_{it} - LS_{it-1})$$

Using the point estimates obtained, I can compute the percentage point change in the labor share caused by the reallocation effect and arising from foreign demand changes, labeled $\Delta \hat{LS}_t^{\text{Between}}$:

$$\begin{aligned} \Delta \hat{LS}_t^{\text{Between}} &= \sum_{i \in S} (\hat{\omega}_{it}^{\text{Between}} - \omega_{it-1}) (LS_{it-1} - LS_{t-1}) \\ &+ \sum_{i \in S} (\hat{\omega}_{it}^{\text{Between}} - \omega_{it-1}) \left(\hat{\zeta}^{\text{Rank}} \tilde{\Delta} \text{ForeignDemand}_{it} + \hat{\chi}^{\text{Rank}} \tilde{\Delta} \text{ForeignDemand}_{it} \times \text{Superstar}_{it_0} \right) \end{aligned} \tag{2.4.1}$$

Table 2.5: Magnitude of the Effects

	$\Delta\hat{LS}_t^{\text{Between}}$	$\Delta\hat{LS}_t^{\text{Within}}$	$\Delta\hat{LS}_t^{\text{Within}} + \Delta\hat{LS}_t^{\text{Between}}$	Contribution Between (%)	Contribution (%)
	(1)	(2)	(3)	(4)	(5)
1994-1995	-0.0065	-0.2127	-0.2192	1.07	6.77
1995-1996	-0.0562	-0.0618	-0.118	6.24	-8.49
1996-1997	-0.0016	-0.0110	-0.0126	0.26	1.48
1997-1998	0.0815	-0.0287	0.0528	-22.03	-13.2
1998-1999	-0.0688	-0.0327	-0.1015	6.62	15.62
1999-2000	-0.1306	-0.0667	-0.1973	25.61	14.3
2000-2001	0.0308	0.0069	0.0377	-440	3.56
1994-2001	-0.1514	-0.4067	-0.5581	3.75	13.68
1994-2000	-0.1823	-0.4136	-0.5959	4.52	11.59

Notes: This decomposition is done for the sample of manufacturing exporters using the estimated parameters recovered from estimating Equations (2.3.1) and (2.3.2). The predicted between term in column 1 is the sum of the between and the cross effect described in Equation (2.4.1). Column 2 contains the predicted within-between firm effect described in Equation (2.4.3). Column 3 is the sum of columns 1 and 2. Column 4 is obtained by taking the ratio $\frac{\Delta\hat{LS}_t^{\text{Between}}}{\Delta\hat{LS}_t^{\text{Between}}}$ for each year interval, using the values reported in column 3 of Table 2.1. Column 5 is obtained by taking the ratio of the predicted labor share change arising from foreign demand growth reported in column 3 to the observed overall change reported in column 1 of Table 2.1 for each year interval. The estimated parameters used to compute the predicted values are reported in columns 1 and 2 of Table 2.3. The last two rows of the table sum the previous rows over the whole 1994-2001 and 1994-2000 period.

The predicted values for the value-added weights are given by:

$$\hat{\omega}_{it}^{\text{Between}} = \frac{VA_{it-1} \left(1 + \hat{\alpha}^{\text{Rank}} \tilde{\Delta}\text{ForeignDemand}_{it} + \hat{\beta}^{\text{Rank}} \tilde{\Delta}\text{ForeignDemand}_{it} \times \text{Superstar}_{it_0} \right)}{\sum_i VA_{it-1} \left(1 + \hat{\alpha}^{\text{Rank}} \tilde{\Delta}\text{ForeignDemand}_{it} + \hat{\beta}^{\text{Rank}} \tilde{\Delta}\text{ForeignDemand}_{it} \times \text{Superstar}_{it_0} \right)} \quad (2.4.2)$$

Value-added is lagged in the previous equation. If there were no effect, $\hat{\alpha}^{\text{Rank}} = \hat{\beta}^{\text{Rank}} = 0$ so that $\hat{\omega}_{it}^{\text{Between}} = \omega_{it-1}$ which would imply that the predicted between-firm component would be nil ($\Delta\hat{LS}_t^{\text{Between}} = 0$).

The percentage point change arising from changes in firms' labor share and caused by foreign demand changes can be obtained using the estimated coefficients from Equation (2.3.2). This gives the predicted within-between term $\Delta\hat{LS}_t^{\text{Within}}$:

$$\Delta\hat{LS}_t^{\text{Within}} = \sum_{i \in S} \omega_{it-1} \left(\hat{\zeta}^{\text{Rank}} \tilde{\Delta}\text{ForeignDemand}_{it} + \hat{\chi}^{\text{Rank}} \tilde{\Delta}\text{ForeignDemand}_{it} \times \text{Superstar}_{it_0} \right) \quad (2.4.3)$$

I use the OLS coefficients provided in the first two columns of Table 2.3 to compute the predicted between-firm margin $\Delta\hat{LS}_t^{\text{Between}}$ and the predicted within-between firm margin $\Delta\hat{LS}_t^{\text{Within}}$.

The main quantitative results are displayed in Table 2.5. In column 1, foreign demand growth generates a 0.15 percentage point decline in the labor share through reallocation towards low-labor share exporters. The within-between firm effect is much stronger

and generates a 0.41 percentage point decline in the labor share. The sum of these two margins is reported in column 3. Both between-firm and within-between firm effects arising from foreign demand growth generate a 0.56 percentage point decline in the manufacturing labor share over 1994-2001. In column 4, I compute the share of the *observed* reallocation effect towards low-labor share exporters explained by foreign demand growth. To do so, I compute the ratio $\frac{\Delta \hat{LS}_t^{\text{Between}}}{\Delta LS_t^{\text{Between}}}$ for each year. Foreign demand explains about 4% of the observed reallocation effect towards low-labor share, superstar exporters in manufacturing. This result complements the findings of [Autor et al. \(2017\)](#) who document the rise of superstar firms. Their rise can be caused by a variety of factors, including globalization, mergers and acquisitions, and technological advances. Column 4 shows that part of their rise is caused by changes in demand conditions on foreign markets. Finally, column 5 computes the share of the actual decline in the French manufacturing labor share that can be attributed to foreign demand growth. To do so, I compare the overall predicted labor share decline reported in column 3 to the actual overall change reported in column 1 of Table 2.1. Foreign demand growth, through the between-firm and within-between firm effects it generates, explains about 14% of the overall decline in the French manufacturing labor share. These results are arguably a *lower* bound for the overall effect of international trade on the labor share. Foreign demand induces firms to patent more ([Aghion et al., 2018](#)). The authors find that the effect is stronger for more productive exporters. This increase in innovation going through changes in foreign demand conditions could further reallocate output towards larger exporters. A more globalized economy also means a country more open to imports from the rest of the world. [Bloom et al. \(2016\)](#) show that the rise of Chinese exports to European countries over the period 1996-2007 spurred innovation. This channel, which goes through the import side of trade, can also lead to intensive margin reallocations towards larger firms. This could reinforce the trade-induced superstar effect.

In Table 2.6, I study the sensitivity of the results to the exclusion of superstar exporters. I first trim the top 1% of the export sales distribution and estimate baseline specifications (2.3.1) and (2.3.2). I then use the point estimates reported in columns 1-2 of Table 2.24 and compute the new predicted labor share changes and quantify their importance in explaining the observed reallocation effect and observed labor share decline. Columns 1-3 of Table 2.6 show that between and within-firm effects are much smaller in the absence of superstar exporters. The labor share decrease generated by foreign demand growth only amounts to 0.26 percentage points, half the amount obtained previously. Foreign demand growth only explains 0.5% of the reallocation effect occurring in the data, as displayed in Column 4. Column 5 points to the key role of superstar exporters in driving down the manufacturing labor share. Not accounting for top sellers on

Table 2.6: Magnitude of the Effects without the Superstar Exporters

	$\Delta\hat{LS}_t^{\text{Between}}$ (1)	$\Delta\hat{LS}_t^{\text{Within}}$ (2)	$\Delta\hat{LS}_t^{\text{Within}} + \Delta\hat{LS}_t^{\text{Between}}$ (3)	Contribution Between (%) (4)	Contribution (%) (5)
1994-1995	-0.0111	-0.1551	-0.1662	1.82	5.13
1995-1996	0.0020	-0.0274	-0.0254	-0.22	-1.83
1996-1997	0.0020	-0.0010	0.001	-0.37	-0.12
1997-1998	-0.0040	-0.0464	-0.0504	1.08	12.6
1998-1999	-0.0075	-0.0066	-0.0141	0.72	2.17
1999-2000	0.0049	0.0102	0.0151	-0.96	-1.09
2000-2001	-0.0045	-0.0155	-0.02	64.29	-1.89
1994-2001	-0.0183	-0.2418	-0.2601	0.45	6.38
1994-2000	-0.0137	-0.2263	-0.24	0.34	4.67

Notes: This decomposition is done for the sample of manufacturing exporters using the estimated parameters recovered from estimating Equations (2.3.1) and (2.3.2). Firms in the top 1% of the initial log export sales distribution have been discarded from the sample. The predicted between term in column 1 is the sum of the between and the cross effect described in Equation (2.4.1). Column 2 contains the predicted within-between firm effect described in Equation (2.4.3). Column 3 is the sum of columns 1 and 2. Column 4 is obtained by taking the ratio $\frac{\Delta\hat{LS}_t^{\text{Between}}}{\Delta\hat{LS}_t^{\text{Between}}}$ for each year interval, using the values reported in column 3 of Table 2.1. Column 5 is obtained by taking the ratio of the predicted labor share change arising from foreign demand growth reported in column 3 to the observed overall change reported in column 1 of Table 2.1 for each year interval. The estimated parameters used to compute the predicted values are reported in columns 1 and 2 of Table 2.24. The last two rows of the table sum the previous rows over the whole 1994-2001 and 1994-2000 period.

international markets leads to foreign demand growth explaining 6% of the labor share decline versus 14% obtained in Table 2.5.

Table 2.5 highlights the importance of the within-between margin in driving the manufacturing labor share down, as it accounts for 73% of both between and within-between effects.³² Although the within-between firm effect is explained by the reallocation effect, the extent to which firm heterogeneity and this reallocation effect can account for this within-between firm effect is uncertain. In Table 2.7, I shut down the heterogeneity parameters β^{Rank} and χ^{Rank} and estimate my baseline specifications, assuming that the effect played by foreign demand on the firms' growth rate and labor share does not vary with their degree of internationalization. Columns 1-3 report much smaller results. In column 4, foreign demand growth only accounts for 0.2% of the reallocation effect. This result is not surprising given that the reallocation effect is about the interaction term between a firm's foreign demand and its degree of internationalization. Column 5 indicates that not allowing foreign demand growth to impact the growth rate of firms and their labor share differently leads to foreign demand growth accounting for 2.5% of the observed labor share decline. Importantly, although the within-firm component of column 2 is still the most important margin and accounts for 93% of the decline generated by foreign demand growth, understanding the role played by foreign demand growth in generating changes in the labor share boils down to understanding the *reallocation* effect that takes place and favors superstar exporters. The reallocation

³²This number is obtained by taking the ratio $\frac{\Delta\hat{LS}_t^{\text{Within}}}{\Delta\hat{LS}_t^{\text{Within}} + \Delta\hat{LS}_t^{\text{Between}}}$ for the whole 1994-2001 period using the numbers reported in columns 2 and 3 of Table 2.5.

Table 2.7: Shutting Down the Heterogeneity Parameters

	$\Delta\hat{LS}_t^{\text{Between}}$	$\Delta\hat{LS}_t^{\text{Within}}$	$\Delta\hat{LS}_t^{\text{Within}} + \Delta\hat{LS}_t^{\text{Between}}$	Contribution Between (%)	Contribution (%)
	(1)	(2)	(3)	(4)	(5)
1994-1995	0.0035	-0.0529	-0.0494	-0.57	1.52
1995-1996	-0.0043	-0.0136	-0.0179	0.48	-1.29
1996-1997	-0.0003	-0.0022	-0.0025	0.05	0.29
1997-1998	0.0097	-0.0089	0.0008	-2.62	-0.2
1998-1999	-0.0065	-0.0066	-0.0131	0.63	2.02
1999-2000	-0.0124	-0.0097	-0.0221	2.43	1.60
2000-2001	0.0034	-0.0005	0.0029	-48.57	0.27
1994-2001	-0.0069	-0.0944	-0.1013	0.17	2.48
1994-2000	-0.0103	-0.0939	-0.1042	0.26	2.03

Notes: This decomposition is done for the sample of manufacturing exporters using the estimated parameters recovered from estimating Equations (2.3.1) and (2.3.2) from which the interaction terms and the Superstar_{it_0} variables are dropped. The predicted between term in column 1 is the sum of the between and the cross effect described in Equation (2.4.1). Column 2 contains the predicted within-between firm effect described in Equation (2.4.3). Column 3 is the sum of columns 1 and 2. Column 4 is obtained by taking the ratio $\frac{\Delta\hat{LS}_t^{\text{Between}}}{\Delta\hat{LS}_t^{\text{Between}}}$ for each year interval, using the values reported in column 3 of Table 2.1. Column 5 is obtained by taking the ratio of the predicted labor share change arising from foreign demand growth reported in column 3 to the observed overall change reported in column 1 of Table 2.1 for each year interval. The estimated parameters used to compute the predicted values are reported in columns 3 and 4 of Table 2.24. The last two rows of the table sum the previous rows over the whole 1994-2001 and 1994-2000 period.

effect accounts for 82% of the role played by foreign demand on the labor share, not only through the pure between-firm effect but also through the within-between firm effect.³³ It is therefore the key effect to rationalize.

2.5 Theory

The previous section highlighted the importance of reallocations towards superstar exporters in driving down the manufacturing labor share, through between-firm and within-between firm effects. I now rely on a monopolistic competition model to rationalize the reallocation effect. The two key results of the model is that larger firms have a lower labor share because they charge higher markups and an increase in demand leads to intensive margin reallocations towards these large firms.

2.5.1 Closed Economy Model

The framework builds on [Zhelobodko et al. \(2012\)](#). The market structure is monopolistic competition and firms are heterogeneous in terms of their productivity. For sake of simplicity and because the focus of the paper is not on the impact of foreign demand on reallocations of export sales across *products* within multi-product firms but rather on

³³This figure is obtained by comparing column 5 of Table 2.7 to column 5 of Table 2.5 for the whole 1994-2001 period.

reallocation across *firms*, firms are assumed to be single-product firms.³⁴ To highlight the relationship between firm size and markups, I further abstract from capital as I have shown that the share of all primary factors of production in a firm's total sales decreases with foreign demand (Figure 2.G.9b). The economy is assumed to be closed. The model in open-economy delivers the same results as the one in closed-economy and is therefore relegated to Appendix 2.E.4. An increase in foreign demand will lead to a reallocation of output towards the most productive exporters with a low labor share.

Consumers side. There are L consumers in the economy who demand x_i units of a differentiated good indexed over the interval $i \in [0, N]$. The wage is the numeraire so that a consumer's income is set equal to one. Preferences are additively separable and each consumer solves:

$$\max_{x_i} \int_0^N u(x_i) di \quad \text{s.t.} \quad \int_0^N p_i x_i di = 1$$

The first-order condition with respect to x_i leads to the following inverse demand function:

$$p(x_i; \lambda) = \frac{u'(x_i)}{\lambda} \quad (2.5.1)$$

The inverse demand function is positive and downward sloping if and only if $u'(x_i) > 0$ and $u''(x_i) < 0$, which I assume. The marginal utility of income λ is defined from the budget constraint and (2.5.1) as:

$$\lambda = \int_0^N u'(x_i) x_i di \quad (2.5.2)$$

From (2.5.1), the marginal utility of income acts as a demand shifter. If it increases, the residual demand curve shifts inward so that prices decrease at any given quantity level.

Firms side. Firms produce a distinct differentiated good and there is a set of entrants N_e who can pay a sunk cost of entry expressed in units of labor f_e to produce or not. If they decide to pay that cost, they draw their productivity level φ from a distribution $G(\varphi)$ whose support is given over $[0, \infty]$. When producing, firms have to pay a fixed cost f which gives rise to increasing returns to scale. Each firm i produces a good q_i using labor l_i as an input. A firm's production function is $q_i = \varphi l_i$ where φ is its

³⁴For a treatment of multi-product firms and evidence of intensive margin reallocations leading to aggregate productivity gains in the French context, see Mayer et al. (2016).

productivity and is firm-specific. The total cost function TC_i of the firm is $TC_i = \frac{w}{\varphi}q_i + f$ where f is the fixed cost of production.

The condition for profit maximization such that marginal revenue is equal to marginal cost entails that the price p_i of a good is equal to that firm's markup μ_i times its marginal cost of production:

$$p_i = \mu_i \frac{w}{\varphi} \quad (2.5.3)$$

Multiplying both sides of (2.5.3) by q_i and rearranging, one obtains:

$$\frac{wl_i}{p_i q_i} = \frac{1}{\mu_i} \quad (2.5.4)$$

This equation relates a firm's labor share to that firm's markup.³⁵ In the cross-section, firms that charge higher markups have a lower labor share.

From the goods market equilibrium condition, total quantity produced is $q_i = x_i L$. Firms choose the x_i that maximizes their per-consumer operating profits π^c .³⁶

$$\pi^c(\varphi, \lambda) := \max_{x_i} \left\{ \left(\frac{u'(x_i)}{\lambda} - \frac{1}{\varphi} \right) x_i \right\} \quad (2.5.5)$$

This gives rise to the optimal quantity demanded by individual consumers:

$$x(\varphi, \lambda) := \arg \max_{x_i} \left\{ \left(\frac{u'(x_i)}{\lambda} - \frac{1}{\varphi} \right) x_i \right\} \quad (2.5.6)$$

Revenue sales per-consumer are defined as:

$$r(\varphi, \lambda) = p(x(\varphi, \lambda), \lambda) x(\varphi, \lambda) \quad (2.5.7)$$

while total net profits are given by:

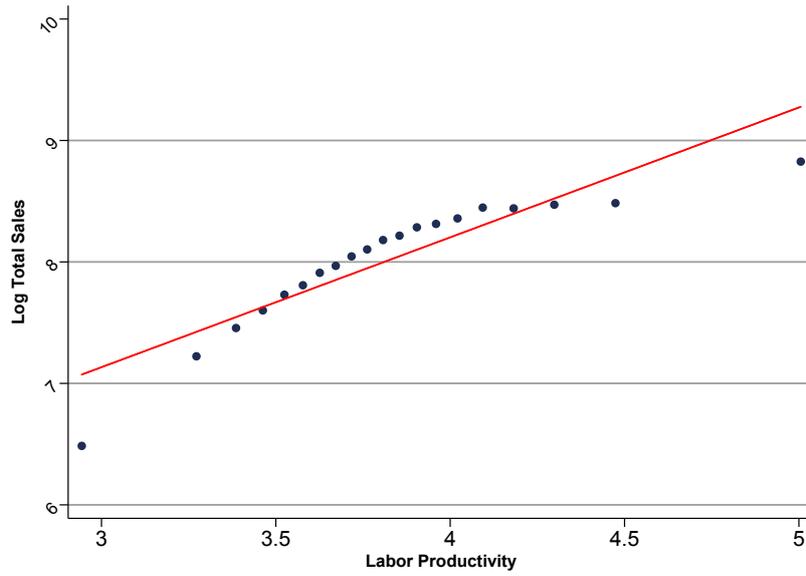
$$\Pi(\varphi, \lambda) = \pi^c(\varphi, \lambda)L - f \quad (2.5.8)$$

Total profits are continuous and from the envelope condition, profits increase in φ so

³⁵The denominator of (2.5.4) corresponds to sales or value-added. Both are equal to each other as I abstract from materials.

³⁶I make use of the inverse demand function given in (2.5.1).

Figure 2.7: Labor Productivity and Firm Size



that there exists a unique cutoff productivity level φ^* that solves:

$$\Pi(\varphi^*, \lambda) = 0 \iff \pi^c(\varphi^*, \lambda)L = f \tag{2.5.9}$$

Firms that are less productive than the cutoff productivity level ($\varphi < \varphi^*$) will not find it profitable to produce and will exit.

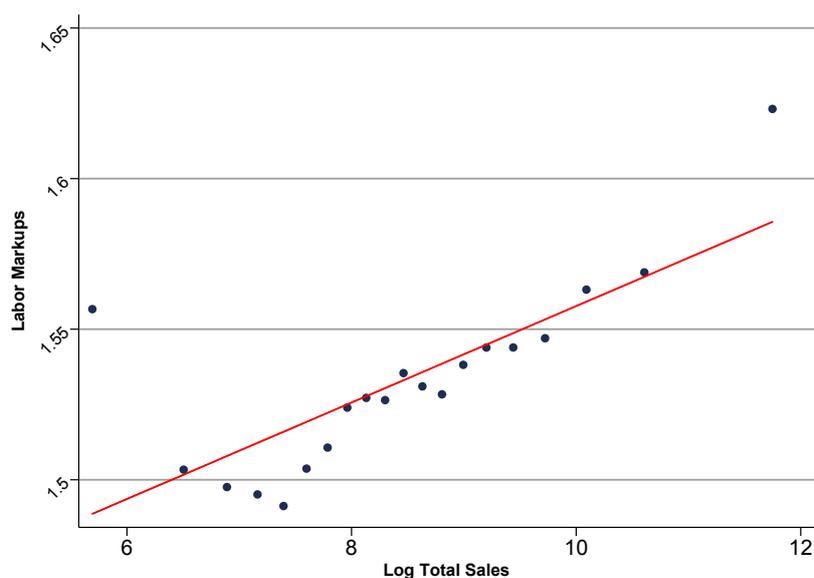
Free entry is assumed to hold and this condition writes:

$$\int_{\varphi^*}^{\infty} [\pi^c(\varphi, \lambda)L - f] dG(\varphi) = f_e \tag{2.5.10}$$

Marshall’s Second Law of Demand. The two key results of the model hinge on an assumption relating a firm’s demand elasticity to its size, assumption commonly referred to as Marshall’s Second Law of Demand (MSLD):

Assumption 1. (Marshall’s Second Law of Demand) The inverse demand elasticity $\sigma_p(x_i) := -\frac{\partial p(x_i)/\partial x_i}{p(x_i)/x_i}$ increases in x_i : $\frac{\partial \sigma_p(x_i)}{\partial x_i} > 0$.

This assumption is equivalent to saying that the demand elasticity decreases with x_i . It implies that a profit-maximizing firm’s marginal revenue decreases in x_i , as shown in Appendix 2.E.1. The fact that marginal revenues decrease with consumption generates a positive relationship between a firm’s productivity level and its production. Assumption 1 is sufficient to generate a positive relationship between firm size and markups.

Figure 2.8: Markups and Firm Size

Krugman (1979) derives a model of international trade with increasing returns to scale in which he studies the effect of an expansion of the world economy on welfare. His model with no firm heterogeneity predicts that trade leads to pro-competitive effects (lower markups). This is because the demand elasticity is not constant. More specifically, “these results depend [...] on the assumption that the elasticity of demand falls with consumption). This assumption, which might alternatively be stated as an assumption that the elasticity of demand rises when the price of a good is increased, seems plausible. In any case, it seems to be necessary if this model is to yield reasonable results, and I make the assumption without apology” (Krugman, 1979). Recent work by De Loecker et al. (2016) shows that markups and quantities are positively correlated with one another. Their method of estimating markups does not make any assumption on the market structure in which firms operate and is therefore consistent with larger firms facing a lower demand elasticity in a monopolistic competition context. Mayer et al. (2016) show that the patterns of product-mix reallocations they find in French manufacturing are consistent with larger firms facing a lower demand elasticity.

Because Assumption 1 is key to rationalize the reallocation effect, I provide evidence that more productive firms are larger, as shown in Appendix 2.E.2. Figure 2.7 indicates a positive relationship between (labor) productivity and firm size, as measured by total sales. I also estimate firms’ total factor productivity (TFP) using production function estimation techniques (Olley and Pakes, 1996; Levinsohn and Petrin, 2003; Akerberg et al., 2015). Figure 2.G.12 also shows a positive correlation between revenue TFP and firm size.³⁷ To show more directly the relationship between markups and firm

³⁷Details on the estimation can be found in Appendix 2.D.

size implied by MSLD, I estimate firm-level markups (Hall, 1988; De Loecker and Warzynski, 2012) using production function estimation techniques. De Loecker and Warzynski (2012) show that for cost-minimizing producers, firm-level markups drive a wedge between the output elasticity of a flexible input and that input's share in total revenues. Thereby, given an input's output elasticity, a lower revenue share of that input in total sales will command a higher markup. More details on this method are provided in Appendix 2.D. The relationship between markups and firm size is shown in Figure 2.8 and points to a positive relationship between markups and firm size in my sample of French manufacturing exporters.³⁸ These pieces of evidence motivate Assumption 1.

As shown in Appendix 2.E.2, MSLD leads to the following proposition:

Proposition 1. *More productive firms charge higher markups and have a lower labor share.*

Proof. See Appendix 2.E.2. □

When MSLD holds, more efficient firms produce more and therefore face a lower demand elasticity. This allows them to charge higher markups as consumers are less sensitive to price changes and this translates into a lower labor share from Equation (2.5.4). The fact that more internationalized firms have a lower labor share (Fact 3) is consistent with Marshall's Second Law of Demand.

Demand increase and reallocation effect. Given the theoretical result linking a firm's productivity level and its size to its labor share, a decline in the manufacturing labor share will occur if an increase in demand reallocates output towards high productivity type firms. Totally differentiating a firm's total profits with respect to L leads to:

$$\frac{d\Pi}{dL} \frac{L}{\Pi} = \frac{\partial\Pi}{\partial L} \frac{L}{\Pi} + \frac{\partial\Pi}{\partial\lambda} \frac{\lambda}{\Pi} \times \frac{d\lambda}{dL} \frac{L}{\lambda} \quad (2.5.11)$$

This equation tells us that the elasticity of profits to a change in demand (population L) can be decomposed into two effects: a market size effect, which is the first component

³⁸This positive relationship between firm size and markups can also be obtained when the market structure is oligopolistic. In the Atkeson and Burstein (2008) and Edmond et al. (2015) framework, more productive firms charge higher markups because they produce more and have lower prices which translates into a higher market share for these firms. In their model, under the assumption that the elasticity of substitution within sectors is higher than that across sectors, this leads to more productive firms charging higher markups. This is because firms with a high market share will mostly compete with firms in other sectors. As the competition is low in their own sector, they will face a low demand elasticity close to the elasticity of substitution across sectors. This result holds regardless of whether firms compete à la Cournot or à la Bertrand.

on the right hand side of the equation, and a competition effect. The first one tends to rise firms' profits while the second one decreases profits as competition is fiercer.³⁹ In general, it is hard to know which effect dominates but with additively separable preferences, the solution turns out to be tractable. As shown in Appendix 2.E.3, Equation (2.5.11) boils down to:

$$\frac{d\Pi}{dL} \frac{L}{\Pi} = 1 - \frac{[\sigma_p(\varphi, \lambda)]^{-1}}{\int_{\varphi^*}^{\infty} \frac{\pi^c(\varphi, \lambda)}{\pi^c(\lambda)} [\sigma_p(\varphi, \lambda)]^{-1} dG(\varphi)} \quad (2.5.12)$$

The market size effect is equal to unity. The competition effect is the ratio of a firm's demand elasticity to a weighted average of demand elasticities faced by all surviving firms. These demand elasticities are weighted by the share of each firm's profit in total profits. The denominator is an average demand elasticity. Firms that have a lower than average demand elasticity will have $\frac{[\sigma_p(\varphi, \lambda)]^{-1}}{\int_{\varphi^*}^{\infty} \frac{\pi^c(\varphi, \lambda)}{\pi^c(\lambda)} [\sigma_p(\varphi, \lambda)]^{-1} dG(\varphi)} < 1$ so that $\frac{d\Pi}{dL} \frac{L}{\Pi} > 0$.

The intuition of the result is as follows. Under Assumption 1, more productive firms face a lower demand elasticity. When demand increases, the market size effect dominates for larger firms as they face a lower than average demand elasticity and are not highly penalized by the concomitant increase in competition. Firms with a higher than average demand elasticity, namely less productive firms, will experience a decrease in profits as the competition effect dominates. This triggers intensive margin reallocations towards more productive firms.⁴⁰ Because these very productive firms also have a low labor share from Proposition 4, this triggers a decline in the manufacturing labor share. As Mrázová and Neary (2017) put it, an increase in demand generates a "Matthew Effect".⁴¹ Proposition 2 follows:

Proposition 2. *A market size increase drives the labor share down through a reallocation of output towards large, low-labor share firms.*

Proof. See Appendix 2.E.3. □

³⁹The fact that an increase in λ leads to lower profits follows from differentiating (2.5.5) with respect to λ and using the envelope theorem. Competition always increases with demand L as shown in the Appendix.

⁴⁰Syverson (2004a,b) shows that greater substitutability, which means more competition, reallocates output from low-productive firms to high-productive firms and reduces productivity dispersion. This is consistent with the fact that concentration can increase in a more competitive environment.

⁴¹The Matthew Effect originally refers to a sentence appearing in the Gospel According to St. Matthew: "For unto every one that hath shall be given, and he shall have abundance: but from him that hath not shall be taken away even that which he hath". Merton (1968) refers to this biblical statement to describe situations in which, everything else equal, more famous researchers get more attention for their work, compared to less famous ones. More famous researchers therefore become more famous, hence the analogy with Proposition 2.

In the model, there exists a negative relationship between a firm's productivity level and its demand elasticity so that more productive firms face a lower demand elasticity. This predicts a heterogeneous response of value-added growth when foreign demand increases. This response is higher for firms that are highly internationalized in my empirical framework. This model is therefore consistent with the between-firm and within-between firm effects highlighted in Section 2.4.

Finally, it is important to note that when preferences are CES, the inverse demand elasticity is constant and given by $\sigma_p(x_i) = \frac{1}{\sigma}$ with σ the elasticity of substitution across varieties. Both effects turn out to be equal to one and cancel each other out:

$$\sigma_p(x_i) = \frac{1}{\sigma} \implies \frac{d\Pi}{dL} \frac{L}{\Pi} = 0$$

Intensive margin reallocations are incompatible with CES preferences when the market structure is monopolistic.

Discussion on markups and labor shares. I now discuss the implications of the model for changes in aggregate and firm-level markups and labor shares. Markups vary across firms because of MSLD. An increase in demand reallocates output towards more productive firms that are larger. Since larger firms charge higher markups, aggregate markups rise through this reallocation effect, consistent with [De Loecker and Eeckhout \(2017, 2018\)](#) and [Bauer and Boussard \(2019\)](#). Here, the fall in the manufacturing labor share through the reallocation effect is therefore consistent with the rise of aggregate markups.

Another interesting implication of the model is that firm-level labor shares should *increase*. The increase in demand abroad generates an increase in competition on the foreign market, leading to a higher price elasticity of demand and to lower markups charged on the foreign market. *Everything else equal*, firm-level markups will decrease, leading to an increase in the labor share at the firm-level from (2.5.4). Empirically, it is possible that within-firm markups increase following an increase in foreign demand, depending on how markups charged on the *domestic* market react.⁴² There exists

⁴²The profit maximization condition that a firm's marginal revenue equals its marginal cost entails that Equation (2.5.3) holds for *each* market. Given that a firm's labor share is the sum of labor compensation divided by the sum of value-added across markets, one can express the *firm-level* labor share LS_{it} as a function of markups charged on each market D and F weighted by the share of export sales in total sales ω_i^F . This leads to the following relationship $LS_{it} = (1 - \omega_i^F)(\mu_i^D)^{-1} + \omega_i^F(\mu_i^F)^{-1}$. The labor share of non-exporters ($\omega_i^F = 0$) is determined by their markup charged on the domestic market. For exporters ($\omega_i^F \neq 0$), the overall effect of foreign demand changes on their firm-level labor share depends on a within-market component (whether μ_i^D and μ_i^F increase or not) and a between-market component. The difference between markups charged on each market can be either exacerbated or

another explanation that could lead to a *decrease* in the labor share of firms. As foreign demand grows and firms get larger and expand, their share of fixed cost in total output might go down. If fixed costs are denominated in labor, this could lead to a decrease in the labor share of firms.

Theoretically, the increase in the labor share of firms predicted by the decrease in markups goes against the result highlighted in column 2 of Table 2.7 that the labor share of firms goes down following an increase in their foreign demand. As argued above, this pure negative within-firm effect only accounts for 18% of the role played by foreign demand on the labor share and is therefore much less important than the reallocation effect in generating changes in the labor share. Investigating the channels (changes in markups, changes in the share of fixed costs in value-added) behind this negative within-firm effect is beyond the scope of the paper and I leave this interesting question for future research.

2.6 Conclusion

In this article, I study and quantify the impact of foreign demand changes on the manufacturing labor share. To do so, I use firm-level data on the universe of French exporters operating in the manufacturing sector.

I provide causal empirical evidence that foreign demand growth allows low-labor share firms, superstar exporters, to grow disproportionately more. Importantly, I also find that this reallocation effect towards superstar exporters triggered by foreign demand growth generates a stronger decrease in their labor share. These effects appear to be robust to a variety of tests and are not driven by the choice of sample, specification or time period. These two channels account for 14% of the labor share decline over 1994-2001.

The finding that export demand drives down the labor share and that reallocations towards superstar exporters are a key mechanism suggests that the impact of international trade on the labor share is more complex than just changes in import exposure. Understanding the role played by international trade in shaping the labor share requires understanding the impact of both its import-side *and* export-side. It is important to note that the results are arguably a lower bound for the overall effect of export demand and international trade more broadly construed on the manufacturing labor share. First, this article has focused exclusively on the role played by foreign demand on the labor share

attenuated by a change in export intensity ω_i^F .

and I have abstracted from studying the impact of offshoring and import competition on the labor share. Second, the analysis is partial equilibrium and does not capture the impact of foreign demand changes on innovation. Recent work has shown that foreign demand spurs innovation and larger firms innovate more in response to an increase in their foreign demand (Aghion et al., 2018). Innovating is also a means to grow and gain market shares, which would likely strengthen the importance of the reallocation effect.

The theoretical framework rationalizes the intensive margin reallocations towards superstar exporters observed empirically and is consistent with increased concentration, as foreign demand growth benefits disproportionately more to superstar exporters. This observation is important for two reasons. First, the disproportionate growth of superstar exporters in response to foreign demand shocks is likely to be the product of *fiercer* competition, at least on international markets. Second, superstar exporters are also more productive, so that their rise is a source of aggregate productivity growth.

Finally, although export demand is a determinant of labor share changes through intensive margin reallocations towards superstar exporters, factors other than trade or pure technological improvements might be at play and reallocate output towards superstar firms. Institutional changes such as changes in competition policy could allow the expansion of large exporters. The emergence of firms' wage-setting power is also an important issue to consider, and in particular, how it might lead large players on the input market to dominate the output market. These are interesting avenues for future research.

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2.A Data Appendix

2.A.1 Sample Selection

I detail below how I construct my main sample and describe the different variables used in the empirical framework.

I only keep observations that report their taxes to the BRN and RSI regime. I drop firm-year observations with missing SIREN or with a SIREN number that only contains zeros or nines. I further keep observations whose first two digits of main activity code is strictly between 15 and 37. That is, I keep manufacturing firms according to NAF Rev. 1. I drop observations with negative, null or missing values for sales, value-added, number of workers. I also get rid of firm-year pairs with negative values for domestic sales, export sales, wages, social contributions. Firm-year observations with a labor share lower than zero or higher than unity are dropped. Finally, I drop values equal to zero for labor compensation and eliminate observations for which the growth rate of sales is lower than the bottom or higher than the top 1% percent of the growth rate distribution within each 2-digit industry. This allows me to remove outliers. I only keep firm-year observations that exported at least once according to the customs data. This sample of exporting firms represents 74% of total value-added of the raw manufacturing sample.

2.A.2 List of Variables

- **Capital:** The capital measure is measured as the book value of fixed tangible assets. I deflate capital expenditures by sector-level price indices from EUKLEMS. *Source: FICUS and authors' calculation*
- **Capital Intensity:** The capital intensity of a firm is the log of the capital-labor ratio of the firm. *Source: Authors' calculation*
- **Destination Served:** Total number of destinations (European and Extra-European) served by a firm in a given year. *Source: Customs data and author's calculation*
- **Employment:** Total number of employees working in each firm. *Source: FICUS*
- **Export Intensity:** Export intensity is the ratio of export sales as reported in FICUS to total sales. This is to ensure that the number takes values between 0 and 1. *Source: FICUS*

- **Export Sales:** Export sales reported by the firm in thousands of euros. This variable is available in the fiscal files and is highly correlated (correlation coefficient above 0.9) with total export sales computed from the customs data. Firms are classified as exporters if they sell a positive amount abroad according to the customs. I use export sales from the customs data for the empirical analysis. Figure 2.2 uses export sales from the balance-sheet data but the pattern is similar when using data from the customs instead. *Source: FICUS and customs data*
- **Imports:** Imports are available from the customs data and are disaggregated at the firm-origin-product-year level. Firm-level imports are obtained by summing a firm's imports across origin countries and product types in a given year. *Source: Author's calculation and customs data*
- **Labor Compensation:** This variable is the sum of two components separately available in the fiscal files: salaries and social benefits that are paid by the employer and that benefit the worker in the form of retirement funds, social security funds etc. *Source: FICUS*
- **Labor Productivity:** Labor productivity is the ratio of real value-added to the number of employees. *Source: FICUS and author's calculation*
- **Labor Share:** I construct the firm-level labor share variable as follows. In accounting, gross value-added is equal to the sum of gross operating surplus, labor compensation (as defined above) and taxes net of subsidies. We therefore do not allocate taxes net of subsidies and build the labor share as the ratio of labor compensation to gross value-added. Observations with values outside the (0,1) interval are discarded. *Source: FICUS and author's calculation*
- **Labor Share (Equipped):** Equipped labor shares are defined as the ratio of a firm's value-added to its total sales. This definition captures the supply of all primary factors of production (labor and capital). It is defined as $LS_{it}^{\text{Equipped}} = \frac{VA_{it}}{\text{Sales}_{it}}$. *Source: Author's calculation*
- **Markups:** Markups are defined as the ratio of a firm's price to its marginal cost. Firm-level markups are estimated using the [De Loecker and Warzynski \(2012\)](#) methodology. The estimation of markups is explained in more detail in Appendix 2.D. *Source: Authors' calculation*
- **Materials:** Materials are defined as the sum of expenditures on raw materials and merchandises including changes in inventory. I further deflate this expenditure variable by 2-digit sector intermediate goods price indices from EU KLEMS to obtain the quantity of materials. *Source: FICUS and authors' calculation*

- **NAF Code:** 2-digit sector code according to the NACE Rev. 1 classification. Some sectors are pooled together, depending to the availability of sector-price deflators from EUKLEMS. *Source: FICUS*
- **Products:** Total number of products defined at the 8-digit level (CN8 classification) exported by a firm in a given year. *Source: Customs data and author's calculation*
- **Total Factor Productivity:** The total factor productivity (TFP) of a firm is measured as the difference between a firm's sales and its use of labor and capital inputs. The estimation of revenue TFP (TFPR) is explained in more detail in Appendix 2.D. *Source: Author's calculation*
- **Total Sales:** Total sales (domestic sales plus export sales) reported by the firm in thousands of euros. *Source: FICUS*
- **Value-Added:** This variable is directly available in FICUS and follows the accounting definition according to which it is equal to total sales minus input expenses taking into account changes in inventories. *Source: FICUS*
- **Wages:** Firm-level wages are obtained by dividing labor compensation by employment for each firm-year observation. *Source: FICUS and authors' calculation*

2.B Alternative Decomposition of Labor Share Changes

Defining \bar{LS}_t and $\bar{\omega}_t$ as the unweighted mean labor share and value-added share, respectively, and $\bar{\Delta}X_{it} = X_{it} - \bar{X}_t$, one can decompose (2.2.1) into two components as initially done in [Olley and Pakes \(1996\)](#) for productivity. This yields

$$LS_t = \bar{LS}_t + \sum_i \bar{\Delta}\omega_{it} \bar{\Delta}LS_{it} \quad (2.B.1)$$

Subtracting LS_{t-1} from (2.B.1), the change in the labor share from one year to the next is therefore given by:

$$LS_t - LS_{t-1} = \left(\bar{LS}_t - \bar{LS}_{t-1} \right) + \left(\sum_i \bar{\Delta}\omega_{it} \bar{\Delta}LS_{it} - \sum_i \bar{\Delta}\omega_{it-1} \bar{\Delta}LS_{it-1} \right) \quad (2.B.2)$$

[Melitz and Polanec \(2015\)](#) (MP) further refine this decomposition method in order to account for entry and exit of firms. Writing the change in a variable X between $t - 1$

and t by ΔX_t , this decomposition writes:⁴³

$$\Delta LS_t = \Delta \overline{LS}_t^S + \Delta \left(\sum_i \bar{\Delta} \omega_{it} \bar{\Delta} LS_{it} \right)^S + \omega_t^{\text{ENT}} \left(LS_t^{\text{ENT}} - LS_t^S \right) + \omega_{t-1}^{\text{EXT}} \left(LS_{t-1}^S - LS_{t-1}^{\text{EXT}} \right) \quad (2.B.3)$$

Between any two years, firms can be survivors (superscript S), new firms or entrants (ENT) or exiters (EXT). ω_t^{ENT} is the overall value-added share of new firms at time t , while $\omega_{t-1}^{\text{EXT}}$ is that of exiters at $t - 1$.⁴⁴ LS_t^S , LS_t^{ENT} and LS_t^{EXT} are each group's aggregate labor share at time t .

The first two terms of (2.B.3) are the within and between-firm effects previously mentioned for survivors. The third term reflects the contribution of entrants to labor share changes. The entry of firms with a larger labor share than survivors in the same period could increase the aggregate labor share. The effect will be larger, the larger the share of entrants in value-added in the second period. The intuition is similar for the last term of the decomposition accounting for the contribution of exit.

The results of this decomposition are provided in Table 2.11 for the sample of exporting firms and in Table 2.12 for the whole manufacturing sample. The within-firm effect given in column 2 is positive over the period, as was already the case with the FHK decomposition. Column 3 shows that there is still a strong association between the overall change in the labor share and the between-firm component. Reallocations of output towards low-labor share firms drive down the labor share. The contribution of entry and exit is lower, however, than with the FHK decomposition provided in Table 2.1 and Table 2.10 (column 4). As Melitz and Polanec (2015) note, the effect of entry and exit is overmeasured with the FHK decomposition because the reference labor share level for the contribution of entrants and exiters is the same (LS_{t-1}). The entry-exit margin absorbs part of the contribution of surviving firms to the overall change in the labor share.

2.C Direction of the Bias with Export Sales as a Proxy

Using export sales as a measure of foreign demand shocks in Equations (2.3.1) and (2.3.2) would be associated with several problems including simultaneity bias. For example, changes in management practices might lead firms to grow more and make it easier to serve foreign markets by exporting more.

⁴³See Equation (6) in their paper.

⁴⁴Note that $\omega_t^{\text{ENT}} + \omega_t^S = 1$ and that $\omega_{t-1}^{\text{EXT}} + \omega_{t-1}^S = 1$.

Let us consider the following simple two-equation framework without interaction terms where the dependent variable is the growth rate of value-added:

$$\Delta \ln VA_{it} = \kappa \Delta \ln EXPORTS_{it} + \Delta \varepsilon_{it} \quad (2.C.1)$$

and

$$\Delta \ln EXPORTS_{it} = \delta \Delta \ln VA_{it} + \Delta \eta_{it} \quad (2.C.2)$$

Let us further assume that

$$\text{Cov}(\Delta \eta_{it}, \Delta \varepsilon_{it}) > 0 \quad (2.C.3)$$

so that the factors affecting value-added and export growth are positively correlated with each other. An example would be growth in foreign demand entering $\Delta \eta_{it}$ being positively associated with better management practices affecting value-added growth through $\Delta \varepsilon_{it}$.

The coefficient κ captures the elasticity between export growth and value-added growth. One can reasonably expect κ to be positive so that higher exports allow the firm to grow and bounded above by unity so that the elasticity is less than 1% for a one percent change in export growth. Similarly, δ captures the percentage change in exports when value-added increases by one percent and we can expect the true coefficient δ to be bounded below and above by zero and unity, respectively. Solving the system of equations leads to:

$$\Delta \ln EXPORTS_{it} = \frac{1}{1 - \kappa \delta} \Delta \eta_{it} + \frac{\delta}{1 - \kappa \delta} \Delta \varepsilon_{it} \quad (2.C.4)$$

and

$$\Delta \ln VA_{it} = \frac{\kappa}{1 - \kappa \delta} \Delta \eta_{it} + \frac{1}{1 - \kappa \delta} \Delta \varepsilon_{it} \quad (2.C.5)$$

The OLS estimate of κ is given by $\hat{\kappa}^{\text{OLS}}$ and is such that:

$$\hat{\kappa}^{\text{OLS}} = \frac{\text{Cov}(\Delta \ln EXPORTS_{it}, \Delta \ln VA_{it})}{\text{Var}(\Delta \ln EXPORTS_{it})} = \kappa + \frac{\text{Cov}(\Delta \ln EXPORTS_{it}, \Delta \varepsilon_{it})}{\text{Var}(\Delta \ln EXPORTS_{it})}$$

Using the solution given in (2.C.4) in the previous equation asymptotically leads to:

$$\text{plim } \hat{\kappa}^{\text{OLS}} = \kappa + \frac{1}{1 - \kappa \delta} \frac{\sigma_{\Delta \eta_{it} \Delta \varepsilon_{it}}}{\sigma_{\Delta \ln EXPORTS_{it}}^2} + \frac{\delta}{1 - \kappa \delta} \frac{\sigma_{\Delta \varepsilon_{it}}^2}{\sigma_{\Delta \ln EXPORTS_{it}}^2} \quad (2.C.6)$$

We therefore get that:

$$\text{sgn}\left\{\hat{\kappa}^{\text{OLS}} - \kappa\right\} = \text{sgn}\left\{1 - \kappa\delta\right\} \quad (2.C.7)$$

Given the relatively mild assumption that $\kappa \in (0, 1)$ and $\delta \in (0, 1)$, this entails that the OLS coefficient of interest would likely to be upward biased:

$$\hat{\kappa}^{\text{OLS}} > \kappa \quad (2.C.8)$$

2.D Estimation Appendix

De Loecker and Warzynski (2012) show that for cost-minimizing producers, firm-level markups drive a wedge between the output elasticity of a flexible input and that input's share in total revenues. Thereby, given an input's output elasticity, a lower revenue share of that input in total sales will command a higher markup. Markups vary across firms because that share varies across firms while the output elasticity is constant. In the case where the production function is assumed to be Translog, the output elasticity of the flexible input varies across firms but this is because the input use varies across firms. The main advantage of this method is that one does not need to know the market structure or specify a demand model in order to estimate markups. In fact, "only" two pieces of information are required: an output elasticity on a flexible input and the revenue share of that input. While the latter is readily available in the French data as well as in most firm-level datasets, the former requires estimating a production function.⁴⁵

Formally, assume that producers are cost-minimizing and write the Lagrangian

$$\mathcal{L}(X_{it}, K_{it}, \lambda_{it}) = \sum_X P_{it}^X X_{it} + r_{it}K_{it} + \lambda_{it}\left(Y_{it} - F_{it}(X_{it}, K_{it})\right) \quad (2.D.1)$$

where P_{it}^X is the price of any variable input X , r_{it} is the rental rate of capital K_{it} , output is given by Y_{it} , the production technology is $F_{it}(\cdot)$ and λ_{it} is the Lagrange multiplier associated to the constraint. The first-order condition with respect to any flexible input is thus

$$P_{it}^X = \lambda_{it} \frac{\partial F(\cdot)}{\partial X_{it}} \quad \forall X_{it} \in \mathbf{X}$$

Because the Lagrange multiplier is equal to the change in total cost arising from relaxing the constraint, it is equal to the marginal cost MC_{it} of producing one extra unit of output,

⁴⁵These methods are discussed at length in De Loecker and Goldberg (2014) and Basu (2019) provides a recent overview of the different methods used to estimate markups.

or $\lambda = MC_{it}$. Defining the markup μ_{it} as the ratio of price P_{it} to marginal cost allows us to write the previous equation as

$$P_{it}^X \mu_{it} = P_{it} \frac{\partial F(\cdot)}{\partial X_{it}} \quad \forall X_{it} \in \mathbf{X}$$

Multiplying both sides by $X_{it}F(\cdot)$ and using the fact that $Y_{it} = F(\cdot)$ this yields the formula for firm-level markups

$$\mu_{it} = \frac{\theta_{it}^X}{\alpha_{it}^X} \quad (2.D.2)$$

where $\theta_{it}^X := \frac{\partial F(\cdot)/\partial X_{it}}{F(\cdot)/X_{it}}$ is the output elasticity of a flexible input X and $\alpha_{it}^X := \frac{P_{it}^X X_{it}}{P_{it} Y_{it}}$ is an input's revenue share. I follow [De Loecker and Warzynski \(2012\)](#) and assume that labor is the flexible input.

Production function estimation. The estimation method relies on the seminal papers of [Olley and Pakes \(1996\)](#), [Levinsohn and Petrin \(2003\)](#) and [Ackerberg et al. \(2015\)](#). The idea is that output is produced by using labor and capital, and depends on productivity. I assume that the production function is Leontief in materials and I abstract from materials. Total factor productivity (TFP) is a residual because it is not observed and most importantly, its absence in standard production function estimation leads to biased estimates of labor and capital. This is due to the fact that these inputs are chosen depending on the productivity realizations that the firm observes. The way one can solve this issue and back out productivity is by assuming that the demand for materials is a function of capital, labor and productivity as in [Ackerberg et al. \(2015\)](#).

Formally, I assume a Translog production function in log-form where output y is being produced by labor l , capital k and depends on productivity ω which is Hicks neutral. Firms are indexed by i .

$$y_{it} = \alpha_l l_{it} + \alpha_k k_{it} + \alpha_{ll} l_{it}^2 + \alpha_{kk} k_{it}^2 + \alpha_{lk} l_{it} k_{it} + \omega_{it} \quad (2.D.3)$$

The Hicks neutral term ω_{it} is a function of a predictable term z_{it} that the firm has access to but is unobserved to the econometrician and a noise ζ_{it} . For simplicity, it is assumed that ω_{it} is the sum of these two components:

$$y_{it} = \alpha_l l_{it} + \alpha_k k_{it} + \alpha_{ll} l_{it}^2 + \alpha_{kk} k_{it}^2 + \alpha_{lk} l_{it} k_{it} + z_{it} + \zeta_{it}$$

I follow [Ackerberg et al. \(2015\)](#) and [De Loecker and Warzynski \(2012\)](#) and assume that the demand for materials is an invertible function of capital and the only unobserved

term z_{it} :

$$m_{it} = \Phi_t(k_{it}, z_{it})$$

This implies that one can invert the demand for materials to control for productivity as a function of observables:

$$z_{it} = \Psi_t(k_{it}, m_{it})$$

where $\Psi_t(\cdot) := \Phi_t^{-1}(\cdot)$. The resulting equation is:

$$y_{it} = \alpha_l l_{it} + \alpha_k k_{it} + \alpha_{ll} l_{it}^2 + \alpha_{kk} k_{it}^2 + \alpha_{lk} l_{it} k_{it} + \Psi_t(k_{it}, m_{it}) + \xi_{it}$$

which can be rewritten as:

$$y_{it} = f_t(l_{it}, k_{it}, m_{it}) + \xi_{it} \quad (2.D.4)$$

The estimation method consists of two steps. In the first step, I non parametrically estimate Equation (2.D.4). In practice, I approximate $f_t(\cdot)$ by a third order polynomial in its arguments as well as interactions of all the terms. This yields predicted output $\hat{f}_t(\cdot)$. I then use the fact that:

$$z_{it} = \hat{f}_t(l_{it}, k_{it}, m_{it}) - \alpha_l l_{it} - \alpha_k k_{it} - \alpha_{ll} l_{it}^2 - \alpha_{kk} k_{it}^2 - \alpha_{lk} l_{it} k_{it} \quad (2.D.5)$$

I now specify the law of motion of productivity which is assumed to follow a first-order Markov process:

$$z_{it} = h_t(z_{it-1}) + \vartheta_{it}$$

In practice, I estimate:

$$\hat{z}_{it}(\alpha_l, \alpha_k, \alpha_{ll}, \alpha_{kk}, \alpha_{lk}) = \sum_{j=1}^3 \beta_j \hat{z}_{it-1}^j(\alpha_l, \alpha_k, \alpha_{ll}, \alpha_{kk}, \alpha_{lk}) + \vartheta_{it} \quad (2.D.6)$$

where it is clear that productivity is derived from the estimation of (2.D.5) and a guess on $(\alpha_l, \alpha_k, \alpha_{ll}, \alpha_{kk}, \alpha_{lk})$. Estimating (2.D.6) gives us an estimate of $\vartheta_{it}(\alpha_l, \alpha_k, \alpha_{ll}, \alpha_{kk}, \alpha_{lk})$ which is the innovation term to productivity.

The second stage of the estimation procedure consists of using moment conditions and estimating the system by GMM:

$$E \left(\hat{\vartheta}_{it}(\alpha_l, \alpha_k, \alpha_{ll}, \alpha_{kk}, \alpha_{lk}) \begin{pmatrix} l_{it-1} \\ k_{it} \\ l_{it-1}^2 \\ k_{it}^2 \\ l_{it-1} k_{it} \end{pmatrix} \right) = 0 \quad (2.D.7)$$

These moment conditions are standard in the empirical IO literature (De Loecker and Warzynski, 2012). Capital is assumed to be a dynamic input so that the innovation term is uncorrelated with its value at time t . Labor is assumed to be flexible so that its demand might vary with the innovation shock in t and its lagged value must be used instead. The parameters of interest solve the moment conditions in (2.D.7).

Once the output elasticities have been recovered, productivity can be defined as the Solow residual:

$$\hat{z}_{it} = y_{it} - \hat{\alpha}_l l_{it} - \hat{\alpha}_k k_{it} - \hat{\alpha}_{ll} l_{it}^2 - \hat{\alpha}_{kk} k_{it}^2 - \hat{\alpha}_{lk} l_{it} k_{it} \quad (2.D.8)$$

In order to recover markups, I use the output elasticity of labor computed as $\hat{\theta}_{it}^L = \hat{\alpha}_l + 2\hat{\alpha}_{ll} l_{it} + \hat{\alpha}_{lk} k_{it}$ and the De Loecker and Scott (2016) correction that takes into account that the production function is Leontief in materials. The estimation is done for each 2-digit industry separately.

2.E Mathematical Appendix

2.E.1 Marshall's Second Law of Demand and Marginal Revenue

The first-order condition of the firm's optimization problem given in (2.5.5) gives:

$$\frac{\partial p(x_i)}{\partial x_i} x_i + p(x_i) = \frac{1}{\varphi} \quad (2.E.1)$$

Defining the inverse demand elasticity as $\sigma_p(x_i) := -\frac{\partial p(x_i)/\partial x_i}{p(x_i)/x_i}$, equation (2.E.1) rewrites:

$$p(x_i) \left(1 - \sigma_p(x_i) \right) = \frac{1}{\varphi}$$

This condition states the well-known condition that profit-maximizing firms produce up to the point where their marginal revenue $MR(x_i)$ is equal to their marginal cost MC . Given the support of $G(\varphi)$, the marginal cost is always non-negative which entails that a firm's marginal revenue must be non-negative. This condition is met if the inverse demand elasticity is such that $\sigma_p(x_i) \leq 1$. A second important condition for profit maximization is that the second-order condition on (2.5.5) is met. This condition reads:

$$\frac{\partial p(x_i)}{\partial x_i} \left(1 - \sigma_p(x_i) \right) - p(x_i) \frac{\partial \sigma_p(x_i)}{\partial x_i} < 0 \quad (2.E.2)$$

This condition is equivalent to saying that a firm's marginal revenue decreases in x_i . Using the definition of the inverse demand elasticity and rearranging (2.E.2), this yields:

$$-p(x_i) \left((1 - \sigma_p(x_i)) + \frac{\partial \sigma_p(x_i)}{\partial x_i} \frac{x_i}{\sigma_p(x_i)} \right) < 0 \quad (2.E.3)$$

Given Assumption 1 that the inverse demand elasticity increases in x_i , or conversely, that the demand elasticity decreases in x_i and that $\sigma_p(x_i) \leq 1$, this yields a downward sloping marginal revenue curve:

$$\frac{\partial \text{MR}(x_i)}{\partial x_i} < 0 \quad (2.E.4)$$

Therefore, MSLD implies that marginal revenues decrease with x_i .

Inverse demand elasticity and CES preferences. CES preferences are very often used in international trade. Their inverse demand function is given by:⁴⁶

$$p(x_i) = \kappa^{\frac{1}{\sigma}} x_i^{-\frac{1}{\sigma}}$$

Deriving $\sigma_p(x_i)$ given the CES inverse demand function leads to $\sigma_p(x_i) = \frac{1}{\sigma}$. This trivially entails that $\frac{\partial \sigma_p(x_i)}{\partial x_i} = 0$ so that MSLD does not hold for this class of functions. As shown in the next subsection, this implies that CES preferences are not consistent with a positive relationship between firm size and markups. More details on functions consistent with MSLD can be found in Mrázová and Neary (2017).

2.E.2 Proof of Proposition 1

In this section, I derive how markups, sales and profits vary with the demand elasticity. Using the first-order condition (2.E.1) and the definition of the inverse demand elasticity, the inverse demand function writes:

$$p(x_i) = \frac{1}{1 - \sigma_p(x_i)} \frac{1}{\varphi}$$

⁴⁶Maximizing the utility function $U = \left(\int_0^1 c_i^{\frac{\sigma-1}{\sigma}} di \right)^{\frac{\sigma}{\sigma-1}}$ subject to the budget constraint $\int_0^1 p_i c_i di = 1$ leads to the following equation with $\kappa := \frac{1}{\int_0^1 p_i^{1-\sigma} di} = \frac{1}{P^{1-\sigma}}$ where P is the price index.

Equation (2.E.4) implies that for any two firms 1 and 2 such that $\varphi_2 < \varphi_1$:

$$\frac{\text{MR}(x_1)}{\text{MR}(x_2)} = \frac{\varphi_2}{\varphi_1} < 1$$

which implies that $x_1 > x_2$. Therefore, more efficient firms produce more. Since $p(x_i) = \frac{u'(x_i)}{\lambda}$ is decreasing in x_i , more productive firms also sell at lower prices.

Regarding the relationship between firm size and markups, Marshall's Second Law of Demand is key. Indeed, given that a firm's markup is defined as $\mu(x_i) := \frac{1}{1-\sigma_p(x_i)}$, this leads to:

$$\text{sgn}\left\{\frac{\partial\mu(x_i)}{\partial x_i}\right\} = \text{sgn}\left\{\frac{\partial\sigma_p(x_i)}{\partial x_i}\right\} > 0 \quad (2.E.5)$$

Given that more productive firms also produce more, these firms face a lower demand elasticity which allows them to charge higher markups. It follows from (2.5.4) that larger, more productive firms have a lower labor share.

2.E.3 Proof of Proposition 2

I derive Proposition 2 that shows how profits vary with a change in market size. First, total operating profits are given by:

$$\Pi(\varphi, \lambda, L) := \max_{q_i} \left\{ \left(\frac{u'(q_i/L)}{\lambda} - \frac{1}{\varphi} \right) q_i \right\} \quad (2.E.6)$$

Market size effect. Differentiating total operating profits with respect to L we get (2.5.11) in the text.

There are several terms whose sign needs be studied. The first one is the market size effect $\frac{\partial\Pi}{\partial L} \frac{L}{\Pi}$. Differentiating (2.E.6) with respect to L and applying the envelope theorem yields:

$$\frac{\partial\Pi}{\partial L} \frac{L}{\Pi} = -\frac{u''}{\lambda} \frac{q^2}{L^2} \frac{L}{\Pi} = -p' \frac{q^2}{L} \frac{1}{[p(x, \lambda) - \frac{1}{\varphi}]q}$$

Using the first-order condition (2.E.1) we get:

$$\frac{\partial\Pi}{\partial L} \frac{L}{\Pi} = 1 \quad (2.E.7)$$

Competition effect. I now derive the first part of the competition effect $\frac{\partial \Pi}{\partial \lambda} \frac{\lambda}{\Pi}$. Applying the envelope theorem and differentiating profits with respect to λ :

$$\frac{\partial \Pi}{\partial \lambda} \frac{\lambda}{\Pi} = -\frac{u'(x)q}{\lambda^2} \frac{\lambda}{\Pi} = -p \frac{q}{\Pi} = -\frac{pq}{\left[p - \frac{1}{\varphi}\right]q} = -\frac{p}{\left[p - \frac{1}{\varphi}\right]}$$

Making use of (2.E.1):

$$\frac{\partial \Pi}{\partial \lambda} \frac{\lambda}{\Pi} = -\frac{1}{\sigma_p(\varphi, \lambda)} < 0 \quad (2.E.8)$$

by the definition of the inverse demand elasticity and the fact that $x = x(\varphi, \lambda)$ at the optimum.

Finally, deriving $\frac{d\lambda}{dL} \frac{L}{\lambda}$ entails making use of the free-entry condition. Let us denote the value of a firm by $V(\lambda, L)$. The expected value of a firm must equal the sunk cost from the free entry condition:

$$V(\lambda, L) := \int_{\varphi^*}^{\infty} [\pi^c(\varphi, \lambda)L - f] dG(\varphi) = f_e$$

Totally differentiating this equation and solving for $\frac{d\lambda}{dL}$ yields:

$$\frac{d\lambda}{dL} = -\frac{\partial V(\lambda, L)/\partial L}{\partial V(\lambda, L)/\partial \lambda} \quad (2.E.9)$$

Applying Leibniz's rule to the free-entry condition and using the cut-off condition in (2.5.9) I obtain:

$$\frac{\partial V(\lambda, L)}{\partial L} = \int_{\varphi^*}^{\infty} \pi^c(\varphi, \lambda) dG(\varphi) - [\pi^c(\varphi^*, \lambda)L - f] \frac{d\varphi^*}{dL} = \int_{\varphi^*}^{\infty} \pi^c(\varphi, \lambda) dG(\varphi)$$

Applying Leibniz's rule to the denominator of (2.E.9) and (2.5.9):

$$\frac{\partial V(\lambda, L)}{\partial \lambda} = \int_{\varphi^*}^{\infty} L \frac{\partial \pi^c(\varphi, \lambda)}{\partial \lambda} dG(\varphi) - [\pi^c(\varphi^*, \lambda)L - f] \frac{d\varphi^*}{d\lambda} = \int_{\varphi^*}^{\infty} L \frac{\partial \pi^c(\varphi, \lambda)}{\partial \lambda} dG(\varphi)$$

Substituting the previous two equations in (2.E.9):

$$\frac{d\lambda}{dL} = -\frac{\int_{\varphi^*}^{\infty} \pi^c(\varphi, \lambda) dG(\varphi)}{\int_{\varphi^*}^{\infty} L \frac{\partial \pi^c(\varphi, \lambda)}{\partial \lambda} dG(\varphi)}$$

Rewriting this equation to obtain an elasticity:

$$\frac{d\lambda}{dL} \frac{L}{\lambda} = - \frac{\int_{\varphi^*}^{\infty} \pi^c(\varphi, \lambda) dG(\varphi)}{\int_{\varphi^*}^{\infty} \lambda \frac{\partial \pi^c(\varphi, \lambda)}{\partial \lambda} dG(\varphi)} = - \frac{\int_{\varphi^*}^{\infty} \pi^c(\varphi, \lambda) dG(\varphi)}{\int_{\varphi^*}^{\infty} \frac{\partial \pi^c(\varphi, \lambda)}{\partial \lambda} \frac{\lambda}{\pi^c(\varphi, \lambda)} \pi^c(\varphi, \lambda) dG(\varphi)}$$

Using (2.E.8) and substituting finally yields:

$$\frac{d\lambda}{dL} \frac{L}{\lambda} = \frac{\int_{\varphi^*}^{\infty} \pi^c(\varphi, \lambda) dG(\varphi)}{\int_{\varphi^*}^{\infty} \pi^c(\varphi, \lambda) \frac{1}{\sigma_p(\varphi, \lambda)} dG(\varphi)} \quad (2.E.10)$$

Combining (2.E.7), (2.E.8) and (2.E.10) in (2.5.11) gives:

$$\frac{d\Pi}{dL} \frac{L}{\Pi} = 1 - \frac{1}{\sigma_p(\varphi, \lambda)} \frac{\int_{\varphi^*}^{\infty} \pi^c(\varphi, \lambda) dG(\varphi)}{\int_{\varphi^*}^{\infty} \pi^c(\varphi, \lambda) \frac{1}{\sigma_p(\varphi, \lambda)} dG(\varphi)} \quad (2.E.11)$$

Defining $\pi^c(\lambda) := \int_{\varphi^*}^{\infty} \pi^c(\varphi, \lambda) dG(\varphi)$, (2.E.11) writes as (2.5.12) in the text.

Noting that $[\sigma_p(\varphi, \lambda)]^{-1}$ is the demand elasticity and that the denominator of (2.5.12) is a profit-weighted average demand elasticity, we find that profits rise with market size for firms that face a lower than average demand elasticity. Given MSLD that the demand elasticity decreases with productivity, this is equivalent to saying that firms that are more productive than average will experience an increase in their profits following an increase in market size. From Proposition 1 that more productive firms have a lower labor share, this implies that an increase in market size will decrease the manufacturing labor share through a reallocation effect.

2.E.4 Open-Economy Framework

This section describes the open economy framework.⁴⁷ There are two countries that populate the world economy. The domestic economy D trades with a foreign economy denoted F . This foreign economy is characterized by a market size level L_F and a competition level λ_F . Preferences are the same on both markets which implies that per-consumer profits, quantity and revenues depend on both the competition level and the firm's productivity level, as in the closed economy case.

As in [Demidova and Rodríguez-Clare \(2013\)](#), I assume that country F is a small economy so that changes in market size abroad do not impact the number of domestic entrants,

⁴⁷The exposition of the open-economy framework is explained in more details in [Mayer et al. \(2016\)](#). As mentioned in the text, I abstract from multi-product exporters.

the competition level λ_D nor the domestic productivity cutoff in D .

Exporting is costly. There is a fixed cost of serving the foreign market for domestic firms. This fixed cost of exporting writes f_F and is paid in units of domestic labor. Exporters also incur an additional iceberg trade cost so that exporting one unit of a good requires sending $\tau > 1$ units. This leads to the following total export profits for any domestic firm.⁴⁸

$$\Pi_X^D(\varphi, \lambda_F) = \pi^c\left(\frac{\varphi}{\tau}, \lambda_F\right)L_F - f_F$$

As before, total export profits $\Pi_X^D(\varphi, \lambda_F)$ are an increasing function of its first argument, so that firms below a certain export productivity threshold φ_X^* might decide not to export. This is given by the following condition:

$$\Pi(\varphi_X^*, \lambda_F) = 0 \iff \pi^c\left(\frac{\varphi_X^*}{\tau}, \lambda\right)L_F = f_F$$

The condition for producing on the domestic market for domestic firms is still given by (2.5.9).

Firms in F draw their productivity level from a distribution $G_F(\varphi)$ and a there is pool of entrants N_e^F . Firms in F will self-select into producing domestically and exporting to D if they are productive enough with the relevant cutoff productivity levels given by the usual zero-profit conditions.

What matters for the purpose of the analysis is that an increase in L_F generates intensive margin reallocation effects towards larger exporters from country D . A change in market size abroad will lead to an increase in the level of competition λ_F because profit opportunities will be higher and with free-entry, this will make some firms enter, leading to fiercer competition.⁴⁹ Because larger domestic exporters have a lower than average demand elasticity, the market size effect will still dominate for these firms, leading to higher export sales and allowing them to grow relative to smaller exporters.

⁴⁸Because the iceberg trade cost enters the marginal cost of production, an increase in τ will decrease the first argument of the per-consumer profit function and therefore lead to lower profits.

⁴⁹Free-entry is inherently a long-run process. The increase in competition would also occur in the short-run, otherwise the consumers' budget constraint would be violated.

2.F Additional Tables

Table 2.8: Summary Statistics Main Sample

	Mean (1)	Standard Deviation (2)	Median (3)
Labor share (%)	70.4	17.1	73.1
ln Export sales	4.9	2.8	4.9
ln Value-added	7	1.6	6.9
ln Labor compensation	6.6	1.6	6.5
Export-intensity (%)	17.9	23.4	7.5
# Products exported	20	37	8
# Destinations served	10.4	13.8	6
Δ Labor share	0.19	11	0
Δ ln Export sales	0.1	1.1	0.07
$\tilde{\Delta}$ Foreign demand	0.04	0.3	0.03
Δ ln Value-added	0.05	0.3	0.04
Δ ln Labor compensation	0.05	0.2	0.04
Δ Export-intensity	0.7	11.6	0
Δ ln # Products exported	0.05	0.5	0
Δ ln # Destinations served	0.05	0.4	0
# Firms		59,374	
# Observations		226,077	
# Survivors (1994-2001)		9,154	

Notes: The sample consists of exporting firms. The period considered is 1994-2001. Export sales, labor compensation and value-added are in thousands of euros. Labor share is the ratio of labor compensation to value-added and is in between 0 and 100.

Table 2.9: Percentiles of Initial Export Sales Distribution

	P1 (1)	P10 (2)	P20 (3)	P30 (4)	P40 (5)	P50 (6)	P60 (7)	P70 (8)	P80 (9)	P90 (10)	P99 (11)
ln Export sales _{t₀}	-0.27	1.04	2.11	3.03	3.86	4.59	5.32	6.09	6.99	8.24	11.09

Notes: The sample consists of exporting firms. The period considered is 1994-2001. Export sales are in thousands of euros. The initial year is defined as the first year in which exporters appear in the sample.

Table 2.10: FHK Decomposition of Labor Share Changes on Whole Sample

	Total Change (1)	Within (2)	Between (3)	Entry-Exit (4)
1994-1995	-1.24	0.01	-0.95	-0.3
1995-1996	0.68	1.64	-0.8	-0.16
1996-1997	-0.97	-0.52	-0.45	0.01
1997-1998	-0.76	0.01	-0.41	-0.36
1998-1999	-0.61	0.21	-0.82	0.006
1999-2000	-1.49	-0.89	-0.24	-0.36
2000-2001	1.36	1.55	0.004	-0.19
1994-2001	-3.03	2	-3.67	-1.36
1994-2000	-4.39	0.45	-3.67	-1.17

Notes: This decomposition uses Equation (2.2.2) for the whole sample of manufacturing firms which includes both exporters and non exporters. Column 1 is the change in the aggregate labor share for the whole sample of firms. Column 2 is the within-firm margin. Column 3 is the sum of the between and the cross effect. Column 4 is the sum of the entry and exit components.

Table 2.11: MP Decomposition of Labor Share Changes

	Total Change (1)	Within (2)	Between (3)	Entry-Exit (4)
1994-1995	-3.24	0.21	-1.07	-2.37
1995-1996	1.39	1.19	-0.12	0.32
1996-1997	-0.85	-0.32	-1.02	0.48
1997-1998	-0.4	-0.17	-0.12	-0.11
1998-1999	-0.65	0.33	-1	0.01
1999-2000	-1.38	-0.41	-0.42	-0.55
2000-2001	1.06	0.83	0.99	-0.76
1994-2001	- 4.08	1.67	-2.76	-2.97
1994-2000	-5.14	0.84	-3.76	-2.22

Notes: This decomposition uses Equation (2.B.3) for the sample of manufacturing exporters. Column 1 is the change in the aggregate labor share for the sample of exporting firms. Column 2 is the within-firm margin. Column 3 is the between-firm margin. Column 4 is the sum of the entry and exit components and refers to entry and exit into exporting.

Table 2.12: MP Decomposition of Labor Share Changes on Whole Sample

	Total Change (1)	Within (2)	Between (3)	Entry-Exit (4)
1994-1995	-1.24	0.75	-1.76	-0.23
1995-1996	0.68	1.27	-0.37	-0.22
1996-1997	-0.97	0.48	-1.52	0.08
1997-1998	-0.76	0.23	-0.64	-0.36
1998-1999	-0.61	0.41	-1.08	0.07
1999-2000	-1.49	-0.21	-1.03	-0.25
2000-2001	1.36	0.63	1.12	-0.38
1994-2001	-3.03	3.56	-5.29	-1.3
1994-2000	-4.39	2.93	-6.41	-0.92

Notes: This decomposition uses Equation (2.B.3) for the whole sample of manufacturing firms which includes both exporters and non exporters. Column 1 is the change in the aggregate labor share for the whole sample of firms. Column 2 is the within-firm margin. Column 3 is the between-firm margin. Column 4 is the sum of the entry and exit components.

Table 2.13: Statistics on Internationalization and Equipped Labor Shares

Statistic	Equipped Labor Share			
	Above Median	Top 25 %	Top 10 %	Top 1 %
Internationalization Measure	(1)	(2)	(3)	(4)
Export intensity	36.8	35.9	35.2	35
ln Export sales	35.2	32.9	31.1	28.2
ln # Products exported	34.1	32.4	31.4	30.3
ln # Destinations served	34.2	33.3	32.9	32.7
# Firms	29,676	14,838	5,936	594

Notes: The results are obtained by taking the mean of each variable (equipped labor share, export intensity, export sales, number of products exported and number of countries served) over time for each firm and calculating the equipped labor share of firms that belong to the top 50, 25, 10 and 1% in terms of export intensity, number of products exported and number of countries served. The equipped labor share is defined as the ratio of value-added to total sales and captures all primary factors of production.

Table 2.14: Internationalization and Labor Share across Groups

	Above Median	Below Median	Difference
Export intensity	70.7 (0.093)	71.9 (0.097)	-1.3*** (0.13)
ln Export sales	70 (0.093)	72.7 (0.096)	-2.7*** (0.13)
ln # Products exported	70.4 (0.091)	72.2 (0.099)	-1.8*** (0.13)
ln # Destinations served	70 (0.091)	72.7 (0.098)	-2.7*** (0.13)
	Top 25%	Bottom 75%	Difference
Export intensity	69.4 (0.14)	72 (0.08)	-2.6*** (0.15)
ln Export sales	67.8 (0.13)	72.5 (0.08)	-4.6*** (0.15)
ln # Products exported	69.5 (0.13)	71.9 (0.08)	-2.4*** (0.15)
ln # Destinations served	69 (0.13)	72.1 (0.08)	-3.1*** (0.15)
	Top 10%	Bottom 90%	Difference
Export intensity	67.4 (0.23)	71.7 (0.07)	-4.3*** (0.22)
ln Export sales	64.9 (0.22)	72 (0.07)	-7.2*** (0.22)
ln # Products exported	68.5 (0.2)	71.6 (0.07)	-3.1*** (0.22)
ln # Destinations served	67.5 (0.2)	71.7 (0.07)	-4.2*** (0.22)
	Top 1%	Bottom 99%	Difference
Export intensity	63.8 (0.88)	71.3 (0.07)	-7.6*** (0.68)
ln Export sales	58.7 (0.73)	71.4 (0.07)	-12.7*** (0.67)
ln # Products exported	65.5 (0.66)	71.4 (0.07)	-5.9*** (0.68)
ln # Destinations served	63.4 (0.7)	71.4 (0.07)	-8*** (0.68)

Notes: This table displays the mean labor share of firms with a labor share above and below several thresholds. The last column tests the difference in these two means. The results show that firms above each given threshold have a lower labor share than firm below it.

Table 2.15: Internationalization and Labor Share: Regression Analysis

Dependent variable	Labor Share					
	(1)	(2)	(3)	(4)	(5)	(6)
Export intensity	-3.96*** (0.33)				-2.9*** (0.34)	-1.83*** (0.33)
ln Export sales		-0.54*** (0.03)			-0.54*** (0.03)	-0.12*** (0.03)
ln # Products exported			-0.17*** (0.06)		0.21*** (0.07)	0.70*** (0.07)
ln # Destinations served				-0.26*** (0.08)	0.26*** (0.1)	0.97*** (0.09)
ln Total sales						-9.52*** (0.19)
Two-digit Sector × Year FE	✓	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓	✓
# Observations	209,114	209,114	209,114	209,114	209,114	209,114

Notes: Standard errors clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1. The coefficients from the regression models are estimated over 1994-2001 using OLS. All columns include industry by year fixed effects and control for firm-specific trends through the inclusion of firm fixed effects..

Table 2.16: Robustness: Future Demand Shocks

Internationalization Measure (Superstar _{<i>it</i>0}) Dependent variable	ln Export Sales			
	$\Delta \ln VA_{it}$		$\Delta \text{Labor Share}_{it}$	
	(1)	(2)	(3)	(4)
$\tilde{\Delta} \text{ForeignDemand}_{it}$	-0.0083 (0.0056)		-0.0031 (0.2509)	
$\tilde{\Delta} \text{ForeignDemand}_{it} \times \text{Superstar}_{it_0}$	0.0040*** (0.0014)		-0.0917 (0.0622)	
$\tilde{\Delta} \text{ForeignDemand}_{it+1}$		0.0074 (0.0058)		-0.1043 (0.2702)
$\tilde{\Delta} \text{ForeignDemand}_{it+1} \times \text{Superstar}_{it_0}$		-0.0011 (0.0014)		0.0125 (0.0633)
Two-digit Sector \times Year FE	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
# Observations	117,721	117,721	117,721	117,721

Notes: Standard errors clustered at the firm level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The coefficients from the regression models are estimated over 1994-2001 using OLS. All columns include industry by year fixed effects and control for firm-specific trends through the inclusion of firm fixed effects. $\Delta \ln VA_{it}$ is the change in a firm's value-added. $\tilde{\Delta} \text{ForeignDemand}_{it}$ is the change in a firm's foreign demand. $\tilde{\Delta} \text{ForeignDemand}_{it+1}$ is the future foreign demand shock, defined as the change in foreign demand from year t to year $t + 1$. Superstar_{*it*0} is a measure of the degree of internationalization of the firm and is the log of the export sales of the firm in the first year in which it appears in the sample.

Table 2.17: Robustness: Alternative Time Period

Internationalization Measure (Superstar _{it₀}) Dependent variable Time Period	ln Export Sales			
	$\Delta \ln VA_{it}$	$\Delta \text{Labor Share}_{it}$	$\Delta \ln VA_{it}$	$\Delta \text{Labor Share}_{it}$
	1994-2007		2001-2007	
	(1)	(2)	(3)	(4)
$\tilde{\Delta} \text{ForeignDemand}_{it}$	-0.0107*** (0.003)	0.35*** (0.133)	-0.0087** (0.0045)	0.633*** (0.1798)
$\tilde{\Delta} \text{ForeignDemand}_{it} \times \text{Superstar}_{it_0}$	0.006*** (0.0008)	-0.2071*** (0.0343)	0.0063*** (0.0011)	-0.293*** (0.0468)
Superstar _{it₀}	-0.0067*** (0.0002)	0.0215*** (0.0058)	-0.0076*** (0.0003)	0.0403*** (0.0093)
Two-digit Sector \times Year FE	✓	✓	✓	✓
# Observations	306,853	306,853	165,703	165,703

Notes: Standard errors clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1. The coefficients from the regression models are estimated over 1994-2007 for columns 1 and 2 and over 2001-2007 for columns 3 and 4 using OLS. All columns include industry by year fixed effects. $\Delta \ln VA_{it}$ is the change in a firm's value-added. $\tilde{\Delta} \text{ForeignDemand}_{it}$ is the change in a firm's foreign demand. Superstar_{it₀} is a measure of the degree of internationalization of the firm and is the log of the export sales of the firm in the first year in which it appears in the sample.

CHAPTER 2

Table 2.18: Robustness: Alternative Internationalization Measures

Dependent variable	$\Delta \ln VA_{it}$			$\Delta \text{Labor Share}_{it}$		
	Export Intensity (1)	$\ln \# \text{ Products Exported}$ (2)	$\ln \# \text{ Destinations Served}$ (3)	Export Intensity (4)	$\ln \# \text{ Products Exported}$ (5)	$\ln \# \text{ Destinations Served}$ (6)
$\Delta \text{ForeignDemand}_{it}$	0.00001 (0.0027)	-0.0031 (0.0037)	-0.0053 (0.0035)	-0.1568 (0.1164)	0.1069 (0.1599)	0.1587 (0.1553)
$\Delta \text{ForeignDemand}_{it} \times \text{Superstar}_{it_0}$	0.0633*** (0.0146)	0.0071*** (0.0019)	0.0116*** (0.0024)	-1.18* (0.64)	-0.2872*** (0.0876)	-0.4248*** (0.1108)
Superstar_{it_0}	-0.0246*** (0.0031)	-0.0124*** (0.0005)	-0.0159*** (0.0006)	0.359*** (0.0991)	0.0085 (0.0163)	0.0036 (0.0192)
Two-digit Sector \times Year FE	✓	✓	✓	✓		
# Observations	166,323	166,323	166,323	166,323	166,323	166,323

Notes: Standard errors clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1. The coefficients from the regression models are estimated over 1994-2001 using OLS. All columns include industry by year fixed effects. $\Delta \ln VA_{it}$ is the change in a firm's value-added. $\Delta \text{ForeignDemand}_{it}$ is the change in a firm's foreign demand. Superstar_{it_0} is a measure of the degree of internationalization of the firm. Columns 1 and 4 use the export intensity of a firm, columns 2 and 5 the log of the total number of products exported by the firm and columns 3 and 6 use the log of the total number of destinations served by the firm as the main measure of internationalization. All these measures are defined in the first year in which the firm appears in the sample.

Table 2.19: Robustness: Period 1995-2000

Internationalization Measure (Superstar_{it_0}) Dependent variable	$\ln \text{ Export Sales}$				
	$\Delta \ln VA_{it}$ (1)	$\Delta \text{Labor Share}_{it}$ (2)	$\Delta \ln \text{ Labor Compensation}_{it}$ (3)	$\Delta \ln \text{ Wages}_{it}$ (4)	$\Delta \ln \text{ Workers}_{it}$ (5)
$\Delta \text{ForeignDemand}_{it}$	-0.0202*** (0.0051)	0.3 (0.2176)	-0.0135*** (0.0049)	-0.0163*** (0.0049)	0.0028 (0.0054)
$\Delta \text{ForeignDemand}_{it} \times \text{Superstar}_{it_0}$	0.0081*** (0.0012)	-0.1876*** (0.0538)	0.0042*** (0.0011)	0.0047*** (0.0010)	-0.0005 (0.0012)
Superstar_{it_0}	-0.0052*** (0.0003)	0.0112 (0.0096)	-0.0054*** (0.0003)	-0.0010*** (0.0002)	-0.0044*** (0.0003)
Two-digit Sector \times Year FE	✓	✓	✓	✓	✓
# Observations	118,498	118,498	118,498	118,498	118,498

Notes: Standard errors clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1. The coefficients from the regression models are estimated over 1995-2000 using OLS. All columns include industry by year fixed effects. $\Delta \ln VA_{it}$ is the change in a firm's value-added. $\Delta \text{ForeignDemand}_{it}$ is the change in a firm's foreign demand. Superstar_{it_0} is a measure of the degree of internationalization of the firm and is the log of the export sales of the firm in the first year in which it appears in the sample.

Table 2.20: Robustness: Dropping Key Industries

Internationalization Measure (Superstar_{it_0}) Dependent variable	$\ln \text{ Export Sales}$				
	$\Delta \ln VA_{it}$ (1)	$\Delta \text{Labor Share}_{it}$ (2)	$\Delta \ln \text{ Labor Compensation}_{it}$ (3)	$\Delta \ln \text{ Wages}_{it}$ (4)	$\Delta \ln \text{ Workers}_{it}$ (5)
$\Delta \text{ForeignDemand}_{it}$	-0.0166*** (0.0046)	0.3245 (0.1993)	-0.0103** (0.0043)	-0.0072 (0.0045)	-0.0032 (0.005)
$\Delta \text{ForeignDemand}_{it} \times \text{Superstar}_{it_0}$	0.0069*** (0.0011)	-0.1722*** (0.0514)	0.0035*** (0.001)	0.0023** (0.001)	0.0012 (0.0011)
Superstar_{it_0}	-0.0060*** (0.0003)	0.0163* (0.0094)	-0.006*** (0.0003)	-0.0015*** (0.0002)	-0.0045*** (0.0003)
Two-digit Sector \times Year FE	✓	✓	✓	✓	✓
# Observations	123,617	123,617	123,617	123,617	123,617

Notes: Standard errors clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1. The coefficients from the regression models are estimated over 1994-2001 using OLS. All columns include industry by year fixed effects. $\Delta \ln VA_{it}$ is the change in a firm's value-added. $\Delta \text{ForeignDemand}_{it}$ is the change in a firm's foreign demand. Superstar_{it_0} is a measure of the degree of internationalization of the firm and is the log of the export sales of the firm in the first year in which it appears in the sample. Naf Rev. 1 industries 23-25, 30-33 and 34-35 are dropped from the sample.

Table 2.21: Robustness: Alternative Lag Structure

Internationalization Measure (Superstar)	ln Export Sales			
	$\Delta \ln VA_{it}$ (1)	$\Delta \ln \text{Labor Share}_{it}$ (2)	$\Delta \ln VA_{it}$ (3)	$\Delta \ln \text{Labor Share}_{it}$ (4)
$\tilde{\Delta} \text{ForeignDemand}_{it}$	-0.0188*** (0.0044)	0.3503* (0.1871)	-0.0213*** (0.0053)	0.6610*** (0.2376)
$\tilde{\Delta} \text{ForeignDemand}_{it} \times \text{Superstar}_{it-1}$	0.0068*** (0.0010)	-0.1713*** (0.0443)		
Superstar_{it-1}	-0.0056*** (0.0002)	0.0573*** (0.0085)		
$\tilde{\Delta} \text{ForeignDemand}_{it} \times \text{Superstar}_{it-2}$			0.0084*** (0.0012)	-0.2492*** (0.0538)
Superstar_{it-2}			-0.0042*** (0.0003)	0.0586*** (0.0094)
Two-digit Sector \times Year FE	✓	✓	✓	✓
# Observations	166,323	166,323	124,140	124,140

Notes: Standard errors clustered at the firm level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The coefficients from the regression models are estimated over 1994-2001 using OLS. All columns include industry by year fixed effects. $\Delta \ln VA_{it}$ is the change in a firm's value-added. $\tilde{\Delta} \text{ForeignDemand}_{it}$ is the change in a firm's foreign demand. Superstar is a measure of the degree of internationalization of the firm and is the log of the export sales of the firm. This measure is lagged one year in columns 1 and 2 and lagged two years in columns 3 and 4.

Table 2.22: Robustness: Sample of Survivors

Internationalization Measure (Superstar _{it₀}) Dependent variable	In Export Sales				
	$\Delta \ln VA_{it}$ (1)	$\Delta \text{Labor Share}_{it}$ (2)	$\Delta \ln \text{Labor Compensation}_{it}$ (3)	$\Delta \ln \text{Wages}_{it}$ (4)	$\Delta \ln \text{Workers}_{it}$ (5)
$\tilde{\Delta} \text{ForeignDemand}_{it}$	-0.0299*** (0.0077)	1.3914*** (0.3910)	-0.0034 (0.0052)	-0.0008 (0.0072)	-0.0026 (0.0074)
$\tilde{\Delta} \text{ForeignDemand}_{it} \times \text{Superstar}_{it_0}$	0.0094*** (0.0016)	-0.3807*** (0.0823)	0.0021** (0.0010)	0.0008 (0.0012)	0.0013 (0.0013)
Superstar _{it₀}	-0.0033*** (0.0003)	0.0438*** (0.0104)	-0.0027*** (0.0003)	-0.0005*** (0.0002)	-0.0022*** (0.0003)
Two-digit Sector \times Year FE	✓	✓	✓	✓	✓
# Observations	64,076	64,076	64,076	64,076	64,076

Notes: Standard errors clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1. The coefficients from the regression models are estimated over 1994-2001 on the sample of surviving exporters using OLS. All columns include industry by year fixed effects. $\Delta \ln VA_{it}$ is the change in a firm's value-added. $\tilde{\Delta} \text{ForeignDemand}_{it}$ is the change in a firm's foreign demand. Superstar_{it₀} is a measure of the degree of internationalization of the firm and is the log of the export sales of the firm in the first year in which it appears in the sample.

Table 2.23: Robustness: Trim Top and Bottom 10% of Employment and Investment Distribution

Internationalization Measure (Superstar _{it₀}) Dependent variable	In Export Sales				
	$\Delta \ln VA_{it}$ (1)	$\Delta \text{Labor Share}_{it}$ (2)	$\Delta \ln \text{Labor Compensation}_{it}$ (3)	$\Delta \ln \text{Wages}_{it}$ (4)	$\Delta \ln \text{Workers}_{it}$ (5)
$\tilde{\Delta} \text{ForeignDemand}_{it}$	-0.016*** (0.0042)	0.3241 (0.2045)	-0.01*** (0.0034)	-0.0108*** (0.0034)	0.001 (0.0021)
$\tilde{\Delta} \text{ForeignDemand}_{it} \times \text{Superstar}_{it_0}$	0.0068*** (0.0011)	-0.1594*** (0.053)	0.0036*** (0.0007)	0.0033*** (0.0007)	0.0002 (0.0004)
Superstar _{it₀}	-0.0041*** (0.0002)	0.0372*** (0.0098)	-0.0037*** (0.0002)	-0.0019*** (0.0002)	-0.0018*** (0.0001)
Two-digit Sector \times Year FE	✓	✓	✓	✓	✓
# Observations	112,090	112,090	112,090	112,090	112,090

Notes: Standard errors clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1. The coefficients from the regression models are estimated over 1994-2001 using OLS. All columns include industry by year fixed effects. $\Delta \ln VA_{it}$ is the change in a firm's value-added. $\tilde{\Delta} \text{ForeignDemand}_{it}$ is the change in a firm's foreign demand. Superstar_{it₀} is a measure of the degree of internationalization of the firm and is the log of the export sales of the firm in the first year in which it appears in the sample. Firm-year observations in the top and bottom 10% of both the employment and investment distributions have been discarded in order to keep a sample of firms that do not experience drastic changes due to outsourcing.

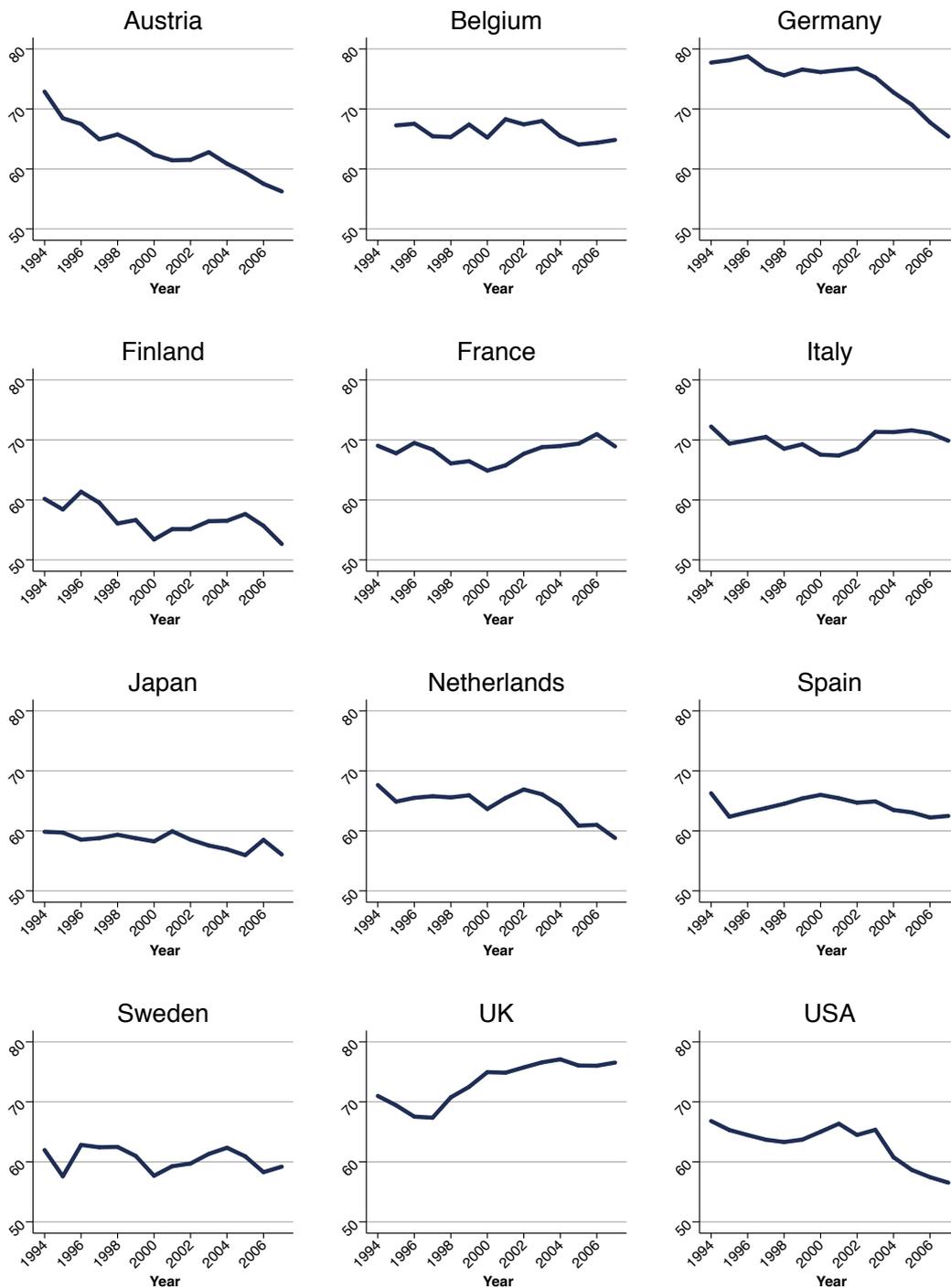
Table 2.24: Sensitivity Analysis

Internationalization Measure (Superstar _{it₀}) Sensitivity Test Dependent variable	ln Export Sales			
	No Superstar Exporters		No Heterogeneous Effect	
	$\Delta \ln VA_{it}$ (1)	$\Delta \text{Labor Share}_{it}$ (2)	$\Delta \ln VA_{it}$ (3)	$\Delta \text{Labor Share}_{it}$ (4)
$\tilde{\Delta} \text{ForeignDemand}_{it}$	-0.0147*** (0.0040)	0.1607 (0.1777)	0.0067*** (0.0023)	-0.2806*** (0.1043)
$\tilde{\Delta} \text{ForeignDemand}_{it} \times \text{Superstar}_{it_0}$	0.0061*** (0.0010)	-0.1299*** (0.0456)		
Superstar _{it₀}	-0.0063*** (0.0003)	0.0199** (0.0084)		
Two-digit Sector \times Year FE	✓	✓	✓	✓
# Observations	163,583	163,583	166,323	166,323

Notes: Standard errors clustered at the firm level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The coefficients from the regression models are estimated over 1994-2001 using OLS. All columns include industry by year fixed effects. $\Delta \ln VA_{it}$ is the change in a firm's value-added. $\tilde{\Delta} \text{ForeignDemand}_{it}$ is the change in a firm's foreign demand. Superstar_{it₀} is a measure of the degree of internationalization of the firm and is the log of the export sales of the firm in the first year in which it appears in the sample. Firms in the top 1% of the initial log export sales distribution have been discarded from the sample in columns 1 and 2. In columns 3 and 4, the interaction terms and the Superstar_{it₀} variables are dropped from the estimation of Equations (2.3.1) and (2.3.2).

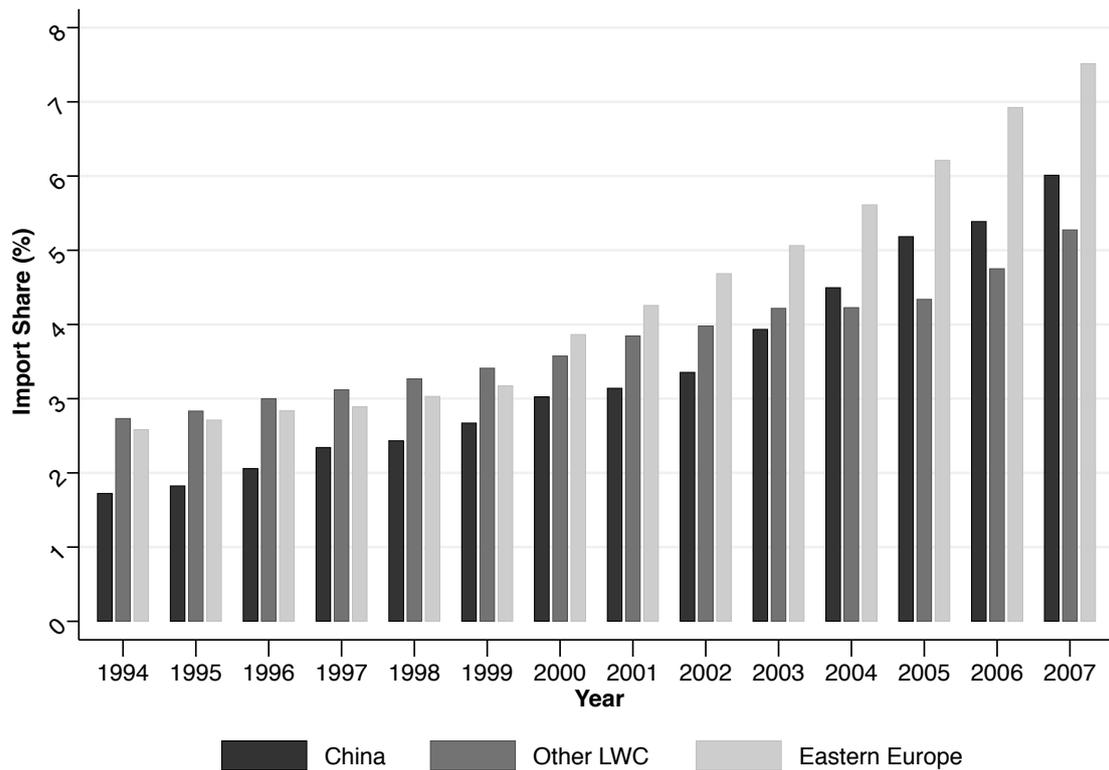
2.G Additional Figures

Figure 2.G.1: Manufacturing Labor Share by Country (1994-2007)

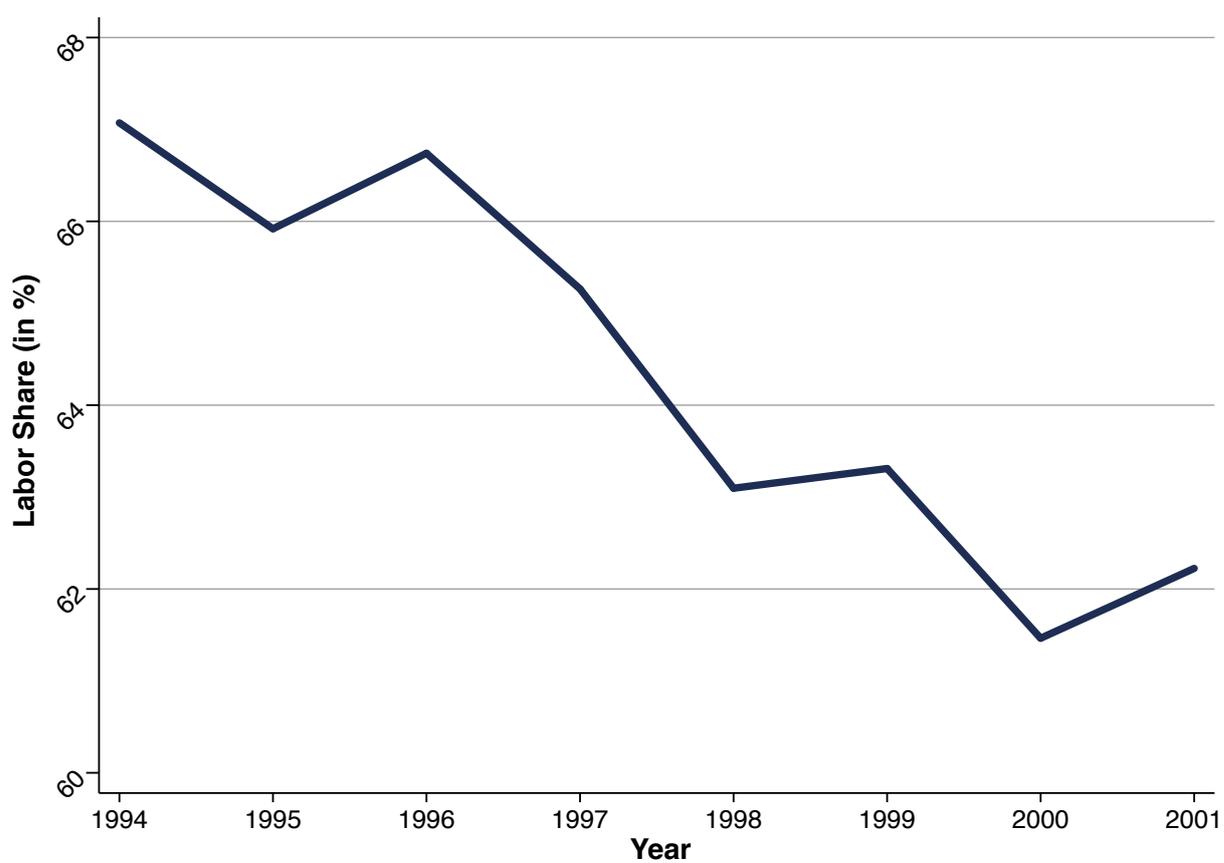


Notes: The data come from EU KLEMS Revision 2012 (O'Mahony and Timmer, 2009).

Figure 2.G.2: Chinese, LWC and Eastern European Exports in Total French Imports

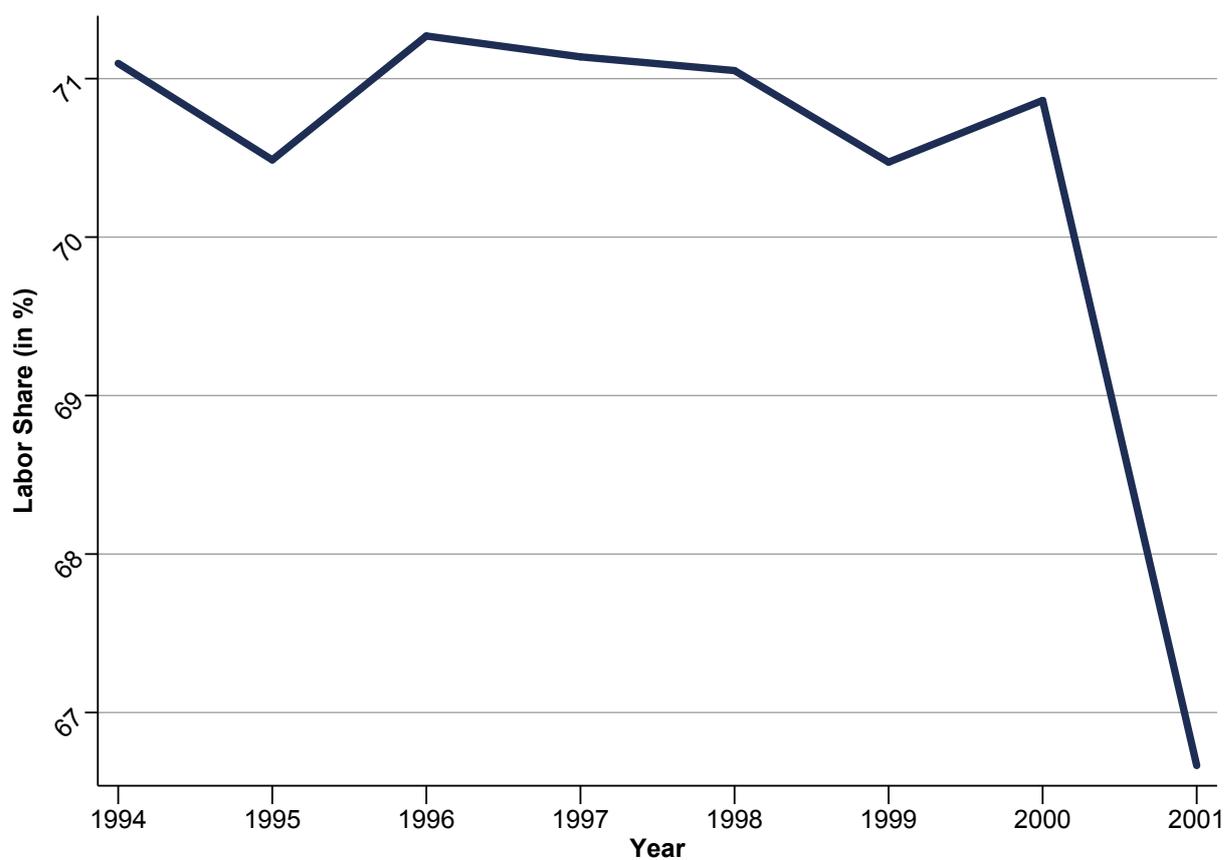


Notes: The data source is BACI. LWC stands for Low-Wage Countries. These countries are defined as in [Auer et al. \(2013\)](#) and the countries included are: India, Malaysia, Mexico, the Philippines, Thailand, Turkey, Poland, Romania, Slovakia. Eastern European countries are defined as in [Dauth et al. \(2014\)](#) and include: Bulgaria, the Czech Republic, Hungary, Poland, Romania, Slovakia, Slovenia, Russia, Belarus, Estonia, Latvia, Lithuania, Moldova, Ukraine, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan.

Figure 2.G.3: Manufacturing Labor Share (Macro Data)

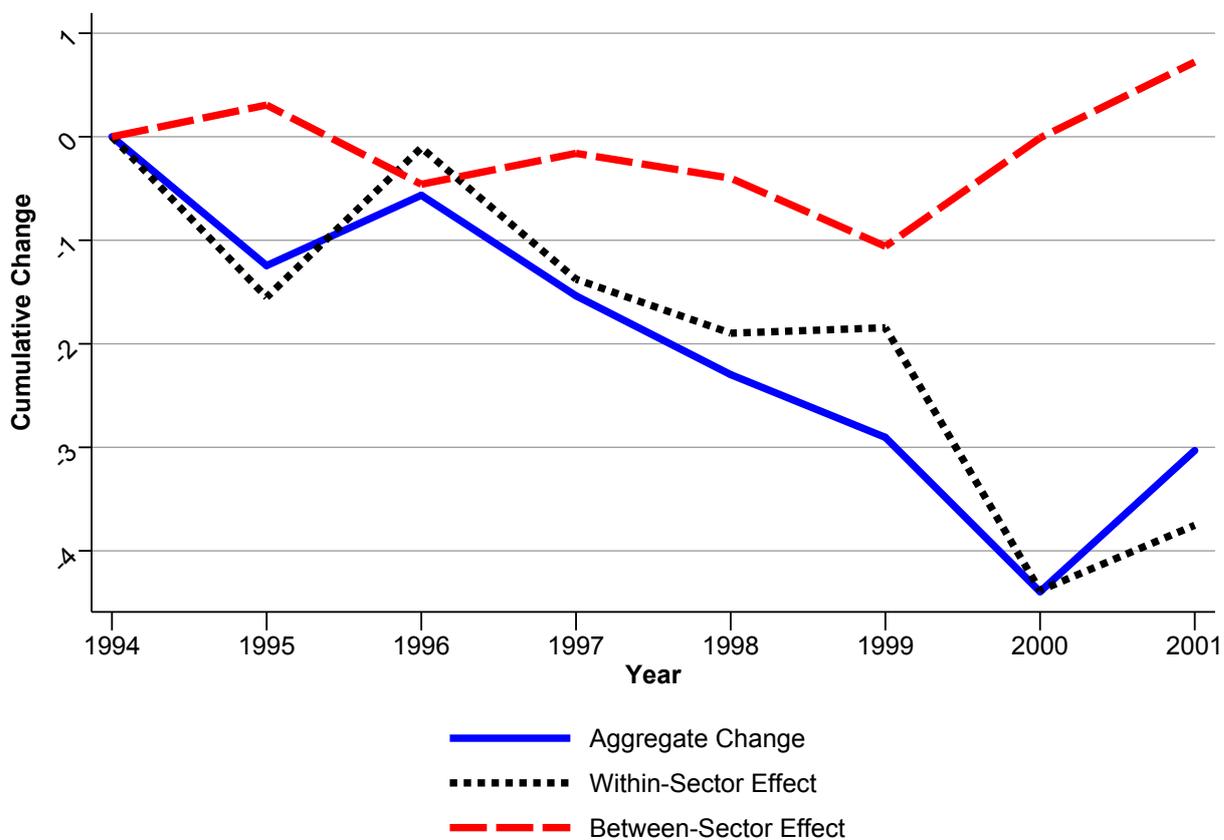
Notes: The data source is EU KLEMS (September 2017 release, Revised July 2018) from Jäger (2016).

Figure 2.G.4: Manufacturing Labor Share of Domestic Firms



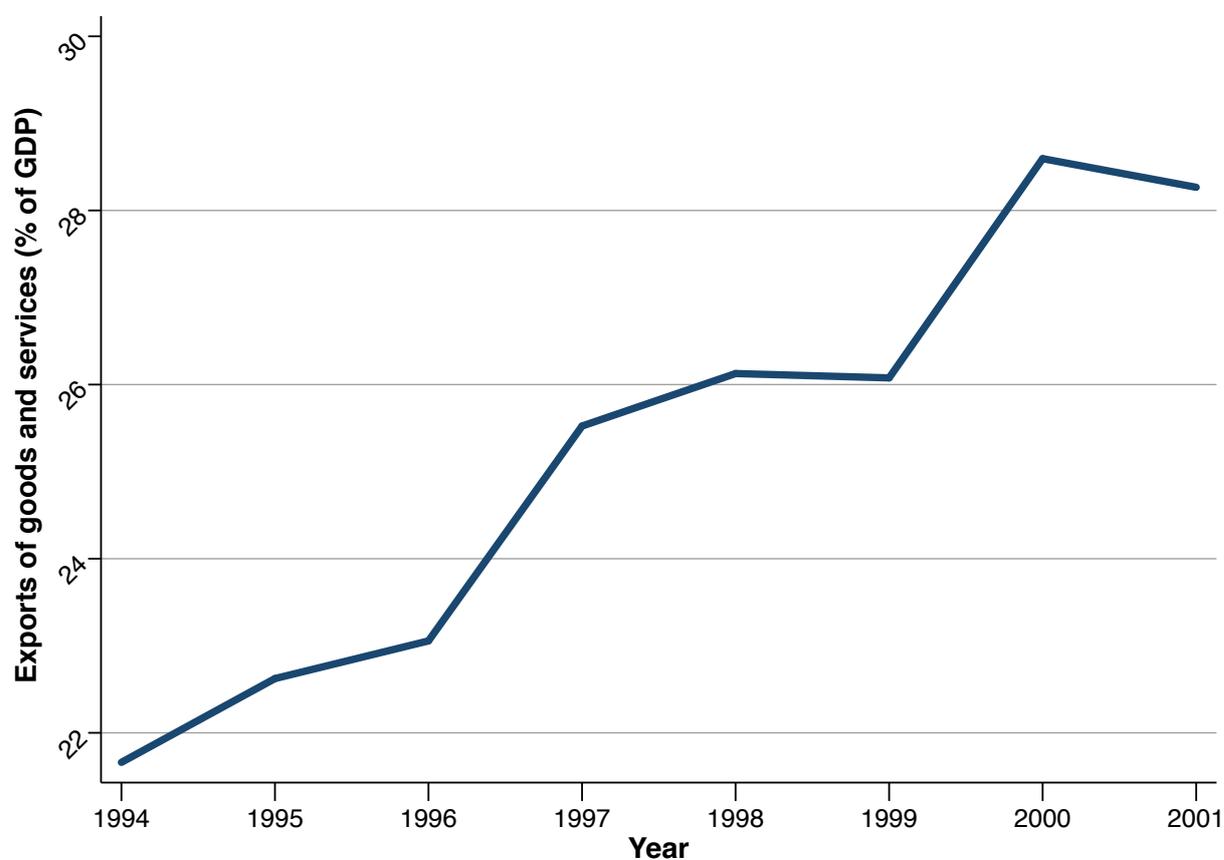
Notes: The data source is FICUS.

Figure 2.G.5: Within/Between-Sector Decomposition of Manufacturing Changes in the Labor Share



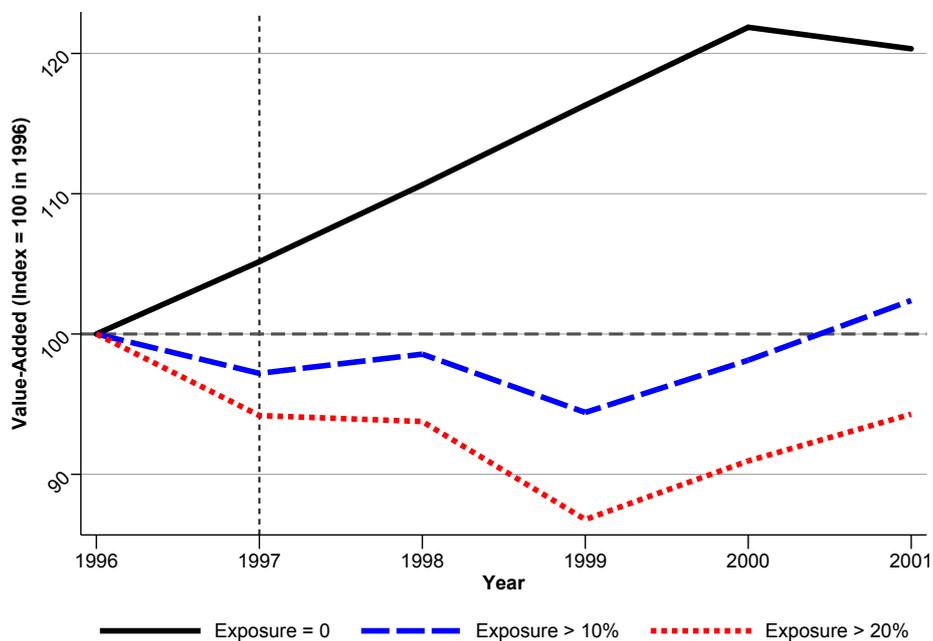
Notes: The data source is FICUS.

Figure 2.G.6: French Exports to GDP Ratio

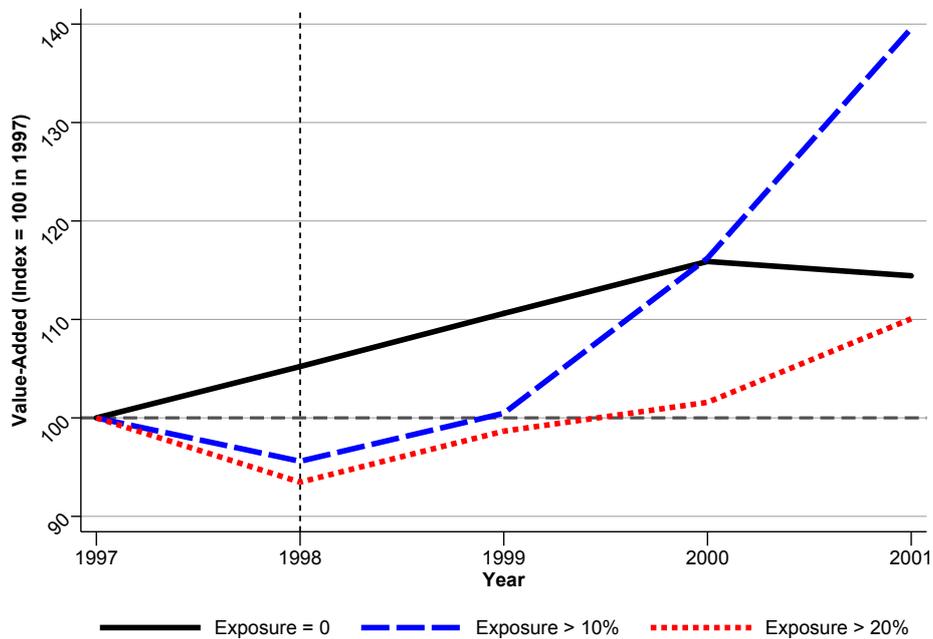


Notes: The data come from the World Bank national accounts data.

Figure 2.G.7: Value-Added of French Exporters during Financial Crisis
 (a) Asian Financial Crisis

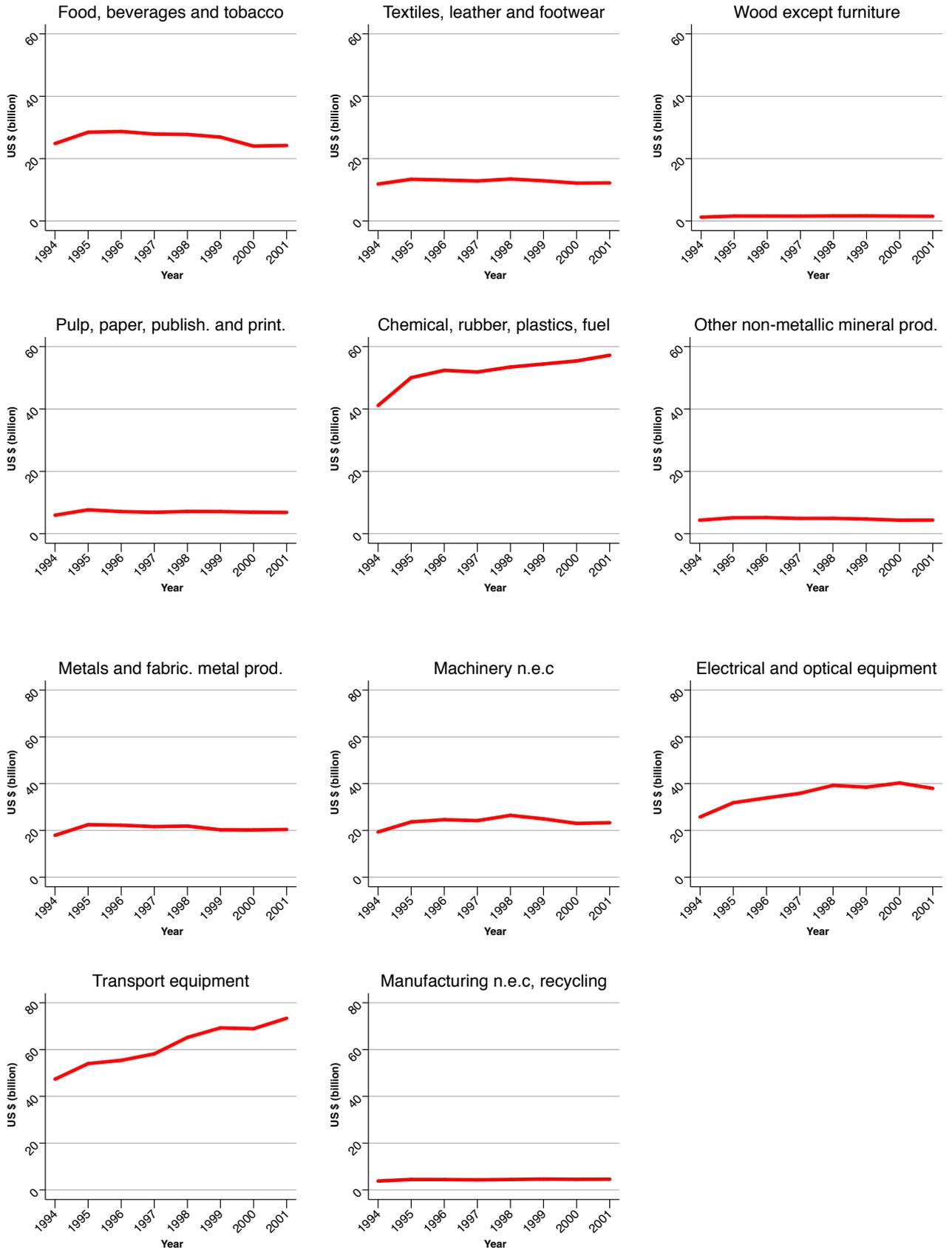


(b) Russian Financial Crisis



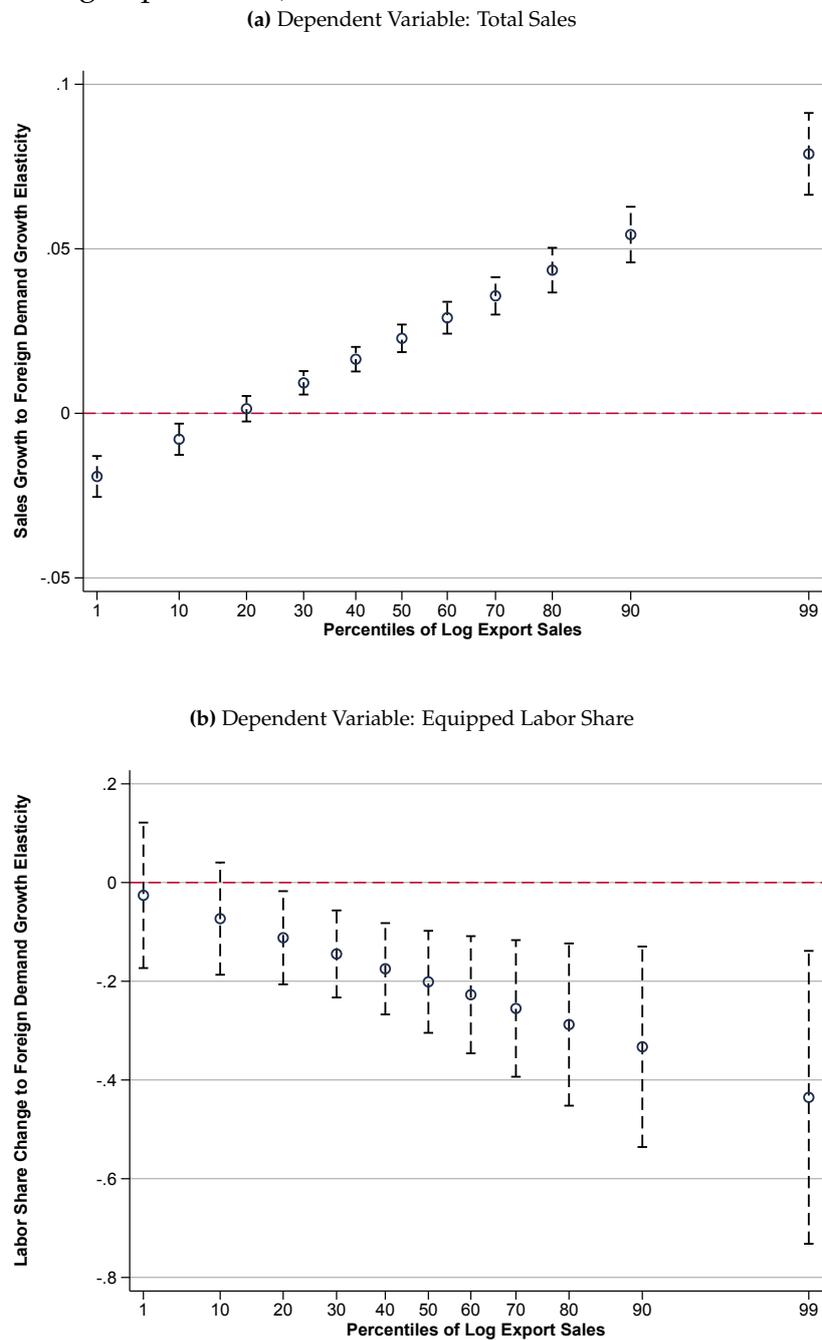
Notes: The sample of firms consists of surviving exporters over the whole 1994-2001 period.

Figure 2.G.8: Sectoral French Exports to the Rest of the World by Industry



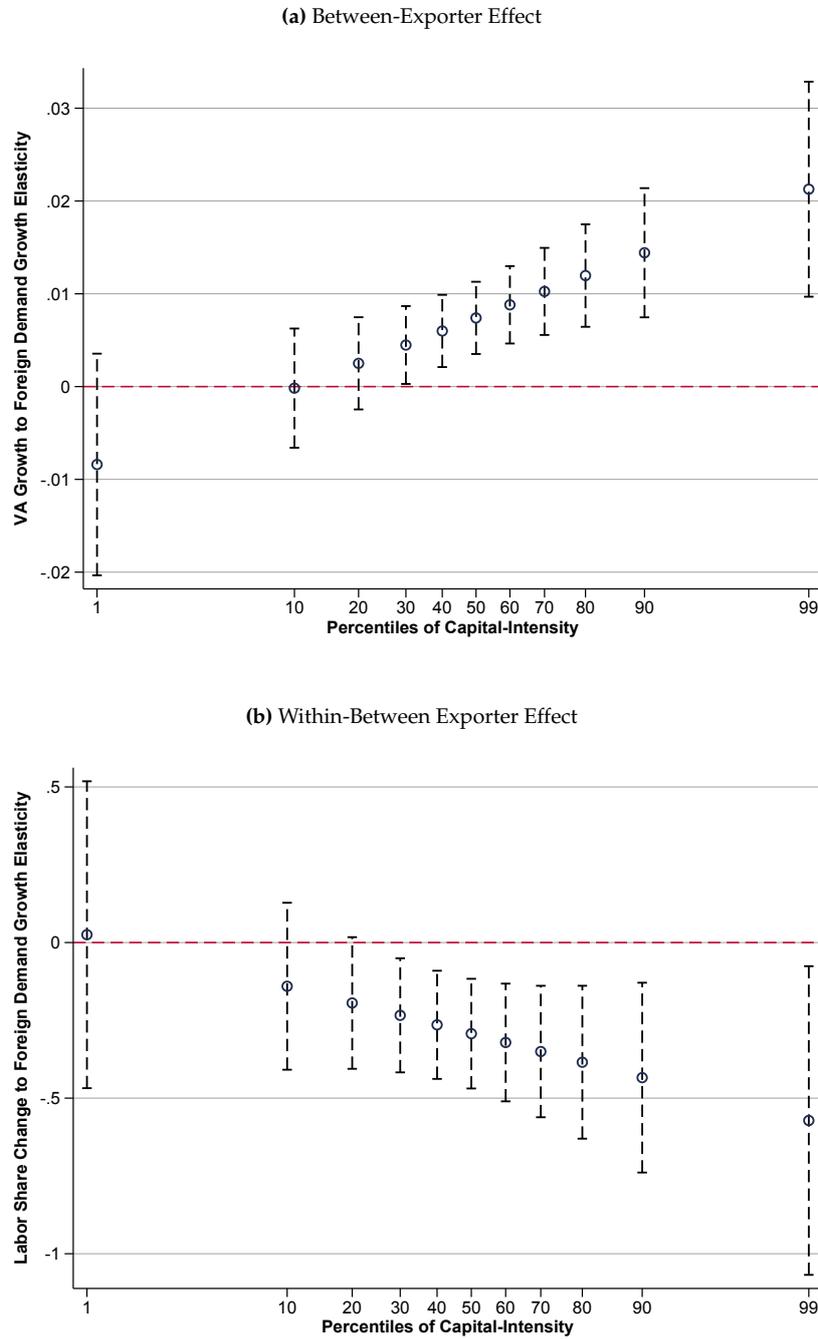
Data Source: BACI

Figure 2.G.9: Foreign Demand, Total Sales, and Equipped Labor Share (Internationalization Measure: log Export Sales)



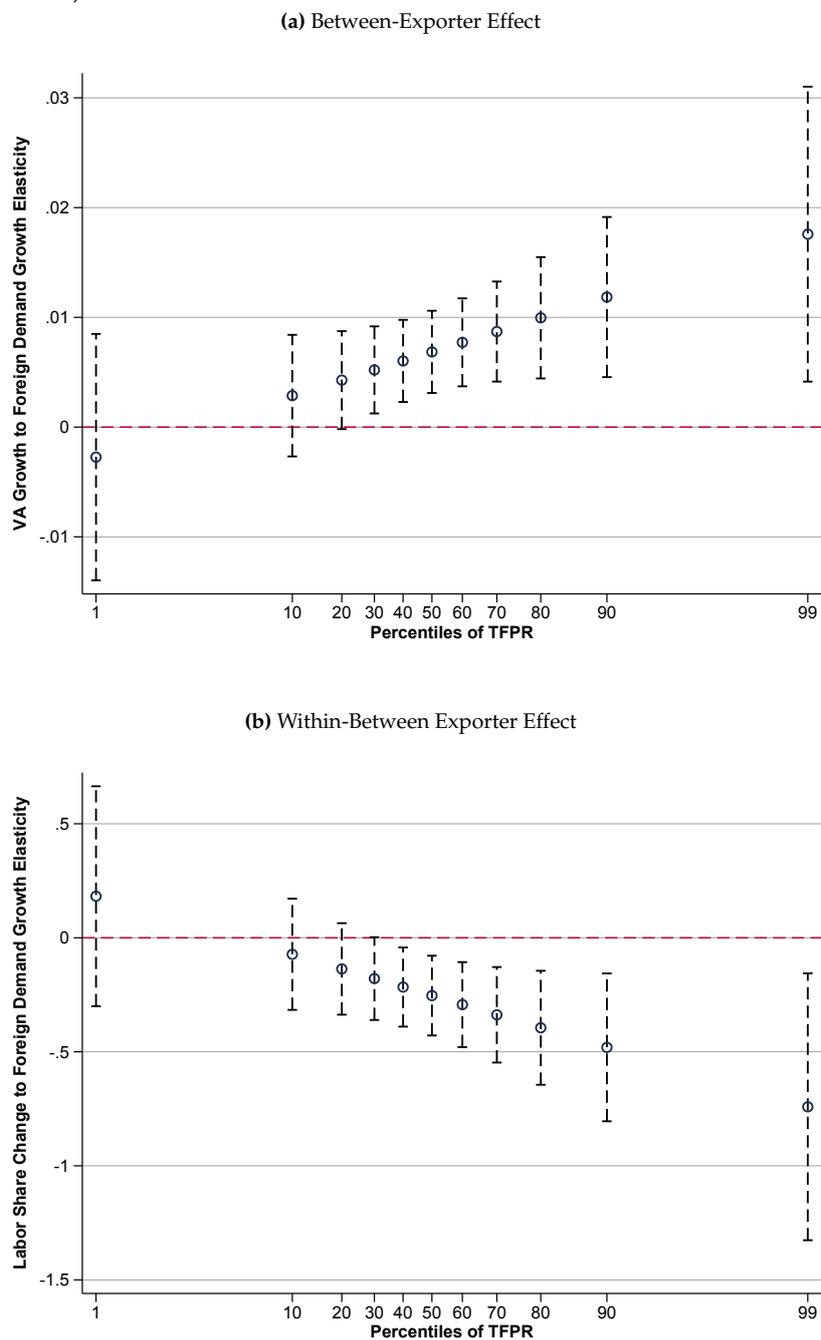
Notes: This Figure is obtained by estimating Equation (2.3.2) but where the dependent variable is the change in a firm's total sales for Panel 2.G.9a and in its equipped labor share for Panel 2.G.9b. This Figure reports the elasticity of the change in a firm's total sales and in its equipped labor share to its foreign demand growth evaluated at different percentiles of the (log) export sales distribution (at time t_0). The percentiles of the initial export sales distribution are reported in Table 2.9.

Figure 2.G.10: Foreign Demand, Value-Added, and Labor Share (Heterogeneity Measure: Capital Intensity)



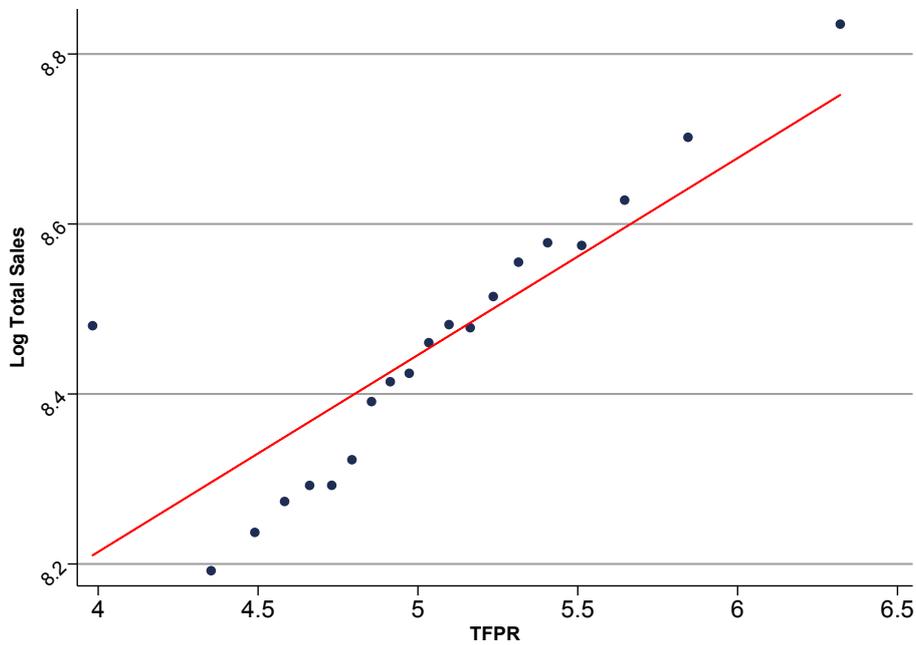
Notes: This Figure is obtained by estimating Equations (2.3.1) and (2.3.2). This Figure reports the elasticity of the change in a firm’s value-added growth and labor share change to its foreign demand growth evaluated at different percentiles of the capital intensity distribution (at time t_0).

Figure 2.G.11: Foreign Demand, Value-Added, and Labor Share (Heterogeneity Measure: Revenue TFP)



Notes: This Figure is obtained by estimating Equations (2.3.1) and (2.3.2). This Figure reports the elasticity of the change in a firm’s value-added growth and labor share change to its foreign demand growth evaluated at different percentiles of the revenue TFP distribution (at time t_0).

Figure 2.G.12: Revenue TFP and Firm Size



Notes: Revenue TFP (x-axis) is estimated as described in Appendix 2.D. Firm size (y-axis) is defined as the log of total sales at the firm level. The sample consists of exporting firms over the period 1994-2001.

Chapter 3

Macroeconomic Effects of Market Structure Distortions

Chapter co-authored with Flavien Moreau.

Abstract

This paper quantifies the economic cost of cartels on aggregate productivity. We assemble a novel firm-level database created from textual analysis of the decisions made by the French Competition Authority over 1994-2007. Empirically, we provide evidence that colluding behaviors are widely spread across sectors and that cartel members are much larger, on average, than non-cartel members. Our model extends the analysis pioneered by [Harberger \(1954\)](#) to a granular economy with heterogeneous firms and cartels. Specifically, our framework shows that dismantling cartels could increase aggregate productivity by 1% to 12%. Both firm heterogeneity and markup dispersion within sectors are key to rationalizing why the cost of market structure distortions arising from cartels is at least one order of magnitude higher than previously found by [Harberger \(1954\)](#).

3.1 Introduction

What is the impact of competition distortions on resource allocation?¹ In his seminal paper, [Harberger \(1954\)](#) suggested that the inefficiency costs generated by monopolies in the U.S. were small, amounting to about a tenth of a percent. This result has become very influential and few papers challenge the consensus that the economic cost of cartels is low.² If cartels are made up of very large and productive firms that charge higher markups as a result, their existence can reallocate production towards less efficient producers, thereby reducing total factor productivity (TFP). In other words, markup dispersion, which is a source of misallocation ([Restuccia and Rogerson, 2008](#); [Hsieh and Klenow, 2009](#)), may be amplified by cartels. Our goal is to quantify the impact of cartels on aggregate productivity through changes in markup dispersion.

Our contribution is twofold. First, we provide new evidence on the characteristics of *detected* cartels and cartel members using detailed administrative micro data. Second, we build on the data and develop a tractable framework that features heterogeneous firms, endogenous markups, and cartels. This allows us to understand the impact of cartels on aggregate productivity and build a bridge with the work of [Harberger \(1954\)](#).

We focus on firms that have been convicted by the national competition regulator for being part of a cartel. In practice, we analyze two decades of antitrust decisions taken by the French Competition Authority, and build a firm-level database on cartels. Our cartel dataset uses all the information contained in the sentencing decisions. Specifically, it contains information on the identify of cartel members, the type of infringement, the duration of the cartel, the fines handed down to each firm.³ We then match this dataset to exhaustive administrative firm-level data. The administrative dataset we use covers the universe of French firms over 1994-2007, allowing us to study how cartel members differ from non-cartel members.

Empirically, we document four stylized facts. The first one has to do with the number of cartel members. The average cartel is made up of six firms. Second, cartels are widely spread in France, in the sense that each two-digit sector contains firms fined by the French competition regulator. These firms are large players in their sector. Third, on average cartel members are much larger and productive than non-cartel members. This

¹In this paper, we define competition distortions as a decrease in competition arising from the existence of cartels.

²A recent exception is the study by [Bridgman et al. \(2015\)](#) who estimate that the New Deal sugar cartel tremendously decreased productivity through reallocation of production towards low productivity firms in the beet and cane industries.

³This database can be extended to other countries and we plan to make it available to researchers interested in studying cartels through the lens of micro data.

is most likely the result of self-selection, whereby larger firms find it more profitable to join a cartel (Bos and Harrington, 2010). Fourth, cartels are made up of relatively homogeneous firms, in the sense that firm-level observable characteristics such as sales, labor productivity etc. are not dispersed within cartels. The third and fourth fact imply that cartel members are very large players and fairly similar. The presence of a cartel might therefore reallocate resources away from these very large and productive firms towards less productive non-cartel members, thereby decreasing aggregate TFP. These observations motivate the use of a macroeconomic model.

We use a static heterogeneous-firm model featuring oligopolistic competition and cartels. In the model, there is a continuum of sectors in which a finite number of firms compete with each other à la Cournot and face Constant Elasticity of Substitution (CES) demand functions.⁴ This allows us to have strategic firms in general equilibrium (Neary, 2003). Collusion is modeled as in the cross-ownership model of O'Brien and Salop (1999), which proves to be a tractable way of microfounding the presence of cartels.

In the model, a few firms in each sector are assumed to be part of a coalition that assigns a positive weight to the profits of all the other coalition members.⁵ Non-members maximize their own profits. The framework endogeneously generates variable markups as a firm's demand elasticity is a function of its market share: firms with a relatively high market share face less elastic demand which allows them to charge higher markups. Cartel members' demand elasticity depends on their own market share as well as the market share of other cartel members. When firms are part of a cartel, they face a lower demand elasticity and charge higher markups.

The key advantage of the framework is that the impact of cartels on aggregate productivity is pinned down by a single parameter. This parameter determines the intensity of collusion and the weight that each cartel member puts on other cartel members' profits. Importantly, our framework naturally nests the seminal work of Atkeson and Burstein (2008) when it is set to zero. In this case, the cartel equilibrium boils down to the Atkeson and Burstein (2008) equilibrium that features markup dispersion and cartels have no effect on aggregate productivity because there are no changes in markup dispersion.⁶

Our exercise consists of comparing aggregate productivity in the cartel equilibrium to

⁴We also consider a variant of the model with price competition à la Bertrand. This alternative yields similar qualitative results.

⁵A cartel member maximizes its profits by internalizing the effect of its decision (quantity or prices) on other cartel members.

⁶Markup dispersion in the no-cartel equilibrium arises from the fact that more productive firms charge higher markups. This is inefficient to the extent that more productive firms could produce more but do not do so because of their market power.

that obtained in the counterfactual competitive Nash-Cournot equilibrium. To do so, we assume that each industry is cartelized and that cartels are made up of the most productive firms, which is consistent with the stylized facts. We find, depending on the value of the collusion intensity parameter, that aggregate TFP would be 1% to 12% higher in the no-cartel equilibrium. This is because when very productive firms collude, they charge higher markups and prices, which reallocates demand towards less productive non-cartel members. Cartels amplify markup dispersion and misallocation, and reduce aggregate productivity.

The numbers we provide are at least one order of magnitude higher than the one found by [Harberger \(1954\)](#) and closer to the ones recently found by [Baqae and Farhi \(2020\)](#).⁷ We show that accounting for firm heterogeneity and markup dispersion within sectors is key to understanding this difference. If firms are homogeneous, there is very little markup dispersion and so, in our model, misallocation is not very high so that cartels have little impact on it through changes in markup dispersion. Second, in the model, if the gap between the within-sector elasticity of substitution and the across-sector elasticity of substitution is low enough, demand can be redirected towards high productivity firms in other sectors, dampening the effect of cartels on productivity. This gap is what pins down the extent of markup dispersion within sectors. Markup dispersion within sectors is higher than across sectors, which is what leads to a higher cost of competition distortions.

Our framework also has clear implications in terms of the relationship between competition and market power. The presence of cartels reduces competition within sectors and increases the market power of *all* firms. Cartels typically reduce competition and allow non-cartel members to price less aggressively. This results in an increase in aggregate markups. This result therefore complements the recent literature that highlights the rise of aggregate markups ([De Loecker and Eeckhout, 2017, 2018](#)). Finally, we show that when all industries are fully cartelized, aggregate TFP may actually be *higher* than in the competitive Nash-Cournot equilibrium, regardless of the value of the collusion intensity parameter. This is because all firms within the industry assign a positive weight to the profits of the rest of the industry when they maximize their profits. This implies that the least productive firms increase their markups relatively more in the presence of a cartel, which drives demand away from them and the contribution of the most productive cartel members to aggregate productivity goes up. In the extreme case where firms maximize their joint profits, all firms within the sector charge the same markup and aggregate productivity is at its efficient level, defined as the level obtained without any markup dispersion. This extreme example is, of course, not consistent

⁷[Baqae and Farhi \(2020\)](#) find that eliminating markup dispersion would raise aggregate TFP by 15%.

with our stylized facts but illustrates how cartels may shape aggregate productivity in some other context.

Related literature. In what follows, we review the different strands of literature that our paper relates to.

Market structure in macroeconomics. Concerns over a decline in competition has revived macroeconomists' interest in market structure. Our work builds on the shoulders of [Harberger \(1954\)](#) and we hope to clarify the reasons why the economic cost of competition distortions brought about by cartels might be larger than previously thought. Our work also relates to recent influential papers that link changes in market concentration to changes in the labor share ([Autor et al., 2017](#)) and document the rise of markups in the US ([De Loecker and Eeckhout, 2017](#)). We show that cartels drive up aggregate markups and market concentration. Our work, however, differs from these papers to the extent that the increase in markups and concentration is not caused by a reallocation towards more productive firms but by a decline in competition. For this reason, our work is more closely related to [Gutiérrez and Philippon \(2018\)](#) who argue that the increase in concentration in the US and Europe is driven by a decline in competition arising from laxer antitrust enforcement. Cartels might be an important reason for this decline in competition. To show that this is the case, we bring the cross-ownership framework of [O'Brien and Salop \(1999\)](#) into the general equilibrium oligopolistic model of [Atkeson and Burstein \(2008\)](#). We allow a subset of firms within each industry to be part of a coalition (cartel) that internalizes the impact of its decision on other cartel members' profits. The model is straightforward to parameterize and nests several cases of interest, including the benchmark competitive Nash-Cournot equilibrium.

Markup dispersion and allocative efficiency. Misallocation of factors of production is an important source of productivity loss ([Restuccia and Rogerson, 2008](#); [Hsieh and Klenow, 2009](#)). We focus on markup dispersion as a source of misallocation, which [Edmond et al. \(2018\)](#) and [Baqee and Farhi \(2020\)](#) also analyze in important contributions.⁸ [Edmond et al. \(2018\)](#) build a dynamic model with heterogeneous firms and endogenous markups to study the welfare cost of markups, which includes misallocation of factors of production. They find that eliminating *size-related* markup

⁸[Edmond et al. \(2015\)](#) build an open-economy version of the [Atkeson and Burstein \(2008\)](#) model and calibrate it to Taiwanese micro data. They find that international trade reduces misallocation and has significant pro-competitive effects.

dispersion would increase aggregate productivity by 1%-2%. [Baqee and Farhi \(2020\)](#) provide a theory of aggregation in inefficient economies. They find that eliminating *total* markup dispersion would raise aggregate TFP by 15%. Our paper, on the other hand, focuses on a specific type of competition distortion arising from the presence of cartels whose economic importance is documented through the use of novel micro data. Furthermore, we study the economic cost of cartels by comparing the cartel allocation to the competitive Nash-Cournot equilibrium that features markup dispersion. While it might be hard to implement policies that fully eliminate markup dispersion, eliminating the extra dispersion caused by the presence of cartels is arguably more easily attainable through competition policy. This is our counterfactual of interest. Our numbers, however, are in the range of those found by [Baqee and Farhi \(2020\)](#) and they show that having a high demand elasticity is also important in explaining the social cost of distortions. For these reasons, we view our contribution and that of [Edmond et al. \(2018\)](#) and [Baqee and Farhi \(2020\)](#) as complementary.

Theory and empirics of cartels. [Bos and Harrington \(2010\)](#) study cartel formation with heterogeneous firms. They show that larger firms have a strong incentive to form a cartel when they are patient enough, and that smaller firms can increase their prices as the larger firms' prices serve as an umbrella. We provide some evidence that discovered cartels are indeed made up of the most productive firms and study how that affects aggregate TFP. The empirical study of cartels and their impact on productivity is limited by the fact that secret agreements are, by definition, hard to observe. [Levenstein and Suslow \(2006\)](#) survey the literature on cartels. Most papers are interested in studying the impact of cartels on prices or the determinants of cartels' success ([Levenstein and Suslow, 2011](#)).⁹ It is possible, however, to focus on specific cartels operating in particular industries. [Bridgman et al. \(2015\)](#) show that the New Deal Sugar Manufacturing Cartel had a strong negative impact on productivity in the beet and cane industries. Our paper instead connects the IO and macroeconomics literature by looking at the macroeconomic implications of cartels from a general equilibrium perspective.

The paper proceeds as follows. Section 2 details our data. We provide stylized facts in Section 3. In Section 4, we introduce our model. Section 5 provides more information on the calibration of the model. Our results are presented in Section 6. Section 7 concludes.

⁹Some papers instead study the impact of cartels on welfare, such as [Röller and Steen \(2006\)](#) in the context of the Norwegian cement industry.

3.2 Data

We build a new firm-level dataset on cartels and anti-competitive practices of French firms over the period 1994-2007, using the reports of all the antitrust decisions taken by the French Competition Authority over the last 26 years. In this section, we describe important institutional details and explain how we build our dataset and combine it with firm-level data on the universe of French firms.

3.2.1 Antitrust Decisions

As mentioned in Appendix 3.C.1, after investigating, the Competition Authority fines companies that are found guilty of engaging in any form of anti-competitive practice (abuse of dominant position, collusion or predatory pricing). Collusive behaviors might involve firms trading information on their prices and markups, imposing standard form contracts, enforcing barriers to entry, imposing exclusive or selective distribution agreements, market sharing, purposely stepping down from call for bids.

The ADLC makes use of two tools in order to deter firm from taking part in illegal activities. The first one consists of fining these companies. The fines are set “according to the seriousness of the facts, the extent of the harm done to the economy, the individual situation of the company that has committed the infringement and of the group to which it belongs to, and whether it is an infringement that has been repeated or not”.¹⁰ The fines are capped as they cannot be higher than “10% of the global turnover of the group to which the company that is being fined belongs to”. If the infringement is not committed by a company, the maximum amount of the fine is 3 million euros.¹¹ The second tool relies on issuing an injunction whereby the ADLC notifies the companies to change their behavior.

In practice, the information we extract to create our database comes from PDF files containing the description of the decisions made by the French Competition Authority. These files are freely available in French on the ADLC website. We make use of an automatic textual analysis to retrieve information on the identity of the firms fined by the antitrust body.¹² Crucially, our database contains the name of the firms that are fined, which signals that these companies behaved illegally and are anti-competitive. We also retrieve information on the amount of the fine in thousands of euros, the type

¹⁰French Commercial Code, L.420-1 or L.420-2.

¹¹French Commercial Code, L.464-2.

¹²We do not use information on firms notified by an injunction. Often, these firms are fined later on by the ADLC and thus appear in our database.

of anticompetitive practice, the duration of the practice, the cause of breakup, the year the verdict is returned and the starting year of the investigation. We then use the companies' names to back out their national identification code ("SIREN" code) given by the French National Institute of Statistics and Economic Studies (INSEE). This allows us to match our database with other firm-level production datasets. We describe in the Data Appendix how we assemble our database and the variables it contains. The number of decisions per year we use and the number of firms involved are reported in Figures 3.B.1 and 3.B.2. Figure 3.B.5 displays a representative report from the ADLC (decision file 17d20). The identity of the cartel members is revealed and publicly available, as well as the amount of the fine. Figure 3.B.4 shows that information on the duration of cartel can also be found in these reports, as well as information on the type of infringement as shown in Figure 3.B.5.

3.2.2 Administrative Data

We match our database on anti-competitive firms with firm-level data for France. Matching the firms is made possible by the fact that French firms are assigned a unique identifier ("SIREN" code). The datasets that we use contain the universe of French firms over the period 1994-2007. These datasets contain the balance sheets and income statements of all French firms. We keep both large and smaller firms which corresponds to two different tax regimes, the Regime of Normal Real Profits (BRN) and the Simplified Regime for the Self-Employed (RSI), respectively. BRN contains firms with annual sales above 763K euros (230K euros for services) whereas smaller firms included in RSI sell at least 76.3K euros (but less than 763K euros) a year and more than 27K euros for services. However, BRN is the most relevant data source given that in 2003, BRN firms' sales share in total sales was 94.3% and is constant over time. This data has been used in previous studies, for instance in [Di Giovanni et al. \(2014\)](#), and we refer to their paper for more information. Importantly, these exhaustive databases allow us to build a firm's labor share, market share and other variables we directly use in our empirical framework. More information on the variables we use and build is provided in Appendix 3.C.

3.3 Empirical Facts

Using our matched micro data on cartels, we provide evidence that guide our choice of modeling.

Characteristics of cartels. Table 3.1 provides statistics on the French cartels detected by the ADLC. We eliminate from our dataset firms that were fined for behaving anti-competitively and were not interacting with other firms. This is the case if firms were abusing their dominant position for example or are repeat offenders. Our data contain 174 cartels and more than a thousand firms. The average duration of a cartel is about 4 years, which is in the range of the average duration reported in [Monnier-Schlumberger and Hutin \(2016\)](#) who find an average duration of five years and consider discovered French cartels observed over the period 2003-2015. This also matches the average duration of cartels summarized in [Levenstein and Suslow \(2006\)](#) for a wide range of studies.¹³ The average number of firms per cartel is 6 and the median is 4. While there are extremely large cartels made up of more than 70 firms, this does not seem to be the norm as the standard deviation is equal to 7. We further report a few statistics on the types of cartels. Most firms that are part of a cartel share confidential information, rig bids, and fix their prices. They also share their customers and their market shares, which is illegal.

Fact 1: *An average cartel is made up of six firms and the median number of firms per cartel is four.*

Cartels across sectors. Table 3.2 shows that cartelization and, more generally, anti-competitive practices are prevalent in France. Most cartels involve firms operating in the construction, wholesale and retail and transportation sectors. These three sectors account for almost 50% of total sales and 36% of total value-added in France. The third and fourth column display the average number of anti-competitive firms in each sector over the period 1994-2007. There are only two sectors in which no firm was convicted, namely the agricultural and the education sectors. They account for 0.5% of total value-added and so are negligible. The last column displays the average market share of the cartel in the whole sector. This shows that these cartels are large players in their *sector* and are present across all sectors.

Fact 2: *Cartels can be found in all 2-digit sectors.*

Cartels and firm size. In Table 3.3, we investigate the characteristics of colluding firms versus firms that have not been officially sentenced. Colluding firms have a much

¹³It is possible to argue that these dates are not a correct approximation of the true duration of cartels as these studies are based on discovered cartels that might not be representative of all cartels.

higher market share on average: 4% versus 0.07% for non-colluders. Colluders also sell more, spend more on intermediate goods, have more employees, use capital more intensively and are more productive, as measured by labor productivity. These statistics are most likely the result of self-selection into colluding, whereby more productive and bigger firms are more likely to find it profitable to join a cartel (Bos and Harrington, 2010). We do not claim the results reported to be causal. One might worry that the numbers reported suffer from sample selection bias as colluding firms in our sample are *discovered* firms. The issue is that there might be a myriad of other colluding companies that go unnoticed and that might behave differently from discovered firms, affecting our statistics. Even more productive and larger undiscovered cartel members would be classified as competitive. While this is a possibility that is impossible to rule out, we argue that this would lead us to underestimate the numbers provided in Table 3.3.¹⁴

Fact 3: *Cartel members are, on average, larger than non-cartel members.*

Size dispersion within cartels. The fourth fact we document relates to the extent to which firms differ within a cartel. We select ten large cartels whose description can be found [here](#).¹⁵ For each firm, we compute its firm average over the years of collusion for sales, value-added (in thousands of euros) and its labor productivity (in logs). In order to assess the dispersion of sales, value-added and productivity within a cartel which would indicate whether firms within a cartel are very heterogeneous or not, we proceed by computing the 75/25, 90/50 and 90/10 ratios of sales, value-added and labor productivity. These measures of dispersion are reported in Table 3.4. The number of firms fined in each cartel is reported in the penultimate row while the last row of the table reports the number of firms we could match to the balance-sheet data for each specific cartel. As we can see in the first column which reports the dispersion measures for the “national and international removal services” cartel, the 90th percentile firm sells for almost 19 thousand euros more than the 10th percentile. This is a very small number. The figures are very similar across cartels and dispersion measures. One exception is the 14d19 cartel where the 90th percentile firm sold 1 million euros more than the 10th percentile firm. This leads us to our fourth empirical fact.

¹⁴This is the case if very large cartel members are able to go unnoticed because they are good at colluding. The other possibility is that discovered cartels are the least productive ones and break down because they are bad at colluding.

¹⁵These cartels are large as the amount of the total fine is high and the French Competition Authority assessed the damage to the economy to be substantial. We exclude the decision “06d09” on practices implemented in the door manufacturing sector as the damage to the economy was small.

Fact 4: *Firms within a cartel are relatively homogeneous.*

3.4 Model

We build a framework to extend the analysis pioneered by [Harberger \(1954\)](#) to a granular economy with heterogeneous firms and cartels. We develop a static, closed-economy, model in which heterogeneous firms choose their markups endogenously along the lines of [Atkeson and Burstein \(2008\)](#), and cartels coexist with competitive firms. The model allows for Cournot and Bertrand competition. The economy is made of a continuum of sectors, but in each sector, only a *finite* number of firms compete. The firms are therefore “large in the small and vice versa” ([Neary, 2003](#)). In equilibrium, firms’ markups increase with their market share.

Collusion is defined as follows: “collusion is when firms in a market *coordinate* their behavior for the purpose of producing a *supracompetitive outcome*” ([Harrington Jr, 2017](#), p.1, emphasis in original). It affects how firms take into account the impact of their production and pricing decisions on the sectoral output and price level. Colluding in our framework is akin to cross-ownership, and produces similar competition distortions ([O’Brien and Salop, 1999](#)).¹⁶ The attractive feature of the model is that it nests several models of competition, depending on the value of a single parameter. Collusion unambiguously raises prices and is harmful to consumers.¹⁷ Since we are interested in quantifying the aggregate productivity gains from eliminating cartels, we believe that the strength of our framework is to provide a *tractable* micro-founded macroeconomic model of cartels.

3.4.1 Oligopolistic Competition with Cartels

We keep the demand side of the economy voluntarily stark in order to focus on the supply side implications of competition distortions. All the important economic decisions are made by the firms. An infinitely-lived representative household maximizes a time-separable utility

$$\mathbb{E} \sum_{t=0}^{\infty} \beta^t \mathcal{U}(c_t, 1 - l_t)$$

¹⁶[Gilo et al. \(2006\)](#) and [de Haas and Paha \(2016\)](#) study how common ownership affects collusion.

¹⁷In the text, we solve the model under Cournot competition. See Appendix 3.D.5 for the version with Bertrand Competition.

The first order conditions for the household are standard and yield the familiar intra-temporal tradeoff between consumption and leisure:

$$-\frac{\mathcal{U}_{l,t}}{\mathcal{U}_{c,t}} = \frac{W_t}{P_t} \quad (3.4.1)$$

Since our environment is static, we drop the time subscript and focus on the stationary equilibrium. The production side of the economy consists of a continuum of sectors indexed by $s \in [0, 1]$. Final consumption c is produced by a competitive firm that combines the outputs from all the sectors y_s with a CES technology with demand elasticity η :

$$c = \left[\int_0^1 y_s^{\frac{\eta-1}{\eta}} ds \right]^{\frac{\eta}{\eta-1}} \quad (3.4.2)$$

The inverse demand function for each intermediate output from sector s is given by:

$$\frac{P_s}{P} = \left(\frac{y_s}{c} \right)^{-\frac{1}{\eta}} \quad (3.4.3)$$

where P , the price index for final consumption representing the “true cost of living”, is a function of the sectoral prices:

$$P = \left[\int_0^1 P_s^{1-\eta} ds \right]^{\frac{1}{1-\eta}} \quad (3.4.4)$$

Each sector is populated by a finite number of firms K_s indexed by k . Because each firm has a non-zero measure, its decisions have an impact on its competitors’ decisions. Firms are “large in the small but small in the large” (Neary, 2003) *i.e.* they are “small” with respect to the economy but “large” in their own sector. The output in sector s is a composite of the firms’ outputs, combined with a CES technology with elasticity parameter ρ :

$$y_s = \left[\sum_{k=1}^{K_s} (q_{sk})^{\frac{\rho-1}{\rho}} \right]^{\frac{\rho}{\rho-1}} \quad (3.4.5)$$

The inverse demand functions within each sector are given by:

$$\frac{P_{sk}}{P_s} = \left(\frac{q_{sk}}{y_s} \right)^{-\frac{1}{\rho}} \quad (3.4.6)$$

The price index in sector s is given by

$$P_s = \left[\sum_{k=1}^{K_s} (P_{sk})^{1-\rho} \right]^{\frac{1}{1-\rho}} \quad (3.4.7)$$

We make the following assumptions:

Assumption 1. *Goods are imperfect substitutes $\rho < \infty$.*

Assumption 2. *Goods are more substitutable within than between sectors $1 < \eta < \rho$.*

Assumption 3. *Firms play a static game of quantity competition (Cournot).*

Assumption 4. *The productivity distribution is lognormal $\log z_{ik} \sim \mathcal{N}(0, \theta)$.*

Several remarks are in order. Assumption 1 is standard. Assumption 2 is crucial for our analysis to go through. It guarantees that firms' markups are increasing in market shares. Assumption 3 can be replaced by Bertrand competition and does not alter our qualitative results. Assumption 4 is made in order to keep the quantitative exercise simple but is unimportant for the proof. We now turn to the maximization problem that cartel members and non-cartel members face.

Cartels and market structure. We assume that a subset of firms in each sector s belong to a cartel \mathcal{C} : $\mathcal{C}_s \subseteq K_s$. This is consistent with stylized facts 1 and 2. For simplicity, we assume that firms only collude within their own industry and abstract from vertical arrangements. Non-cartel members behave competitively and maximize their own profits.

Fundamentally, collusion distorts firms' conduct in the same way that common ownership claims between firms alter managers' behavior (O'Brien and Salop, 1999).¹⁸ Instead of only maximizing its own profits, each cartel member internalizes part of its price impact on the other firms. The objective function of cartel members takes the form of a linear combination of all the cartel members' profits, just as in the case of cross-ownership claims. Collusion between cartel members can therefore be understood as a pooling of control or financial claims on the pricing or quantity decisions of each firm. This flexible formulation allows straightforward analytical derivations of collusion of various intensity and size.

How do cartels change the market structure of this economy? When a cartel is created, firms' productivities are unchanged but cartel members' pricing decisions become

¹⁸See also Azar and Vives (2018) for a model where firms are also large in the economy. Azar et al. (2018) look at the effect of common ownership on price tickets in the US airline industry.

mutually dependent. Cartel members partially internalize the effects of their own production decisions on other members' profits. As a consequence colluding firms' markups rise and so does the price index of their sector, therefore affecting non-cartel members. An increase in the price index arising from cartelization might increase or decrease markup dispersion, as we will see below. For now, we note that it is theoretically possible that collusion may boost aggregate productivity if it leads to less variation in markups.¹⁹ In the model, cartels affect aggregate TFP through changes in markup dispersion. This is pinned down by one parameter determining the intensity of the collusion, by the number of firms operating in a cartel and by the productivity type of cartel members.

We start by describing the profit maximization problem of cartel members before turning to that of non-cartel members.

Cartel members. Consider an industry with K firms, let Π_k denote the profit function of firm k . Corporate control – the influence over the firm's production decisions – is distinct from financial ownership – the claim to a share of its profits –. Let β_{jl} denote the share of firm j which is owned by firm l and γ_{lj} firm's l 's control or influence over firm j 's decisions. The financial profits accruing to firm l correspond to the portfolio $\pi^l = \sum_j \beta_{jl} \pi_j$, where π_l are the profits generated by firm l 's operations. However, because other firms can influence firm k 's operations, and that their shareholders' interests are not perfectly aligned, the managers of firm k maximize a weighted average, $\tilde{\pi}_k$, of the firm's shareholders portfolios, where the weights depend on the controlling shares. The objective function of firm k is given by:

$$\tilde{\pi}_k = \sum_l \gamma_{kl} \pi^l = \sum_l \gamma_{kl} \sum_j \beta_{jl} \pi_j \quad (3.4.8)$$

Taking π_k out of the second summation and normalizing by $\sum_l \gamma_{kl} \beta_{kl}$ so as to isolate π_k , we can rewrite the objective function as (dropping the sectoral index s):

$$\tilde{\pi}_k \propto \pi_k + \sum_{j \in \mathcal{C} \setminus \{k\}} \frac{\sum_l \gamma_{kl} \beta_{jl}}{\sum_l \gamma_{kl} \beta_{kl}} \pi_j = \pi_k + \sum_{j \in \mathcal{C} \setminus \{k\}} \lambda_{kj} \pi_j \quad (3.4.9)$$

Equation (3.4.9) makes it clear that firm k maximizes its own profits given by π_{sk} and other firms' profits. A weight given by $\lambda_{kj} := \frac{\sum_l \gamma_{kl} \beta_{jl}}{\sum_l \gamma_{kl} \beta_{kl}}$ is assigned to other firm's profits and these weights are *firm-specific*.²⁰ Cartel members therefore solve the following

¹⁹If all firms maximize their joint profits, this will be the case and aggregate productivity will be at its first-best level.

²⁰We note that it is possible that these profit weights can be larger than one, in which case a firm values other firms' profits more than its own. Such a case is studied in Backus et al. (2019) but we deem this

maximization problem:

$$\max_{P_{sk}, q_{sk}} \left[\left(P_{sk} - \frac{W}{z_{sk}} \right) q_{sk} + \sum_{j \in \mathcal{C} \setminus \{k\}} \lambda_{kj} \left(P_{sj} - \frac{W}{z_{sj}} \right) q_{sj} \right], \quad \forall k \in \mathcal{C}_s \quad (3.4.10)$$

subject to the inverse demand function obtained by combining equations (3.4.3) and (3.4.6):

$$\left(\frac{P_{sk}}{P} \right) = \left(\frac{q_{sk}}{y_s} \right)^{-\frac{1}{\rho}} \left(\frac{y_s}{c} \right)^{-\frac{1}{\eta}} \quad (3.4.11)$$

Non-cartel members. Competitive firms that do not belong to the cartel ($i \notin \mathcal{C}_s$) instead maximize their own profits. Their prices P_{si} and quantities q_{si} solve the following maximization problem:

$$\max_{P_{si}, q_{si}} \left[\left(P_{si} - \frac{W}{z_{si}} \right) q_{si} \right], \quad \forall i \notin \mathcal{C}_s \quad (3.4.12)$$

subject to (3.4.11):

$$\left(\frac{P_{si}}{P} \right) = \left(\frac{q_{si}}{y_s} \right)^{-\frac{1}{\rho}} \left(\frac{y_s}{c} \right)^{-\frac{1}{\eta}} \quad (3.4.13)$$

Profit-maximizing implies that the equilibrium price is a markup over the marginal cost of production where the markup is pinned down by the demand elasticity:

$$\begin{aligned} \tilde{\mu}_{sk} &= \frac{\tilde{\varepsilon}_{sk}(\omega_{sk})}{\tilde{\varepsilon}_{sk}(\omega_{sk}) - 1} \\ \mu_{si} &= \frac{\varepsilon_{si}(\omega_{si})}{\varepsilon_{si}(\omega_{si}) - 1} \end{aligned}$$

where the demand elasticities $\tilde{\varepsilon}_{sk}(\omega_{sk})$ and $\varepsilon_{si}(\omega_{si})$ of cartel members and non-cartel members, respectively, are given by:

$$\begin{aligned} \tilde{\varepsilon}_{sk}(\omega_{sk}) &= \left[\frac{1}{\rho} + \left(\frac{1}{\eta} - \frac{1}{\rho} \right) \left(\omega_{sk} + \sum_{j \in \mathcal{C} \setminus \{k\}} \lambda_{kj} \omega_{sj} \right) \right]^{-1} \\ \varepsilon_{si}(\omega_{si}) &= \left[\frac{1}{\rho} (1 - \omega_{si}) + \frac{1}{\eta} \omega_{si} \right]^{-1} \end{aligned}$$

This leads to the following proposition:

Proposition 3 (Prices and Markups). *The equilibrium prices \tilde{P}_{sk} of each cartel member and*

case to be implausible in the case of cartels and do not consider it.

P_{si} of each non-cartel member are characterized by

$$\begin{aligned}\tilde{P}_{sk} &= \tilde{\mu}_{sk} \frac{W}{z_k}, \quad \forall k \in \mathcal{C} \\ P_{si} &= \mu_{si} \frac{W}{z_i}, \quad \forall i \notin \mathcal{C}\end{aligned}\tag{3.4.14}$$

where firm-level markups are given by

$$\begin{aligned}\frac{1}{\tilde{\mu}_{sk}} &= \frac{\rho - 1}{\rho} + \frac{\eta - \rho}{\eta\rho} \left(\omega_{sk} + \sum_{j \in \mathcal{C} \setminus \{k\}} \lambda_{kj} \omega_{sj} \right), \quad \forall k \in \mathcal{C} \\ \frac{1}{\mu_{si}} &= 1 - \frac{1}{\rho} (1 - \omega_{si}) - \frac{1}{\eta} \omega_{si}, \quad \forall i \notin \mathcal{C}\end{aligned}\tag{3.4.15}$$

and where ω_{sk} is the market share of firm k in its sector s :

$$\omega_{sk} := \frac{P_{sk} q_{sk}}{\sum_{j=1}^K P_{sj} q_{sj}} = \left(\frac{P_{sk}}{P_s} \right)^{1-\rho}\tag{3.4.16}$$

Proof. The proof is detailed in Appendix 3.D.1. □

The demand elasticities are firm-specific and are a linear combination of the within- and between- sector elasticities of substitution ρ and η . The CES structure of the framework entails that these demand elasticities are a function of relative prices as $\omega_{si} = \left(\frac{P_{si}}{P_s} \right)^{1-\rho}$. Hence, firm-level markups are heterogenous and endogenous, reflecting their comparative advantage within their sector. In the absence of cartels, all firms' markups are defined by the demand elasticity $\varepsilon_{si}(\omega_{si})$. In this case, small firms care mostly about the competition coming from firms in the same sector whereas larger firms dominant in their sector internalize some of the substitution effect between sectors. As the market share converges to 1, the relative price $\frac{P_{sk}}{P_s}$ converges to 1 from above and μ_{sk} tends to $\frac{\eta}{\eta-1}$, the markup associated with the between-sector elasticity of substitution. Conversely, firms whose market share tends to 0 will compete exclusively with firms within their sector and will charge the constant markup $\frac{\rho}{\rho-1}$, as in the monopolistic competition framework with CES preferences (Krugman, 1980; Melitz, 2003).

Firm-level markups of cartel members are higher under collusion as colluding firms in the same sector internalize part of the effect of their decisions on the other cartel members' profits and the extent to which they do so depends on the weights they assign to other cartel members' profits, defined by the profit weights λ_{kj} . Importantly our model nests several cases of interest in which markups of cartel members vary.

Competitive Nash-Cournot. When the profit weights are set to zero and there are no cartels, the model boils down to a competitive Nash-Cournot model with heterogeneous firms. In this case, all firms' markups within an industry are given by $\frac{1}{\mu_{si}} = 1 - \frac{1}{\rho}(1 - \omega_{si}) - \frac{1}{\eta}\omega_{si}$. This is the benchmark model we consider to compute the aggregate gains from eliminating cartels. This framework features markup dispersion as more productive firms charge higher markups.

Full collusion. We first consider the case where the profit weights are equal to unity $\lambda_{kj} = 1$. This is the case, for example, when the share of two different rival firms j and k owned by investor l is the same, *i.e.* $\beta_{jl} = \beta_{kl}$. This also arises when the control shares are the same across firms $\gamma_{kl} = \gamma_k$.²¹ This case does not require making any assumption on the control weights that are harder to measure empirically, as pointed in the common ownership literature (Backus et al., 2019). The case where the profit weights are equal to unity boils down to full collusion where firms maximize their joint profits and equally weight all cartel members' profits.²² In this case, cartel member k 's markup is given by:

$$\frac{1}{\tilde{\mu}_{sk}} = \frac{\rho - 1}{\rho} + \frac{\eta - \rho}{\eta\rho} \sum_{j \in \mathcal{C}} \omega_{sj} \quad (3.4.17)$$

All colluding firms that belong to \mathcal{C} charge the same markup that is governed by the combined market share $\sum_{j \in \mathcal{C}} \omega_{sj}$. This *reduces* markup dispersion for firms within the cartel. Markup dispersion at the sectoral level, however, might increase depending on the reaction of non-cartel members.

Imperfect Collusion. The second case we consider is that of imperfect collusion where the profit weights differ from unity but are *constant* across cartel members. Regarding our micro-founded model, this is the case when firms' ownership shares are constant across different firms so that $\beta_{jk} = \beta_j$ and $\beta_{kl} = \beta_k$. These shares can vary so that $\beta_j \neq \beta_k$ as long as certain parametric restrictions are satisfied. For instance, if $\beta_j \propto \beta^{\zeta_j}$, $\beta_k \propto \beta^{\zeta_k}$ and $\zeta_j - \zeta_k = 1$, the profit weights are equal to β .²³ Markups are given by:

$$\frac{1}{\tilde{\mu}_{sk}} = \frac{\rho - 1}{\rho} + \frac{\eta - \rho}{\eta\rho} \left(\omega_{sk} + \beta \sum_{j \in \mathcal{C} \setminus \{k\}} \omega_{sj} \right) \quad (3.4.18)$$

²¹The profit weights also equal unity in this case as $\sum_l \beta_{jl} = 1$.

²²This is the case considered by Brooks et al. (2016) who study how Chinese industrial clusters affect competition.

²³We assume that $\beta \in (0, 1)$, $\zeta_j > 0$, $\zeta_k > 0$. In this case $\lambda_{kj} = \frac{\sum_l \gamma_{kl} \beta_{jl}}{\sum_l \gamma_{kl} \beta_{kl}} = \frac{\beta_j}{\beta_k} = \frac{\beta^{\zeta_j}}{\beta^{\zeta_k}} = \beta$ where the last step follows from $\zeta_j - \zeta_k = 1$.

Equation (3.4.18) generates markup dispersion as each cartel member's decision's impact on the other cartel members' profits is not fully internalized. As a result, markups depend both on a firm's own market share and the combined market share. Markup dispersion for cartel members is higher in this case than in the full collusion case, as the weights assigned to other cartel members is not necessarily equal to one.

Heterogeneous Collusion. The last case we consider is that where the weights are firm-specific. There are two interesting cases we can consider. The first one is one in which the weights are firm-specific but do not vary depending on the identity of the cartel members so that $\lambda_{kj} = \lambda_k$. This occurs under the assumption that firms l 's ownership shares on j are equal to firm k 's own ownership share, *i.e.* $\beta_{jl} = \beta_{kk}$. In this case, the profit weights are independent of j and are uniform across cartel members.²⁴ Markups of cartel members in this case are given by:

$$\frac{1}{\tilde{\mu}_{sk}} = \frac{\rho - 1}{\rho} + \frac{\eta - \rho}{\eta\rho} \left(\omega_{sk} + \lambda_k \sum_{j \in \mathcal{C} \setminus \{k\}} \omega_{sj} \right) \quad (3.4.19)$$

The second case is such that each cartel members assign a different weight to other cartel members' profits. This case is the one depicted in equation (3.4.15). This case also generates markup dispersion within the cartel.

General equilibrium. The model's equilibrium is found by solving a fixed point problem in the aggregate variables $\{\mathbf{P}, W, c, l\}$. The equilibrium exists and is unique (see [Nocke and Schutz \(2018b\)](#) for a detailed proof based on a nested fixed-point approach.) In practice, finding the numerical solution takes three steps: i) given \mathbf{P}, c, W we solve for the prices and quantities in every sector; then ii) using, in each sector, the system of K nonlinear equations (3.4.14) by substituting the expression for the market share (3.4.16); finally iii) we check that the household's first order conditions (3.4.1) holds.²⁵

²⁴In this case, we obtain $\lambda_{kj} = \frac{\sum_l \gamma_{kl} \beta_{jl}}{\sum_l \gamma_{kl} \beta_{kl}} = \frac{\beta_{kk}}{\sum_l \gamma_{kl} \beta_{kl}} = \lambda_k$ which does not depend on j .

²⁵Entry would create more complications. It would require, in order to pin down the equilibrium, to specify the order in which potential entrants with different productivity draws enter the market.

3.4.2 Aggregate Markups and Concentration

Our framework has clear implications for the impact of cartels on aggregate markups and concentration. A change in the market structure, namely from the competitive Nash-Cournot equilibrium to the cartel equilibrium entails an increase in the sectoral price index and leads to an increase in the markups of *all* firms:

Proposition 4. *An increase in the sectoral price index i) increases the markups of all firms, and ii) this increase is larger for larger non-cartel members.*

Proof. The proof follows from Lemmas 2 and 3 in Appendix 3.D.3. □

The introduction of cartels and anti-competitive behaviors generates an increase in the sectoral price index, which in turn increases the demand of individual firms. This allows them to gain market shares and charge higher markups. The framework therefore features an “umbrella pricing” effect, whereby all firms are able to increase their markups when very productive firms form a cartel. This leads to an increase in aggregate markups, consistent with recent evidence on the rise of *aggregate* markups (De Loecker and Eeckhout, 2017, 2018).

The sectoral markup can in turn be expressed simply as a harmonic average of the within and between markups weighted by the Herfindahl-Hirschman Index (HHI) ($HHI_s := \sum_{k=1}^{K_s} \omega_{sk}^2$):²⁶

$$\mu_s = \left(HHI_s \cdot \mu_\eta^{-1} + (1 - HHI_s) \cdot \mu_\rho^{-1} \right)^{-1} \quad (3.4.20)$$

The sectoral markup is determined by the elasticity of substitution across sectors (μ_η) if the firm in the sector is a monopoly ($HHI_s = 1$) and by the elasticity of substitution within firms (μ_ρ) if the sector is composed of atomistic firms ($HHI_s = 0$). Market power at the sectoral level (markups) increases with concentration as measured by the HHI index. This relationship is common in oligopoly models (Cowling and Waterson, 1976).²⁷

In the presence of a cartel, the sectoral markup can be expressed as:

$$\mu_s = \left(MHHI_s \cdot \mu_\eta^{-1} + (1 - MHHI_s) \cdot \mu_\rho^{-1} \right)^{-1} \quad (3.4.21)$$

²⁶The derivation is in Appendix 3.D.4.

²⁷Nocke and Schutz (2018a) use an aggregative games approach to show that changes in the HHI approximates the market power impact of a merger.

where the modified HHI is

$$MHHI_s = HHI_s + \underbrace{\sum_{k \in \mathcal{C}} \sum_{j \in \mathcal{C} \setminus \{k\}} \lambda_{skj} \omega_{sk} \omega_{sj}}_{>0} \quad (3.4.22)$$

Equations (3.4.20) and (3.4.21) will allow us to discipline our model to match moments on concentration observed in the French data. It will further allow us to study by how much concentration would have to decrease to reach the competitive Cournot equilibrium.

3.4.3 Aggregate Productivity

The model can be aggregated analytically. Output in this economy can be represented by an aggregate production function $Y = AL$, where A measures aggregate productivity and L is total labor employed in the economy. All aggregate quantities are nested harmonic means of the firm-level counterparts. Aggregate productivity follows from the first-order condition for the optimal use of labor combined with the labor market clearing condition:

$$A = \left[\int_0^1 \left(\sum_{k=1}^{K_s} \frac{y_{sk}}{Y} \cdot z_{sk}^{-1} \right) ds \right]^{-1} \quad (3.4.23)$$

Aggregate productivity A is a *quantity*-weighted harmonic average of firm productivities. The aggregate markup in the economy, defined as the ratio of the aggregate price to the marginal cost, $\mu_{agg} = \frac{P}{W/A}$, can similarly be expressed as a revenue-weighted harmonic mean of firm-level markups:

$$\mu_{agg} = \left[\int_0^1 \left(\sum_{k=1}^{K_s} \frac{p_{sk} y_{sk}}{PY} \cdot \mu_{sk}^{-1} \right) ds \right]^{-1} \quad (3.4.24)$$

Alternatively, aggregate productivity can be written in terms of the firm productivity levels and the relative markups

$$A = \left[\int_0^1 \left(\frac{\mu_{agg}}{\mu_s} \right)^\eta z_s^{\eta-1} di \right]^{\frac{1}{\eta-1}} \quad (3.4.25)$$

where z_s is the sector-level productivity given by:

$$z_s = \left[\sum_{k=1}^{K_s} \left(\frac{\mu_s}{\mu_{sk}} \right)^\rho z_{sk}^{\rho-1} \right]^{\frac{1}{\rho-1}} \quad (3.4.26)$$

and $\mu_s := \frac{P_s}{W/z_s}$ is the sectoral markup.

The competitive Cournot framework where the profit weights are set equal to zero exhibits markup dispersion arising from firm heterogeneity. Different producers have a different market share and therefore charge different markups. The economy is not at its first-best level: more productive firms have more market power, charge a higher markup and produce less than what is socially optimal. As a result their contribution to aggregate productivity is muted.

The exercise we are interested in consists of comparing the aggregate productivity level obtained in the presence of cartels A_{Cartel} to the one obtained in the *competitive* Nash-Cournot equilibrium featuring markup dispersion $A_{\text{Competitive}}$. Any difference between these two productivity levels therefore arises from changes in markup dispersion. This is different from the exercise done by [Edmond et al. \(2015\)](#) and [Baqae and Farhi \(2020\)](#) who are instead interested in comparing $A_{\text{Competitive}}$ to the efficient productivity level $A_{\text{Efficient}}$ obtained in the absence of markup dispersion:²⁸

$$A_{\text{Efficient}} = \left[\int_0^1 \left[\sum_{k=1}^{K_s} z_{sk}^{\rho-1} \right]^{\frac{\eta-1}{\rho-1}} di \right]^{\frac{1}{\eta-1}} \quad (3.4.27)$$

We will, however, further show how the existence of cartels distorts aggregate productivity compared to the efficient allocation.

Misallocation and welfare. Our framework also allows us to study how cartels impact the welfare of the representative consumer. The impact of cartels on welfare is pinned down by the *level* of markups. High markups reduce labor participation through the household's first-order condition:

$$-\frac{U_{l,t}}{U_{c,t}} = \frac{1}{\mu_{agg}} \frac{Y_t}{L_t} \quad (3.4.28)$$

The framework also allows us to use the HHI index as a sufficient statistic to determine the ratio of consumer surplus to total surplus, which has also been shown to be the case in the recent IO literature ([Nocke and Schutz, 2018a](#); [Spiegel, 2019](#)).

²⁸This allows [Edmond et al. \(2015\)](#) to assess the extent to which opening a country to international trade leads to pro-competitive effects.

3.5 Quantification

The key parameters determining the extent to which aggregate productivity varies in the presence of cartels are the within and across-sector elasticities of substitution ρ and η , respectively. The gap between these two parameters pin down how dispersion in market shares translates into markup dispersion. We assign a value to these parameters based on the calibration procedure of [Atkeson and Burstein \(2008\)](#) who parameterize their model to match data on trade volumes and the amount of concentration in the US. We therefore set $\rho = 10$ and $\eta = 1.01$. We further assume that the productivity parameter z follows a log-normal distribution such that $\log z \sim \mathcal{N}(0, \kappa)$ and set $\kappa = 0.385$ as in [Atkeson and Burstein \(2008\)](#). We will show that firm heterogeneity is also a key component in driving the cost of cartels. We further set the number of firms per industry to 20. The assigned parameters are displayed in [Table 3.5](#).

We illustrate the mechanics of the model in the absence of cartels. The relationship between firm-level prices and markups and productivity in the Nash-Cournot equilibrium case is displayed in [Figure 3.B.6](#). Very productive firms have lower prices as a result but charge higher markups, resulting from the fact that they have a larger market share. The sectoral price index is displayed as the blue dashed line.

To build the bridge with [Proposition 4](#) on umbrella pricing, we plot the evolution of firm-level prices and markups of all firms in a given sector in both equilibria in [Figure 3.B.7](#). This corresponds to the case of full collusion in which $\beta = 1$. Firms that never collude are depicted in blue while colluders are in red. When there is full collusion, the cartel sets the exact same markup (red crosses on the right panel) and non-cartel members set higher markups. The markup increase for non-cartel members is larger for more productive firms as argued in [Proposition 4](#). The markup rise of cartel members translates into a sectoral price increase and the most productive non cartel members rise their prices, phenomenon described as “umbrella pricing”. The case with imperfect collusion ($\beta = 0.5$) is shown in [Figure 3.B.8](#). As we can see, the rise in markups and prices of both cartel members and non-cartel members is lower than in the full collusion case, which translates into a smaller increase in the sectoral price index.

3.6 Aggregate Effects of Cartels

We present the aggregate productivity gains from dismantling cartels and reaching the Nash-Cournot equilibrium which features markup dispersion. We then discuss the

robustness of our results and discuss how possible future extensions of our framework would affect our numbers.

3.6.1 Cartels and Aggregate Productivity

The aggregate productivity loss resulting from the existence of cartels is measured by computing the percentage change difference in aggregate productivity displayed in equation (3.4.25) between the competitive Nash-Cournot equilibrium and the collusive equilibrium. We further provide results on aggregate markup changes by using the fact that $\mu_{agg} = P \times A$. We assume that labor is inelastic and that the top five firms collude in each sector in the economy. Making the top producers collude is consistent with stylized facts 3 and 4.

Harberger triangles. In his seminal article, [Harberger \(1954\)](#) finds that the loss arising from monopoly distortions amounts to 0.1% of GDP. We argue that our framework leads us to find estimates that are at least one order of magnitude higher because of two key mechanisms: the presence of firm heterogeneity and the fact that there is more markup dispersion within than across sectors. Harberger's calculation uses industry-level data and assumes a demand elasticity equal to unity. To compute the area in the triangle, Harberger uses excess profits, which he defines as the return of capital beyond an average return of about 10%. Our methodology nests and improves on Harberger's method. We show that we can correct for these sources of bias.²⁹

The first point can be illustrated graphically. Figure 3.B.9 plots the inverse demand function and marginal revenue curves that oligopolists face in our model. Marginal costs are assumed to be constant. Allowing for heterogeneity in firms' productivity levels means that the dispersion of markups matters for misallocation as argued above. As a result, the deadweight loss associated to more productive firms is larger. Failing to account for this dispersion in markups creates a downward bias in the measurement of the impact of cartels on aggregate productivity.

In the model, Assumption 2 insures that goods are more substitutable within than across sectors. This implies that in the presence of a cartel made up of top producers, firms produce less, charge higher markups and prices. Part of the demand is redirected towards less productive firms *within the sector*. This increases markup dispersion. There is, however, some reallocation that occurs across sectors as consumers shift

²⁹Of course, it must be recognized that Harberger's methodology was probably the best possible given the data limitations at his time.

towards consuming more goods from other sectors. This reallocation of demand towards potentially less distorted sectors acts as a counteracting force and can reduce the negative effect of cartels on aggregate productivity. But this force is limited by the elasticity of substitution across sectors, which is relatively low. This is shown in Figure 3.B.10.

Aggregate results. The productivity loss arising from the existence in cartels is displayed in Panel A of Table 3.6. We provide results for different values of the intensity of collusion parameter β . When there are five cartel members, productivity is 1.3% to 12.3% lower than in the competitive Nash-Cournot equilibrium. The negative impact of cartels on aggregate productivity increases with the intensity of collusion. This is because as β rises, the least productive firms of the cartel assign a higher weight to the profits of the most productive cartel members and experience a higher rise in their markups which redirects demand towards less productive non-cartel members. By a similar token, the most productive cartel members also increase their markups by a larger amount when β increases. This also contributes to redirecting demand towards less productive cartel members and non-cartel members, thereby reducing aggregate productivity. The productivity loss arising from the existence of cartels is one to two orders of magnitude higher than previously found by Harberger (1954). It is important to note that the benchmark model is the competitive Nash-Cournot equilibrium that features markup dispersion. In Panel B, we compute the difference in aggregate TFP arising from eliminating markup dispersion altogether. Not surprisingly, we obtain much larger numbers, ranging from of 8.5% to 19.6%.

Although our framework is static, we can directly see for which values of β the cartel arrangement is stable in the sense that cartel members want to be part of the cartel and non-cartel members are better off outside (d'Aspremont et al., 1983; Donsimoni et al., 1986). In the context of Table 3.6, we find that the cartel is incentive compatible in the sense that the profits of all firms increase in the presence of a cartel when $\beta = \{0.1, 0.2, 0.3, 0.4\}$.

We further investigate how cartels impact aggregate markups. As expected, cartels lead to an increase in aggregate markups, in the order of 4.5 to 10 points, starting from a value of 1.35 in the Nash-Cournot equilibrium. The presence of firms behaving anti-competitively and cartels can help account for the rise of aggregate markups observed in the US, as shown in De Loecker and Eeckhout (2017) and De Loecker and Eeckhout (2018).

Table 3.7 shows how cartel size affects aggregate productivity. We consider several

cases where 50%, 75% of all industries are cartelized, as well as the case where all industries are made up of anticompetitive firms. As shown in the first six rows, in the case where the industries are not fully cartelized, increasing the intensity of collusion leads to higher aggregate productivity losses, as in Table 3.6. When industries are fully cartelized ($K_C = 20$), meaning that the number of collusive firms is equal to the total number of firms in that industry, aggregate productivity actually *increases* compared to the competitive Nash-Cournot situation. This result stems from the fact that when all firms are part of a cartel and maximize their joint profits, their markups more closely align with each other, which reduces markup dispersion and contributes to increasing aggregate productivity. In the extreme case where $\beta = 1$, all firms in all industries charge the same markup and the economy is at its first-best aggregate productivity level, although aggregate markups explode. It is also interesting to note that when the industry is not fully cartelized, holding the collusive intensity parameter constant, there is a threshold level such that larger cartels lead to lower aggregate productivity losses. For instance, when $\beta = 0.1$, aggregate productivity is 0.7% lower than in the competitive Nash-Cournot equilibrium when half the firms in the industry collude, whereas this number is equal to 0.1% when 75% of firms collude. This result is reversed when $\beta > 0.5$. In that case, larger cartels lead to larger aggregate productivity losses compared to the competitive Nash-Cournot equilibrium.

3.6.2 Robustness

We test the sensitivity of our results to alternative parameter values, competition models and cartel types.

We show in Panel A of Table 3.8 how our results vary with the degree of firm heterogeneity. We set $\kappa = 0.01$, which corresponds to a case with considerably less heterogeneity along the productivity dimension. We find results in the order of Harberger (1954). In the presence of cartels, aggregate TFP is 0.03% to 0.6% lower than in the competitive Nash-Cournot equilibrium and the rise in markups is also lower. We further test the sensitivity of our results to changes in the elasticities of substitution ρ and η . In the baseline parameterization of the model, we set $\rho = 10$ and $\eta = 1.01$, consistent with the values used in Atkeson and Burstein (2008). Panel B of Table 3.8 shows that our results are similar, albeit smaller, when setting $\rho = 5$. Aggregate TFP in the cartel equilibrium now ranges from 0.6% to 8.3% of its level in the competitive equilibrium. This is because the gap between ρ and η closes, leading to less markup dispersion and therefore less reallocation towards less productive, not cartelized firms. Similarly, setting $\eta = 1.05$ in Panel C leads to similar results as in the case where $\rho = 5$. This

exercise illustrates that allowing for firm heterogeneity and markup dispersion within sectors are key to obtaining plausible numbers of the aggregate cost of cartels.

In our baseline results, firms compete in quantity. In Table 3.9, we instead assume that firms compete in prices, *i.e.* à la Bertrand. In this case, the demand elasticity is given by $\varepsilon_{sk}(\omega_{sk}) = \rho(1 - \omega_{sk}) + \eta\omega_{sk}$ as shown in Appendix 3.D.5. The smaller numbers obtained can be explained by the fact that markup dispersion is much lower when firms compete à la Bertrand. Our results, however, are still one order of magnitude higher than found in Harberger (1954) for values of β higher than one half.

The assumption that the top five firms of each sector collude is motivated by the empirical fact that colluders are considerably larger than non-colluders. In Table 3.10, we show how the numbers evolve when the top firm (Panel A) or top two firms (Panel B) of each sector do not collude and cartels are made up of the next top five producers. In Panel A, we obtain lower numbers ranging from a TFP loss of 0.06% to 3.3%. This is because the relatively less productive firms increase their markups which redirect some demand towards the most productive firm and leads to less markup dispersion. When the top two firms of each sector collude (Panel B), aggregate productivity in the cartel equilibrium is now *higher* than in the competitive case. The two most productive firms benefit from the existence of a cartel. However, when the collusion intensity parameter is high enough, cartel members' markups rise more which increases markup dispersion, leading to a lower TFP. This exercise shows that very productive cartels are the ones that generate a distortion. The value of the collusion intensity parameter β is the key parameter that determines the extent of markup dispersion. The results presented in Table 3.10 are illustrative, however, as they are not consistent with Stylized facts 3 and 4.

3.6.3 Discussion

We discuss several interesting possible extensions of our analysis.

First, we abstract from input-output (I-O) network linkages. Cartelized industries will lead to higher prices in downstream industries, which in turn translates into higher prices in other downstream industries etc. The increase in the cost of production in downstream industries is absorbed, however, through a reduction in markups. This might result in lower markup dispersion and therefore a lower cost of cartels if more productive firms in non-cartelized industries increase their prices relatively less than less productive firms. Allowing for I-O linkages in the vein of Grassi (2018) is an interesting extension to consider.

Second, we have relied on marginal costs being constant. Allowing marginal costs to be increasing and sufficiently upward sloping,³⁰ would lead to a higher dead-weight loss. The impact on misallocation is more subtle: the cost of cartels now depends on the extent to which the output of more efficient producers varies with respect to the constant marginal costs case. It is possible that markup dispersion would be dampened by the cost structure, yielding a lower cost of cartels. The quantitative implications of the cost structure remain to be studied.

Finally, labor is assumed to be supplied inelastically. Allowing labor to be supplied elastically would also lead to changes in *welfare*. Higher markups caused by cartels decrease the amount of labor supplied, decreasing the amount of output produced. The *level* of markups acts like a distortionary tax that affects the consumption-leisure trade-off.³¹ Dismantling cartels therefore increases welfare.

3.7 Conclusion

We study the impact of market structure distortions arising from cartelization on aggregate productivity.

We use new firm-level data to document the pervasiveness and importance of cartels and anticompetitive behaviors in France. Importantly, we provide evidence that cartels are widely spread across sectors and that they are formed by very large and productive firms.

We develop a tractable macroeconomic framework with heterogeneous firms, endogenous markups and cartels. In the model, collusive practices distort firms' markups and reallocate demand towards less productive firms, which increases misallocation and decreases aggregate productivity. We find that the cost of cartels is high. Specifically, dismantling cartels would raise aggregate TFP by 1% to 12%, depending on the degree of collusion intensity. We show that firm heterogeneity and markup dispersion within sectors are key to finding these results. This explains why the aggregate cost of cartels is likely to be at least one order of magnitude higher than previously found in [Harberger \(1954\)](#). Our framework also contributes to explaining the rise of aggregate markups.

Finally, our results are likely to understate the true cost of cartels on TFP. Indeed, the

³⁰[Almunia et al. \(2018\)](#) provide recent evidence that the drop in domestic demand experienced in Spain during the Great Recession lead to a considerable boost in exports, which is consistent with *increasing* marginal costs.

³¹[Edmond et al. \(2018\)](#) find that this is the most important determinant of welfare costs.

focus of our article is on the *static* cost of cartels. Cartels may impose or reinforce barriers to entry, thereby preventing productive firms from entering an industry. They may also reduce the incentive to invest in research and development and innovate. These important questions are left for future research.

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3.A Tables

Table 3.1: Characteristics of Cartels

	Mean (1)	Std. Dev. (2)	Median (3)	Min (4)	Max (5)
Duration (years)	3.9	4.5	3	1	47
# Firms per cartel	6.3	7.4	4	2	76
Price fixing	0.35	0.48	0	0	1
Market allocation	0.29	0.46	0	0	1
Production quotas	0.04	0.2	0	0	1
Information sharing	0.59	0.49	1	0	1
Repeat offender	0.08	0.27	0	0	1
Bid rigging	0.40	0.49	0	0	1
Dominant leader	0.04	0.2	0	0	1
Abuse of dominant position	0.03	0.18	0	0	1
Guaranteed buy-backs	0.07	0.25	0	0	1
Exclusive dealing contracts	0.18	0.38	0	0	1
# Cartels			174		
# Colluders			1,037		

Notes: The table displays some important characteristics of cartels, using the firm-level database detailed in Appendix 3.C.2. We only consider the decision files involving at least two firms over the period 1994-2007. The duration of the cartel is expressed in years but can be less than a year, in which case it is rounded to one year. The variables price fixing, market allocation, etc., are dummy variables.

Table 3.2: Cartels across Sectors

NAF	Sector	Sales Share (%)	VA Share (%)	# Colluding Firms	Cartel Mkt Share (%)
01-05	Agriculture, hunting, forestry, fishing	0.13	0.19	0	X
10-14	Mining and quarrying	0.33	0.47	6	1.6
15-16	Food products, beverages and tobacco	5.54	5.35	45	6.03
17-19	Textiles, leather and footwear	1.41	1.49	1	X
20	Wood and wood products	0.48	0.51	11	3.28
21-22	Pulp, paper, publishing and printing	2.28	2.62	16	2.56
23	Coke	2.37	2.63	4	73.62
24	Chemicals	4.35	4.04	27	9.96
25	Rubber and plastics	1.52	1.69	5	1.07
26	Other non-metallic mineral prod.	1.09	1.34	30	8.31
27-28	Basic metals and fabricated metal prod.	3.62	4.12	31	1.14
29	Machinery and equipment n.e.c.	2.5	2.65	19	5.77
30-33	Electrical and optical equipment	3.79	4.12	21	2.8
34-35	Transport equipment	5.32	4.06	3	X
36-37	Other manufacturing n.e.c	1.02	1.07	6	0.34
40-41	Electricity, gas and water supply	2.85	4.24	3	X
45	Construction	5.99	7.62	197	7.47
50-52	Wholesale and retail	35.18	18.73	258	1.48
55	Hotels and restaurants	2	3.14	8	1.29
60-63	Transport and storage	4.74	5.56	141	5.44
64	Post and telecommunications	2.39	4.94	8	87.71
70	Real estate activities	1.41	2.25	9	0.03
71-74	Renting and business activities	7.39	12.8	92	0.87
80	Education	0.16	0.31	0	X
85	Health and social work	0.81	1.64	31	0.11
90-93	Other service activities	1.74	3.05	26	3.5

Notes: The sales share column represents sector-level sales in total sales over the period 1994-2015. The VA share column represents sector-level value-added in total value-added over the period 1994-2015. The values displayed for the number of collusions are averages over the period 1994-2015. The last column displays the cumulative market share of cartel members in their sector. A few statistics in the last column cannot be reported when the number of cartel members is less than four for confidentiality reasons.

Table 3.3: Colluders are Larger

	Colluding Firms				Non Colluding Firms			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Market Share (%)	3.43	10.79	0	100	0.07	0.92	0	100
Sales	295,277	1,851,776	10	36,700,000	2,070	56,499	1	45,600,000
Value-added	118,799	988,271	4	18,400,000	599	14,206	1	9,926,973
ln Labor Productivity	3.87	0.65	0.097	8.36	3.49	0.64	-2.8	9.52
Labor	1402	13,014	1	295,030	12	156	1	86,587
ln Wage	3.6	0.4	0.61	7.45	3.2	0.6	-2.4	8.6
ln Capital/Labor ratio	2.25	1.25	-2.04	6.47	1.71	1.24	-2.16	10.3
Intermediates	181,175	1,055,268	4	28,900,000	1479	45,876	1	39,800,000
# Obs.		10,721				12,441,919		
# Firms		907				2,167,168		
# Exporters		613				232,316		

Notes: The values displayed are for the period 1994-2015. Sales and value-added are in thousands of euros. Labor productivity is real value-added (deflated by 2-digit price indices) divided by the number of workers. Labor is the number of workers. The capital-labor ratio is expressed in real terms where capital has been deflated. Intermediates is the value of expenditures on intermediate goods in thousands of euros.

Table 3.4: Heterogeneity within Ten Large Cartels

Cartel (decision number)	07d47 (1)	08d12 (2)	08d32 (3)	11d17 (4)	12d09 (5)	13d12 (6)	14d19 (7)	14d20 (8)	15d03 (9)	15d19 (10)
75/25 Sales	15.3	6.2	12.7	1.4	5.1	17.3	13.8	1.6	1.6	2.8
90/50 Sales	3.6	4.4	14.7	1.2	4.2	6.3	3	2.2	1.9	3.5
90/10 Sales	18.6	63.2	76	1.5	10.6	96.2	1000	3.7	38.4	28.4
75/25 Value-added	7.1	3.3	3.8	1.5	5.3	14.9	18	2.4	5.8	3.1
90/50 Value-added	2.9	3.5	12.3	1.1	6.1	6.2	6	3.1	5.1	3.6
90/10 Value-added	7.7	14.5	39	2.2	23.7	183.9	191	6.1	12.3	23.8
75/25 ln Labor productivity	1.07	1.21	1.16	1.07	1.07	1.11	1.17	1.12	1.07	1.07
90/50 ln Labor productivity	1.06	1.22	1.19	1.05	1.05	1.04	1.11	1.06	1.2	1.08
90/10 ln Labor productivity	1.15	1.2	1.23	1.11	1.1	1.2	1.25	1.46	1.37	1.13
# Firms in cartel	13	7	12	4	17	7	13	7	11	21
# Matched firms	11	7	11	4	7	5	11	5	5	17

Notes: The figures are obtained by taking the firm mean of sales, value-added and labor productivity. We then compute the relevant ratios for each cartel case. Sales and value-added are in thousand of euros while labor productivity is the ratio of value-added to the number of employees deflated by 2-digit price indices.

Table 3.5: Baseline Parameterization

<i>Assigned Parameters</i>		
ρ	10	Within-sector elasticity of substitution
η	1.01	Across-sector elasticity of substitution
κ	0.385	Log-normal distribution parameter
K	20	Number of firms per sector

Notes: The parameters assigned are taken from [Atkeson and Burstein \(2008\)](#).

Table 3.6: Baseline Results

Collusion Intensity Parameter	$\beta = 0.1$	$\beta = 0.2$	$\beta = 0.3$	$\beta = 0.4$	$\beta = 0.5$	$\beta = 0.6$	$\beta = 0.7$	$\beta = 0.8$	$\beta = 0.9$	Full collusion
<i>Panel A. Cartel equilibrium versus competitive Nash-Cournot</i>										
Δ TFP (in %)	-1.28	-2.82	-4.43	-5.99	-7.42	-8.70	-9.82	-10.79	-11.63	-12.33
Δ Aggregate markups (in points)	4.52	7.44	9.16	10.09	10.53	10.68	10.66	10.53	10.33	10.09
<i>Panel B. Cartel equilibrium versus efficient allocation</i>										
Δ TFP (in %)	-8.54	-10.08	-11.70	-13.25	-14.68	-15.96	-17.08	-18.06	-18.89	-19.59

Notes: The table displays the aggregate productivity gains and the change (in points) in aggregate markups resulting from going from the cartel equilibrium to the competitive Nash-Cournot equilibrium in Panel A ($\beta = 0$) and to the efficient allocation without markup dispersion (Panel B). The top 5 firms of each sector are assumed to collude. Each column represents a different value of the intensity of collusion parameter β . There is full collusion, *i.e.* full joint profit maximization when $\beta = 1$. The assigned parameters are displayed in Table 3.5. Aggregate markups are equal to 1.35 in the Nash-Cournot equilibrium.

Table 3.7: Cartel Size and Aggregate Productivity

Collusion Intensity Parameter	$\beta = 0.1$	$\beta = 0.2$	$\beta = 0.3$	$\beta = 0.4$	$\beta = 0.5$	$\beta = 0.6$	$\beta = 0.7$	$\beta = 0.8$	$\beta = 0.9$	Full collusion
<i>Panel A. Cartel equilibrium versus competitive Nash-Cournot ($K_C = 10$)</i>										
Δ TFP (in %)	-0.65	-2.16	-4.63	-7.70	-10.91	-13.91	-16.57	-18.85	-20.75	-22.29
Δ Aggregate markups (in points)	11.41	21.26	27.98	31.43	32.58	32.48	31.78	30.87	29.90	28.94
<i>Panel B. Cartel equilibrium versus competitive Nash-Cournot ($K_C = 15$)</i>										
Δ TFP (in %)	-0.09	-0.48	-1.68	-4.42	-8.80	-14.02	-19.16	-23.72	-27.52	-30.48
Δ Aggregate markups (in points)	14.35	30.95	48.25	62.62	70.83	73.25	72.41	70.32	67.97	65.71
<i>Panel C. Cartel equilibrium versus competitive Nash-Cournot ($K_C = 20$)</i>										
Δ TFP (in %)	0.01	0.02	0.03	0.05	0.08	0.12	0.18	0.30	0.65	7.26
Δ Aggregate markups (in points)	14.80	33.25	56.87	88.22	131.81	196.54	302.75	509.06	1083.03	9964.99

Notes: The table displays the aggregate productivity gains and the change (in points) in aggregate markups resulting from going from the cartel equilibrium to the competitive Nash-Cournot equilibrium ($\beta = 0$). Each column represents a different value of the intensity of collusion parameter β . Each panel displays the results for different number of colluding firms. Colluders are the top firms in each industry. The assigned parameters are displayed in Table 3.5. Aggregate markups are equal to 1.35 in the Nash-Cournot equilibrium.

Table 3.8: Robustness: Alternative Parameter Values

Collusion Intensity Parameter	$\beta = 0.1$	$\beta = 0.2$	$\beta = 0.3$	$\beta = 0.4$	$\beta = 0.5$	$\beta = 0.6$	$\beta = 0.7$	$\beta = 0.8$	$\beta = 0.9$	Full collusion
<i>Panel A. Homogeneous firms ($\kappa = 0.01$)</i>										
Δ TFP (in %)	-0.03	-0.09	-0.15	-0.22	-0.29	-0.36	-0.43	-0.50	-0.57	-0.63
Δ Aggregate markups (in points)	0.58	1.01	1.33	1.59	1.80	1.96	2.10	2.21	2.31	2.38
<i>Panel B. $\rho = 5$</i>										
Δ TFP (in %)	-0.63	-1.41	-2.27	-3.18	-4.10	-5.01	-5.89	-6.73	-7.53	-8.29
Δ Aggregate markups (in points)	3.38	6.01	8.01	9.49	10.57	11.34	11.87	12.22	12.43	12.52
<i>Panel C. $\eta = 1.5$</i>										
Δ TFP (in %)	-0.46	-1.11	-1.93	-2.85	-3.81	-4.75	-5.66	-6.49	-7.26	-7.94
Δ Aggregate markups (in points)	3.95	7.15	9.60	11.38	12.60	13.39	13.87	14.11	14.18	14.12

Notes: The top 5 firms of each sector are assumed to collude in all Panels. Each column displays the aggregate productivity gains and the percentage point in aggregate markups resulting from going from the cartel equilibrium to the competitive Nash-Cournot equilibrium. Each column represents a different value of the intensity of collusion parameter β . The assigned parameters are displayed in Table 3.5. Aggregate markups are equal to 1.35 in the Nash-Cournot equilibrium.

Table 3.9: Robustness: Bertrand Competition

Collusion Intensity Parameter	$\beta = 0.1$	$\beta = 0.2$	$\beta = 0.3$	$\beta = 0.4$	$\beta = 0.5$	$\beta = 0.6$	$\beta = 0.7$	$\beta = 0.8$	$\beta = 0.9$	Full collusion
Δ TFP (in %)	-0.12	-0.26	-0.45	-0.68	-0.98	-1.37	-1.86	-2.42	-3.00	-3.60
Δ Aggregate markups (in points)	1.33	2.86	4.61	6.61	8.84	11.23	13.65	15.84	17.58	18.62

Notes: The table displays the aggregate productivity gains and the change (in points) in aggregate markups resulting from going from the cartel equilibrium to the competitive Nash-Bertrand equilibrium ($\beta = 0$). The top 5 firms of each sector are assumed to collude. Each column represents a different value of the intensity of collusion parameter β . There is full collusion, *i.e.* full joint profit maximization when $\beta = 1$. The assigned parameters are displayed in Table 3.5. Aggregate markups are equal to 1.2 in the Nash-Bertrand equilibrium.

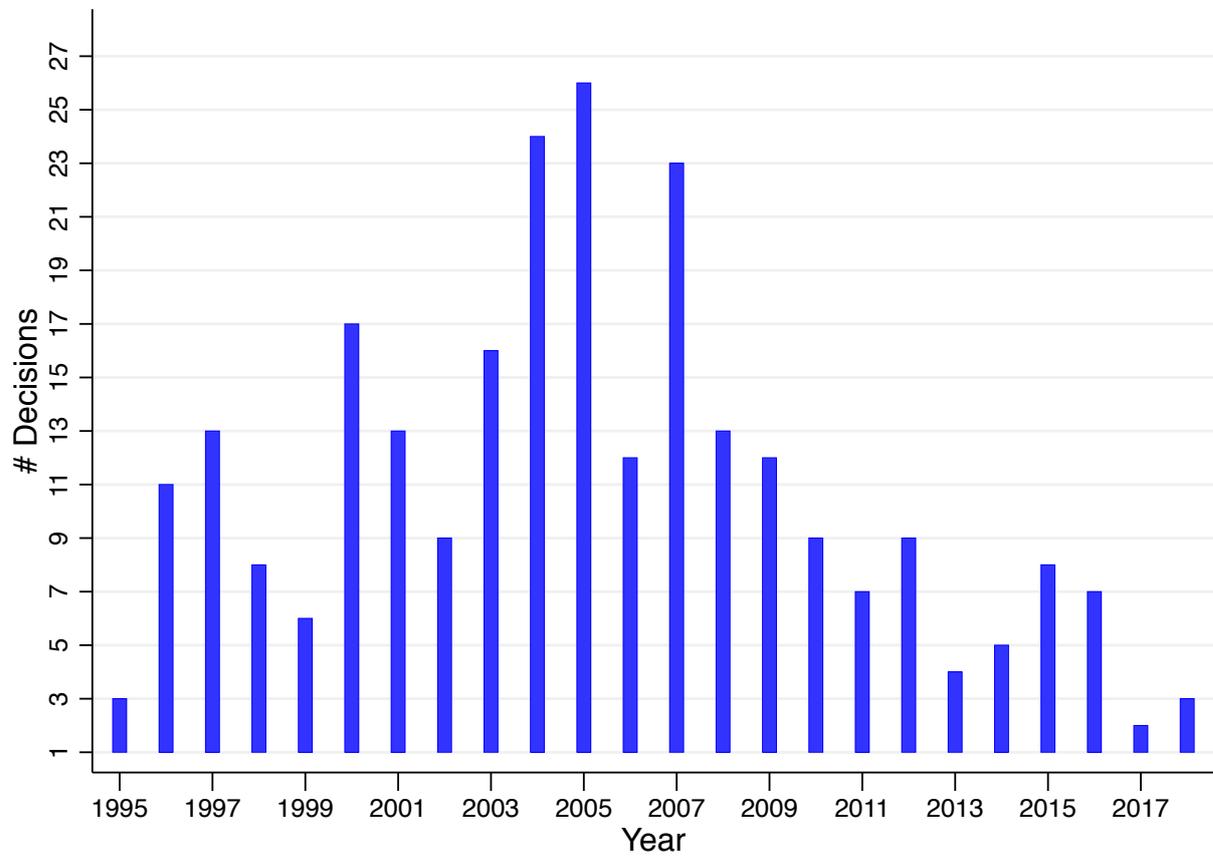
Table 3.10: Robustness: Less Productive Cartels

Collusion Intensity Parameter	$\beta = 0.1$	$\beta = 0.2$	$\beta = 0.3$	$\beta = 0.4$	$\beta = 0.5$	$\beta = 0.6$	$\beta = 0.7$	$\beta = 0.8$	$\beta = 0.9$	Full collusion
<i>Panel A. Top firm does not collude</i>										
Δ TFP (in %)	-0.06	-0.27	-0.59	-0.97	-1.37	-1.78	-2.19	-2.58	-2.94	-3.29
Δ Aggregate markups (in points)	3.63	6.46	8.63	10.29	11.56	12.53	13.26	13.82	14.23	14.51
<i>Panel B. Top 2 firms do not collude</i>										
Δ TFP (in %)	0.22	0.33	0.37	0.36	0.31	0.25	0.16	0.07	-0.03	-0.14
Δ Aggregate markups (in points)	2.52	4.55	6.21	7.56	8.68	9.61	10.39	11.03	11.58	12.03

Notes: The top 5 firms of each sector are assumed to collude in all Panels. Each column displays the aggregate productivity gains and the percentage point in aggregate markups resulting from going from the cartel equilibrium to the competitive Nash-Cournot equilibrium. Each column represents a different value of the intensity of collusion parameter β . The assigned parameters are displayed in Table 3.5. Aggregate markups are equal to 1.35 in the Nash-Cournot equilibrium.

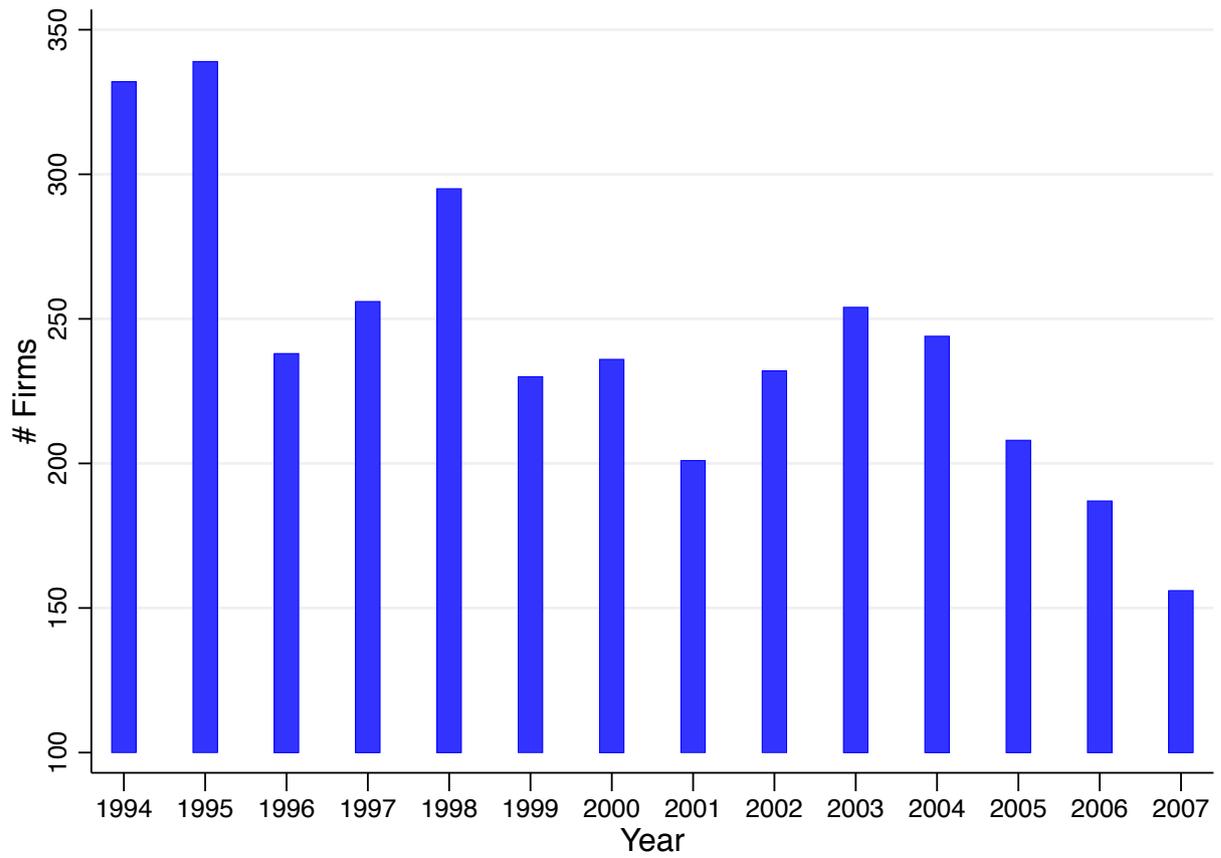
3.B Figures

Figure 3.B.1: Number of Decisions per Year



Data Source: Authors.

Figure 3.B.2: Number of Anti-competitive Firms per Year



Data Source: Authors.

Figure 3.B.3: Example of Decision File (17d20): Firms' Identity

DÉCISION

Article 1^{er} : Il est établi que les sociétés Tarkett France, Tarkett, Tarkett AB et Tarkett Holding GmbH, Forbo Sarlino, Forbo Participations et Forbo Holding LTD, Gerflor SAS, Midfloor SAS et Topfloor SAS et le syndicat français des enducteurs calandriers et fabricants de revêtements de sols et murs (SFEC) ont enfreint les dispositions de l'article L. 420-1 du code de commerce et du paragraphe 1 de l'article 101 du traité sur le fonctionnement de l'Union européenne en mettant en œuvre les pratiques visées par les trois griefs exposés au paragraphe 408.

Article 2 : À ce titre, sont infligées les sanctions pécuniaires suivantes :

- à la société Tarkett France, en tant qu'auteur et solidairement avec les sociétés Tarkett, Tarkett AB et Tarkett Holding GmbH, en leur qualité de sociétés mères, une sanction d'un montant de cent soixante-cinq millions d'euros (165 000 000 d'euros) ;

- à la société Forbo Sarlino, en tant qu'auteur et solidairement avec les sociétés Forbo Participations et Forbo Holding LTD, en leur qualité de sociétés mères, une sanction d'un montant de soixante-quinze millions d'euros (75 000 000 d'euros) ;

- à la société Gerflor SAS, en tant qu'auteur et solidairement avec les sociétés Midfloor SAS et Topfloor SAS en leur qualité de sociétés mères, une sanction d'un montant de soixante-deux millions d'euros (62 000 000 d'euros) ;

- au SFEC, en tant qu'auteur, une sanction d'un montant de de trois cent mille euros (300 000 euros).

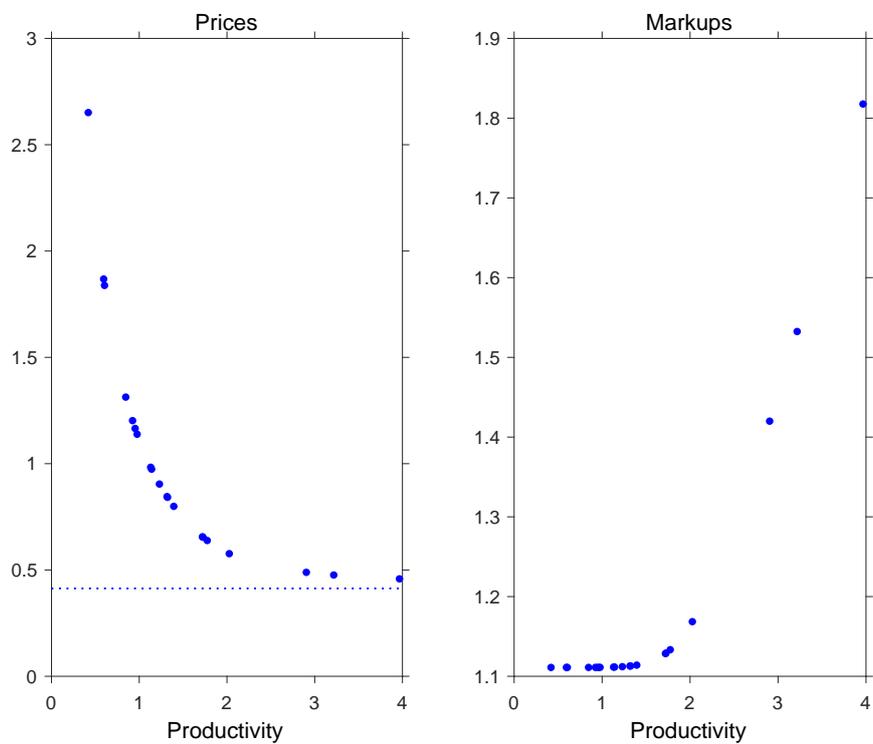
Figure 3.B.4: Example of Decision File (17d20): Duration of Cartel

430. Ces accords et pratiques concertées constituent, par conséquent, une entente unique, complexe et continue dans le secteur de la fabrication et de la commercialisation des revêtements de sols résilients à laquelle Forbo, Gerflor et Tarkett ont participé, de manière continue, entre le 8 octobre 2001 et le 22 septembre 2011.

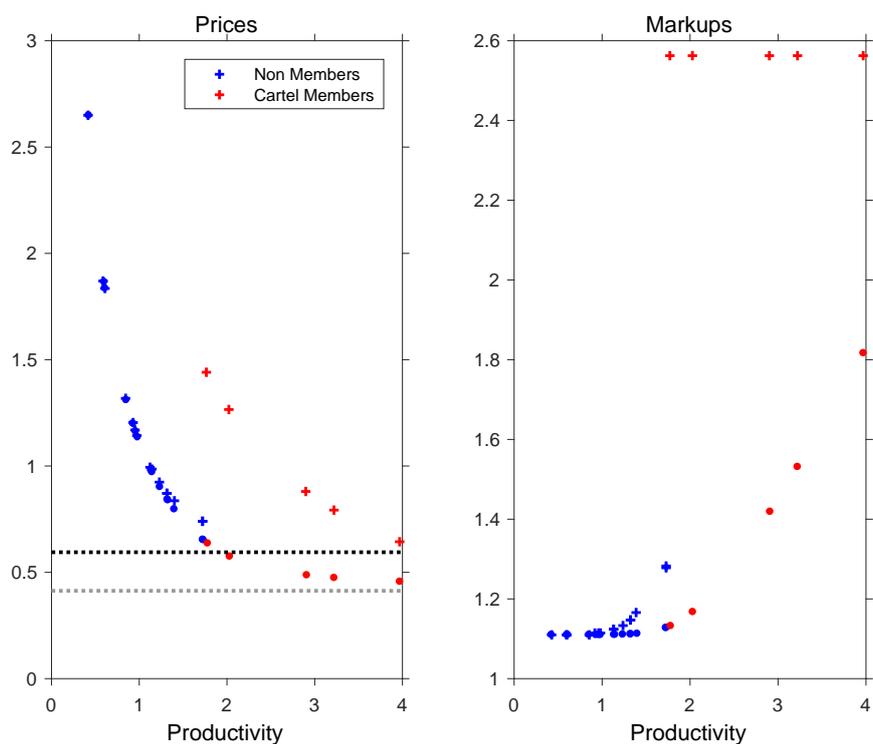
Figure 3.B.5: Example of Decision File (17d20): Type of Infringement

435. Il résulte de ce qui précède, que ces échanges d'informations, mis en œuvre entre 1990 et la fin de l'année 2013, ont été de nature à restreindre la concurrence, en violation du premier paragraphe de l'article 101 du TFUE et de l'article L. 420-1 du code de commerce.

Figure 3.B.6: Prices and Markups (Nash-Cournot equilibrium)

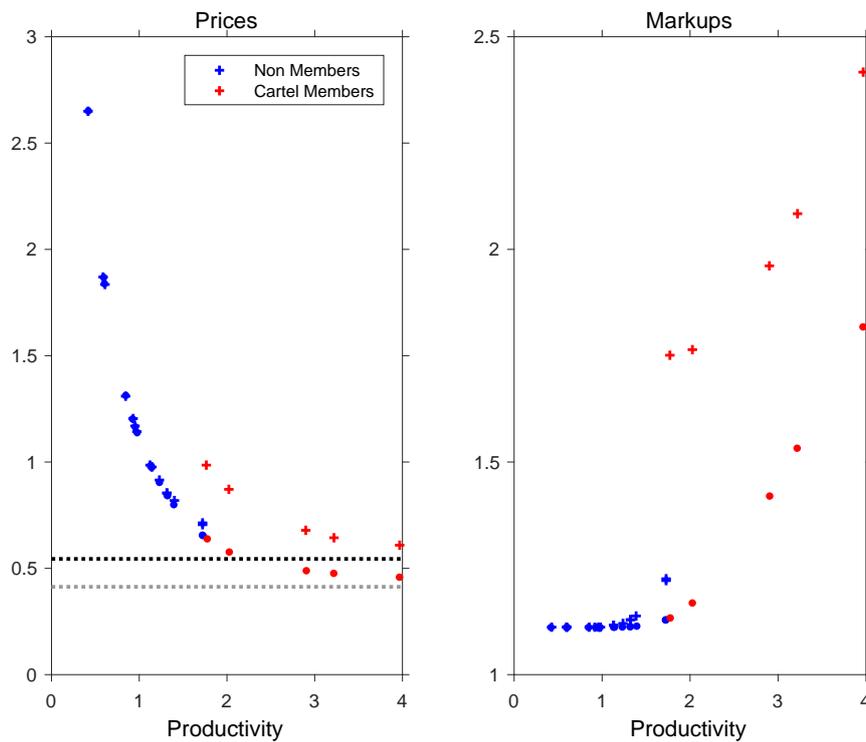


Notes: The figure displays firm-level prices and firm-level markups as a function of productivity in a given sector (Nash-Cournot equilibrium). The sectoral price index is displayed as a dashed line on the left panel.

Figure 3.B.7: Prices and Markups (Full Collusion)

Notes: The figure displays firm-level prices and firm-level markups as a function of productivity in a given sector in the presence of a cartel ($K_C = 5$ and $\beta = 1$). Firms in the Nash-Cournot equilibrium are represented by dots and crosses in the cartel equilibrium. Red (blue) firms are (non) cartel members. The sectoral price index in the Nash-Cournot (cartel) equilibrium is displayed as a grey (black) dashed line on the left panel.

Figure 3.B.8: Prices and Markups (Imperfect Collusion)



Notes: The figure displays firm-level prices and firm-level markups as a function of productivity in a given sector in the presence of a cartel ($K_C = 5$ and $\beta = 0.5$). Firms in the Nash-Cournot equilibrium are represented by dots and crosses in the cartel equilibrium. Red (blue) firms are (non) cartel members. The sectoral price index in the Nash-Cournot (cartel) equilibrium is displayed as a grey (black) dashed line on the left panel.

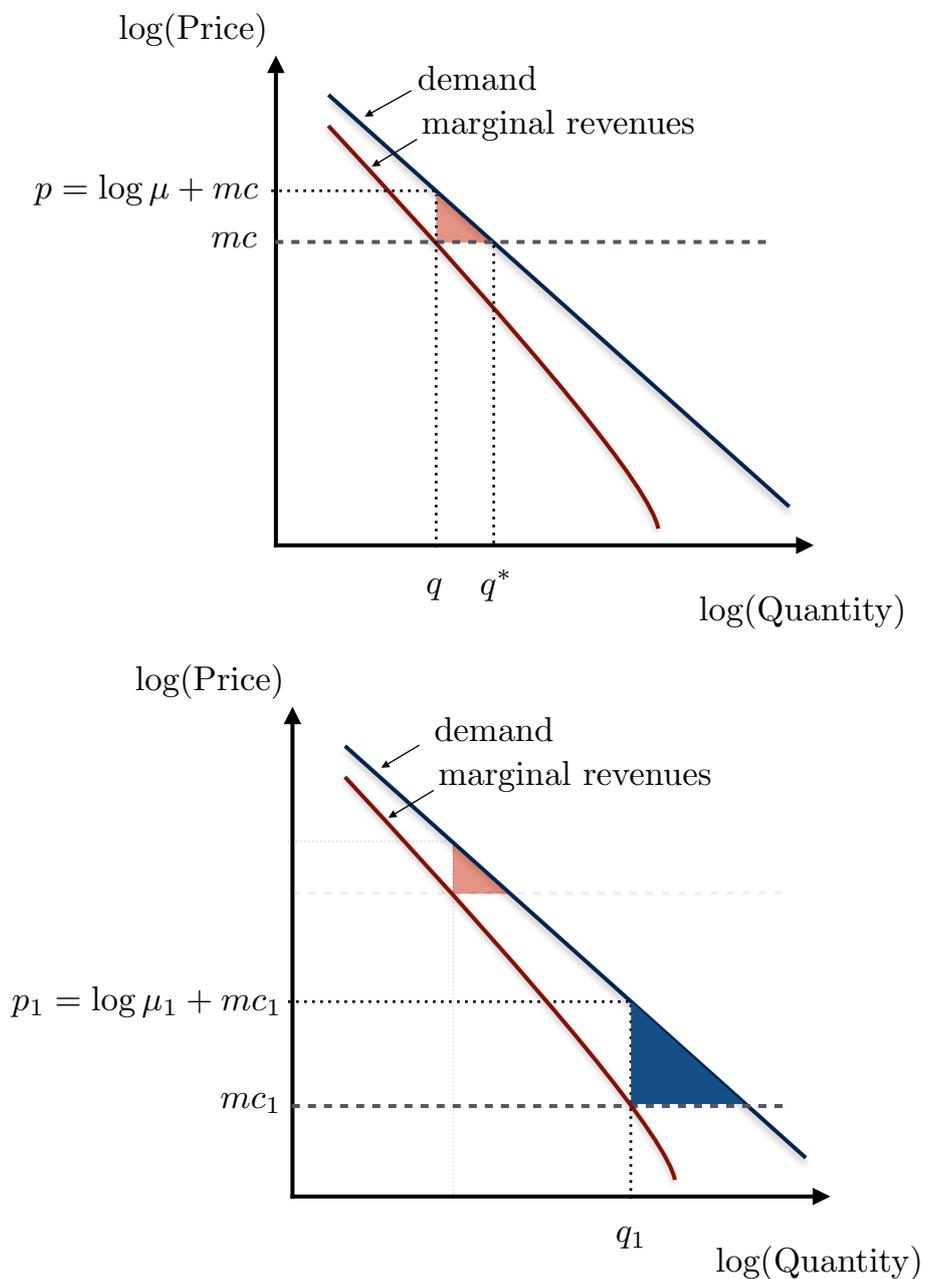


Figure 3.B.9: Deadweight Loss Triangles with Firm Heterogeneity

Notes: The top panel depicts the welfare loss due to the market power of a generic firm. The equation for the inverse demand for firm k in sector i is $P_{sk} = q_{sk}^{-\frac{1}{\rho}} \cdot P_s \cdot y_s^{\frac{1}{\rho} - \frac{1}{\eta}} \cdot c^{\frac{1}{\eta}}$, which is log linear at the first order. The bottom panel shows that more productive firms have a lower marginal cost but also command higher markups. Their market-power therefore create a larger welfare loss.

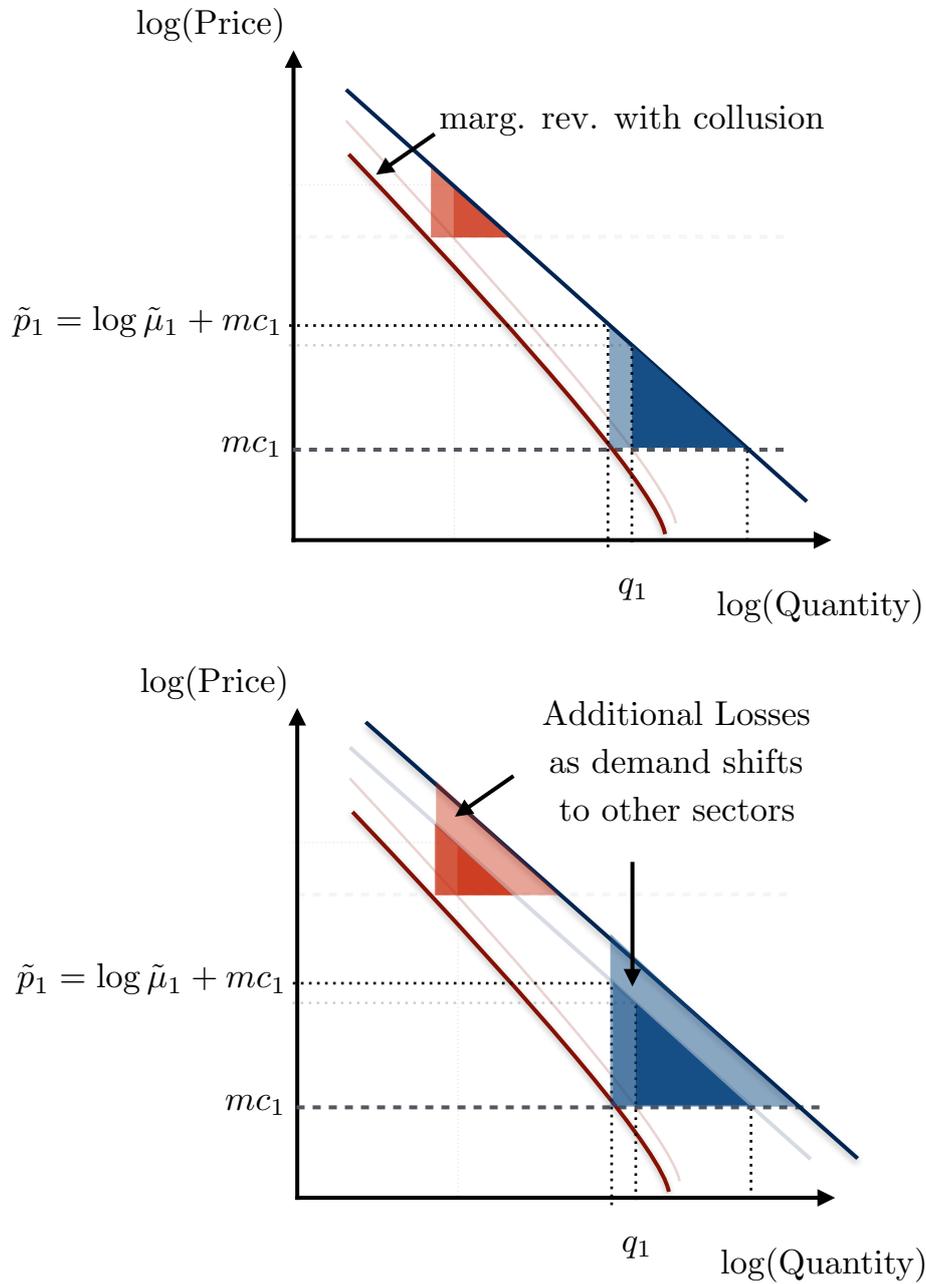


Figure 3.B.10: Effect of Cartels on Deadweight Loss Triangles in General Equilibrium

Cartels raise markups – the demand curve shifts down for cartel members, and lower demands as the relative price of the sector rises.

3.C Data Appendix

3.C.1 Institutional Background

Despite a strong tradition in industrial policy, antitrust regulation in France has a relatively short formal history. It can be roughly simplified into four periods, during which the competition regulator changed its name several times, and saw its mission successively specified and broadened. First established in 1953,³² the French Technical Commission for Collusions and Dominant Positions' main goal was the fight against cartels and widespread price fixing in post-war France. In 1963, the Commission's objectives were extended to allow the formal investigation of cases of dominant positions.³³ In practice, this Commission would directly notify the Economic Ministry, which would then decide whether to impose fines.

Following the 1973 oil crisis, Prime Minister Raymond Barre and also an economics professor, advocated a stronger control of price fixing arising from anti-competitive behaviors. In 1977, the Commission became the Competition Commission (*Commission de la Concurrence*). In parallel of its mandate of detecting cartel and abuse of dominant positions, the Commission was to advise the French government on all competition-related matters, including on vertical and horizontal mergers and acquisitions.

The period 1986 to 2009 is important as it spans the beginning of our empirical analysis. Over this period, the Commission undergoes important transformations: its name is changed to the Competition Council (*Conseil de la Concurrence*) and the 1986 Ordinance introduces several changes. Companies can directly refer cases to the Council. Moreover, the antitrust body becomes more independent, better protects concerned parties' rights and is now able to directly fine the firms found guilty of anti-competitive practices, though this does not apply to merger projects. The 2001 New Economic Regulation Law further introduces leniency and transaction programs to better detect and fight cartels.³⁴

Finally, as of 2008, the Competition Council turns into the Competition Authority (*Autorité de la Concurrence* or ADLC, henceforth). The 2008 Law on the Modernization of Economy not only gives the right to the Authority to review merger and acquisitions independently from the Minister of Economy, but also to investigate potential anti-

³²Décret n°53-704 du 9 août 1953.

³³Loi n°63-628 du 2 juillet 1963.

³⁴A firm part of a cartel can go to the authority and report it. Under specific circumstances the firm will receive a more lenient fine than the other members of the cartels or not be fined at all. Large cartels dismantled through a leniency program can be found [here](#).

competitive cases on its own.

3.C.2 Firm-level Database on Cartels

In order to extract information on the identity of the firms fined by the ADLC we proceed as follows. First, we scrape the website of the ADLC to recover all the decision files over the period 1994-2019. These PDF documents contain information on the situation of the market impacted by anti-competitive behaviors, the notification date of the case to the ADLC, the names of the firms fined for anti-competitive behaviors, the types of infraction they committed, their sales and the duration of the infraction. Some of these files contain information on when the firms were notified by the ADLC that an investigation is going to be launched. Extracting and getting data on the identity of these anti-competitive companies is straightforward to the extent that the layout is relatively similar across decision files. A salient and important example is that of the companies' name which always appear at the end of the PDF right after the word *Décide* ("Decides").

Second, we use Python's textual analysis tools to back out the name of these companies, their sales, the date when the ADLC was first notified of the infraction and the corresponding amount of the fine for each firm. This step requires some manual cleaning as some companies, numbers and cases are misreported. We therefore go through all the files to complement the information extracted from the textual analysis and double check that our newly created dataset is not missing anything that would appear in the original PDF files but that we would miss via the textual analysis exercise. At this stage, the dataset is informative about the identity (name) of the firms that were fined by the French Antitrust Authority, their sales, the case number of the decision, the amount of the fine for each firm and the notification date of the case to the ADLC.

Third, we make use of Orbis and Python to recover information on the identification number of the firms which will then allow us to match our database to the balance-sheets data. To do so, we upload our temporary database into the Batch Search engine of Orbis to look for the SIREN number of each firm given its name. We complement this information with a Python script that allows us to obtain the SIREN number of firms based on a Bing search of that firm's name.³⁵ Although these methods are imperfect, they facilitate the matching with FICUS-FARE.

Finally, before matching our database with FICUS-FARE, we manually verify that the SIREN numbers obtained from Orbis and from our scraping procedure are correct. We

³⁵We thank Arthur Guillouzouic Le Corff for sharing his code.

do so by making sure that the sales (in euros) of the firm in our database correspond to those reported in FICUS-FARE. For the firms that were not matched by any means in our third step, we manually search for them in FICUS-FARE using the information on their sales and add their SIREN number directly in our database.

3.C.3 List of Variables

We describe below the different variables used in our empirical framework. Note that our main sample consists of observations with strictly positive values for gross value-added, total and domestic sales, number of employees, labor compensation, expenditures on materials and capital.

- **Anti-Competitive Industry:** For each 5-digit industry in a given year, we count the total number of colluding firms and create a dummy variable equal to one if there is at least one firm in that industry. We choose a value equal to one because firms can abuse their dominant position. *Source: Moreau-Panon database*
- **APE Code:** 5-digit industry code. Before 2008, APE codes are available in a 4-digit format corresponding to the NAF Rev. 1 classification. We convert all these NAF Rev. 1 codes into Naf Rev. 2 codes using a correspondence table available on the INSEE website. Our matching procedure is such that each of the 712 NAF Rev. 1 APE code is assigned to one NAF Rev. 2 APE code. Our code is available upon request. *Source: FICUS-FARE and authors' calculation*
- **Capital:** Net book value of capital. We cannot build a capital measure using the perpetual inventory method as there is a break between FICUS and FARE and no data on investments is reported in 2008. We further deflate capital expenditures by sector-level price indices from EUKLEMS (Jäger, 2017). *Source: FICUS-FARE and authors' calculation*
- **Colluder:** Dummy variable that takes the value one if the firm engaged in anti-competitive practices in a given year. *Source: Moreau-Panon database*
- **Employment:** Total number of employees working in each firm. *Source: FICUS-FARE*
- **Export Sales:** Export sales reported by the firm in thousands of euros. This variable is available in the fiscal files and is highly correlated (correlation coefficient above 0.9) with total export sales computed from the customs data. Firms are classified as exporters if they sell a positive amount abroad according to the customs. *Source: Customs data and FICUS-FARE*

- **Gross Value-Added:** This variable is directly available in FICUS-FARE and follows the accounting definition according to which it is equal to total sales minus input expenses taking into account changes in inventories. *Source: FICUS-FARE*
- **Labor Compensation:** This variable is the sum of two components separately available in the fiscal files: salaries and social benefits that are paid by the employer and that benefit the worker in the form of retirement funds, social security funds etc. *Source: FICUS-FARE*
- **Market Shares:** A firm's market share is defined at the 5-digit level. We compute market shares by dividing a firm's total sales by the total amount sold by all the firms operating in the same market at a point in time. *Source: FICUS-FARE and authors' calculation*
- **Materials:** Materials are defined as the sum of expenditures on raw materials, final goods and other categories. We further deflate this expenditure variable by 2-digit sector intermediate goods price indices from EUKLEMS. *Source: FICUS-FARE and authors' calculation*
- **NAF Code:** 2-digit sector code according to the NACE Rev. 2 classification. Some sectors are pooled together, depending to the availability of sector-price deflators. *Source: FICUS-FARE*
- **Total Sales:** Total sales (domestic sales plus export sales) reported by the firm in thousands of euros. *Source: FICUS-FARE*
- **Wages:** Firm-level wages are obtained by dividing labor compensation by employment. *Source: FICUS-FARE and authors' calculation*

Market definition. We use both 2-digit and 4-digit industry classification. In the FICUS dataset, each firm is assigned a 4-digit principal activity code ("Code APE") by the INSEE and whose aim is to pin down in which industry the firm mostly operates. Because the precise breakdown of sales across products is not available for the French data, the relevant market for a firm is its 4-digit industry code. Therefore, throughout the paper, we will denote a firm's market share by its market share in the relevant 4-digit industry code. Our definition of sector follows the NAF Rev. 1 classification.

3.D Mathematical Appendix

3.D.1 Proof of Proposition 1

This section shows how to obtain the equilibrium prices given in equation (3.4.14) when firms compete à la Cournot.

Proof. Given the definition of sectoral output y_s in equation (3.4.5) and the inverse demand function (3.4.11), prices P_{sk} can be rewritten as:

$$P_{sk} = Pc^{\frac{1}{\eta}} q_{sk}^{-\frac{1}{\rho}} y_s^{\frac{\eta-\rho}{\rho}} = Pc^{\frac{1}{\eta}} q_{sk}^{-\frac{1}{\rho}} \left(\sum_{k=1}^{K_s} (q_{sk})^{\frac{\rho-1}{\rho}} \right)^{\frac{\eta-\rho}{\eta(\rho-1)}}$$

Using the previous equation in the maximization problems detailed in equation (3.4.12) yields:

$$\max_{q_{sk}} \left[Pc^{\frac{1}{\eta}} q_{sk}^{\frac{\rho-1}{\rho}} \left(\sum_{k=1}^{K_s} (q_{sk})^{\frac{\rho-1}{\rho}} \right)^{\frac{\eta-\rho}{\eta(\rho-1)}} - \frac{W}{z_{sk}} q_{sk} \right], \quad \forall k \notin \mathcal{C}$$

Firms do not internalize the effect of their decision on c and P and take wages and productivity levels as given. The first-order condition with respect to q_{sk} yields:

$$P_{sk} \frac{\rho-1}{\rho} + \frac{q_{sk}^{\frac{\rho-1}{\rho}}}{\sum_{j=1}^{K_s} q_{sj}^{\frac{\rho-1}{\rho}}} \frac{\eta-\rho}{\eta\rho} P_{sk} - \frac{W}{z_{sk}} = 0$$

Given the CES inverse demand functions given in equation (3.4.6), the market share of a firm in its sector $\omega_{sk} := \frac{P_{sk} q_{sk}}{\sum_{j=1}^{K_s} P_{sj} q_{sj}}$ can be expressed as $\omega_{sk} = \frac{q_{sk}^{\frac{\rho-1}{\rho}}}{\sum_{j=1}^{K_s} q_{sj}^{\frac{\rho-1}{\rho}}}$. Using this expression and rearranging the first-order condition yields:

$$P_{sk} = \left[1 - \frac{1}{\rho} (1 - \omega_{sk}) - \frac{1}{\eta} \omega_{sk} \right]^{-1} \times \frac{W}{z_{sk}} \quad (3.D.1)$$

Defining the demand elasticity as $\varepsilon(\omega_{sk}) = \left[\frac{1}{\rho} (1 - \omega_{sk}) + \frac{1}{\eta} \omega_{sk} \right]^{-1}$ and rearranging the previous equation yields equation (3.4.14) for non-cartel members.

Similarly, the problem solved by cartel members in equation (3.4.10) can be written as:

$$\max_{q_{sk}} \left[Pc^{\frac{1}{\eta}} q_{sk}^{\frac{\rho-1}{\rho}} \left(\sum_{k=1}^{K_s} (q_{sk})^{\frac{\rho-1}{\rho}} \right)^{\frac{\eta-\rho}{\eta(\rho-1)}} - \frac{W}{z_{sk}} q_{sk} + \sum_{j \neq k} \lambda_{kj} \left(Pc^{\frac{1}{\eta}} q_{sj}^{\frac{\rho-1}{\rho}} \left(\sum_{k=1}^{K_s} (q_{sk})^{\frac{\rho-1}{\rho}} \right)^{\frac{\eta-\rho}{\eta(\rho-1)}} - \frac{W}{z_{sj}} q_{sj} \right) \right]$$

Taking the derivative of this equation with respect to q_{sk} yields:

$$\frac{\partial \tilde{\pi}_{sk}}{\partial q_{sk}} = \frac{\partial \Pi_{sk}(q_{sk}, q_{s-k})}{\partial q_{sk}} + \sum_{j \neq k} \lambda_{kj} \frac{\partial \Pi_{sj}(q_{sk}, q_{s-k})}{\partial q_{sk}}$$

The first term is exactly the same as in the FOC without collusion while the second term is the additional term created by the cartel, whereby a firm internalizes only partially the positive externality on the other members of the cartel. This can be rewritten as:

$$\frac{\partial \tilde{\pi}_{sk}}{\partial q_{sk}} = \left[1 - \left\{ \frac{1}{\rho} + \left(\frac{1}{\eta} - \frac{1}{\rho} \right) \cdot \omega_{sk} \right\} \right] P_{sk} - \frac{W}{z_{sk}} + \sum_{j \neq k} \lambda_{skj} \frac{\partial P_{sj}}{\partial q_{sk}} \cdot q_{sj}$$

where

$$\frac{\partial P_{sj}}{\partial q_{sk}} \cdot q_{sj} = \left(\frac{1}{\rho} - \frac{1}{\eta} \right) P_{sk} \omega_{sj}$$

Collecting the terms and rearranging yields the equilibrium price of cartel members shown in equation (3.4.14) with the equilibrium markups expressed as in equation (3.4.15). The parameter λ_{kj} controls the degree of symmetry of the cartel agreement. If $\lambda_{kj} = 1$ then a member of the cartel cares equally about her own-profits than that of other members of the cartel. In this extreme case, all the members of the cartels set the same markups, that depends only on the sum of the equilibrium market shares of the cartel members. Conversely, $\kappa = 0$ corresponds to the baseline Nash-Cournot equilibrium. \square

3.D.2 Properties of the Industry Equilibrium

This section formulates the industry equilibrium as a nested fixed point in the space of prices and derives the main results of the paper.

Lemma 1 (Nested Fixed Point). *The vector of equilibrium prices, $\mathbf{P} = (P_k)_{k=1, \dots, K}$ is the unique solution to the following nested fixed point problem*

$$\begin{cases} P_k = \Phi(P_k; z_k, P) \quad \forall k = 1, \dots, K \\ P = \Psi(\mathbf{P}). \end{cases}$$

Proof. For ease of notation, we drop the sector subscript s and focus on the competitive Nash-Cournot equilibrium. Rearranging the firms' first order conditions on prices, we have

$$\begin{aligned}
 P_k &= \frac{1}{1 - \frac{1}{\epsilon_k}} \frac{W}{z_k} \\
 &= \left[1 - \frac{1}{\epsilon_k} \right]^{-1} \frac{W}{z_k} \\
 &= \left[1 - \frac{1}{\rho} (1 - \omega_k) - \frac{1}{\eta} \omega_k \right]^{-1} \frac{W}{z_k} \\
 &= \left[1 - \frac{1}{\rho} - \left(\frac{1}{\eta} - \frac{1}{\rho} \right) \omega_k \right]^{-1} \frac{W}{z_k} \\
 &= \left[\left(1 - \frac{1}{\rho} \right) - \left(\frac{1}{\eta} - \frac{1}{\rho} \right) \left(\frac{P_k}{P} \right)^{1-\rho} \right]^{-1} \frac{W}{z_k}
 \end{aligned}$$

As a consequence the equilibrium price vector is the solution to a set of $K+1$ non-linear equations composed of K fixed point conditions, together with the definition of the aggregate price index. Define $\Phi(\cdot; z_k, P) : x \rightarrow \frac{1}{\left[\left(1 - \frac{1}{\rho} \right) - \left(\frac{1}{\eta} - \frac{1}{\rho} \right) \left(\frac{x}{P} \right)^{1-\rho} \right] z_k}$ and

$\Psi(\mathbf{P}) \equiv \left[\sum_{k=1}^K \left(\frac{1}{P_k} \right)^{\rho-1} \right]^{-\frac{1}{\rho}}$. The K response-price equations can each be written $P_k = \Phi(P_k; z_k, P)$ and the function $\Phi(\cdot; z_k, P)$ is strictly decreasing in its first argument and maps $\left(P \left(\frac{1}{\eta} \frac{\rho-\eta}{\rho-1} \right)^{\frac{1}{\rho-1}}, +\infty \right)$ into $\left(\frac{\rho}{\rho-1} \frac{W}{z_k}, \frac{\eta}{\eta-1} \frac{W}{z_k} \right)$.

□

3.D.3 Proof of Proposition 2

We show that an increase in the sectoral price index i) increases the markups of all firms, and ii) this increase is larger for larger non-cartel members. For simplicity, we focus on the competitive Nash-Cournot equilibrium. The proof is made of two lemmas.

Lemma 2 (Price Index). *The price index is more elastic with respect to the pricing decisions of the larger firms.*

Proof. The sectoral price index is given by equation (3.4.7). The *elasticity* of the sectoral price index with respect to a change in a firm's individual price is:

$$\frac{\partial \log P_s}{\partial \log P_{sk}} = \omega_{sk} \tag{3.D.2}$$

A 1% increase in a firm's individual price increases the sectoral price index by $\omega_{sk}\%$, everything else equal. Larger firms (with a larger market share) will have a larger impact on the sectoral price index.

Moreover, totally differentiating the sectoral price index yields:

$$dP_s = \sum_{k=1}^{K_s} \left(\frac{P_{sk}}{P_s} \right)^{-\rho} dP_{sk} = \sum_{k=1}^{K_s} \omega_{sk}^{\frac{\rho}{\rho-1}} dP_{sk}$$

where we have used the fact that $\omega_{sk} = \left(\frac{P_{sk}}{P_s} \right)^{1-\rho}$. The change in the sectoral price index induced by a change in a firm's individual markup is:

$$\frac{d \log P_s}{d \log \mu_{sk}} = \omega_{sk} + \sum_{l \neq k} \omega_{sl} \frac{d \log \mu_{sl}}{d \log \mu_{sk}}, \quad \forall l \neq k \quad (3.D.3)$$

This change is a market share weighted average of each firm's markup cross elasticity. In the limiting case where a firm is the only player in its sector, the change is equal to unity. This shows that in the presence of a cartel, the sectoral price index will increase more if cartel members are very productive and large. □

Lemma 3 (Markup elasticities with respect to the price index). *The markup elasticities of individual firms with respect to the price index are i) positive for all firms, ii) strictly smaller than unity, and iii) increasing with the size of the firm, as measured by its market share.*

Proof. Totally differentiating equation (3.4.15) leads to:

$$\frac{d\mu_{sk}}{\mu_{sk}} = \mu_{sk} \left(\frac{\eta - \rho}{\eta\rho} \right) \omega_{sk}(\rho - 1) \left(\frac{dP_{sk}}{P_{sk}} - \frac{dP_s}{P_s} \right) \quad (3.D.4)$$

Let us define $v_{sk} := \mu_{sk} \left(\frac{\rho - \eta}{\eta\rho} \right) \omega_{sk}(\rho - 1)$. We get:

$$\frac{d \log \mu_{sk}}{d \log P_s} = \frac{v_{sk}}{1 + v_{sk}} \quad (3.D.5)$$

where we have used the fact that since marginal costs are constant, $d \log P_{sk} = d \log \mu_{sk}$. Given Assumption 2, this elasticity is positive and strictly smaller than unity.

For the last part of the lemma, we take the derivative of equation (3.D.5) with respect to ω_{sk} . This leads to:

$$\frac{\partial \left\{ \frac{d \log \mu_{sk}}{d \log P_s} \right\}}{\partial \omega_{sk}} = \text{sgn} \left\{ \rho - \eta \right\}$$

This implies that the markup elasticity with respect to the price index increases with firm size for non-cartel members. Proposition 1 follows from Lemma 2 and 3. The cartel

will lead to an increase in the sectoral price index and this increase is stronger when cartel members are very productive firms. In return, this translates into an increase in all firms' markups. \square

3.D.4 Sectoral Markups as HHI

We show how to obtain equation (3.4.20).

Sectoral markups μ_s are defined as $\mu_s := \frac{P_s}{W/z_s}$. Using the fact that $W = 1$, $z_{sk} = \mu_{sk} P_{sk}^{-1}$, $z_s = \left[\sum_{k=1}^{K_s} \left(\frac{\mu_s}{\mu_{sk}} \right)^\rho z_{sk}^{\rho-1} \right]^{\frac{1}{\rho-1}}$ and rearranging yields:

$$\mu_s = \left(\sum_{k=1}^{K_s} \omega_{sk} \mu_{sk}^{-1} \right)^{-1} \quad (3.D.6)$$

Sectoral markups are a market share weighted harmonic mean of firm-level markups. Substituting the expression for $\mu_{sk}^{-1} = \mu_\rho + \frac{\omega_{sk}}{\rho} - \frac{\omega_{sk}}{\eta}$ and using the fact that $\sum_{k=1}^{K_s} \omega_{sk} = 1$ into equation (3.D.6) leads to equation (3.4.20).

Sectoral markups are a function g of the HHI. Given that $\rho > \eta$, $g(0) = \mu_\rho$ and $g(1) = \mu_\eta$, this implies that sectoral markups increase with concentration.

Obtaining equation (3.4.21) is straightforward.

3.D.5 Bertrand Competition

We can alternatively solve the model under the assumption that firms engage in a static game of Bertrand Competition. One can combine the inverse demand functions (3.4.3) and (3.4.6) which yields the combined inverse demand function:

$$q_{sk} = P_{sk}^{-\rho} \left(\sum_k P_{sk}^{1-\rho} \right)^{\frac{\rho-\eta}{\eta\rho}} c P^\eta$$

The firm chooses its prices subject to the above constraint. This yields the first-order condition:

$$q_{sk} + \left(P_{sk} - \frac{W}{z_{sk}} \right) \frac{\partial q_{sk}}{\partial P_{sk}} = 0 \quad (3.D.7)$$

The derivative of the constraint with respect to the firm's price gives:

$$\frac{\partial q_{sk}}{\partial P_{sk}} = -\rho \frac{q_{sk}}{P_{sk}} + (\rho - \eta) \omega_{sk} \frac{q_{sk}}{P_{sk}}$$

Plugging this equation back into (3.D.7) and rearranging yields:

$$P_{sk} = \frac{\rho + (\eta - \rho) \omega_{sk}}{\rho + (\eta - \rho) \omega_{sk} - 1} \frac{W}{z_{sk}} \quad (3.D.8)$$

In the competitive Nash-Bertrand case, the demand elasticities are given by

$$\varepsilon(\omega_{sk}) = \rho + (\eta - \rho) \omega_{sk}$$

In the cartel equilibrium, the demand elasticities of the cartel members are given by:

$$\varepsilon(s) = \rho + (\eta - \rho) \left(\omega_{sk} + \sum_{j \in \mathcal{C} \setminus \{k\}} \lambda_{kj} \omega_{sj} \right)$$

We obtain qualitatively similar effects but slightly different magnitudes. Because the firm-specific demand elasticities are now arithmetic means instead of harmonic means, they are at least as large as in the Cournot case. And therefore the markups in the Bertrand setting are smaller than in the Cournot setting.

Chapter 4

Asylum Policies, International Tensions and Trade Flows

Chapter co-authored with Florin Cucu.

Abstract

This article studies the relationship between asylum policies and international tensions. Using panel data on asylum applications in the European Union from 1999 to 2017, we show that, in addition to humanitarian conditions in the origin country, asylum policies are significantly correlated with a series of measures of international tensions. We provide evidence that EU countries are more likely to accept refugees from rival states than from partner states, even after controlling for conflicts and political terror in the sending country. We use this result to rationalize a robust and negative relationship between asylum policies and European imports from the rest of the world.

4.1 Introduction

Over the past several years, the European Union has witnessed a surge in the number of individuals seeking asylum on its soil.¹ As Figure 4.B.1 illustrates, the number of asylum demands doubled in less than a year, exceeding one million applications in 2016 and 2017. The ensuing public debate did not focus exclusively on the international humanitarian context. National security, economic and cultural concerns received extensive treatment in the media as well (Berry et al., 2016). In this article, we study the extent to which non-humanitarian factors, such as political economy considerations, shape asylum policies and highlight their importance for empirical studies in international trade.

The existing literature documents significant variation in asylum recognition rates (i.e. the share of asylum seekers who are granted refuge) across EU states, even among individuals originating from the same country (Neumayer, 2005a). As an example, Table 4.1 shows the number of asylum applications from Turkish citizens in Great Britain, Germany and France from 1999 to 2017. Despite having received a similar number of demands, Germany admitted substantially more Turkish refugees than France, its recognition rate being twice as large as the French rate. Great Britain received substantially fewer applications, yet had an acceptance rate in between those of France and Germany. The apparently different treatment of asylum seekers facing similar conditions of oppression and political terror in their home country is at odds with a normative view of asylum policies, according to which demands should be evaluated exclusively in terms of their humanitarian merit.

A simple model that would rationalize the observed heterogeneity in asylum policies is to assume that governments derive utility from providing assistance to refugees and other activities. At the optimum, the marginal utility of refugee assistance should equal that of other activities. If diplomatic interests or national security concerns make up an important part of the non-assistance-related activities, then utility maximization will lead to variation in recognition rates across countries, even among refugees from the same country of origin. In this article, we focus on one such non-humanitarian factor, namely foreign policy concerns.

The idea that asylum policies are informed by diplomatic considerations is not new and has received significant treatment in the political science literature. Scheinman (1983) argues that asylum policies have become a tool of the receiving state's foreign

¹Throughout this paper, we refer to individuals filing a request for refuge as asylum seekers. Asylum seekers whose requests are approved become refugees, while those whose requests are denied lose the right to stay in the host country and may be deported.

policy vis-à-vis the sending country, a view that is further explored by [Teitelbaum \(1984\)](#). As the argument goes, host countries admit refugees in order to signal human rights violations in the origin country and mount, in this way, international pressure on adversary regimes.² Similarly, governments should be less inclined to grant asylum to individuals fleeing partner countries, as this could generate bilateral tensions and be construed by domestic opposition groups as evidence of complicity with an oppressive regime.

History provides many examples of strategic admissions of refugees, ranging from the massive inflow of asylum seekers in the US fleeing communist countries during the Cold War, to Tanzania's more benevolent attitude towards refugees from Burundi as compared to Rwandans ([Jacobsen, 2002](#)). Quantitative studies of political determinants of asylum policies include [Rosenblum and Salehyan \(2004\)](#), [Salehyan and Rosenblum \(2008\)](#), [Moorthy and Brathwaite \(2016\)](#) and [Jackson and Atkinson \(2019\)](#). We build on this previous work and estimate the relevance of political economy determinants in shaping asylum policies in the EU from 1999 to 2017. To this aim, we build a matrix of bilateral refugee flows using data provided by [Eurostat \(2018\)](#). Specifically, for each bilateral pair, we observe the number of filed applications, the number of processed demands and the number of positive decisions. We also gather data on measures of conflict and political violence in the origin states, as well as measures of bilateral cooperation, including voting in the UN General Assembly, free trade agreements and international incidents.

Consistent with the evidence in [Hatton \(2016\)](#) and [Neumayer \(2005a,b\)](#), we find that both asylum seeker flows and recognition rates increase in response to humanitarian crises in the countries of origin. However, our results also show that, conditional on humanitarian conditions, European countries are more likely to admit refugees coming from rival countries. In particular, recognition rates are negatively correlated with an index of voting similarity in the UN General Assembly and the presence of a free trade agreement. Moreover, we show that international disputes are associated with higher recognition rates, while episodes of cooperation are associated with lower recognition rates. It is important to mention that our regressions include country-pair fixed effects, such that all bilateral, time-invariant factors such as history or cultural proximity are controlled for. In sum, we show that previous results in the political science research survive a more rigorous quantitative assessment.

²Alternative motivations are possible. Refugee admissions may create dissident communities in exile or drain the origin country of human capital. Concerns about relations with a third party may also play a role in shaping asylum policies. [Basok \(1990\)](#) asserts that the Costa Rican government adopted a more generous asylum policy towards Nicaraguan refugees relative to Salvadorans in an attempt not to antagonize the United States, an important aid donor.

The second main contribution of our paper is to assess the relevance of our results for the empirical international trade literature. Several recent studies have used refugees as an instrument for migrant flows in order to estimate the pro-trade effects of migration (Steingress, 2018; Parsons and Vézina, 2018). If our argument is correct and asylum policies are indeed informed by considerations related to strategic and diplomatic interests, then it seems unlikely that the exclusion restriction will be met in more general setups.

We test this hypothesis by estimating the relationship between international trade flows and asylum policies using a gravity regression model. We find a robust, negative correlation between European imports and both the number of refugees and asylum recognition rates. The effect, however, is not persistent, and appears to fade away in two-to-three years. Moreover, we find evidence that the effect is mainly driven by trade in homogeneous goods. We conjecture that, for this type of products, the positive effects related to a larger diaspora (for instance, reduced informational costs) are minimal and therefore dominated by the component capturing international tensions. We do not find evidence of a contemporaneous effect for European exports. While our results rely mainly on correlations, they invite nonetheless to caution when using refugee flows as an instrument for international migration.

Our paper contributes to three main strands in the literature. First, it speaks to the scholarship that studies the determinants of asylum policies.³ Neumayer (2005a) documents significant variation in refugee acceptance rates across European countries from 1980 to 1999 and a lack of convergence in asylum policies. He shows that recognition rates are nonetheless sensitive to humanitarian conditions in the origin country and, to some extent, to the economic conditions in the destination country. Hatton (2009) confirms the importance of humanitarian conditions in shaping asylum policies and finds that tougher admission policies explained only a third of the sharp drop in applications that occurred from 2001 to 2006.⁴ We contribute to this literature by studying the political economy considerations that affect admission rates. In particular, we show that recognition rates are correlated in a robust and significant way with bilateral measures of international tensions.

Second, our paper speaks to a large body of work studying the relationship between migration and international trade.⁵ The existing literature has firmly established a

³Chin and Cortes (2015) provide a recent survey of the literature on asylum seeker and refugee flows. Becker and Ferrara (2019) review the evidence on economic and political consequences of forced migration, while Brell et al. (2020) discuss the labor market integration of refugees.

⁴Hatton (2016) provides a more recent assessment of the determinants of asylum applications.

⁵Refugees differ from other migrants in several respects. First, they are more likely to report exposure to persecution prior to migration. Second, there is less selection on characteristics valued in the labor

positive correlation between migrant networks and international trade (Gould, 1994; Head and Ries, 1998; Dunlevy and Hutchinson, 1999; Girma and Yu, 2002; Rauch and Trindade, 2002). Within this literature, several recent studies have measured a positive causal effect of migrant stocks on trade flows. Parsons and Vézina (2018) use the random allocation of Vietnamese refugees across US states to identify pro-trade effects after trade restrictions with Vietnam were lifted in 1994. Steingress (2018) uses the random allocation of political refugees across US states as an instrumental variable and demonstrates that higher stocks of recent immigrants raise both imports and exports with the immigrants' origin countries. Bahar et al. (2018) use the repatriation of Yugoslavian refugees under temporary protection in Germany to study the link between migration and trade. They find a high elasticity of trade with respect to return migration. In contrast to these results, we document a robust, negative correlation between asylum policies and trade patterns. While not causal, this result is nevertheless surprising and we rationalize it as being confounded by international tensions.

Insofar as the negative correlation between asylum policies and trade flows is due to interstate rivalries, our study is also related to the literature on the deleterious effects of conflict on trade. Michaels and Zhi (2010), Fuchs and Klann (2013), Davis et al. (2019) and Crozet and Hinz (2016) provide ample evidence of the negative impact of international tensions and conflicts on bilateral trade flows. By connecting asylum policies to interstate conflicts, our study shows how the latter could potentially confound the relationship between refugees and trade.

The remainder of the paper proceeds as follows. Section 4.2 presents the data and the methodology used to construct the final sample. In Section 4.3, we discuss the complex relationship between asylum policies and international tensions and provide empirical evidence on it. Section 4.4 introduces the theoretical framework that we use to study the link between international trade flows and asylum policies and the estimation method we employ. Section 4.5 presents the results. Finally, Section 4.6 concludes.

4.2 Data

In order to study the determinants of asylum policies and how the latter correlate with international trade flows, we use data from various sources.⁶ In this section, we present the data and discuss summary statistics.

market. Refugees exhibit lower educational attainment, lower linguistic aptitudes and worse health (Chin and Cortes, 2015).

⁶Section 4.C.1 lists the main variables used in this paper. For each, we mention the source, the coverage and the methodology used to compute them.

4.2.1 Data Sources

The core of this paper analyzes the interplay between normative and interest-based factors that shape asylum policies in the EU. To this aim, we use the data set on asylum applications compiled by Eurostat, the Statistical Office of the European Union. From this, we extract the number of applications from non-EU countries processed by every EU member state from 1999 to 2017.⁷ It is important to note that the number of processed applications (i.e. applications for which a decision was made) is not equal to the total number of filed claims (but not necessarily processed), although the two series are highly correlated. In this article, we focus on processed applications because they enter as the denominator in the formula for recognition rates. Another methodological issue is related to the type of decisions reported in the data sets. Prior to 2008, Eurostat does not distinguish between first-instance and final decisions and provides only aggregate measures. In order to be consistent, we combine the first-instance and final decision samples after 2008 and compute the total number of applications. Finally, we disregard all internal flows within the EU, as they never materialize into the grant of asylum. We thus construct a matrix of bilateral recognition rates, defined as the share of asylum seekers from a given non-EU country who were granted refugee status in a EU country. The final sample consists of 27 EU countries (including Great Britain) and 145 non-EU countries.⁸

To study the determinants of asylum policies, we use information on humanitarian conditions in refugees' countries of origin, as well as bilateral measures of interstate relations. The normative variables capturing humanitarian conditions include the intra-national conflict score (Marshall, 2017) and the political terror scale (Gibney et al., 2018). The conflict score is the summed magnitude of several measures of societal and inter-state violence, each ranging from 0 (lowest magnitude) to 10 (highest magnitude). The political terror scale captures the degree of political violence and ranges from 1 in countries with a secure rule of law to 5 in countries with generalized violations of civil and political rights.

The bilateral measures of interstate tensions include an index of voting similarity in the UN General Assembly and an indicator variable for the presence of a free trade agreement (FTA). The UN voting index is computed as the probability that two states

⁷Not all member states reported asylum statistics in every year of our sample. New member states typically start reporting asylum statistics later. For instance, Croatian data are available from 2012 onward. Section 4.C.3 discusses the implications of missing values in our study.

⁸We observe asylum outcomes for the 28 countries of the European Union. Because in the trade data Luxembourg and Belgium form a single entity, we aggregate the asylum data for these two countries as well. We further drop non-European countries that did not send any refugees throughout the sample period. Table E1 in Section 4.E lists the countries included in our sample.

voted in the same way in a given year and uses data from Voeten et al. (2009).⁹ We only consider votes marked in the database as important, as these are more likely to capture international relations.¹⁰ The FTA dummy variable is taken from the CEPII database (Head et al., 2010) and takes the value 1 if there is a bilateral free trade agreement between the two countries.

We complement this data with information on the occurrence of international events. We use the Global Data on Events, Location and Tone (GDELT) to construct a bilateral matrix of international incidents. The GDELT data set contains more than 200 million geolocated reports from 1979 to the present.¹¹ Because our focus is on inter-state tensions, we only consider events that involve national governments. Furthermore, we only keep events that are marked in the original data set as important, although we perform several robustness checks to test the sensitivity of our results to these criteria. Overall, we identify 11,783 international incidents that can be classified as conflicts and 91,413 incidents that can be classified as agreements. Table E2 in Section 4.E breaks down events by category.¹²

Finally, we use the BACI database to construct the bilateral matrix of trade flows. The BACI data set is based on UN Comtrade data and reports trade flows between country pairs at the HS6 level since 1995 (Gaulier and Zignago, 2010). We aggregate these flows at the country pair level.

4.2.2 Descriptive Statistics

Figure 4.B.1 shows the evolution of the total number of asylum claims from 1999 to 2017. Because data are unavailable for many of the new member states in the beginning of our sample period, we focus on EU-15 countries. Several patterns emerge. First, the number of asylum applications in the 2000s averages 250,000 per year. With the outbreak of the European Migrant Crisis in 2015, this figure is multiplied by a factor of 4. Second, the number of processed claims is highly correlated with the number of filed

⁹The UN affinity index is equal to the ratio of the number of votes when both states agree (they either both vote “yes” or both vote “no”) to the total number of joint votes. Davis et al. (2019) and Umana Dajud (2013) use the voting similarity index as a measure of political proximity.

¹⁰For instance, voting similarity with the US is extremely low when including non-key votes. Focusing on important votes produces greater similarity between the European bloc and the US.

¹¹Despite its richness, the GDELT database is surprisingly under-exploited in the literature. Notable exceptions include Acemoglu et al. (2017) and Hinz (2014). We present in Section 4.C.2 the procedure we employ to create the incident matrix.

¹²Verbal disputes make up 63% of conflicts. Expressing disapproval is the most common form of verbal dispute. Among material conflicts, coercing and reducing relations are most recurrent. Verbal agreements account for almost 95% of cases of cooperation. Consulting is the most common form of verbal cooperation. Yielding and providing aid are the most common forms of material cooperation.

applications. The coefficient of correlation between the two flows is 0.86. Third, prior to the crisis, the number of processed claims exceeds that of filed applications, as the former also includes appeals to first-instance rulings. On average, first-instance rulings account for 70% of the total number of decisions. Fourth, the number of approved applications increases even before 2015, although the growth rate accelerates after this date.

Another important feature of the asylum data is the geographic concentration of asylum seekers. EU-15 countries receive more than 95% of the total number of applications and 3 countries, France, Germany and Great Britain, account for more than 50% of the asylum claims in our data set. Furthermore, as Panel A of Figure F1 in the Appendix shows, not only has the average number of asylum demands per country pair increased significantly since 2015, but so has its standard deviation. Over the period we study, a small number of origin countries made up an increasing share of asylum demands. The five countries that sent the highest numbers of asylum seekers accounted for 33% of the total applications in 2010 and 40% in 2014; in 2016, the top five countries made up 60% of asylum demands.

Panel B of Figure F1 shows the average recognition rate in every sample year. Following relatively high levels in the beginning of our sample period, acceptance rates experienced consequential declines in the early 2000s. This pattern does not appear to be an artifact of the changing composition of our sample during this period, as similar declines can be observed in most of the countries in our sample. Starting in 2005, acceptance rates steadily increased before jumping to 26% in 2014 and remaining constant thereafter. Despite having significantly fewer demands, new member states exhibit similar recognition rates as EU-15 countries. Throughout the period, the average recognition rate was 20%.¹³

The average conflict score was marginally higher in the beginning of our sample period and stable subsequently as demonstrated in Panel C. There was significant variation across countries, the 95% confidence interval being particularly wide.¹⁴ In sharp contrast, none of the EU countries experienced any episode of violence from 1999 to 2017. The evolution of the average political terror scale over time is an inverted U-shape (Panel D). Among the countries experiencing the most severe violations of political freedom one finds Afghanistan, the Congo, Iraq, North Korea, Sudan, Syria

¹³The average probability of an asylum seeker being granted refugee status was slightly higher, around 27%.

¹⁴The countries experiencing the largest internal conflicts are Afghanistan (1999-2001), Angola (1999-2002), the Congo (2013-2017), Ethiopia (1999-2000), Iraq (2003-2010), the Philippines (1999-2000), Pakistan (2005-2017), Serbia (1999), Sudan (1999-2017), Syria (2011-2017) and, surprisingly, India (1999-2017). The high magnitude for the latter is due to ethnic tensions in the north-east.

and Yemen. The average political terror scale is significantly lower for EU countries (1.61) than for non-EU countries (2.84).

Similarity in voting in the UN General Assembly shows remarkable shifts over time, starting from 80% in 1999 and dropping to 60% in less than three years. Towards the end of the period we study, there is evidence of an increasing trend in voting similarity. Among the larger countries, South Korea, the Ukraine, Japan, Serbia and New Zealand vote systematically along European lines, while North Korea, Syria, Iran, Cuba and China show the largest dissimilarity. The probability that a non-European country and a EU member state are linked through a free trade agreement increases over time (Panel F). There is a jump in this probability in 2004 when, in addition to an association agreement with Egypt being ratified, the new member states entered free trade agreements with a number of non-European countries. A significant increase also occurs in 2008 when the CARIFORUM-EU Economic Partnership Agreement came into force, followed by other free trade agreements in the late 2010s.

4.3 Asylum Policy and Interstate Tensions

A growing body of work in the political science literature highlights the tension between norms and strategic interests that shape asylum policies. Granting asylum to vulnerable individuals is widely recognized as a fundamental value in western democracies. Receiving refugees is nonetheless a costly action and usually implies strategic trade-offs. This section provides a brief discussion of the interplay between norms and diplomatic interests and documents a significant relationship between asylum policies and international tensions.

4.3.1 Asylum Policies as a Tool of Foreign Policy

The international relations scholarship has approached asylum policies from two, often competing angles. On the one hand, *constructivists* argue that human rights play a key role in international relations. [Finnemore and Sikkink \(1998\)](#), for instance, argue that norms related to the protection against bodily harm are more salient to the general public and more likely to secure the support of the international community. In this context, the last decades have witnessed the emergence of a legal system in which the rights of the *individual* take precedence over traditional notions of *citizenship* ([Jacobson, 1996](#)). States have the legal obligation to shelter people facing imminent danger. The goal of asylum policies is therefore to offer protection to individuals who are subject

to discrimination and other forms of abuse in their home countries, irrespective of the cost such a policy might entail.

Instrumentalists, on the other hand, claim that states are self-interested agents, seeking to maximize their utility. Governments will deviate from their international commitments whenever it is profitable to do so (Mearsheimer, 1994). Economic, diplomatic and national security considerations play an equally important role in determining asylum policies.

Foreign policy considerations as a driving factor of asylum policies have received great attention from political scientists. The grant of political asylum is often construed by host countries as an overt acknowledgement of serious human rights violations and used to mount international pressure on a rival regime. Teitelbaum (1984) writes that “from the perspective of receiving countries, refugee admission policies have been guided in many important cases by the belief that refugee outflows serve to embarrass and discredit adversary nations”. Furthermore, admitting refugees can encourage the development of dissident communities,¹⁵ as well as deprive rivals of human capital.¹⁶ By the same token, governments should be reluctant to grant refugee status to individuals originating from “friendly” countries. Admitting refugees in this case might not only generate diplomatic tensions, but also be interpreted domestically as evidence of the government’s cooperation with a regime that its own bureaucracy recognizes as oppressive.

Foreign policy interests would thus imply a positive correlation between interstate rivalries and asylum recognition rates: good diplomatic relations are associated with low recognition rates, while tense relations are associated with high recognition rates. It is important to mention that a more sophisticated version of the instrumentalist view does not deny the importance of normative factors. In many cases, humanitarian concerns and strategic interests prescribe the same course of action. During the Cold War, the US admission of refugees fleeing communist regimes could be justified in terms of human rights protection and used to discredit the Soviet Bloc. In more general setups, one can argue that, *conditional* on humanitarian conditions, governments are more likely to admit refugees from rival countries than from partner states.

There is a plethora of historical evidence that supports the instrumentalist view. For

¹⁵Granting asylum to individuals fleeing rival neighboring countries was often used as a means of encouraging opposition groups. For instance, the counter-revolutionary army that sought to overthrow Fidel Castro in 1961 comprised 1400 CIA-trained Cuban refugees living in exile in the US.

¹⁶It is claimed that President Lyndon B. Johnson maintained the “open door” policy for Cuban refugees in an attempt to continue what was perceived as the ‘brain drain’ of Cuban intellectuals (Pedraza, 1996). For a more in-depth discussion of the political and geo-strategic implications of asylum policies, see Loescher (1994).

instance, prior to the passing of the Refugee Act in 1980, only individuals from communist countries and the Middle East were legally allowed to claim asylum in the US. Despite facing similar humanitarian conditions, refugees from enemy states like Cuba or Nicaragua were admitted at higher rates than refugees from partner states like Haiti, Guatemala or El Salvador (McBride, 1999). During the Carter and Reagan administrations, Cuban refugees underwent a perfunctory screening process and were granted asylum almost automatically. By contrast, Haitians were detained in prisons, treated as economic migrants and more often than not deported (Stepick, 1992). Similarly, Pakistan was reluctant to accept refugees from Iran, but welcomed refugees from Afghanistan (Moorthy and Brathwaite, 2016). During the Mozambican Civil War, Zimbabwe refused to grant asylum to fleeing Mozambicans in order not to compromise good relations with their neighbor (Jacobsen, 1996).

4.3.2 Normative and Interest-Based Determinants of Asylum Policies

To the best of our knowledge, Rosenblum and Salehyan (2004) provide the first quantitative study of norms and strategic interests as determinants of asylum policies. They construct a sample of 42 countries sending refugees to the US from 1983 to 1989 and consider two normative factors (the political terror scale and polity score indices) and four interest-based measures (indicator variables for military aid, economic sanctions, and trade and undocumented migrant flows). Both types of factors have predictive power, albeit their importance changes over time (trade variables become more important in later years). They also find that interest-based variables account for more of the variation in recognition rates than normative factors.¹⁷

Rottman et al. (2009) use a sample of decisions made by asylum officers and immigration judges in the US on applications from 96 countries from 1999 to 2004. They find that humanitarian concerns are less important when immigration judges process claims and that the linguistic heritage of asylum seekers is correlated with acceptance rates. Moorthy and Brathwaite (2016) use a large panel data set covering the period from 1951 to 2008 and find support for the instrumentalist view. Governments are more likely to accept refugees from rival countries and less likely to accept refugees from contiguous allies. In a recent paper, Jackson and Atkinson (2019) find that countries

¹⁷In a follow-up paper, Salehyan and Rosenblum (2008) study how accounting for public and congressional attention to immigration alters their previous results. Overall, they find that increased public attention amplified the importance of normative factors. Congressional hearings have an ambiguous effect on recognition rates, depending on whether asylum policies are perceived as immigration enforcement or a humanitarian issue.

contending over issues related to ideology are more likely to admit their rivals' refugees than countries contending over other issues.¹⁸

We build on these results and estimate a gravity-type equation relating asylum outcomes and a series of norm and interest-based variables. Specifically, we estimate the following equation:

$$Asylum_{ijt} = Norms'_{it}\alpha + Interests'_{ijt}\beta + Covariates'_{ij}\gamma + \delta_i + \theta_j + \mu_t + v_{ijt}, \quad (4.3.1)$$

where $Asylum_{ijt}$ is a measure of country j 's policy with respect to asylum seekers from i in year t ; $Norms_{it}$ is a vector of normative variables capturing humanitarian conditions in the sending country; they include the intra-national conflict score and the political terror scale; $Interests_{ijt}$ is a vector of interest-based variables capturing diplomatic relations between countries i and j ; they include the index of voting similarity in the UN General Assembly and an indicator variable that takes the value 1 if countries i and j are linked by a free trade agreement; $Covariates_{ij}$ is a vector of time-invariant bilateral variables, including distance, contiguity, common language, colonial ties and common religion;¹⁹ δ_i and θ_j are origin and destination fixed effects that control for time-invariant country-specific characteristics;²⁰ μ_t are year fixed effects that control for common trends in migration and asylum patterns; v_{ijt} is a time-varying bilateral random error.

Following what has become customary in the trade literature, we estimate eq. (4.3.1) by Poisson-Pseudo Maximum Likelihood whenever the dependent is a measure of flows. We discuss the advantages of this estimator over ordinary least squares further below. When the dependent variable is the share of approved applications (recognition rates), we use OLS. Table 4.2 shows the main results.

In columns (1) and (2), the dependent variable is the number of processed demands, which as shown previously is highly correlated with the number of asylum seekers.²¹ Because migrants first enter the country and only afterwards apply for refugee status,

¹⁸In a closely related study, Neumayer (2005a) documents substantial spatial variation in acceptance rates in Western Europe and a lack of convergence from 1980 to 1999. That being said, he does find that recognition rates are sensitive to measures of political oppression and human rights violations in the origin country but they are lower when the destination country has higher unemployment rates.

¹⁹In specifications that include dyadic fixed effects, these bilateral covariates are dropped to avoid multicollinearity.

²⁰Unlike in standard gravity-equations, we assume these fixed effects to be time-invariant. Allowing for time-varying fixed effects would not allow us to estimate the coefficients on normative variables, as these are origin-specific. Moreover, we find that time-varying origin and destination fixed effects, together with country-pair fixed effects, explain almost 98% of the variation in the interest-based variables.

²¹Using the number of demands instead of the number of processed applications produces similar point estimates. The results are available upon request.

the receiving state cannot effectively affect type of applicants it receives. International tensions should matter only insofar as they have been internalized by the asylum seekers themselves. The coefficients on both interest-based variables are small and statistically insignificant. In sharp contrast, the coefficients on both norm-based factors are positive and highly significant: the number of asylum applications rises, on average, by 16% ($(e^{0.147} - 1)$) and 36% ($(e^{0.306} - 1)$) for a one-unit increase in the conflict score and in the political terror scale, respectively. The results are robust to including dyadic fixed effects, as demonstrated in column (2).

In columns (3) and (4), we re-estimate eq. (4.3.1) using the number of approved applications as the dependent variable. In contrast to asylum seeker flows, the number of approved applications can be directly affected by governmental policy. Strategic interests should now play a more important role. As expected, the coefficients on normative values are negative and statistically significant. An increase in the UN voting affinity index of 10 percentage points corresponds to a drop in the number of approved applications of 14% ($10 \times (e^{-0.014} - 1)$). Similarly, free trade agreements are associated with a decrease of 57% ($(e^{-0.850} - 1)$), significant at 1%. The coefficients on the norm-based variables are positive and highly significant. In column (4), we add dyadic fixed effects. The point estimates change only marginally. This entails that our results are not driven by unobserved country-pair specific characteristics, such as cultural proximity or historical ties.

The last two columns of Table 4.2 show the results when the dependent variable is the recognition rate. Better diplomatic relations are associated with lower acceptance rates: increasing the voting index by 10 percentage points decreases recognition rates by 0.65 percentage points, while free trade agreements are associated with a reduction of 2 points. Worse humanitarian conditions in the origin country raise recognition rates by 2 and 3 percentage points with a one-unit increase in the conflict score and political terror scale, respectively. The results are robust to controlling for dyadic effects. The effect of UN voting is slightly smaller and significant at 10%, while the effect of free trade agreements is larger and highly significant.

Table E3 in Section 4.E reports results from additional robustness checks. Column (1) shows the estimates from the baseline specification. One concern about the previous results is that recognition rates depend on the number of asylum claims. If governments face budgetary constraints, a higher number of applications will mechanically translate into lower acceptance rates. We do not find evidence that this affects our results. In column (2) we condition on the number of applications from the sending country and in column (3) we control for the total number of applications filed in the destination country. The point estimates are extremely similar to those in the baseline

specification.²² Another issue is related to the effects of the European Migrant Crisis. In column (4), we show estimates for the pre-crisis period (1999-2014). The coefficients on UN voting are not affected by the change of sample; the effect of free trade agreements is, on the other hand, smaller and less significant.

The relevance of foreign policy concerns in shaping asylum policies may also depend on individual states' status on the international scene. To test this hypothesis, in columns (5) and (6) we estimate eq. (4.3.1) separately for EU-15 countries and the new member states. The point estimates are mainly significant for the older, richer member-states. Lastly, governments' ability to use asylum policies as an instrument of foreign policy may also depend on the salience of humanitarian crises in the origin countries. In columns (7) and (8) we estimate eq. (4.3.1) only for countries of origin with no internal conflicts and limited political violence. In columns (9) and (10), we replicate the analysis for countries experiencing conflict and extensive political violence. While the results are not conclusive, the coefficients on interest-based variables seem more robust for countries experiencing less internal violence, which is consistent with the hypothesis that countries have more room for maneuver when humanitarian conditions are less salient.

4.3.3 International Incidents and Asylum Recognition Rates

The analysis in the preceding section comes with several caveats. First, the interest-based variables exhibit relatively little within-pair variation over time. For instance, only 22.5% of the country pairs in the sample experienced a change in the trade agreement variable from 1999 to 2017. Second, the EU forms a trading bloc, which prevents individual member states from directly negotiating with other nations. This limits the ability of trade treaties to capture changes in bilateral relationships over time. Third, there is evidence that voting patterns in the UN assembly are affected by prospects of material gains (Dreher et al., 2008; Dreher and Jensen, 2013). This would be a source of measurement error that could bias our coefficients. In this section we consider an alternative measure of interstate rivalries based on the occurrence of international incidents.

In order to study the relationship between international events and asylum policies, we estimate eq. (4.3.1) using the number of episodes of conflict and cooperation as the explanatory variables. The results are shown in Table 4.3, which has the same

²²Interestingly, we find that recognition rates are positively correlated with the number of applications from the sending country, but negatively correlated with the total number of applications in the receiving country.

structure as Table 4.2. The dependent variable in the first two columns is the number of applications, in columns (3) and (4) the number of approved applications and in columns (5) and (6) the recognition rate. Regressions of flows are estimated by PPML, while regressions of shares by OLS. Columns (1), (3) and (5) include origin, destination and year-specific fixed effects, as well as bilateral covariates. Column (2), (4) and (6) report results that include bilateral fixed effects.

Regression in columns (1) and (2) provide some evidence that international tensions are correlated with the number of processed applications, although the point estimates are small and not always significant. Each additional conflict increases the number of claims by 1.2% (insignificant), while each episode of cooperation decreases the number of claims by 0.6% (significant at 5%). The point estimates do not change in a significant way once we add dyadic fixed effects, although they are slightly more significant. The results are therefore not driven by unobserved cultural or historical factors. Unlike UN voting or free trade agreements, which are perhaps not salient enough to a wider audience, international events appear to be correlated with the sorting of asylum seekers across different destinations.²³

In columns (3) and (4) we show the results when the dependent variable is the number of refugees. For each additional conflict and agreement, the number of approved asylum applications changes by roughly +2% and -1%, respectively. Both coefficients are significant at the 5% level. The point estimates are larger once we include dyadic fixed effects and remain significant at conventional levels. Together, the results in columns (1) through (4) imply that recognition rates correlate positively with the number of conflicts and negatively with the number of agreements. As shown in columns (5) and (6), the coefficients have the expected sign, are highly significant and robust to controlling for pair-specific fixed effects.

International incidents vary in terms of importance. We exploit the fine classification in the GDELT database to estimate how asylum outcomes correlate with different types of events. Specifically, we distinguish between verbal and material conflicts or agreements. The results are reported in Table E4 in Section 4.E. The coefficients on verbal and material conflicts are not significant in any of the regressions using flows as the dependent variable. They are significantly correlated, however, with recognition rates. These are estimated to increase by 0.41 and 0.34 percentage points with each additional verbal and material dispute. Only the effect of verbal conflicts is significant. Concerning interstate cooperation, the coefficients on verbal agreements are negative

²³An alternative hypothesis is that refugee flows cause an increase in the number of international incidents. To test this, we drop from the event matrix incidents involving refugees. We find that this does not affect our results.

and statistically significant in all regressions. The coefficients on material cooperation are positive in the flow regressions and negative in the share regressions, but are never statistically significant. The evidence suggests that our relationship is mainly driven by verbal incidents. When material conflicts occur, bilateral relations are arguably highly deteriorated, while for countries to engage into material cooperation their relations need to be cordial enough. These dynamics may explain the lack of a significant relationship between these particular events and recognition rates.

Finally, Table E5 in Section 4.E reports additional robustness checks. Column (1) shows the coefficients in the baseline specification. In columns (2) and (3), we condition on the number of applications from the sending country and from all other countries. The point estimates are only marginally affected. In column (4), we estimate our regression for the pre-crisis period. The coefficients we obtain are similar in magnitude to those in the baseline specification. In columns (5) and (6), we run our regression for the EU-15 countries and the new member states separately. Consistent with our results in the previous section, we obtain significant coefficients only for the richer and larger states in the EU. An additional concern is that the geographic coverage of the GDELT is biased in favor of the largest countries. For instance, France, Germany and Great Britain are each referenced at least 1,000 times in the database (Great Britain has more than 4000 entries). By contrast, the remaining EU countries have an average of 150 entries. In column (7), we restrict the sample to France, Germany and the United Kingdom. The point estimates are less significant but have the expected sign and are of the same order of magnitude. In columns (8) and (9) we test the sensitivity of our estimates to different definitions of international events. In column (8) we include minor events, while in column (9) we consider all government-affiliated entities. The coefficients are not significantly altered. In column (10), we allow for time-varying origin and destination fixed effects. The coefficients have the right sign, although they are slightly smaller in absolute terms and relatively less significant.

This section documents a robust relationship between different measures of interstate tensions and asylum policies. In particular we show that, conditional on humanitarian conditions in the origin country and a strictly positive number of asylum demands, EU countries are more likely to admit refugees from “non-partner” than from “partner” states. Of course, we do not claim that this relationship is causal. The relationship between norms, interests and asylum policies is more complex than modeled here.²⁴ Humanitarian conditions in the sending countries may themselves generate international tensions and amplify their effect on recognition rates. Asylum policies can also

²⁴In Section 4.D, we discuss the evolution of asylum policies in Germany with respect to Turkish asylum seekers. The example highlights the complicated nature of the relationship between asylum and international tensions.

heighten tensions, especially when prominent dissidents are granted asylum. That being said, we think that such considerations do not weaken our argument, but reinforce the idea of a close relationship between asylum policies and interstate relations.

4.4 Gravity Model and Estimation

In this section we briefly describe a canonical model of international trade that delivers a gravity equation. We then discuss the estimation method we adopt to study the relationship between asylum policies and trade flows.

4.4.1 Gravity Equation

A host of models micro-found gravity equations. Demand-side models use CES preferences with either national product differentiation (Anderson, 1979), monopolistic competition (Krugman, 1979) or CET production (Baier and Bergstrand, 2001) to derive gravity equations. Supply-side models build on comparative advantage (Eaton and Kortum, 2002) or firm heterogeneity (Chaney, 2008).²⁵ In what follows, we briefly present a demand-side micro-foundation of the gravity equation, based on Anderson and Van Wincoop (2003). The economy consists of N countries indexed by i .

Production. The model builds on the Armingtonian assumption that every country is the unique producer of a variety. i can therefore be used to index both countries and the variety they produce. Labor is the only factor of production and the production technology features constant returns to scale. Markets are assumed to be competitive, which means that workers are paid their marginal product ($w_i = p_i$).

Consumption. Consumers have identical, homothetic preferences that are described by a CES utility function, with σ denoting the elasticity of substitution between goods. Consumers maximize utility subject to their budget constraint. Solving this optimization problem yields an expression for each country j 's nominal expenditure on goods produced in country i .

Trade Costs. We follow a long established tradition in the international trade literature and assume that trade costs take the iceberg form: for one unit of a variety produced in i to reach consumers in j , $\tau_{ij} - 1 > 0$ additional units need to be shipped. Assuming competitive markets, the price of variety i in country j will simply be $p_{ij} = \tau_{ij}p_i$.

²⁵See Head and Mayer (2014) for a review of the recent literature on the gravity equation.

Gravity equation. Plugging the expression for prices into the expenditure function delivers the following gravity equation:

$$X_{ij} = S_i M_j \tau_{ij}^{1-\sigma}, \quad (4.4.1)$$

where $S_i = a_i^{\sigma-1} w_i^{1-\sigma}$ and $M_j = X_j P_j^{\sigma-1}$. a_i is a measure of the quality of country i 's products, X_j is country j 's total expenditure and P_j the dual price index in j . This equation corresponds to [Head and Mayer \(2014\)](#)'s definition of structural gravity.²⁶ Bilateral trade flows can be decomposed into an origin-specific term (S_i), a destination-specific term (M_j) and a term capturing bilateral frictions ($\tau_{ij}^{1-\sigma}$).

4.4.2 Estimation

Asylum policies and trade costs. We make the assumption that asylum policies are correlated with international trade flows only through their effect on the iceberg trade costs.^{27,28} Specifically, we posit that trade costs take the following form:

$$\tau_{ij} = \exp(\delta \text{Asylum}_{ij} + \mathbf{Z}'_{ij} \mu + \varepsilon_{ij}), \quad (4.4.2)$$

where Asylum_{ij} is our measure of asylum policies, \mathbf{Z}_{ij} is a vector of bilateral covariates and ε_{ij} is the bilateral error term.

Econometric specification. Making the time dimension explicit and plugging eq. (4.4.2) into eq. (4.4.1), we obtain the following gravity equation that we take to the data:

$$X_{ijt} = S_{it} M_{jt} \exp\left((1-\sigma)(\delta \text{Asylum}_{ijt} + \mathbf{Z}'_{ijt} \mu + \varepsilon_{ijt})\right) \quad (4.4.3)$$

Theory-consistent estimation. Estimation of eq. (4.4.3) that is consistent with the theory requires adequate controls for the origin and destination-specific terms in the gravity equation. One possible solution was proposed by [Anderson and Van Wincoop \(2003\)](#).

²⁶Specifically, country j 's expenditure on goods produced in country i , $\pi_{ij} = \frac{X_{ij}}{X_j}$, can be expressed in the multiplicatively separable form: $\pi_{ij} = \frac{S_i \phi_{ij}}{\Phi_j}$ where $\Phi_j = \sum_k S_k \phi_{kj}$. In our case $\phi_{ij} = \tau_{ij}^{1-\sigma}$ and $S_i = a_i^{\sigma-1} w_i^{1-\sigma}$.

²⁷Of course, this is an extreme assumption. Higher asylum rates may reflect a worsening humanitarian crisis, such as a war or civil unrest, in which productive capital gets destroyed. If, as a result, production costs increase in the origin country, higher recognition rates may also be correlated with trade flows through the origin-specific term. We discuss how we address this issue further below.

²⁸We remain agnostic about the exact mechanisms through which recognition rates correlate with trade costs. Higher recognition rate, by increasing the size of ethnic business and social groups, could reduce contracting and informational costs and promote trade ([Rauch and Trindade, 2002](#)). Higher recognition rates may also signal higher tensions and reduce trade flows.

They use market clearing conditions to derive implicit solutions for these terms, which they then substitute into the gravity equation. The resulting equation is estimated by nonlinear least squares, minimizing the sum of squared errors.²⁹ A more simple method, that goes back to [Harrigan \(1996\)](#), consists of controlling for S_{it} and M_{jt} through an appropriate set of fixed effects. In what follows, we use this second method and include origin and destination-specific time-varying fixed effects in all specifications.

Estimator. One straightforward solution to estimating eq. (4.4.3) is to log-linearize it and perform ordinary least squares. This method, however, raises several issues. First, by taking logs we exclude from the regression zero trade flows, which has the potential to generate systematic selection bias. Second, in the presence of heteroskedasticity, [Silva and Tenreyro \(2006\)](#) show that OLS estimates of gravity equations are biased. We therefore estimate eq. (4.4.3) by Poisson Pseudo Maximum Likelihood (PPML). This estimator is robust to both the presence of zero trade flows and heteroskedastic errors, as demonstrated in [Silva and Tenreyro \(2006\)](#) and [Head and Mayer \(2014\)](#).³⁰ As a robustness check, we also estimate eq. (4.4.3) using a Multinomial Pseudo-Maximum Likelihood (MPML) estimator ([Eaton et al., 2012](#)). This estimator also yields unbiased estimates in the presence of heteroskedasticity. Moreover, because the independent variable is expressed as a trade share, lower weights are attributed to countries that trade significantly more and might have different asylum policies as a result.

Discussion. In addition to making minimal assumptions on the structure of gravity and its ease of implementation, controlling for the origin and destination-specific terms through fixed effects has another advantage in our framework. Including time-varying origin-specific fixed effects allows us to control for humanitarian conditions in sending countries. The coefficient on asylum policies will therefore not be confounded by factors related to the destruction of productive capacities in the origin. Similarly, by including time-varying destination-specific fixed effects we control for the general policy towards refugees in the receiving country. The coefficients we estimate will thus not be confounded by institutional differences across EU countries.

Equally important, in our baseline specification we also include country-pair specific fixed effects. We thus effectively control for all geographic, cultural, historical and

²⁹[Head and Mayer \(2014\)](#) build on [Anderson and Van Wincoop \(2003\)](#) to propose a more easily implementable estimation method. They first estimate the cost parameters for an initial value of the multilateral resistance terms and then use a contraction mapping algorithm to update the latter with the obtained fixed points. They iterate this procedure until the estimates stop changing.

³⁰A key advantage of using PPML is that the dependent variable does not have to follow a Poisson distribution, nor does it have to be an integer for the PPML estimator to be consistent ([Gourieroux et al., 1984](#)). In addition, the PPML has another advantage over OLS. Specifically, the estimated fixed effects end up corresponding to their theoretical counterparts ([Fally, 2015](#)).

political bilateral determinants of trade flows that are time-invariant.³¹ This is particularly important in our context as asylum seekers are likely to sort across destinations based on factors that are unobserved to the researcher. Insofar as these factors are time-invariant, they will be absorbed into our fixed effects.

The estimated coefficient on asylum policies, $(1 - \sigma)\delta$, should, nevertheless, not be interpreted as a causal effect. We cannot rule out the existence of time-varying bilateral confounding factors. If anything, we rationalize the negative sign we document in the next section as being (at least partly) an artifact of the high correlation between asylum policies and international tensions. Furthermore, trade patterns themselves can determine asylum policies. States, as rational agents, may refuse to grant refugee status to asylum seekers from trade partners in an effort not to antagonize them.³² Conversely, the lack of economic ties, as measured by trade flows between two countries, can induce them to signal political disagreements through asylum policies.

4.5 Asylum Policies and Trade Flows

In this section we describe our baseline results linking asylum policies to trade flows. We then test the robustness of our results and show how asylum policies correlate with trade flows at the industry level.

4.5.1 Baseline Results

Table 4.4 displays our baseline results when estimating eq. (4.4.3). In columns (1) and (2), we report results for European imports, while in columns (3) and (4) we use the exports to the rest of the world as the dependent variable. All regressions include time-varying importer and exporter fixed effects. This allows us to control for humanitarian conditions in the origin (the “push” factors) and economic conditions in the destination (the “pull” factors). We also include time-invariant dyadic fixed effects. As already mentioned, all bilateral determinants of trade and asylum policies that do not change over time (i.e. historical or cultural proximity) will be absorbed by these fixed effects.

³¹Felbermayr and Toubal (2010) construct a measure of cultural proximity using votes in the Eurovision Song Contest and show that it is positively associated with trade flows over time. Nunn and Trefler (2014) review the literature between institutions and trade.

³²Martin et al. (2008) show that countries that trade more are less likely to engage in war. However, the probability of MIDs is higher when countries trade more with the rest of the world, as bilateral dependence on a given trade partner is lower.

Column 1 shows that recognition rates are *negatively* correlated with European imports. A 10 percentage point increase in recognition rates is associated with a decline in imports of 0.5%. The point estimate is significant at 5%. In column 2, we investigate how the number of admitted refugees correlates with trade flows. In this specification, we also control for the total number of asylum demands. We find that doubling the number of refugees decreases European imports from the rest of the world by 1.3%.³³ An important result is that asylum policies are only correlated with (aggregate) import flows. Columns (3) and (4) show that the coefficients on recognition rates and the number of refugees are never significant for European exports.

Overall, we find a negative correlation between asylum policies and imports and no robust, significant relationship for exports. This result contrasts with the evidence in [Parsons and Vézina \(2018\)](#). However, while they find a positive effect of Vietnamese refugees in 1975 on exports in 1995, we focus on the contemporaneous correlation between asylum policies and trade flows. Insofar as asylum policies capture EU countries' attitudes towards other states, the patterns we document are consistent with the findings in the trade and international conflict literature. [Michaels and Zhi \(2010\)](#) find that following the French opposition to the war in Iraq and the decline of France's favorability rating in the US, export impediments from France to the US rose by 14 percentage points, whereas the effect for export impediments from the US to France was smaller. Similarly, [Fuchs and Klann \(2013\)](#) show that Chinese imports from other countries experienced a temporary decline following official visits of the Dalai Lama.

We further investigate the persistence of these effects in Table E6 in Section 4.E. Specifically, we re-estimate eq. (4.4.3) using the lagged values of the number of refugees as the independent variable.³⁴ The coefficient on the one-period lagged number of refugees is half the non-lagged estimate and no longer significant. The two-period lag is even smaller, while the three-period lag becomes positive, albeit non-significant. The correlation between asylum policies and imports is therefore not persistent and survives for one to two years at most. Surprisingly, the effect becomes significant for exports with a two-year lag. This may reflect delayed retaliation or the destruction of trading networks due to the initial reduction in imports.

Table E7 in Section 4.E reports results from several robustness checks. In Panel A, we show estimates when we use a Multinomial PML estimator. The dependent variable is in this case the market share (i.e. bilateral flows divided by total expenditure,

³³The size of the sample increases significantly in the refugee specification as we also include bilateral pairs with no filed claims. We do not find evidence that this biases our results. Estimating eq. (4.4.3) for observations with a non-missing recognition rate produces similar coefficients.

³⁴The results are similar if we use the lagged values of the recognition rates. We do not report them to save space, but are available upon request.

X_{ij}/X_j). The coefficient on recognition rates is negative, significant at 10% and only marginally smaller (column 1). The coefficient on the log of the number of refugees is not statistically significant at conventional levels, but is of the same order of magnitude as in the baseline specification. Using exports as the dependent variables produces coefficients that are not significant. In Panel B, we also include pair-specific time trends that control for unobserved linear bilateral evolutions in diplomatic relations. The results are only marginally affected. In Panel C, we estimate our specifications excluding the years 2015-2017. Humanitarian conditions worsened during this period in many countries in the Middle East, leading to massive inflows of asylum seekers in Europe. These might be correlated with changes in diplomatic relations with EU countries. The results in Panel C demonstrate that our results are not driven by the European Migrant Crisis. Finally, we show that the relationship between refugees and trade flows is robust to alternative measures of refugees. In Panel D, we use the hyperbolic sine transformation of the number of refugees (MacKinnon and Magee, 1990).³⁵ Our point estimates in columns (2) and (4) are close to the ones obtained in the baseline specification.

4.5.2 Results by Industry

A related issue is whether the relationship between asylum policies and trade varies across different types of products. To test this hypothesis, we use Rauch (1999)'s classification of goods into homogeneous, reference-priced and differentiated.³⁶ We also use the SITC codes to classify different types of trade flows and study how they correlate with asylum policies.

As Section 4.B illustrates, from 1999 to 2017 the EU exported predominantly differentiated goods. 86% of trade flows leaving Europe consisted of differentiated goods, albeit there was some variation across countries.³⁷ The share of trade in differentiated goods is much smaller for imports, with almost 50% of trade being in homogeneous and reference-priced products. Once again, there was significant variation across states, as shown in Section 4.B. These import and export shares are relatively stable across time. The export shares for differentiated goods increased marginally from 1999 to 2017, while the import shares for differentiated goods were slightly smaller than average in

³⁵For any variable x , the hyperbolic sine transformation is expressed as $\ln(x + (x^2 + 1)^{\frac{1}{2}})$. This function is well defined when x takes the value 0.

³⁶Both homogeneous and reference-priced goods have reference prices. The only difference is that the latter are traded on organized exchanges.

³⁷Bulgaria, Cyprus and Greece exhibited export shares in differentiated goods lower than 50%, while the exports of differentiated goods exceeded 90% for Austria, the Czech Republic, Germany, Hungary, Italy, Malta, Sweden and Slovakia.

the mid 2010s (Figure F2 in Section 4.F).

Rauch and Trindade (2002) argue that “commodities that do not possess reference prices are taken to be sufficiently differentiated that prices cannot convey all the information relevant for international trade”. This has several implications. First, search frictions are likely higher for differentiated goods, implying a greater difficulty to find alternative suppliers. This means that trade exchanges in differentiated goods are likely to be stickier even in the context of deteriorating bilateral interstate relations (i.e. higher recognition rates) than trade in homogeneous goods. Second, the existence of a larger diaspora (i.e. higher recognition rates) may help mitigate informational costs, which are more prevalent for trade in differentiated goods. These considerations lead us to hypothesize that the correlation between asylum policies and trade flows is more negative for homogeneous goods than for differentiated products.

We report tests for this hypothesis in Panel A of Table 4.5. Each row shows the results from a different regression in which the dependent variable is trade flows in either homogeneous, reference-priced or differentiated goods. The first three columns use the recognition rate as our measure of asylum policies, while in the last three columns we use refugee flows. All specifications include time-varying importer and exporter fixed effects, as well as dyadic fixed effects. The estimator is PPML.

Consistent with our hypothesis, we find a large and significant correlation between recognition rates and imports of homogeneous goods: an increase of 10 percentage points in recognition rates is associated with a 3.5% decrease in homogeneous product imports. The coefficient is significant at 1%. We find a similar effect for refugee flows: doubling the number of refugees corresponds to a 3.3 decrease in imports. The coefficients for reference-priced goods, while negative, are smaller and not significant at conventional levels. The results for differentiated goods are not robust, the point estimates changing sign from one specification to the other. Replicating the results for exports does not produce robust coefficients, as shown in Table 4.6.

If, conditional on the set of fixed effects, recognition rates contain information on changes in international relations, then the negative coefficients we find for imports could be driven by firms and state-owned companies reducing their purchases from rival countries or by consumer boycott. In a recent study, **Pandya and Venkatesan (2016)** show that Americans bought less French-sounding products after the French government’s decision to oppose the US over the invasion of Iraq. While the available data do not allow us to distinguish between these two channels, we provide tentative evidence by re-estimating eq. (4.4.3) at the industry-level.

The results of these regressions are displayed in Panel B of Table 4.5 for European imports. Out of ten industries, we find negative coefficients for six of them in both regressions with recognition rates and refugees flows as the independent variables. The largest effect is observed for animal and vegetable oils, fats and waxes (SITC 4). We also find statistically significant coefficients on recognition rates for crude materials, inedible, except fuel (SITC 2) and on refugee flows for manufactured goods (SITC 6). Davis et al. (2019) show that the Dalai Lama effect is due in great part to a reduction in exports of machinery and transport equipment (SITC 7). We also find negative coefficients for this industry, although the effects are not statistically significant. Most importantly, the coefficients for food, live animals (SITC 0), beverages and tobacco (SITC 1) and miscellaneous manufactured articles (SITC 8) are positive (but not significant). This would suggest that consumer boycott could have played only a limited role, and most of the effect was driven by changes in the purchasing patterns of private firms and state-owned companies. The results for exports are less robust, and rarely significant, as shown in Panel B of Table 4.6.

To sum up, the results presented in this section are consistent with our hypothesis that, after controlling for the origin and destination component, asylum policies reflect bilateral tensions that show up in their negative correlation with international trade flows. In particular, we only find a strong relationship for trade in homogeneous goods, for which it is arguably easier to find alternative suppliers in international markets. The lack of a strong correlation for trade in differentiated goods may be due to positive network effects offsetting the effects of interstate conflict.

4.6 Conclusion

This paper builds on evidence in the political science literature and estimates a robust relationship between asylum policies in the EU and international tensions. In particular, we find that higher similarity in voting patterns in the UN General Assembly and the presence of a free trade agreement are associated with a lower probability that an asylum seeker will be granted asylum in the EU. We also show that international incidents impact recognition rates. Episodes of interstate conflict typically occur in years with higher recognition rates, while episodes of interstate cooperation typically occur in years with lower recognition rates. Even though our results put the emphasis on the sensitivity of asylum policies to political economy considerations, they do not downplay the importance of humanitarian conditions in evaluating the merits of individual asylum applications. In fact, we confirm previous findings that conflict and political terror in the countries of origin lead to higher recognition rates.

We show the relevance of international tensions as a determinant of asylum policies by studying the relationship between asylum policies and international trade. We document a robust and statistically significant relationship between trade flows and asylum policies, even after controlling for humanitarian conditions in the countries of origin, general asylum policies in the destination countries, as well as bilateral determinants of asylum policies that do not vary over time. In particular, we find that higher recognition rates (or higher refugees flows) are associated with lower levels of European imports from the rest of the world. We also show that the effect is driven mainly by trade in homogeneous goods. Equally important, the effect is not persistent and disappears in less than three years. Exports appear to be less sensitive to contemporaneous asylum policies.

We acknowledge that the evidence presented in this article relies mostly on correlations and we encourage caution in interpreting our results in a causal way. If anything, the relationship between international trade and asylum policies is a complex one and a causal effect may exist in both directions. Second, linking asylum data to firm-level data would permit testing additional channels that may be operating and achieve a better understanding of how firms adjust to a disruption in political ties. We hope our research will prompt future inquiries in this direction.

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4.A Tables

Table 4.1: Recognition Rates for Turkish Asylum Seekers

	Processed applications (1)	Positive decisions (2)	Recognition rate (%) (3)
Great Britain	17295	2580	15
Germany	71230	13270	19
France	80055	7450	9

Notes: This table shows the total number of applications filed by Turkish asylum seekers in three EU countries from 1999 to 2017. We also show the number of positive decisions (applications which led to the grant of refugee status) and the corresponding recognition rate.

Table 4.2: Interest-Based and Norm-Based Variables

Dependent variable	Processed applications		Positive decisions		Recognition rate	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Interest-based factors</i>						
UN affinity score index - important votes	-0.004 (0.005)	-0.006 (0.005)	-0.014* (0.008)	-0.015* (0.008)	-0.065** (0.027)	-0.047* (0.027)
Regional trade agreement	0.008 (0.221)	0.032 (0.221)	-0.850*** (0.283)	-0.875*** (0.259)	-2.031* (1.075)	-3.169*** (1.060)
<i>Norm-based factors</i>						
Conflict magnitude score	0.147*** (0.049)	0.143*** (0.050)	0.301*** (0.063)	0.298*** (0.063)	2.222*** (0.368)	2.161*** (0.374)
Political terror scale	0.306*** (0.062)	0.294*** (0.060)	0.432*** (0.090)	0.434*** (0.088)	2.980*** (0.477)	2.881*** (0.478)
R-squared	0.727	0.868	0.809	0.903	0.325	0.443
Observations	33,381	33,354	19,687	17,249	19,745	19,471
Origin FE	Yes	Yes	Yes	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes	Yes	Yes	Yes
Dyadic FE	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Specifications in columns (1) through (4) are estimated by PPML. Specifications in columns (5) through (6) are estimated by OLS. The sample includes all bilateral asylum seeker flows for which we observe at least one positive value during the sample period. In columns (3) through (6), the sample is restricted to bilateral flows with a positive number of asylum seekers. Standard errors, clustered at the country-pair level, are reported in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 4.3: International Incidents and Asylum Policies

Dependent variable	Processed applications		Positive decisions		Recognition rate	
	(1)	(2)	(3)	(4)	(5)	(6)
Number of conflicts	0.012 (0.008)	0.021* (0.011)	0.021** (0.011)	0.042* (0.022)	0.387*** (0.133)	0.436*** (0.163)
Number of agreements	-0.006** (0.003)	-0.008*** (0.003)	-0.009** (0.004)	-0.010** (0.004)	-0.087*** (0.033)	-0.079** (0.038)
R-squared	0.714	0.856	0.778	0.870	0.316	0.432
Observations	33,127	33,127	19,572	17,178	19,620	19,358
Origin FE	Yes	Yes	Yes	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes	Yes	Yes	Yes
Dyadic FE	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Specifications in columns (1) through (4) are estimated by PPML. Specifications in columns (5) through (6) are estimated by OLS. The sample includes all bilateral asylum seeker flows for which we observe at least one positive value during the sample period. In columns (3) through (6), the sample is restricted to bilateral flows with a positive number of asylum seekers. Standard errors, clustered at the country-pair level, are reported in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 4.4: Asylum Policies and International Trade Flows

Dependent variable	Trade flows			
	European imports		European exports	
	(1)	(2)	(3)	(4)
Recognition rate	-0.049** (0.024)		0.012 (0.017)	
ln(1+Refugees)		-0.014** (0.006)		-0.006 (0.005)
ln(1+Asylum seekers)		0.001 (0.005)		-0.007* (0.004)
Regional trade agreement	-0.133 (0.164)	0.109 (0.085)	0.569*** (0.094)	0.252* (0.145)
Exporter × Year FE	Yes	Yes	Yes	Yes
Importer × Year FE	Yes	Yes	Yes	Yes
Importer × Exporter FE	Yes	Yes	Yes	Yes
# Observations	19,091	64,903	22,467	76,285

Notes: All specifications are estimated by Poisson Pseudo-Maximum Likelihood. The sample includes bilateral trade flows between EU countries and the rest of the world from 1999 to 2017. Recognition rates are computed as the share of asylum seekers who are granted refugee status. The variable $\ln(\text{Refugees})$ is the log of the number of refugees plus one. $\ln(\text{Asylum Seekers}_{ijt})$ is the log of total number of asylum seekers plus one. The number of observations differ across columns because observations with a number of asylum seekers equal to 0 are discarded in columns 1 and 3. Standard errors, clustered at the country-pair level, are reported in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 4.5: Asylum Policies and European Imports by Industry

Independent Variable	Recognition rate			ln(1+Refugees)		
	Coef.	Std. Err.	Obs.	Coef.	Std. Err.	Obs.
Types of goods	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A: Rauch classification</i>						
Homogeneous goods	-0.303***	(0.073)	11,822	-0.033**	(0.016)	29,020
Reference-priced goods	-0.061	(0.038)	13,632	-0.018	(0.011)	34,568
Differentiated goods	0.031	(0.038)	16,616	-0.005	(0.011)	44,810
<i>Panel B: SITC Industries</i>						
Food, live animals (SITC 0)	0.027	(0.027)	15,390	-0.005	(0.007)	41,829
Beverages and tobacco (SITC 1)	0.061	(0.076)	9,067	-0.003	(0.016)	24,338
Crude materials, inedible, except fuels (SITC 2)	-0.113**	(0.049)	15,378	-0.005	(0.010)	37,643
Mineral fuels, lubricants and related materials (SITC 3)	-0.117	(0.072)	7,432	-0.016	(0.014)	16,422
Animal and vegetable oils, fats and waxes (SITC 4)	-0.401***	(0.151)	6,073	-0.057**	(0.023)	13,492
Chemicals and related products, n.e.s. (SITC 5)	-0.009	(0.039)	12,328	-0.023	(0.015)	31,676
Manufactured goods classified chiefly by material (SITC 6)	-0.043	(0.040)	15,780	-0.023***	(0.009)	41,424
Machinery and transport equipment (SITC 7)	-0.047	(0.050)	16,453	-0.006	(0.010)	44,261
Miscellaneous manufactured articles (SITC 8)	0.033	(0.029)	16,146	0.000	(0.008)	44,276
Not classified elsewhere (SITC 9)	-0.006	(0.520)	4,917	0.096	(0.092)	11,195

Notes: All coefficients are estimated by Poisson Pseudo-Maximum Likelihood. All specifications include time-varying origin and destination-specific fixed effects, as well as time-invariant dyadic fixed effects. Standard errors, clustered at the country-pair level, are reported in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 4.6: Asylum Policies and European Exports by Industry

Independent Variable	Recognition rate			ln(1+Refugees)		
	Coef.	Std. Err.	Obs.	Coef.	Std. Err.	Obs.
Types of goods	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A: Rauch classification</i>						
Homogeneous goods	0.201*	(0.107)	14,101	-0.052*	(0.028)	29,879
Reference-priced goods	0.032	(0.034)	19,097	0.014	(0.010)	48,496
Differentiated goods	-0.032	(0.029)	21,662	-0.012	(0.007)	64,140
<i>Panel B: SITC Industries</i>						
Food, live animals (SITC 0)	0.039	(0.036)	19,795	-0.008	(0.008)	51,436
Beverages and tobacco (SITC 1)	0.012	(0.091)	16,138	0.019	(0.020)	39,767
Crude materials, inedible, except fuels (SITC 2)	0.054	(0.044)	18,590	0.006	(0.012)	44,391
Mineral fuels, lubricants and related materials (SITC 3)	0.039	(0.112)	15,535	0.007	(0.025)	36,263
Animal and vegetable oils, fats and waxes (SITC 4)	0.323***	(0.102)	11,433	-0.000	(0.023)	23,068
Chemicals and related products, n.e.s. (SITC 5)	0.045	(0.027)	20,620	0.005	(0.008)	57,385
Manufactured goods classified chiefly by material (SITC 6)	-0.006	(0.033)	21,007	-0.003	(0.007)	59,735
Machinery and transport equipment (SITC 7)	-0.028	(0.028)	21,606	-0.013*	(0.007)	64,630
Miscellaneous manufactured articles (SITC 8)	-0.033	(0.022)	21,273	-0.004	(0.006)	61,495
Not classified elsewhere (SITC 9)	-0.555	(0.400)	6,646	-0.171*	(0.101)	15,922

Notes: All coefficients are estimated by Poisson Pseudo-Maximum Likelihood. All specifications include time-varying origin and destination-specific fixed effects, as well as time-invariant dyadic fixed effects. Standard errors, clustered at the country-pair level, are reported in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%.

4.B Figures

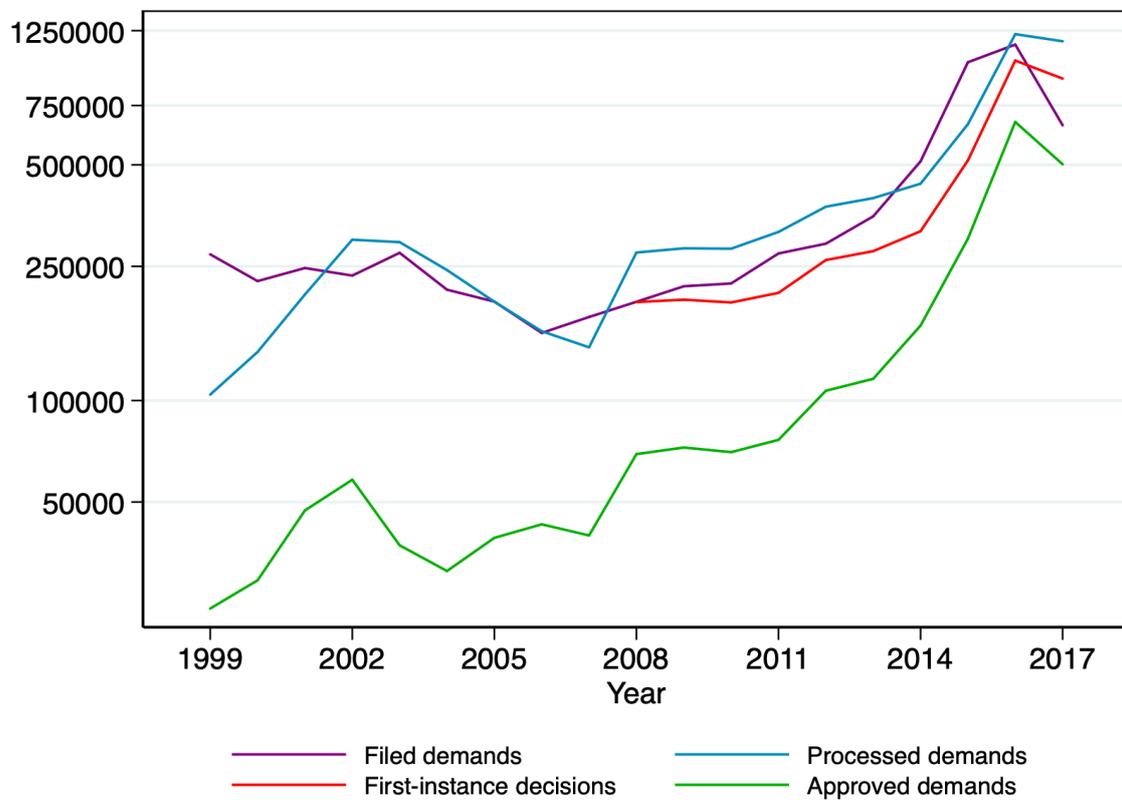


Figure 4.B.1: Evolution of Asylum Applications, 1999-2017

Notes: This figure shows the evolution of asylum applications in the EU-15 countries from 1999 to 2017. The number of filed demands corresponds to the number of applications for asylum submitted in a year. The number of processed demands corresponds to the number of applications for which a decision was made. First-instance decisions refer to decisions made in response to a demand at the first instance level of the procedure. The number of approved demands corresponds to the number of applications for which a positive decision was made and includes both first-instance and final decisions. Data for the following countries is missing: Belgium (2002, 2007), Germany (1999, 2000), Denmark (2002), Spain (1999, 2000), Great Britain (1999-2001), Greece (1999-2002), Ireland (2000-2002), Italy (1999, 2007), the Netherlands (2007) and Portugal (1999).

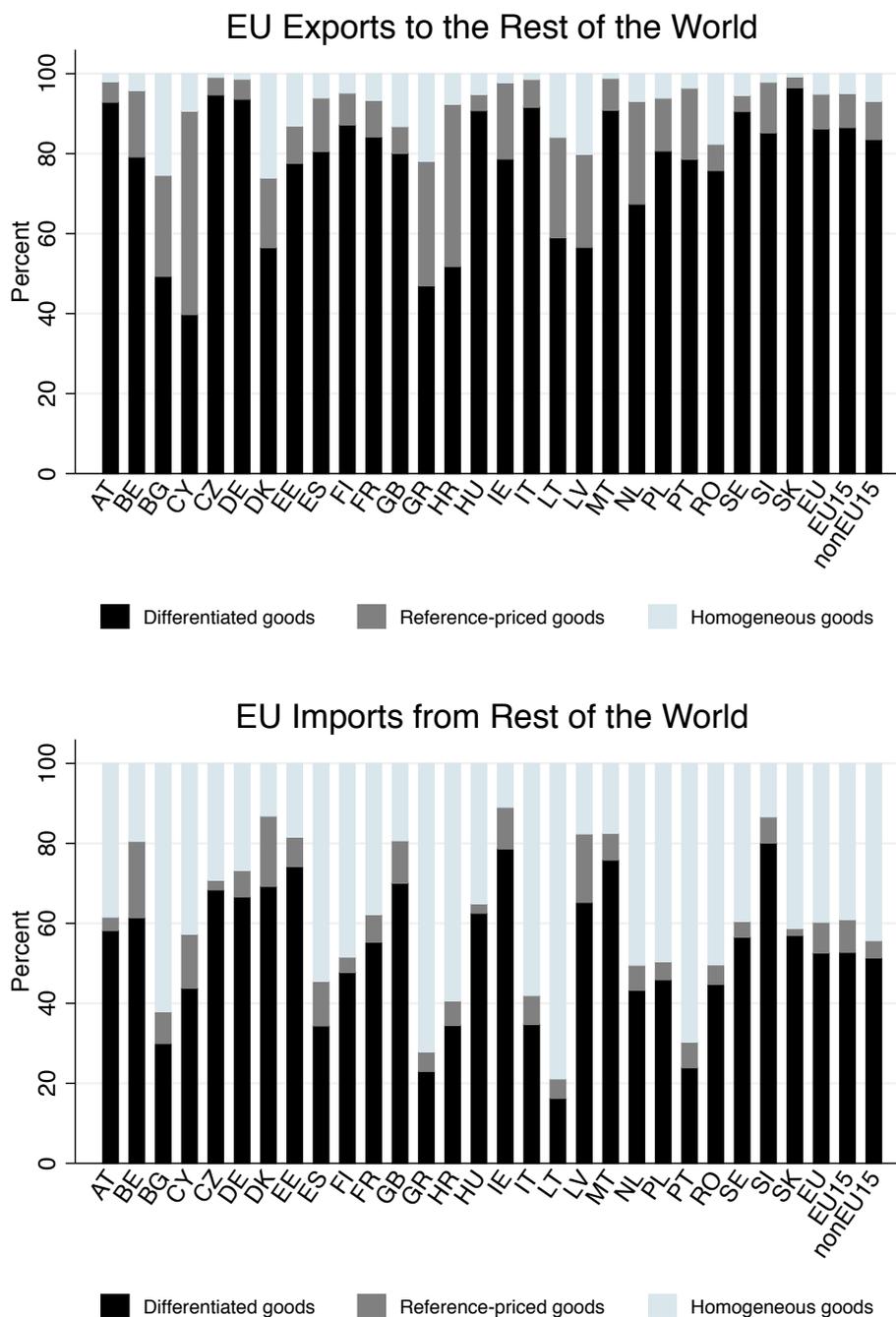


Figure 4.B.2: Trade Shares for Different Categories of Goods

Notes: This figure shows the share of aggregate imports and exports for different categories of products. We use Rauch (1999)'s classification of goods into differentiated, reference-priced and homogeneous.

4.C Data

4.C.1 Data Sources

Variable	Source	Sample	Notes
Trade Flows	BACI: International Trade Database at the Product-Level (Gaulier and Zignago, 2010)	Trade flows between 27 European countries (Belgium and Luxembourg are aggregated and the UK is included) and 145 non-European countries from 1999 to 2017.	The data set provides information on trade-flows at the product level for nearly all countries from 1999 to 2017. Values are reported in thousands of dollars and have not been deflated. In our final sample, we only keep countries that are independent political entities.
Asylum Statistics	Eurostat (Eurostat, 2018)	Asylum seeker and refugee flows from 145 countries in 27 European states from 1999 to 2017.	The data sets provide information on the yearly number of asylum demands and first-instance decisions by citizenship. We drop intra-European flows.
Political Terror Scale (PTS)	Freedom House (Gibney et al., 2018).	195 countries observed from 1999 to 2017.	The PTS is a measure of political violence and terror in a given country. It ranges from 1 (countries with a secure rule of law) to 5 (countries with generalized violations of civil and political rights). The data set compiles three indices from three different sources: the yearly reports of Amnesty International, the reports on Human Rights Practices of the U.S. State Department and the World Reports of Human Rights Watch. Our PTS variable is the average of these indices.

Variable	Source	Sample	Notes
Conflict in the country of origin	Center for Systemic Peace - Major Episodes of Political Violence (Marshall, 2017)	167 countries observed from 1999 to 2017.	The data set records major episodes of political violence and conflict at the national level. The events covered are international violence and warfare, civil violence and warfare and ethnic violence and warfare. Our measure of conflict is the sum of magnitudes of all societal and interstate episodes of violence.
UN Voting Similarity	Voeten et al. (2009)	Bilateral affinity indices between 27 European countries and 145 non-European countries from 1999 to 2017.	This data set contains dyadic affinity scores, computed as the probability that two states vote in the same way in the UN General Assembly.
Events	GDELT (Leetaru and Schrodtt, 2013)	The sample contains international events involving 27 European countries and 145 non-European countries from 1999 to 2017.	The GDELT database contains international events reported in newspapers and classified either as verbal or material conflict or as verbal or material cooperation.
Distance and other gravity variables	Head et al. (2010)	Bilateral distance and other gravity variables between 27 European countries and 145 non-European states from 1999 to 2017.	The data set contains data on the geographic distance between states, as well as other gravity-related variables: contiguity, common official language, common religion, colonial ties, WTO membership as well as GDP and population levels.

4.C.2 Event Data

The international event data set was downloaded from the GDELT Project's website (<https://www.gdeltproject.org/>).³⁸ The database references more than 200 million geolocated reports of events from 1979 to the present. International incidents are grouped into several classes and categories, as defined in the Conflict and Mediation Event Observations (CAMEO) framework. The main classes and categories are summarized in the table below.

News reports concerning the events in the data set set come from various English-speaking international sources and are coded using the Textual Analysis by Augmented Replacement Instructions (TABARI) software. The TABARI algorithm analyses the lead sentence of a news report. For example, a report that starts with the sentence, "The US imposes economic sanctions on Russia", will be recorded in the following way. The US is coded as the lead actor and Russia is coded as the actor being affected by the lead actor's decision. The class of the event is "Material Conflict", the category "Reduce Relations" and the sub-category "Impose embargo, boycott, or sanctions". Daily news reports are recorded from April 2013 to December 2017. From January 2006 to March 2013, the data set contains monthly reports while from 1999 to 2005 there are only yearly records.

Event Classes and Categories in the GDELT Database

Verbal Cooperation	Material Cooperation	Verbal Conflict	Material Conflict
Make public statement	Engage in material cooperation	Demand	Exhibit force posture
Appeal	Provide aid	Disapprove	Reduce relations
Express intent to cooperate	Yield	Reject	Coerce
Consult	Investigate	Threaten	Assault
Diplomatic Cooperation		Protest	Fight
			Unconventional mass violence

Notes: Each event type contains several subcategories. More information can be found on the GDELT project's website.

In order to create the event database, we run four Python scripts. The first script downloads the zip files from the GDELT website and unzips them. The second script trims the original data set by keeping only those observations in which at least one of the actors is a EU Member State and saves it as a csv file. The third script further trims the data set by dropping observations with missing actors and those in which at least one actor is a supra-national entity (i.e. the EU as a whole, the Balkans, the African Union). We only keep events for which both the lead actor and the destination actor are national entities. We then collapse the data set at the yearly level, such that

³⁸For a more in-depth discussion of the GDELT database, see [Leetaru and Schrodtt \(2013\)](#).

the resulting csv file contains yearly dyadic pairs, each member corresponding to a national entity. Finally, the fourth script creates two data sets, the former containing events classified as “Verbal and Material Conflict”, and the latter containing “Verbal and Material Cooperation” events.

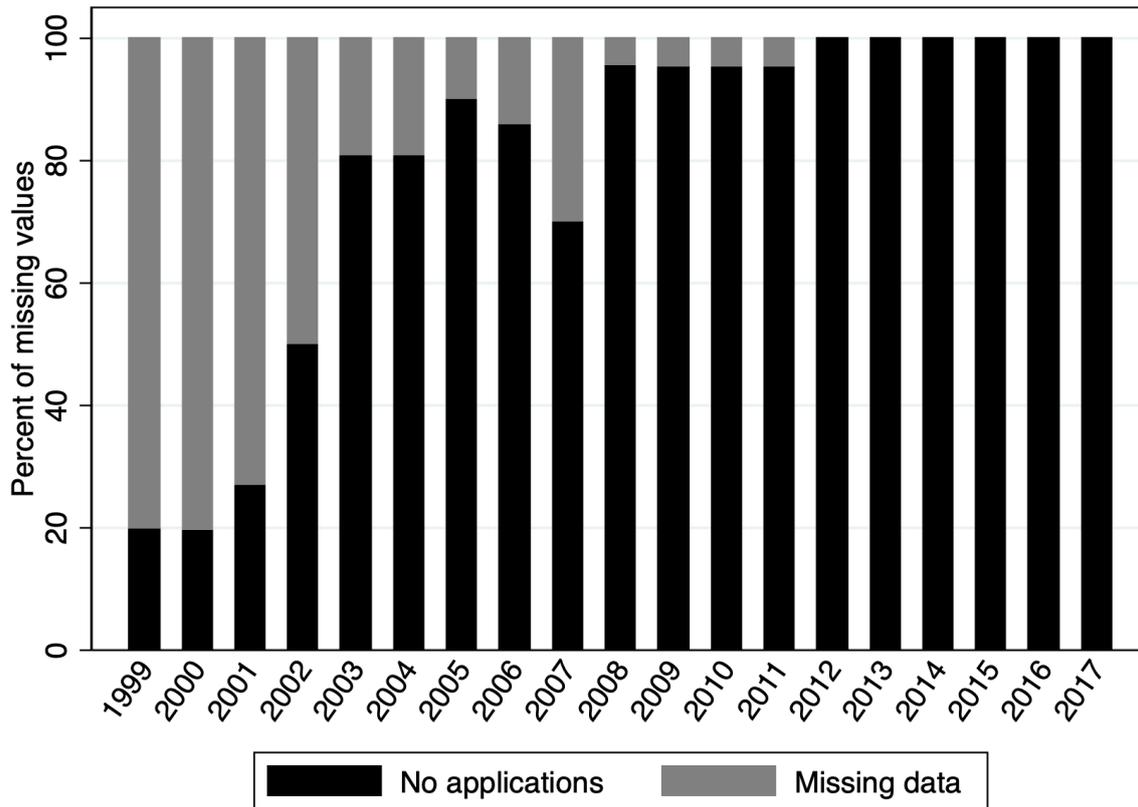
4.C.3 Missing Recognition Rates

One important concern about the analysis carried out in this paper is related to the high frequency of missing recognition rates. For more than 75% of the bilateral pairs in our data set (61,418 out of 81,567), we cannot compute recognition rates. This is due to the unavailability of asylum data and the presence of a significant number of zero asylum seeker flows. In this section, we discuss the determinants of missing values and how this affects our results.

Several European countries do not report asylum statistics in every year in our sample: Belgium in 2002 and 2007, Bulgaria from 1999 to 2001, Croatia from 1999 to 2011, Cyprus from 1999 to 2002, the Czech Republic from 1999 to 2001, Germany in 1999 and 2000, Denmark in 2002, Estonia from 1999 to 2002, Spain in 1999 and 2000, Great Britain from 1999 to 2001, Greece from 1999 to 2002, Hungary from 1999 to 2001, Ireland from 2000 to 2002, Italy from 1999 to 2007, Latvia from 1999 to 2001, Lithuania from 1999 to 2001, Malta from 1999 to 2002, the Netherlands in 2007, Poland from 1999 to 2001, Portugal in 1999, Romania in 1999 and 2000, Slovenia from 1999 to 2001 and Slovakia from 1999 to 2002. This type of non-reporting generates 12,402 missing recognition rates. There are 269 other cases of missing data, in which a government does not report the number of applications from a given sending country. This implies that non-reporting accounts for only 20% of the missing recognition rates in our sample, the remaining 80% being due to zero asylum seeker flows.

As the graph below illustrates, missing recognition rates due to data unavailability were more likely during the first years covered in our sample, when the lack of asylum statistics accounted for almost 80% of missing values. Starting with 2003, this becomes less of an issue and the vast majority of missing recognition rates can be imputed to zero asylum seeker flows.

In the table below, we estimate a linear probability model that expresses the conditional probability of missing asylum data as a function of interest-based, norm-based and bilateral covariates. It is noteworthy to mention that the sample probability of missing data is 15.53%. In column (1), we present results from an OLS regression that does not include any fixed effects. We find that voting similarity, conflicts in the sending



Sources of Missing Recognition Rates

country and sharing a common religion increase the probability of missing data, while free trade agreements, distance and colonial ties are negatively associated with this probability. These results are not affected by the estimation method: using a Probit model produces similar coefficients, as demonstrated in column (3). The evidence, however, suggests that the results are driven by the new member states, which were more likely not to report data in the beginning of our sample period. These states were also more likely to vote in a similar fashion with the rest of the world than EU-15 countries, less likely to have a free trade agreement, were located closer to sending countries (the new member states form a contiguous eastern bloc within the EU) and were less likely to share colonial ties with other countries. Also, internal conflicts in sending countries appear to have been of a greater magnitude from 1999 to 2001, which corresponds to the period when missing data were more likely. In column (2), we re-estimate the linear probability model including origin and destination fixed effects, as well as year fixed effects. There are fewer significant coefficients, and those that remain significant have a small effect on the probability of missing data. An increase in the voting affinity index of 10 percentage points increases the probability by 1 percent, while regional trade agreements reduces it by 2.3 percent.

We believe data unavailability to be less of an issue in our study. When a country

does not report data, recognition rates are marked as missing for all bilateral pairs that include it and are excluded from regressions. Selection bias is likely to occur if countries systematically sort into reporting and non-reporting based on unobservable, time-varying characteristics. To test whether this is a source of concern for us, we re-estimated our regressions for the 2008-2017 period, when data availability was less of an issue. All of our results carry through.

Missing Recognition Rates						
	Probability missing			Probability zero flow		
	(1) OLS	(2) OLS	(3) Probit	(4) OLS	(5) OLS	(6) Probit
<i>Interest-based factors</i>						
UN voting affinity Index	0.004*** (0.000)	0.001*** (0.000)	0.004*** (0.000)	0.001 (0.001)	0.001*** (0.000)	0.001*** (0.000)
Regional Trade Agreement	-0.156*** (0.004)	-0.023*** (0.004)	-0.230*** (0.005)	0.025** (0.011)	0.007 (0.006)	0.043*** (0.005)
<i>Norm-based factors</i>						
Conflict magnitude score	0.009*** (0.002)	0.000 (0.001)	0.009*** (0.001)	-0.027*** (0.004)	-0.013*** (0.002)	-0.014*** (0.001)
Political Terror scale	-0.001 (0.002)	-0.000 (0.002)	-0.001 (0.002)	-0.104*** (0.005)	-0.027*** (0.002)	-0.137*** (0.002)
<i>Gravity covariates</i>						
log(Distance)	-0.017*** (0.005)	0.001 (0.002)	-0.020*** (0.002)	0.209*** (0.009)	0.121*** (0.007)	0.240*** (0.004)
Contiguity	-0.014 (0.035)	0.003 (0.013)	-0.003 (0.016)	0.180** (0.071)	0.004 (0.019)	0.229*** (0.026)
Common language	0.007 (0.007)	0.002 (0.005)	0.007 (0.006)	-0.166*** (0.024)	-0.141*** (0.007)	-0.189*** (0.009)
Colonial ties	-0.021** (0.010)	-0.001 (0.006)	-0.027*** (0.008)	-0.322*** (0.029)	-0.115*** (0.009)	-0.356*** (0.012)
Common religion	0.037*** (0.010)	0.002 (0.006)	0.034 (0.005)	0.156*** (0.019)	0.055*** (0.009)	0.197*** (0.010)
Origin & Destination FE	No	Yes	No	No	Yes	Yes
Year FE	No	Yes	No	No	Yes	No

Notes: In columns (1) through (3), the dependent variable is an indicator variable that takes the value 1 for bilateral pairs with missing values. In columns (4) through (6), the dependent variable is an indicator variables that takes the value 1 for bilateral pairs zero flows. The sample used in columns (4) through (6) includes only bilateral pairs for which asylum data is available. For the Probit regressions, we report marginal effects calculated at the sample mean. * significant at 10%, ** significant at 5%, *** significant at 1%.

More worrisome is the high number of zero asylum seeker flows. In the absence of a strictly positive number of applications, recognition rates cannot be computed and remain unobserved (there is no reason that recognition rates would not have been positive had any applications been filed). The selection bias now arises from asylum seekers sorting across destinations based on unobservable characteristics. In columns (4) through (6) of the table below, we estimate the probability of no asylum seeker flows as a function of interest-based, norm-based and bilateral variables, conditional on data being available. The sample probability of no flows, conditional on data availability,

is 70.75%. Column (4) reports estimates from a linear probability model with no fixed effects. Better inter-state relations, as measured by a higher voting affinity index and by the presence of trade agreements, are associated with a higher probability of zero flows, while worse humanitarian conditions in the country of origin reduce it. A larger distance, the absence of a common language and colonial ties increase the probability of zero flows, which is consistent with higher relocating costs for asylum seekers in these cases. Contiguity and common religion have both a positive and significant coefficient. The marginal effects from a Probit regression are of a similar magnitude, as shown in column (6). In column (5), we estimate a linear probability model with origin, destination and year fixed effects. Most coefficients remain significant, although they are lower. This suggests that zero flows are not randomly distributed across country pairs, which may be a source of selection bias.

4.D Case Study: Turkish Refugees in Germany

During the period we study, Germany received the highest number of asylum seekers in the EU. One third of the total number of asylum applications in Europe were filed in Germany. Most of asylum seekers originated from war-torn countries, like Syria, Afghanistan and Iraq. Prior to the European Migrant Crisis, however, the third largest group of asylum seekers in Germany were from Turkey. In this section, we examine the evolution of German recognition rates for Turkish asylum seekers and the diplomatic relationship between the two countries.

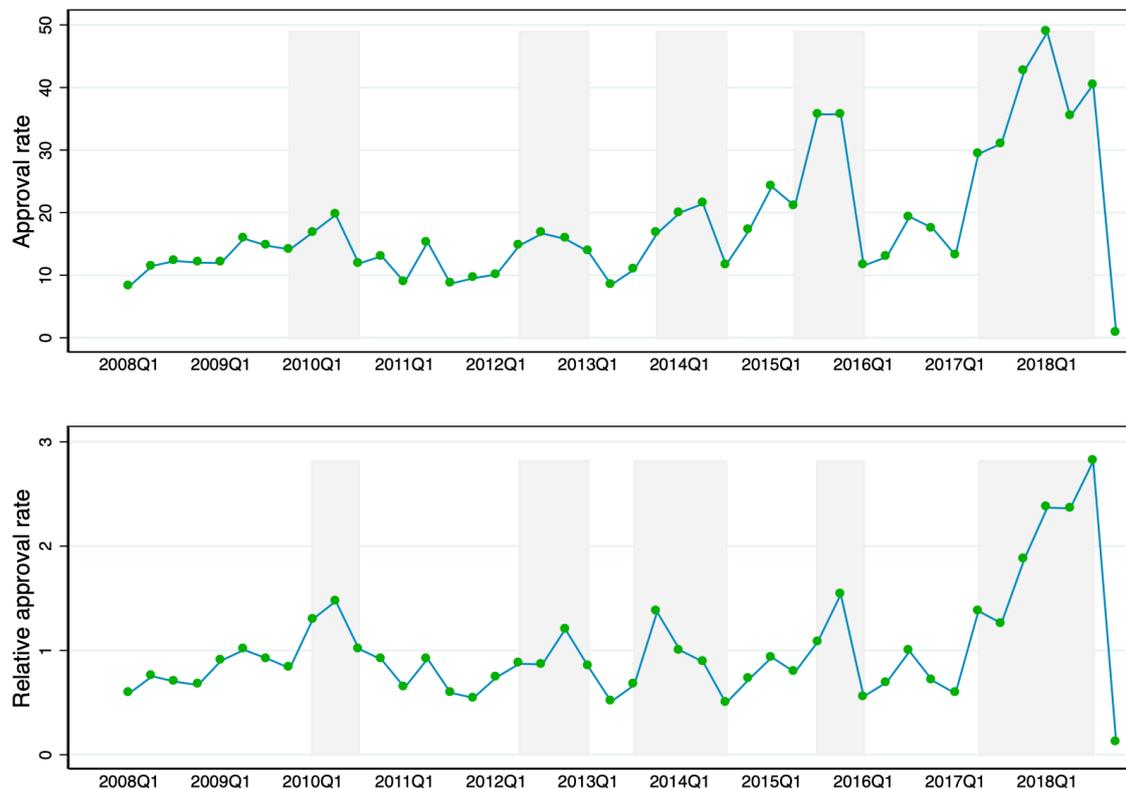
In the early 2000s, more than 10,000 Turkish citizens claimed asylum in Germany every year. The numbers decreased significantly over the next ten years, reaching an all-time minimum in 2015 when only 450 applications were recorded. Since then, the number has exploded, exceeding 10,000 demands in 2017. These fluctuations most certainly reflect Turkey's internal tensions. The economic crisis of 2001 might be responsible for the impressive number of asylum claims from 2001 to 2003, while subsequent economic growth may explain the sharp reduction in applications. The recent surge in the number of demands followed the failed coup d'état of 2016, which resulted in a series of arrests and purges of political opponents. Recognition rates also varied considerably during this period, ranging from 5% in the mid-2000s to 33% in 2017.

Germany's current relationship with Turkey can at best be described as tense. Germany is one of the most vocal opponents to Turkey's accession to the European Union, a recurrent bone of contention between the two countries.³⁹ Germany also hosts more

³⁹Negotiations between Turkey and the EU began in 2005, more than 18 years after Turkey first applied

than 3 million persons of Turkish descent, half of them having the right to vote in Turkish elections. It is for this reason that Turkish politicians often organize rallies in Germany, at times in defiance of German authorities.⁴⁰ Tensions between the two countries heightened after the failed coup of 2016 and the arrest by Turkish authorities of several German human rights activists. ([Reference click here.](#))

The Figure below illustrates the evolution of quarterly recognition rates from 2008 to 2018. Because these numbers may be correlated with general changes in asylum policies, we also show relative recognition rates, defined as the ratio between the individual rate and the acceptance rate averaged across all countries origin. We find that the two series are highly correlated, with a coefficient of correlation of 0.86. This means that higher recognition rates correspond to a greater chance of being granted asylum relative to asylum seekers from other countries.



Recognition Rates for Turkish Asylum Seekers in Germany

for EU membership. Negotiations stalled five years later after France and Germany officially expressed their opposition to Turkey joining the EU. In addition to government officials, a vast majority of Germans also oppose Turkey's accession to the EU. ([Reference click here.](#))

⁴⁰In a 2014 speech in Cologne, Turkish Prime Minister Tayyip Erdogan addressed 16,000 Turks commending them to integrate but not to assimilate. ([Reference click here.](#)) In 2016, a German court prohibited the now-President Erdogan from addressing supporters during a rally in Cologne. ([Reference click here.](#)) In June 2017 the German Government did not allow the Turkish President to hold a speech in front of supporters in the run-up to the constitutional referendum. ([Reference click here.](#))

The shaded areas correspond to quarters in which recognition rates were higher than the average. While the evidence we provide here is anecdotal, the spikes in acceptance rates happen to coincide with periods of mounting tensions between the two countries. In 2009, recognition rates for Turkish refugees started increasing and peaked in mid-2010. At the same time, the newly established CDU-FDP coalition Government defined the general lines for EU's "enlargement policy" which provides only a "privileged partnership" for Turkey.⁴¹ ([Reference click here.](#))

Recognition rates declined and remained relatively low for the next two years, before surging in late 2012 and again in late 2013 and early 2014. Tensions with Germany regained in intensity in 2013 following criticism of the Turkish government for its harsh treatment of protesters and Germany's renewed opposition to Turkey's EU accession. After meeting his Turkish counterpart, German Foreign Minister Guido Westerwelle had to admit that "You can't deny the tensions," while at the same time affirming Germany's dedication to work towards achieving better relationship with Turkey. ([Reference click here.](#)) 2016 marked a new milestone in German-Turkish relations, with the German Parliament adopting a resolution recognizing the Armenian genocide of 1915. The vote came in at a most delicate time, with the German government seeking to appease Turkish officials in a bid to arrive at an agreement regarding the influx of refugees arriving from the Middle East. ([Reference click here.](#)) Recognition rates dropped in early 2016, but were on the rise again, as tensions renewed over Germany's ban on president Erdogan addressing supporters and the purges that occurred following the failed coup of July 2016. ([Reference click here.](#))

Of course, the tensions between Germany and Turkey are intrinsically related to the latter's treatment of political dissidents. As argued above, the deterioration of the rule of law in Turkey, together with arrests of human rights activists, are responsible for both heightened tensions and an increase in recognition rates. We therefore do not claim a causal effect of interstate tensions on recognition rates. Instead, we highlight the complex relationship between refugee acceptance rates, international tensions and human rights violations.

⁴¹Tensions between the two countries became so tangible that two days before the planned visit of chancellor Angela Merkel in Turkey in April 2010, the Turkish Prime-Minister Erdogan complained of Germany's display of "so much hatred towards Turkey". ([Reference click here.](#))

4.E Additional Tables

Table E1: List of Countries

Panel A: Non-EU countries (145)			
Afghanistan	Djibouti	Lesotho	Saint Vincent and the Grenadines
Albania	Dominica	Liberia	Sao Tome and Principe
Algeria	Dominican Republic	Libya	Saudi Arabia
Angola	Ecuador	Macedonia (FYR)	Senegal
Argentina	Egypt	Madagascar	Seychelles
Armenia	El Salvador	Malawi	Sierra Leone
Australia	Equatorial Guinea	Malaysia	Singapore
Azerbaijan	Eritrea	Maldives	Somalia
Bahamas	Ethiopia	Mali	South Africa
Bahrain	Fiji	Mauritania	Sri Lanka
Bangladesh	Gabon	Mauritius	Sudan
Barbados	Gambia	Mexico	Suriname
Belarus	Georgia	Moldova (Republic of)	Swaziland
Belize	Ghana	Mongolia	Syrian Arab Republic
Benin	Grenada	Morocco	Taiwan
Bhutan	Guatemala	Mozambique	Tajikistan
Bolivia	Guinea	Myanmar	Tanzania, United Republic of
Bosnia and Herzegovina	Guinea-Bissau	Namibia	Thailand
Botswana	Guyana	Nauru	Togo
Brazil	Haiti	Nepal	Trinidad and Tobago
Burkina Faso	Honduras	New Zealand	Tunisia
Burundi	India	Nicaragua	Turkey
Cabo Verde	Indonesia	Niger	Turkmenistan
Cambodia	Iran	Nigeria	Uganda
Cameroon	Iraq	North Korea	Ukraine
Canada	Israel	Oman	United Arab Emirates
Central African Republic	Jamaica	Pakistan	United States of America
Chad	Japan	Panama	Uruguay
Chile	Jordan	Papua New Guinea	Uzbekistan
China	Kazakhstan	Paraguay	Venezuela
Colombia	Kenya	Peru	Vietnam
Comoros	Korea (Democratic People's Republic)	Philippines	Yemen
Congo (Republic of the)	Korea (Republic of)	Qatar	Zambia
Congo (Democratic Republic of the)	Kuwait	Russian Federation	Zimbabwe
Costa Rica	Kyrgyzstan	Rwanda	
Côte d'Ivoire	Laos	Saint Kitts and Nevis	
Cuba	Lebanon	Saint Lucia	
Panel B: EU countries (27)			
Austria	Estonia	Italy	Romania
Belgium (with Luxembourg)	Finland	Latvia	Slovakia
Bulgaria	France	Lithuania	Slovenia
Croatia	Germany	Malta	Spain
Republic of Cyprus	Greece	Netherlands	Sweden
Czech Republic	Hungary	Poland	United Kingdom
Denmark	Ireland	Portugal	

Notes: The sample includes all non-European countries that sent at least one asylum seeker from 1999 to 2007.

Table E2: Summary of Events, 1999-2017

Event	Frequency	Percent	Event	Frequency	Percent
<i>Conflict</i>	11783	-	<i>Cooperation</i>	91413	-
<i>Verbal Conflict</i>	7456	63.28%	<i>Verbal Cooperation</i>	86764	94.91%
Demand	683	9.16%	Make public statement	6267	7.22%
Disapprove	2794	37.47%	Appeal	3321	3.83%
Reject	928	12.45%	Express intent to cooperate	6205	7.15%
Threaten	547	7.34%	Consult	51832	59.74%
Protest	866	11.61%	Diplomatic cooperation	10706	12.34%
Unclassified	1638	21.97%	Unclassified	8433	9.72%
<i>Material Conflict</i>	4327	36.72%	<i>Material Cooperation</i>	4649	5.09%
Exhibit force posture	52	1.20%	Engage in material cooperation	917	19.72%
Reduce relations	926	21.40%	Provide aid	947	20.37%
Coerce	1180	27.27%	Yield	1690	36.35%
Assault	417	9.64%	Investigate	571	12.28%
Fight	884	20.43%	Unclassified	524	11.28%
Unconventional mass violence	7	0.16%			
Unclassified	861	19.90%			

Table E3: Interest-Based and Norm-Based Variables - Robustness Checks

Dependent variable	Recognition rate									
	(1) Baseline	(2) Asylum seekers from origin	(3) Asylum seekers from all countries	(4) 1999-2014	(5) EU-15	(6) New member states	(7) No conflict in origin	(8) Limited political violence	(9) At least some conflict in origin	(10) Extensive political violence
<i>Panel A: No dyadic fixed effects</i>										
<i>Interest-based factors</i>										
UN affinity score index - important votes	-0.065** (0.027)	-0.066** (0.027)	-0.065** (0.027)	-0.072*** (0.027)	-0.058** (0.029)	-0.158** (0.069)	-0.032 (0.030)	-0.005 (0.063)	0.021 (0.055)	-0.074** (0.029)
Regional trade agreement	-2.031* (1.075)	-2.014* (1.071)	-1.989* (1.072)	-0.639 (1.286)	-2.590** (1.218)	1.569 (2.293)	-1.774 (1.193)	-3.740** (1.888)	-0.614 (3.899)	-0.397 (1.343)
<i>Norm-based factors</i>										
Conflict magnitude score	2.222*** (0.368)	2.170*** (0.363)	2.215*** (0.369)	1.845*** (0.333)	1.962*** (0.404)	3.276*** (0.823)	-13.220 (9.616)	0.993** (0.478)	1.999*** (0.366)	
Political terror scale	2.980*** (0.477)	2.853*** (0.472)	2.948*** (0.475)	2.043*** (0.501)	2.800*** (0.497)	3.075** (1.302)	1.569*** (0.560)	-0.555 (2.121)	4.408*** (0.936)	4.177*** (0.595)
Adjusted R-squared	0.325	0.326	0.327	0.305	0.337	0.370	0.256	0.224	0.406	0.335
Observations	19,745	19,745	19,745	15,890	15,728	3,999	13,702	2,897	6,043	16,846
<i>Panel B: Dyadic fixed effects</i>										
<i>Interest-based factors</i>										
UN affinity score index - important votes	-0.047* (0.027)	-0.048* (0.027)	-0.047* (0.027)	-0.046* (0.027)	-0.054* (0.029)	-0.091 (0.075)	-0.024 (0.028)	-0.029 (0.065)	0.058 (0.054)	-0.056* (0.029)
Regional trade agreement	-3.169*** (1.060)	-3.175*** (1.054)	-3.132*** (1.057)	-2.365* (1.296)	-3.661*** (1.164)	-0.128 (2.565)	-2.543** (1.165)	-4.772** (1.913)	-0.402 (4.298)	-1.987 (1.341)
<i>Norm-based factors</i>										
Conflict magnitude score	2.161*** (0.374)	2.074*** (0.363)	2.154*** (0.375)	1.769*** (0.334)	1.938*** (0.411)	3.125*** (0.835)	-11.890 (9.886)	0.874* (0.474)	1.978*** (0.371)	
Political terror scale	2.881*** (0.478)	2.653*** (0.469)	2.855*** (0.477)	2.150*** (0.501)	2.810*** (0.500)	3.676*** (1.407)	1.460*** (0.566)	-0.952 (2.169)	4.545*** (0.930)	4.005*** (0.601)
Adjusted R-squared	0.443	0.444	0.444	0.434	0.444	0.432	0.394	0.320	0.513	0.451
Observations	19,471	19,471	19,471	15,609	15,579	3,892	13,386	2,596	5,918	16,615

Notes: All regressions are estimated by ordinary least squares. Standard errors, clustered at the dyad level, are reported in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table E4: International Incidents by Type and Asylum Policies

Dependent variable	Processed applications		Positive decisions		Recognition rate	
	(1)	(2)	(3)	(4)	(5)	(6)
Number of verbal conflicts	0.001 (0.024)	0.024 (0.028)	0.031 (0.030)	0.072 (0.050)	0.414** (0.180)	0.442** (0.214)
Number of material conflicts	0.025 (0.041)	0.004 (0.041)	-0.011 (0.045)	-0.014 (0.033)	0.342 (0.226)	0.421* (0.220)
Number of verbal cooperation	-0.007** (0.004)	-0.010*** (0.004)	-0.012** (0.006)	-0.018*** (0.005)	-0.087** (0.037)	-0.080* (0.041)
Number of material cooperation	0.042 (0.027)	0.041 (0.028)	0.043* (0.025)	0.047* (0.025)	-0.116 (0.335)	-0.071 (0.290)
R-squared	0.715	0.856	0.779	0.872	0.316	0.432
Observations	33,127	33,127	19,572	17,178	19,620	19,358
Origin & Destination FE	Yes	Yes	Yes	Yes	Yes	Yes
Dyadic FE	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Specifications in columns (1) through (4) are estimated by PPML. Specifications in columns (5) through (6) are estimated by OLS. The sample includes all bilateral asylum seeker flows for which we observe at least one positive value during the sample period. In columns (3) through (6), the sample is restricted to bilateral flows with a positive number of asylum seekers. Standard errors, clustered at the country-pair level, are reported in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table E5: International Incidents and Asylum Policies - Robustness Checks

Dependent variable	Recognition rate									
	(1) Baseline	(2) Asylum seekers from origin	(3) Asylum seekers from all countries	(4) 1999-2014	(5) EU-15	(6) New member states	(7) France, Germany, United Kingdom	(8) Including minor events	(9) Including all agents	(10) Time-varying fixed effects
<i>Panel A: No dyadic fixed effects</i>										
Number of conflicts	0.395*** (0.132)	0.385*** (0.131)	0.387*** (0.133)	0.501*** (0.193)	0.378*** (0.138)	1.090 (0.868)	0.252* (0.153)	0.277*** (0.102)	0.301*** (0.101)	0.186* (0.113)
Number of agreements	-0.087** (0.034)	-0.092*** (0.034)	-0.083** (0.034)	-0.078* (0.041)	-0.088** (0.035)	-0.237 (0.185)	-0.049 (0.041)	-0.068** (0.030)	-0.082** (0.033)	-0.056* (0.032)
Adjusted R-squared	0.316	0.317	0.317	0.299	0.329	0.351	0.402	0.315	0.314	0.418
Observations	19,620	19,620	19,620	15,791	15,615	3,988	4,675	19,681	19,725	19,306
<i>Panel B: dyadic fixed effects</i>										
Number of conflicts	0.436*** (0.163)	0.413*** (0.155)	0.429*** (0.163)	0.589*** (0.218)	0.392** (0.164)	0.147 (0.874)	0.289 (0.181)	0.307** (0.124)	0.351*** (0.130)	0.123 (0.117)
Number of agreements	-0.079** (0.038)	-0.074** (0.037)	-0.074* (0.038)	-0.066 (0.045)	-0.060* (0.036)	-0.393 (0.252)	-0.030 (0.043)	-0.058* (0.033)	-0.073** (0.037)	-0.043 (0.029)
Adjusted R-squared	0.432	0.434	0.433	0.428	0.434	0.414	0.458	0.430	0.431	0.546
Observations	19,358	19,358	19,358	15,521	15,473	3,885	4,654	19,417	19,457	19,037

Notes: All regressions are estimated by ordinary least squares. Standard errors, clustered at the dyad level, are reported in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table E6: Asylum Policies and International Trade Flows: Lagged Results

Dependent variable	Trade flows					
	European imports			European exports		
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln(1+\text{Refugees}_{ijt-1})$	-0.008 (0.006)			-0.005 (0.005)		
$\ln(1+\text{Asylum seekers}_{ijt-1})$	-0.005 (0.005)			-0.007* (0.004)		
$\ln(1+\text{Refugees}_{ijt-2})$		-0.001 (0.006)			-0.011* (0.006)	
$\ln(1+\text{Asylum seekers}_{ijt-2})$		-0.003 (0.005)			0.000 (0.004)	
$\ln(1+\text{Refugees}_{ijt-3})$			0.005 (0.007)			-0.010** (0.005)
$\ln(1+\text{Asylum seekers}_{ijt-3})$			-0.003 (0.005)			-0.001 (0.004)
Exporter \times Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Importer \times Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Importer \times Exporter FE	Yes	Yes	Yes	Yes	Yes	Yes
# Observations	60,771	56,622	52,484	61,797	57,659	53,576

Notes: All specifications are estimated by Poisson Pseudo-Maximum Likelihood. The sample includes bilateral trade flows between EU countries and the rest of the world from 1999 to 2017. The variable $\ln(\text{Refugees})$ is the log of the number of refugees plus one. $\ln(\text{Asylum Seekers}_{ijt})$ is the log of total number of asylum seekers plus one. The number of observations differ across columns because observations with a number of asylum seekers equal to 0 are discarded in columns 1 and 3. Standard errors, clustered at the country-pair level, are reported in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table E7: Asylum Policies and International Trade Flows: Robustness Checks

Dependent variable	European imports		European exports	
	(1)	(2)	(3)	(4)
<i>Panel A: Multinomial pseudo-maximum likelihood estimator</i>				
Recognition rate	-0.058*		0.023	
	(0.032)		(0.025)	
ln(1 + Refugees)		-0.011		-0.006
		(0.009)		(0.006)
ln(1+Asylum seekers)		0.008		-0.003
		(0.009)		(0.006)
# Observations	19,091	64,903	22,467	76,285
<i>Panel B: Include pair specific time trends</i>				
Recognition rate	-0.045**		-0.003	
	(0.021)		(0.017)	
ln(1 + Refugees)		-0.013***		-0.000
		(0.004)		(0.004)
ln(1 + Asylum seekers)		0.003		-0.000
		(0.004)		(0.003)
# Observations	19,089	64,898	22,397	76,000
<i>Panel C: Pre-European Migrant Crisis (1999-2014)</i>				
Recognition rate	-0.089***		0.013	
	(0.030)		(0.027)	
ln(1 + Refugees)		-0.019***		-0.005
		(0.007)		(0.005)
ln(1 + Asylum seekers)		0.005		-0.005
		(0.005)		(0.004)
# Observations	15,290	52,560	17,788	61,106
<i>Panel D: Hyperbolic sine transformation</i>				
Refugees		-0.012**		-0.005
		(0.005)		(0.004)
Asylum seekers		0.001		-0.005*
		(0.004)		(0.003)
# Observations		64,903		76,285

Notes: The specifications in Panel A are estimated by Multinomial Pseudo-Maximum Likelihood. All remaining specifications are estimated by Poisson Pseudo-Maximum Likelihood. All specifications include time-varying exporter and importer-specific fixed effects, time-invariant dyadic fixed effects and a free trade indicator variable. Standard errors, clustered at the country-pair level, are reported in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%.

4.F Additional Figures

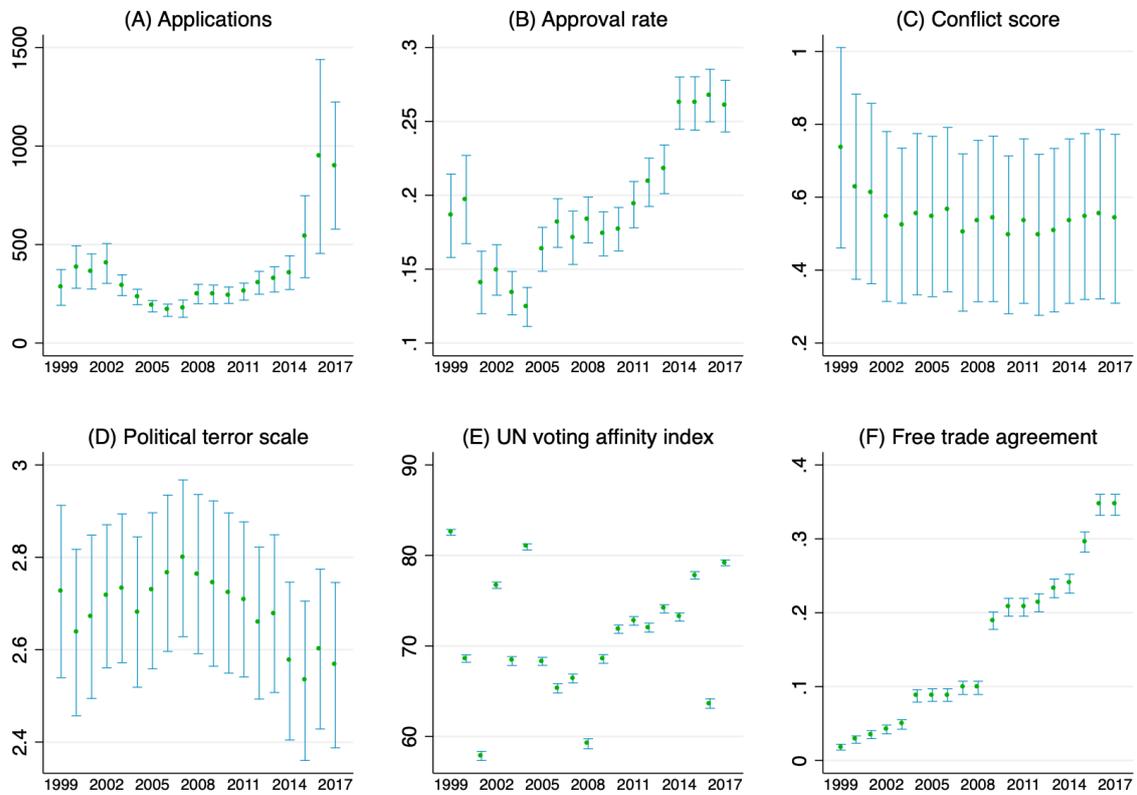


Figure F1: Average Statistics by Year, 1999-2017

Notes: This figure shows yearly averages and their 95% confidence intervals for a series of variables in our sample.

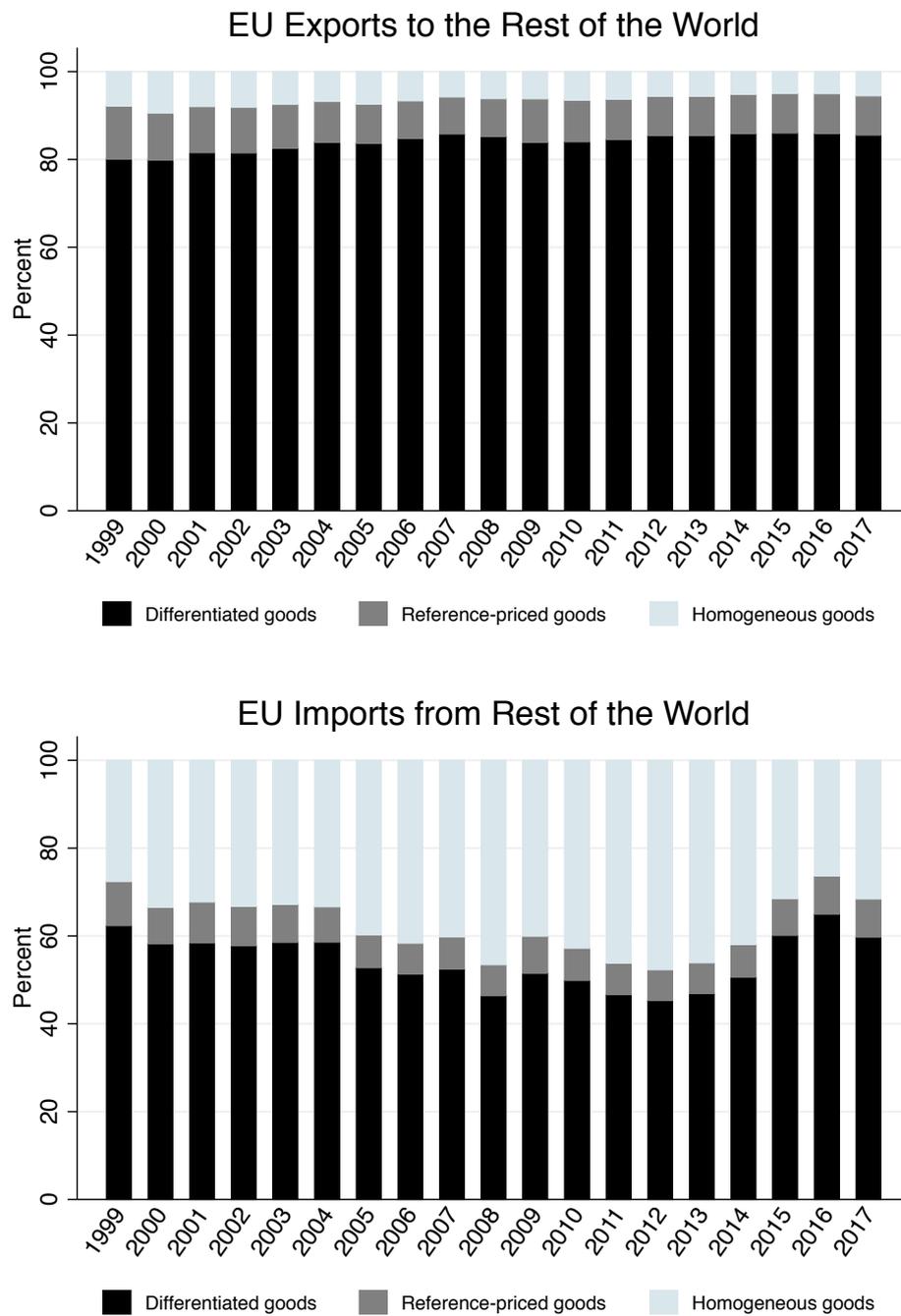


Figure F2: Trade Shares for Different Categories of Goods (Yearly Evolution)

Notes: This figure shows the share of aggregate imports and exports for different categories of products. We use Rauch (1999)'s classification of goods into differentiated, reference-priced and homogeneous.

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Essais en Commerce International et Organisation Industrielle

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Résumé

**Essais en Commerce International et Organisation
Industrielle**

Le commerce international et l'organisation industrielle (OI) sont intrinsèquement liés. La relation entre les deux branches est soulignée par le prix Nobel 2008 Paul Krugman.⁴² "La croissance rapide de l'application des concepts d'organisation industrielle au commerce international semble redonner à la théorie du commerce l'image de l'OI" (Krugman, 1989). Avec ces avancées théoriques, les entreprises sont devenues, avant les pays, le principal centre d'intérêt dans l'analyse du commerce international. L'accent plus récent à des données microéconomiques a permis d'affiner l'étude des entreprises et des industries, et de documenter de nouveaux faits stylisés (Bernard et al., 2007).

Les deux premiers chapitres de cette thèse s'appuient sur deux constats distincts en macroéconomie et en OI. Cependant, ils se concentrent tous deux sur les implications macroéconomiques de l'hétérogénéité des entreprises. Le troisième chapitre porte sur la migration des réfugiés et le commerce international. Après avoir contextualisé chacun des chapitres, j'en propose une description détaillée.

Le premier constat est que la part du travail dans le PIB a baissé dans toutes les industries et les économies développées depuis les années 1980 (Karabarbounis and Neiman, 2013). Le rôle joué par le commerce international et les entreprises exportatrices dans l'évolution de la part du travail a toutefois été négligé. L'article de Marc Melitz (Melitz, 2003) fournit les outils permettant de comprendre la manière dont le commerce international affecte les agrégats macroéconomiques lorsque les entreprises sont hétérogènes.⁴³ Plus précisément, le modèle de Melitz nous apprend que l'hétérogénéité des entreprises détermine la productivité agrégée. Lorsqu'un pays s'ouvre au commerce (ou libéralise davantage son économie), les entreprises les moins productives du secteur *disparaissent* et les plus productives croissent. Cette marge d'ajustement augmente la productivité agrégée au sein de l'industrie. En d'autres termes, les gains de productivité s'opèrent par la réaffectation des parts de marché vers les entreprises plus productives.⁴⁴ Les changements de productivité agrégée ne sont toutefois déterminés que par la sortie d'entreprises (la marge *extensive*). Les changements de parts de marché entre entreprises *existantes* (la marge *intensive*) causés par une concurrence accrue sur le marché peuvent-ils affecter la part du travail ?⁴⁵ Si oui, sont-ils quantitativement

⁴²On trouvera dans Krugman (1979) et Krugman (1980) deux importantes contributions en commerce international qui s'appuient sur les outils d'OI.

⁴³Le modèle est conforme à l'observation selon laquelle la productivité diffère largement d'une entreprise à une autre, "même au sein d'industries étroitement définies" (Syverson, 2004). Syverson (2011) fournit une étude approfondie des déterminants de la productivité.

⁴⁴Les entreprises exportatrices sont plus grandes et plus productives que les entreprises non exportatrices (Bernard et al., 1995, 2007). Ces entreprises internationales paient des salaires plus élevés, utilisent relativement plus de capital et sont plus productives. Des travaux ultérieurs ont montré que ces différences sont en partie la *cause* de l'exportation (Bernard and Jensen, 1999), bien que l'exportation entraîne également des gains de productivité accrus au niveau de l'entreprise grâce à l'apprentissage par l'exportation, comme le montre De Loecker (2007).

⁴⁵Melitz (2018) expose clairement la façon dont les réaffectations de parts de marché via les marges

importants ?

Les économistes ont récemment mis en lumière la manière dont les réaffectations de parts de marché entre entreprises en place affectent la part du travail (Autor et al., 2020) et les marges bénéficiaires (De Loecker et al., 2020). Autor et al. (2020) montrent que la baisse de la part du travail peut être attribuée à la croissance des entreprises extrêmement productives ayant une faible part du travail (entreprises “superstars”), plutôt qu’à une diminution de la part du travail au sein des entreprises. De Loecker et al. (2020) et De Loecker and Eeckhout (2018) fournissent la preuve que le pouvoir de marché, mesuré par les marges, a augmenté depuis les années 1980, respectivement aux États-Unis et dans le monde. Il est important de noter que cette augmentation est due à la croissance des entreprises à marge élevée. Étant donné que nos économies sont interconnectées, il semble naturel de penser que la mondialisation des échanges pourrait contribuer à cet effet de réaffectation et faire baisser la part du travail. Les opportunités d’échanges internationaux entraînent une augmentation de la taille du marché desservi par les entreprises exportatrices. Dans le même temps, elles augmentent la concurrence à laquelle les entreprises exportatrices sont confrontées sur les marchés internationaux, réduisant ainsi leurs bénéfices. Ces deux mécanismes ont un effet opposé sur le profit des entreprises et donc sur leur taux de croissance. Quel effet domine? Les entreprises les plus productives profitent de l’augmentation de la taille du marché sans être pénalisées par l’augmentation concomitante de la concurrence, tandis que les entreprises les moins productives décroissent. Le chapitre 1 montre que le commerce international interprété sous l’angle d’une augmentation de la demande étrangère diminue la part du travail dans le secteur de l’industrie manufacturière en France via des réaffectations à la marge *intensive*. Celles-ci sont quantitativement importantes. Ce chapitre montre que le rôle joué par le commerce international dans l’évolution de la part du travail est plus important qu’on ne le pensait auparavant et requiert une étude plus approfondie car ce phénomène est complexe.

Le deuxième constat important et étudié dans le deuxième chapitre est que la mauvaise affectation (misallocation) des facteurs de production entre entreprises réduit la productivité agrégée (Restuccia and Rogerson, 2008; Hsieh and Klenow, 2009). Quel est le lien entre pouvoir de marché des entreprises et misallocation des facteurs de production?⁴⁶ En général, le fait d’avoir du pouvoir de marché signifie que l’entreprise produit moins qu’elle ne le ferait si elle n’avait pas la capacité de fixer des prix supérieurs à son coût marginal. Par conséquent, si les entreprises les plus productives sont celles qui ont le

extensives et intensives façonnent la productivité agrégée.

⁴⁶Le pouvoir de marché d’une entreprise se traduit par le fait qu’elle puisse choisir son prix afin d’avoir un prix supérieur à son coût marginal de production. Le coût marginal d’une entreprise est la variation de son coût total de production provenant de la production d’une unité supplémentaire.

plus de pouvoir de marché, la demande est réorientée vers des entreprises relativement moins productives, ce qui réduit la productivité agrégée. En d'autres termes, les entreprises à marge élevée qui sont très productives sont trop petites par rapport à ce qu'elles *pourraient* être. Cela est-il un problème pour l'économie? Dans les années 1950, Arnold Harberger estimait que le coût des distorsions monopolistiques était faible : "L'élimination des mauvaises affectations de ressources dans l'industrie manufacturière américaine à la fin des années 1920 entraînerait une amélioration du bien-être des consommateurs d'un peu plus d'un dixième de pour cent". (Harberger, 1954). Ce résultat important suggère qu'il n'y a aucune raison de s'inquiéter des distorsions dues aux monopoles, puisque leur coût estimé est négligeable.

Dans le chapitre 2, Flavien Moreau et moi-même étudions comment les comportements anticoncurrentiels et les cartels influent sur la productivité agrégée en modifiant l'affectation des ressources. On craint en effet de plus en plus que l'augmentation de la concentration observée dans l'UE et aux États-Unis soit due à un *déclin* de la concurrence (Gutiérrez and Philippon, 2018). À cette fin, nous rassemblons de nouvelles microdonnées sur l'identité des entreprises anticoncurrentielles condamnées à des amendes par l'autorité française de la concurrence. Nous documentons le fait que les entreprises anticoncurrentielles sont présentes dans tous les secteurs et sont, en moyenne, des entreprises très grandes. Théoriquement, elles peuvent réduire la productivité agrégée en redirigeant les ressources des entreprises très productives vers des entreprises moins productives et, en même temps, d'entraîner une augmentation des marges des firmes. Nos résultats quantitatifs suggèrent que le coût des distorsions de concurrence causées par les cartels est beaucoup plus élevé que celui constaté précédemment par Harberger (1954) et que les raisons de s'inquiéter sont en fait bien fondées. Plus généralement, ces résultats rappellent l'idée, également étudiée au chapitre 1, que l'hétérogénéité microéconomique détermine la productivité agrégée.

Enfin, le troisième chapitre porte sur le commerce international et les migrations. L'afflux récent de demandeurs d'asile en Europe a mis en exergue le manque de coopération en matière de politiques d'asile entre pays européens. Ne s'agit-il que de divergences humanitaires ? Si tel est le cas, quel est leur lien avec les flux commerciaux ? Avec Florin Cucu, nous montrons que les politiques d'asile reflètent à la fois des préoccupations purement humanitaires *et* des préoccupations de politique étrangère pour discréditer les États rivaux. Cette relation entre les politiques d'asile et les tensions internationales explique la corrélation négative entre les politiques d'asile et les importations européennes en provenance du reste du monde. Ces résultats suggèrent en outre qu'il est peut-être peu judicieux d'utiliser les réfugiés comme variable instrumentale pour mesurer l'impact causal des migrants sur le commerce international, dans

la mesure où les politiques d'asile et les tensions internationales sont corrélées.

Les trois chapitres reposent sur l'utilisation de données et le recours aux outils théoriques pour aider à comprendre les implications ou les origines des résultats empiriques. J'en viens maintenant à une description plus détaillée de chaque chapitre.

Chapitre 1 - Part du Travail, Demande Étrangère et Exportateurs Superstars

Le déclin de la part du travail a été souligné dans la littérature macroéconomique récente pour différents pays et secteurs de l'OCDE (Karabarbounis and Neiman, 2013; Autor et al., 2020). Plusieurs explications concurrentes ont été avancées pour rationaliser l'évolution de la part du travail et le rôle du commerce international a été mis en avant. Le rôle spécifique de l'exposition aux *importations* est généralement souligné (Elsby et al., 2013). Les auteurs constatent que les industries américaines qui ont été les plus exposées aux importations sont aussi celles qui ont connu les plus fortes baisses de leur part du travail. Il est toutefois très probable que le volet "exportation" joue un rôle dans l'évolution de la part du travail, du moins dans le secteur manufacturier.

Ce volet du commerce international fait référence aux changements de la demande sur les marchés étrangers, causés par les guerres, les troubles politiques, les changements démographiques, les chocs économiques, etc. Ces changements de demande étrangère sont susceptibles d'affecter la part du travail des entreprises desservant les marchés étrangers en influençant leur structure salariale. Par exemple, une augmentation de la demande étrangère peut augmenter le salaire moyen de cette entreprise, ce qui augmente la part du travail de cette entreprise (en maintenant constante sa valeur ajoutée totale). Il est également possible que la croissance des entreprises *en place* soient affectées de manière *différente* par un changement de demande étrangère. Si les entreprises dont la part du travail est inférieure à la moyenne bénéficient relativement plus d'une augmentation de la demande étrangère et connaissent par conséquent une croissance relativement plus importante, cela peut avoir un impact sur la part du travail agrégée du secteur manufacturier via la réaffectation de parts de marché à la marge intensive.

La première contribution consiste à estimer l'effet *causal* des changements de demande étrangère sur la part du travail dans le secteur manufacturier. Je constate qu'une augmentation de la demande étrangère à laquelle les exportateurs français sont confrontés *diminue* la part du travail au niveau *agrégé*.⁴⁷ La seconde contribution consiste à chiffrer

⁴⁷L'évolution de la part du travail du secteur manufacturier dépend de l'évolution de la part du travail des *entreprises* qui produisent dans ce secteur, ainsi que de l'évolution de leur taux de croissance de la valeur ajoutée.

l'importance de ce mécanisme lié au commerce international. Je trouve que la demande étrangère explique une part non négligeable de la baisse de la part du travail dans l'industrie manufacturière sur la période étudiée (1994-2001). Dans l'ensemble, ce chapitre montre que le rôle joué par le commerce international dans l'évolution de la part du travail est bien plus complexe qu'on ne le pensait.

J'utilise les données administratives et douanières françaises sur l'univers des firmes exportatrices sur la période 1994-2001. Je commence par montrer que la baisse en points de pourcentage de la part du travail dans le secteur manufacturier sur cette période est corrélée de manière plausible à la hausse des exportations sur la même période. Je montre ensuite que cette baisse n'est pas due à une diminution de la part du travail dans les entreprises, mais à la croissance des entreprises à faible part du travail, qui se trouvent être également de très grandes entreprises sur les marchés internationaux, ou "exportateurs superstars".⁴⁸

J'étudie empiriquement l'effet de la demande étrangère sur la part du travail des entreprises et leur taux de croissance, mesuré par leur taux de croissance de la valeur ajoutée. Les variations de ces deux variables dépendantes d'intérêt se traduisent par des changements dans la part du travail au niveau agrégé. Pour estimer un effet causal, je mesure les variations de la demande étrangère pour chaque entreprise à un moment donné et utilisée dans les branches du commerce international et de l'économie du travail (Hummels et al., 2014; Mayer et al., 2016). Cette mesure me permet d'attribuer les changements de taux de croissance des entreprises et de leur part du travail à la demande étrangère sans les confondre avec l'automatisation, l'externalisation et la délocalisation, qui peuvent être corrélées aux changements de la demande à l'étranger.

Je constate qu'une augmentation de la demande étrangère a deux effets. Premièrement, elle permet aux *grandes* entreprises exportatrices de croître plus *rapidement* alors que les petits exportateurs *décroissent*. Deuxièmement, ces réaffectations de parts de marché à la marge intensive affectent également la part du travail des entreprises : celle-ci diminue relativement plus pour les grandes que pour les petites firmes exportatrices. Je trouve cependant que les salaires moyens augmentent davantage dans les grandes entreprises exportatrices : bien que la *rémunération* du travail dans ces entreprises augmente avec la demande étrangère, la *part* du travail diminue parce que la croissance de la valeur ajoutée est plus importante. Cet effet est hétérogène entre entreprises et plus fort chez les exportateurs superstars.

Quelle est l'importance de ces deux effets pour expliquer les changements *observés*

⁴⁸Ces entreprises sont les plus performantes en termes de ventes à l'exportation, vendent une part importante de leurs biens à l'étranger, vendent de nombreux produits différents et desservent de nombreux pays de destination différents.

dans la part du travail du secteur manufacturier ? Je constate que ces deux effets représentent ensemble 14% de la baisse de la part du travail observée dans les données. Je montre en outre que ce chiffre est essentiellement lié aux exportateurs superstars et aux réaffectations de parts de marché favorisant ces entreprises.

Le fait que les exportateurs superstars sont les entreprises qui bénéficient d'une hausse de la demande étrangère s'explique de façon rationnelle grâce aux récentes avancées de la littérature en commerce international et en organisation industrielle : (Zhelobodko et al., 2012; Mayer et al., 2016; Mrázová and Neary, 2017). L'idée est qu'une augmentation de la demande étrangère a deux effets opposés sur le taux de croissance des entreprises. Une augmentation de la demande étrangère permet à toutes les entreprises de bénéficier de l'augmentation de la taille du marché à l'étranger, ce qui stimule leurs ventes à l'exportation et leur permet de se développer. Cependant, cette augmentation de la taille du marché entraîne également une *augmentation* de la concurrence sur ce marché étranger, ce qui va réduire les bénéfices des entreprises les moins productives.⁴⁹ Ces petites entreprises seront donc fortement pénalisées par l'augmentation de la concurrence et ne bénéficieront pas de l'effet positif de la taille du marché. Les entreprises plus productives et plus grandes seront protégées de l'effet de la concurrence et se développeront.

Il est essentiel de comprendre les mécanismes par lesquels la demande étrangère peut façonner la part du travail. En effet, plusieurs auteurs ont montré que les industries qui sont devenues plus concentrées sont aussi celles qui ont connu les plus fortes baisses de leur part du travail (Barkai, 2019; Autor et al., 2020). Une hausse de la concentration du marché correspond soit à une augmentation soit à une diminution de la concurrence sur le marché.⁵⁰ Mon article suggère que bien que la part du travail diminue avec la demande étrangère, ces changements sont compatibles avec une concurrence *plus* féroce sur les marchés internationaux qui favorise les grandes entreprises qui sont également plus productives. En conséquence, ces changements qui se produisent entre entreprises sont également une source de gains de productivité agrégée grâce à une meilleure affectation des ressources.

Chapitre 2 - Effets Macroéconomiques des Distorsions de la Structure du Marché

Dans le deuxième article de cette thèse, Flavien Moreau et moi-même étudions l'impact des distorsions de concurrence sur la productivité agrégée.

⁴⁹Cela se produit lorsque des entreprises moins productives ont une élasticité de la demande plus élevée, ce qui est supposé dans le modèle sur lequel je m'appuie.

⁵⁰Voir par exemple Syverson (2019) pour une discussion récente.

Des articles récents ont estimé que le rôle joué par le pouvoir de marché des entreprises sur la productivité agrégée pouvait être beaucoup plus important que ce que [Harberger \(1954\)](#) avait constaté précédemment ([Edmond et al., 2018](#); [Baqaee and Farhi, 2020](#)). Dans ce chapitre, nous montrons que la mauvaise affectation des ressources peut être liée à l'existence de cartels. Pour ce faire, nous documentons ce mécanisme à l'aide de nouvelles micro-données sur l'identité des entreprises anticoncurrentielles et des cartels sanctionnés par l'autorité française de la concurrence.

Nous commençons par montrer qu'en moyenne, les cartels sont constitués de six entreprises. Ces entreprises sont largement réparties dans l'économie, en ce sens qu'elles opèrent dans tous les secteurs en France. Ces entreprises qui pratiquent la collusion commerciale sont, en moyenne, beaucoup plus grandes et plus productives que celles qui ne pratiquent pas d'entente. Elles vendent plus, créent plus de valeur ajoutée, utilisent relativement plus de capital, sont plus susceptibles de servir les marchés internationaux, ont une part de marché plus importante, etc. Ces entreprises semblent également être relativement homogènes au sein d'un cartel donné. Ces faits suggèrent que la présence de cartels composés d'entreprises très grandes et productives est susceptible de réduire la demande à laquelle elles sont confrontées et de réorienter la production vers des entreprises moins productives, ce qui diminue la productivité agrégée. D'où le recours à l'utilisation d'un modèle macroéconomique.

Pour évaluer l'impact quantitatif des cartels sur la productivité globale des facteurs (PGF), nous intégrons les cartels dans un modèle d'équilibre général dans lequel les entreprises sont en oligopole et dans lequel les marges varient d'une entreprise à une autre, en fonction de leur part de marché. Plus précisément, nous supposons qu'un nombre donné d'entreprises s'associent dans chaque secteur et maximisent leur profit, ainsi que ceux des autres membres de la coalition. Les cartels créent une distorsion de concurrence qui est semblable aux distorsions qui se produisent dans les modèles de propriété croisée ([O'Brien and Salop, 1999](#)). En l'absence de cartels, l'équilibre du modèle se résume à l'équilibre concurrentiel Nash-Cournot étudié dans [Atkeson and Burstein \(2008\)](#). Dans le modèle, la PGF est déterminée par la dispersion des marges. En l'absence de cartels, l'équilibre du modèle se caractérise par la dispersion des marges : les entreprises très productives ont une part de marché plus élevée, ce qui leur permet d'avoir des marges plus élevées.⁵¹ L'existence d'un cartel permet aux membres du cartel d'augmenter leurs marges, en réaffectant la demande vers les entreprises moins productives qui ne font pas partie du cartel.

Quantitativement, nous montrons que l'hétérogénéité des entreprises et l'élasticité de la

⁵¹Cette affectation n'est pas efficace car la suppression des marges permettrait à des entreprises plus productives de produire davantage.

demande à laquelle elles sont confrontées déterminent le coût des ententes sur la PGF. Si les entreprises sont homogènes, il n'y a pas de dispersion des marges et les cartels n'ont donc aucun effet sur l'affectation des ressources. En outre, dans le modèle, la mesure dans laquelle la dispersion des parts de marché se traduit par une dispersion des marges est déterminée par l'écart entre l'élasticité de substitution au sein des secteurs et entre les secteurs. Dans le cas où la demande peut être facilement redirigée entre les secteurs, l'impact d'une entente sur la PGF est atténué parce que les entreprises à forte productivité d'autres secteurs peuvent se développer. Ces deux différences expliquent pourquoi nous constatons que le coût des distorsions de concurrence résultant des ententes est probablement supérieur d'au moins un ordre de grandeur à celui obtenu par [Harberger \(1954\)](#). Il est important de noter que ce coût varie en fonction de l'intensité de la collusion. Si les membres de l'entente n'accordent qu'un faible poids aux profits des autres, ils augmenteront leurs marges bénéficiaires d'un montant moindre, ce qui réduira le coût économique des cartels.

Le coût des cartels est important. Ces résultats sont cohérents avec ceux de [Edmond et al. \(2018\)](#) et [Baqaee and Farhi \(2020\)](#) qui étudient le coût de la dispersion des marges liée à la taille et totale. Nos résultats suggèrent que la politique de la concurrence a un rôle important à jouer. L'élimination de la dispersion accrue des marges provoquée par les ententes est susceptible d'être une source de gains de productivité agrégée.

Chapitre 3 - Politiques d'Asile, Tensions Internationales et Flux Commerciaux

Le troisième chapitre de cette thèse examine la relation entre les politiques d'asile, les tensions internationales et le commerce international. Il s'appuie sur un article rédigé conjointement avec Florin Cucu.

La récente crise des réfugiés et l'afflux de demandeurs d'asile provenant de divers pays d'origine ont mis en évidence le manque de coopération entre pays européens. Si les conditions humanitaires étaient le seul facteur déterminant des politiques d'asile, nous pourrions penser que l'ensemble des pays européens accorderait de la même manière le statut de réfugié aux personnes venant de pays déchirés par la guerre. Cependant, à nombre donné de demandeurs d'asile turcs en France et en Allemagne, on observe que les taux d'acceptation sont beaucoup plus élevés en Allemagne qu'en France. Cet exemple illustre le fait que les considérations de politique étrangère sont susceptibles de jouer un rôle dans l'élaboration des politiques d'asile. Notre article utilise les données sur le nombre de demandes d'asile déposées, traitées et acceptées par les pays européens entre 1999 et 2017 pour étudier en premier lieu la relation entre les politiques d'asile et les tensions internationales. Nous examinons ensuite la manière

dont cette relation peut affecter la relation entre les réfugiés et les flux commerciaux internationaux.

Nous montrons d'abord que si les conditions humanitaires sont positivement corrélées aux taux d'acceptation, les pays européens sont plus susceptibles d'accorder l'asile à des personnes provenant d'États rivaux.⁵² En effet, les taux d'acceptation sont négativement corrélés avec un indice de similarité des votes à l'Assemblée générale des Nations unies et la présence d'un accord de libre-échange. Nous montrons également que les litiges internationaux sont associés à des taux d'acceptation plus élevés, tandis que les épisodes de coopération sont associés à des taux d'acceptation plus faibles. Nos régressions incluent des effets fixes paires de pays, de sorte que tous les facteurs bilatéraux et invariants dans le temps, tels que l'histoire ou la proximité culturelle, sont capturés et pris en compte. En résumé, nous montrons que les résultats issus de la recherche en science politique survivent à une évaluation quantitative plus rigoureuse.

Plusieurs études ont mis en évidence un effet causal des migrants sur les flux commerciaux en utilisant les réfugiés comme variable instrumentale pour répondre à la critique que le lien entre immigration et commerce ne soit inversé (Parsons and Vézina, 2018; Steingress, 2018) : les opportunités commerciales peuvent inciter les gens à migrer. Le fait que les politiques d'asile soient corrélées avec les tensions internationales suggère que l'utilisation de réfugiés comme instrument pour les migrants peut être malavisée étant donné que ce lien est confondu par les tensions entre états. Nous étudions ensuite la relation entre les politiques d'asile et les flux commerciaux internationaux en utilisant un modèle de régression gravitaire.⁵³ Nous prenons en compte le fait que la relation entre les politiques d'asile et les flux commerciaux peut être confondue par les conditions humanitaires dans les pays d'envoi, les politiques d'acceptation des réfugiés propres aux pays d'accueil, et tous les facteurs bilatéraux géographiques, culturels, historiques et politiques qui ne varient pas dans le temps en incluant des effets fixes appropriés dans les spécifications économétriques. Nous constatons qu'une augmentation des taux d'acceptation ou du nombre de réfugiés est négativement corrélée aux importations européennes en provenance du reste du monde. Cet effet ne semble toutefois pas persister dans le temps, car une augmentation du nombre de réfugiés au cours des dernières années n'affecte pas les importations actuelles (tant d'un point de vue économique que statistique). L'effet est principalement dû aux importations de biens homogènes pour lesquels il est plus facile de trouver un autre partenaire commercial. Ces résultats confirment le fait que la relation entre les réfugiés et le commerce peut être brouillée par les tensions internationales.

⁵²Cela correspond à la conclusion de Neumayer (2005) qui constate que les taux d'acceptation des demandes d'asile ne convergent pas entre pays européens entre 1980 et 1999.

⁵³Voir Head and Mayer (2014).

Bien que nos résultats ne puissent être interprétés comme étant causaux, ce chapitre met en évidence la complexité du lien entre le commerce international et les politiques d’asile. Notre article met également en garde contre l’utilisation de réfugiés comme variable instrumentale pour évaluer l’impact causal des migrants sur le commerce dans des situations où les politiques d’asile sont guidées par des préoccupations de politique étrangère.

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