

Import Competition, Heterogeneous Preferences of Managers, and Productivity*

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December 9, 2016

Abstract

Empirical evidence on the relationship between import competition and firm productivity is mixed. We re-investigate this question focusing on heterogeneous effects. Using rich Spanish firm-level data, we show that the response to import competition is mainly driven by family managed rather than professionally managed firms, and has a distinct, robust pattern: Family managers in firms with *low* initial productivity *increase* productivity whereas family managers in firms with *high* initial productivity *decrease* productivity. Productivity changes are driven by new organizational methods in process innovation, and by family management rather than family ownership. A model with heterogeneous preferences of managers over firm profits relative to private benefits and effort cost can rationalize the empirical evidence.

Keywords: Import Competition, Productivity, Family Firms, Organizational Innovation, Organizational Methods, Management Practices.

JEL Codes: F10; F14; F61; L20; O31; O32.

*We thank Laura Alfaro, Pol Antràs, Morten Bennedsen, Richard Blundell, Davin Chor, David Dorn, Taiji Furusawa, Luis Garicano, Gene Grossman, Oliver Hart, Réka Juhász, Yao Lu, Hong Ma, Hong Luo, Gianmarco Ottaviano, Nina Pavcnik, Andrea Prat, Benjamin Pugsley, Steve Redding, Raffaella Sadun, Pian Shu, Jagadeesh Sivadasan, Hei-wai Tang, Stephen Terry, John van Reenen, Steve Pischke and Daniel Xu, as well as seminar participants at various institutions for their comments. Chen acknowledges financial support from the University of Hong Kong, and Steinwender acknowledges financial support from McKinsey & Co. for acquiring the data. Emails: ccfour@hku.hk and csteinwender@hbs.edu.

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1 Introduction

The recent surge in China's exports has triggered the re-examination of an old unsettled, yet important, economic question: Does (import) competition spur innovation and thus productivity growth, or does it discourage it? The empirical evidence of recent papers remains mixed. While some papers find positive effects of competition (e.g., Gorodnichenko et al., 2010; Iacovone, 2012; Bloom et al., 2016; Coelli et al., 2016), others find almost no, mixed, or even negative effects (Gilbert, 2006; Brandt et al., 2012; Hashmi, 2013; Hombert and Matray, 2015; Arora et al., 2015; Gong and Xu, 2015; Autor et al., 2016). Perhaps not surprisingly, there is also very little empirical evidence on the mechanism of how competition affects productivity (Holmes and Schmitz Jr, 2010).

We aim to shed light on this issue by focusing on the person in the firm who ultimately makes decisions regarding innovation: the manager. Managers have been found to have heterogeneous utility functions (e.g., Pennings and Smidts, 2003; Pennings and Garcia, 2009; Bandiera et al., 2014b; Holtz-Eakin et al., 1993). In this paper we introduce heterogeneous preferences of managers to the trade literature, as they may explain why not all firms react to import competition in the same way, instead generating heterogeneous effects and therefore mixed empirical evidence across data sets and studies.¹

In the empirical part of this paper, we distinguish between the reactions of family managers and professional managers. This has two reasons: First, the literature has described that family managers have very distinct utility functions. For example, they enjoy a variety of amenities and private benefits beyond pure monetary compensation from their firms, such as the pleasure of being one's own boss, flexible work hours, but also the ability to use firm resources for personal purposes, or jobs for relatives (Demsetz and Lehn, 1985; Bertrand and Mullainathan, 2003; Bandiera et al., 2014a; Hurst and Pugsley, 2011). Second, family firms are an important economic phenomenon. They are widespread, even in developed countries. For example, 15% of the American Fortune Global 500 firms are family firms. In Europe, 40% of large, listed companies are controlled by families.² In developing countries, family firms are even more dominant: Out of large (>\$1 billion) firms, 85% are family run in South-East Asia, 75% in Latin America, 67% in India and around 65% in the Middle East.³ Even in countries such as China, where many large firms are state-owned, this proportion is still 40%. The presence of family firms is far from declining. On the contrary, family-owned businesses are

¹The literature is just beginning to explore heterogeneous effects of foreign competition on innovation. For examples, see Hombert and Matray (2015).

²See <http://www.economist.com/news/leaders/21629376-there-are-important-lessons-be-learnt-surprising-resilience-family-firms-relative>.

³See <http://www.economist.com/news/business/21629385-companies-controlled-founding-families-remain-surprisingly-important-and-look-set-stay>.

expected to remain an important feature of the global economy for the foreseeable future.⁴

We use Spanish firm-level data between 1993 and 2007 to investigate how increased import competition has affected the productivity of family managed firms and non-family managed firms differently. The Spanish context and data present an ideal scenario for the purposes of this paper. First, there were large shocks to import competition: Imports grew substantially between 1993 and 2007, driven both by increased European integration and an unprecedented increase in Chinese exports.⁵ Second, Spain's import tariffs are determined at the EU level and therefore arguably exogenous to Spanish firms. Third, Spain has a large number of family firms: 40% of the observations in our sample are family managed firms. In general, family businesses account for a larger share of economic activities in Spain than in Europe.⁶ Fourth, the Spanish data set is unusually rich in that it allows us to differentiate between family management and family ownership, and this distinction is important for verifying the mechanism underlying our results. On top of this, the Spanish data set has a number of variables that allow us to avoid common problems in productivity estimation. For instance, it provides firm specific input and output price changes that allow us to obtain a measure of total factor productivity that is not driven by changes in markups. It also provides data on different innovation outcomes (e.g., introduction of new machinery vs. introduction of new organizational methods, product innovation, patenting, R&D) that allow us to study how managers achieve productivity improvements. Finally, we can distinguish firm exits from non-responses, which allows us to check whether positive productivity responses are generated purely by a selection effect.

The empirical analysis uncovers a specific, robust pattern of heterogeneous responses. After a reduction in import tariffs, only family-managed firms respond with productivity changes. The family firms in the *left* tail of the initial productivity distribution (i.e., initially unproductive firms) *increase their productivity*, whereas those in the *right* tail of the productivity distribution (i.e., initially productive firms) *reduce it*. In contrast, we do not observe any significant changes in productivity for professionally-managed firms.

Our empirical specification is demanding and allows for firm fixed effects, firm-specific growth rates, and year fixed effects. Beyond this, we provide a battery of robustness checks, including: Non-parametric estimation by different quartiles (or terciles or quintiles) of the

⁴See <http://www.economist.com/news/special-report/21648171-far-declining-family-firms-will-remain-important-feature-global-capitalism>.

⁵In the latter respect, Spain had an experience similar to other developed countries, e.g., the US (Autor et al., 2013) and the UK (Bloom et al., 2016).

⁶Overall in Spain 85% of companies are categorized as being family-owned, accounting for 70% of Spain's GDP (see <http://www.campdenfb.com/article/infographic-spanish-family-businesses>). In contrast, in Europe family businesses make up about 60% of all companies and 50% of GDP (see <http://www.europeanfamilybusinesses.eu/> and https://ec.europa.eu/growth/smes/promoting-entrepreneurship/we-work-for/family-business_en). In another study on publicly traded companies, the share of family firms in Spain is 56%, less than in Germany or France (both 65%), but more than in the UK (24%), Ireland (25%), or Scandinavian countries (39% to 49%).

initial productivity distribution; controlling for foreign tariffs faced by Spanish exporters; checking for selection effects generated by exiting firms; propensity score matching techniques to correct for the endogenous selection into family firms; alternative productivity measures and tariff measures; excluding alternative responses that might show up as productivity responses in the data, such as changes in imported inputs or exporting; or checking for endogenous switching between family firms and non-family firms. Our findings are driven by older family firms, and by those with more than one family manager, i.e. by multigenerational, inherited businesses rather than the typical owner-entrepreneur or startup.

Our empirical findings can be rationalized with a partial equilibrium, heterogeneous firm model with endogenous productivity that embeds heterogeneous preferences of managers. Based on our reading of the literature on family firms, we assume that compared to professional managers, family managers derive relatively more utility from private benefits and relatively more disutility from private effort relative to utility from firm profits. The higher utility from private benefits is motivated by the various amenities and private benefits that family managers may derive from their firms. Examples include the pleasure of being one's own boss, flexible work hours, but also the use of firm resources for personal purposes, the opportunity to use the firm to address family issues (e.g., finding a prestigious job for a low-ability offspring), empire building, or eponymy (Demsetz and Lehn, 1985; Bertrand and Mullainathan, 2003; Hurst and Pugsley, 2011; Bandiera et al., 2014a; Belenzon et al., 2014). Also, family managers - at least on average - seem to derive higher disutility from exerting effort for the firm, as they have been found to work less, enjoy more leisure, and prefer flexible work hours and life styles (Bandiera et al., 2014b, 2011; Hurst and Pugsley, 2011; Villalonga and Amit, 2006; Bennedsen et al., 2007; Holtz-Eakin et al., 1993; Morck et al., 2000).⁷ Overall, this characterization probably fits second generation family managers or heirs of family businesses better than owner-entrepreneurs and startup founders, which is in line with our empirical findings that the effect is stronger in older firms and firms with more family members.

In the model, each firm receives an initial, random productivity draw, but managers can improve on this productivity draw, and thus profitability of the firm, by exerting effort which entails private cost. Managers derive utility from firm profits, private benefits (which are lost when the firm goes bankrupt), and disutility from cost (due to effort). We examine the behavior of two types of managers who have different preferences for firm profits (relative to private benefits and costs) after an import competition shock. Our model predicts a distinctive pattern of heterogeneous productivity responses that depends not only on the type of manager but also on the firm's initial productivity draw. First, managers who care most about private benefits (and cost) relative to firm profits react the strongest to an import competition shock.

⁷Bandiera et al. (2014b) finds this to be true in several countries around the world (Brazil, France, Germany, India, United Kingdom, United States), using survey results.

Interestingly, their (i.e., family managed firms) response depends on the location of the firm in the initial productivity distribution. Family managed firms which are in the left tail of the initial productivity distribution have lower endogenous productivity and are closer to bankruptcy. When import competition increases, their managers exert additional effort because they do not want the firm to go bankrupt (and thus lose the private benefit).⁸ On the other hand, family managed firms in the right tail of the initial productivity distribution show reduced productivity after an import competition shock because the marginal benefit of exerting effort is reduced.

The model can rationalize our key empirical findings about how productivity responds to import competition. Furthermore, in contrast to alternative explanations that we are aware of, the model matches additional empirical patterns. First, the driving feature of the model revolves around the characteristics of the manager of the firm rather than the owner of the firm, so explanations that are based on the latter are not consistent with the data (e.g. tax incentives, asset mixes, political connections, or investment horizons that differ for family owned vs non-family owned firms). Second, in the data productivity improvements are generated by the introduction of new organizational methods rather than by investments (like new machinery or increased R&D), which is a typical managerial task and more costly to the manager (in terms of effort) than to the firm (in terms of dollars spent) compared to alternative ways to improve measured productivity (e.g., employment reductions or a better access to imported materials or technology). Third, our model is also consistent with the cross-sectional differences in the first four moments of the productivity distribution of family firms (i.e. it has a lower average, and thicker left tail) compared to non-family firms. Fourth, our empirical findings are particularly strong for older firms and firms with more family members, which are also the firms for which the preferences for private benefits and costs are likely to be strongest, in line with the theory.

Our paper is related to four strands of literature. First, our paper contributes to the literature on how trade liberalization affects firm productivity. There are many excellent studies on how trade liberalization facilitates resource reallocation between firms⁹ and affects firm-level R&D, innovation,¹⁰ and product scope and quality.¹¹ A related literature studies how increased exporting opportunities incentivize firms to improve productivity.¹² Only recently, the literature started to investigate how stiffer import competition affects firm productivity and innovations among surviving firms.¹³ Breaking from the existing papers,

⁸If the initial productivity draw is too low to justify the extra effort, managers choose to let the firm exit.

⁹E.g. Pavcnik (2002); Trefler (2004)

¹⁰E.g. Baldwin and Robert-Nicoud (2008); Costantini and Melitz (2008); Teshima (2008)

¹¹E.g. Bas and Ledezma (2010); Kugler and Verhoogen (2012); Bas and Bombarda (2013)

¹²E.g. De Loecker (2007, 2011); Lileeva and Trefler (2010); Bustos (2011)

¹³Examples include Fernandes and Paunov (2009); Brandt et al. (2012); Iacovone (2012); Dhyne et al. (2014); Hombert and Matray (2015); Bloom et al. (2016); Autor et al. (2016); Bena and Simintzi (2016); Coelli et al. (2016).

we focus on the role of managers, especially family managers, in creating heterogeneous productivity responses. Given that most developing countries host a large number of family firms and have also often experienced dramatic trade liberalization episodes, paying attention to the impact of trade liberalization on family firms seems to be particularly important.

Second, we contribute to the literature on family firms.¹⁴ Some papers in this literature document that family firms, and especially family managed firms, perform worse than non-family firms.¹⁵ Other research in this literature argues that family ownership is associated with better firm performance.¹⁶ We contribute to this literature by highlighting how economic forces, specifically increased competition, can incentivize some unproductive family firms to become better.

Third, the literature in corporate finance studies how ownership concentration (e.g., in family firms) affects firm value.¹⁷ The main finding is that concentrated ownership (above a certain threshold) reduces firm value due to an entrenchment effect and an amenity effect, i.e., it generates owner-managers that have enough power to be able to indulge their preferences for non-value-maximization. We also focus on managers with non-profit preferences, but breaking from this literature, we focus on the channel through which family-managed firms change productivity after an arguably exogenous shock: increased managerial effort and organizational innovation.¹⁸

Fourth, the theoretical literature in industrial organization on competition and productivity usually arrives at a non-monotonic or ambiguous relationship (e.g., Hart, 1983; Hermalin, 1992; Schmidt, 1997; Raith, 2003; Aghion et al., 2005; Vives, 2008). There are a variety of models that predict a possible increase in innovation resulting from competition (e.g., Holmes et al., 2012; Bloom et al., 2013; Waugh et al., 2014). In particular, reduced X-inefficiency (Horn et al., 1995; Aghion et al., 1997, 1999) is one of the channels investigated.¹⁹ Our model is in spirit most closely related to this type of argument. However, none of these models considers heterogeneous effects that depend on the preferences of managers.

The rest of the paper is organized as follows. Section 2 describes the data, section 3 de-

¹⁴E.g. Shleifer and Vishny (1986); Morck et al. (1988); Shleifer and Vishny (1997); Morck et al. (2000); Anderson and Reeb (2003); Pérez-González (2006); Bennedsen et al. (2007); Bertrand et al. (2008); Mullins and Schoar (2016); Villalonga and Amit (2006)

¹⁵E.g., Pérez-González (2006); Bennedsen et al. (2007); Bloom and van Reenen (2007); Bandiera et al. (2011, 2014b); Mullins and Schoar (2016); Lemos et al. (2016). This has also been documented for Spanish family firms (Gallo and Estape, 1992) and is consistent with our data.

¹⁶E.g. Anderson and Reeb (2003). For example, because family ownership facilitates monitoring inside the firm (Demsetz and Lehn, 1985; Burkart et al., 2003) or reduces short-termism (Stein, 1988, 1989; James, 1999).

¹⁷See Jensen and Meckling (1976); Morck et al. (1988); Faccio and Lang (2002); Kim and Lu (2011).

¹⁸Related papers which study the effect of a minimum wage increase in China are Hau et al. (2016), who show that Chinese private firms with good management practices improved productivity and Mayernis et al. (2016), who show that productivity improvements were due to better management practices such as inventory management.

¹⁹Also note that in Holmes and Stevens (2014), large firms are more impacted by import competition because small firms focus on niches.

scribes our empirical strategy, and section 4 shows our empirical results. Section 5 rationalizes these findings with a model with heterogeneous preferences of managers. Section 6 concludes.

2 Data description

We use panel data from a Spanish survey of manufacturing firms (ESEE; Encuesta Sobre Estrategias Empresariales) that is collected by the Fundación SEPI, a foundation affiliated with the Spanish Ministry of Finance and Public Administration.²⁰ The survey is designed to cover a representative sample of Spanish manufacturing firms and includes around 1,800 firms per year. Participation of firms with more than 200 employees is required, while firms with more than 10 but less than 200 employees are sampled via a stratified sampling approach. SEPI makes a great effort to replace non-responding and exiting firms to ensure the continuing representativeness of the sample, leading to a total number of around 4,000 observed firms between 1993 and 2007. We focus on data before 2007 in order to avoid confounding shocks that were brought about by the financial crisis.

The advantage of the Spanish data set is that it provides very rich information on several dimensions that are important for our empirical analysis.²¹

Family firms. We can distinguish between family-managed and professionally-managed firms because the survey includes a variable that gives the number of “owners and working relatives who hold managing positions.”²² We classify firms as family-managed firms (or family firms, in short) if this number is bigger than or equal to one in the first year of our sample, 1993. We use the first year of the sample for this definition in order to avoid a potentially endogenous definition of management type that responds to changed competition.

Family firms are prevalent in Spain: 41% of our observations are family firms, as can be seen in Table B.1. 58% of family firms in our sample have just one family manager, and none of the firms have more than seven family managers (see Online Appendix for a histogram). Consistent with the literature, family firms are on average smaller (both in terms of sales and employment), have lower productivity, and spend less on R&D. The share of family firms ranges from 19% to 68% across different industries.²³ Family management is relatively persistent: 74% of family-managed firms in 1993 are still family-managed in 2007.²⁴ This finding is consistent with earlier work on Spanish family firms using different data (Gallo

²⁰For more information, see <http://www.fundacionsepi.es/esee/sp/spresentacion.asp>

²¹More details on variable construction can be found in the Online Appendix.

²²Note that an owner is not necessarily a majority owner, and a founder is not necessarily an owner.

²³In the Online Appendix, we show that differences in family firm shares across industries are uncorrelated with import tariff reductions.

²⁴In robustness checks we make sure that changes in management type are not responsible for the observed productivity responses. In the Online Appendix, we also show that the probability of switching from family to professional management is uncorrelated with the tariff reduction that we use as a measure for import competition and a firm’s initial productivity.

and Pont, 1989).

Productivity. We need detailed data on capital stock, output, employment and intermediate inputs to estimate total factor productivity (TFP) at the firm level. In many firm-level data sets, capital stock is not available and must be reconstructed using investment data (often using only average depreciation rates). The problem of missing initial capital stock is only negligible if data over a long period of time is available and initial capital stock is depreciated for much of the observed sample period. Fortunately, the Spanish data set provides both gross and net capital stock together with firm-level depreciation and investment, which allows for a precise construction of the capital stock at any point in time.

Estimation of total factor productivity by OLS may suffer from several problems: Employment and capital choices are endogenous and TFP cannot be easily distinguished from markup changes (Beveren, 2012). To deal with the endogeneity problem, we estimate TFP using the Levinsohn-Petrin method, which uses intermediate inputs to control for unobserved expected productivity changes. This is preferable to the Olley-Pakes method, which uses investment as control, as investment is often reported as zero. The monotonicity condition, which is key for the Olley-Pakes method, is more likely to be satisfied for intermediate inputs, as firms usually report positive use of intermediate goods.

Beveren (2012) points out that policy evaluation is usually robust to the TFP estimation method with one exception: It is necessary to control for input and output prices (De Loecker, 2011). Luckily, the Spanish firm-level survey provides a remedy to this omitted price bias, as it also reports input and output prices. Firms are asked by how much % the sales price of its products and the purchasing price of its intermediate inputs and services has changed compared to the previous year. The price changes are a weighted average across final products and markets (for output prices) and a weighted average across intermediate inputs, energy consumption, and purchased services (for input prices). We use these price changes to deflate output and intermediate inputs at the firm level (instead of usually used industry-wide deflators).²⁵

We use TFP estimated by Levinsohn-Petrin in the described way for our main results. Our empirical results, however, are also robust to using simpler productivity measures, such as TFP estimation without price adjustment, labor productivity, or productivity backed out from a simple OLS regression with firm and year fixed effects.

Entry and exit. One concern is that we might falsely pick up a positive effect of competition on productivity because firms that are hit very hard by a negative productivity shock exit the sample. Without correcting for this selection effect, the productivity effect might be overestimated. Unfortunately in many data sets it is not possible to distinguish exiting from non-responding firms. The Spanish data set however provides this information, as it follows

²⁵Ornaghi (2006) has first demonstrated the importance of using firm level instead of industry level price deflators using the Spanish firm level data.

up on non-responding firms to determine their status. Exiting firms include closed firms, firms in liquidation, and firms that are taken over by other firms, and we can check for differential exit rates across family-managed and professionally-managed firms. Note that exit rates are quite small in the sample (2.4% on average), so they do not turn out to be a major confounding problem.

Innovation outcomes. The Spanish data set comprises of a number of other outcome variables that are related to innovation and help us to understand how managers increase productivity. These outcomes include dummies for whether new machinery or new organizational methods were used in process innovation, as well as information on product innovation, R&D spending and the number of patents.

Trade related outcomes. We can also check whether increased import competition is associated with changed importing and exporting by the firm by looking at firm-level imports, exports, and a dummy that indicates whether the firm has adopted imported technology.

Family management vs. family ownership. Our main regressions use information on family members in managing positions. As a robustness check, however, we can use a variable indicating whether the firm is controlled by a family group as an indicator for family ownership and thereby distinguish between family-owned and family-managed, and family-owned but professionally-managed firms. This variable, however, is available only after 2006, so we only use it in robustness checks.

Tariff data. This paper exploits variation in industry-specific import tariffs over time. We use tariffs that the EU imposes on imports from the rest of the world (“import tariffs”) to construct our main regressor. All tariff data used in the analysis is from TRAINS (provided by UNCTAD); accessed via the WITS software provided by the World Bank.²⁶ We use the weighted average of the import tariff in each product category (ISIC Rev. 3; 244 product categories) and aggregate them to the NACECLIO industries that the Spanish data uses (20 NACECLIO categories²⁷) by using trade shares in 1993 (to avoid endogeneity of the weights). Our results are robust to using trade shares from the previous year to calculate the industry-level tariffs, or just using tariffs imposed on China (which experienced the largest decreases in our sample period). For robustness checks, we calculate average tariffs that other countries impose on imports from the EU (“export tariffs”) as an indicator for export opportunities with the same methodology, and import tariffs on the inputs (“input tariffs”) of an industry based on Spanish input-output tables to control for changed access to imported inputs.

The resulting import tariffs are shown in Figure A.1. Tariffs fell over time, especially

²⁶<http://wits.worldbank.org/wits/>

²⁷The 20 industries are: Meat related products; food and tobacco; beverage; textiles and clothing; leather, fur, and footwear; timber; paper; printing and publishing; chemicals; plastic and rubber products; nonmetal mineral products; basic metal products; fabricated metal products; industrial and agricultural equipment; office machinery, data processing, precision instruments and similar; electric materials and accessories; vehicles and accessories; other transportation materials; furniture; miscellaneous.

during the 1990's. A large heterogeneity of tariffs across industries is also visible. Beverages, food/tobacco, meat related products, and textiles all started with the highest tariffs. While tariffs dropped for food and drink related industries, tariffs on textiles fell very little. Tariffs for leather/fur/footwear and vehicles also changed little and remain on the higher end.

Important trade liberalization episodes that occurred during the sample period were several EU enlargement episodes (e.g., also studied by Berger and Nitsch, 2008; Bergin and Lin, 2012; Brouwer et al., 2008) and China's accession to the WTO in 2001 (also studied in Bloom et al., 2016; Autor et al., 2013). While our main analysis uses average import tariffs across all countries in the world as regressor, in robustness checks, we use only variation in import tariffs against China, which have the largest variation over time in the data.

3 Empirical strategy

Separate regressions. We start with a specification that regresses productivity changes ΔTFP_{ist} on changes in import competition ΔIMP_{st} , and run it separately for family and non-family firms. We also allow for a potential heterogeneous effect depending on the firm's initial productivity $TFP93_i$, in line with the heterogeneous firms literature in trade inspired by Melitz (2003),

$$\Delta TFP_{ist} = \beta_1 \Delta IMP_{st} + \beta_2 (TFP93_i \cdot \Delta IMP_{st}) + \text{yearFE} + \text{firmFE} + \eta_{it}, \quad (3.1)$$

where i denotes firm, s denotes industry, and t denotes year.

For easier interpretation we use the *negative* of the industry- and year-specific EU import tariff, denoted as IMP_{st} , as our exogenous variation for import competition. This means when IMP_{st} increases, import competition increases due to a reduction in import tariffs. In general, it is not always clear whether tariff changes can be interpreted as exogenous to firms and industries, as large companies often try to influence policy makers in order to negotiate favorable tariffs. However, in the Spanish case, tariffs are negotiated at the European level, and it is less likely that Spanish firms are able to influence European decision making. Furthermore, many tariff changes are part of a larger political process (e.g., the EU enlargement, or China's WTO accession), and therefore likely out of the control of specific Spanish firms.

The main empirical measure for productivity, TFP_{ist} , is obtained via Levinsohn-Petrin estimation as described above. Since 1993 is the initial year of our sample period, $TFP93_i$ is used to proxy for the initial productivity of the firm.

Our specification allows for year fixed effects to absorb macroeconomic shocks. Since the model is in first differences, any time-invariant firm or industry characteristics are absorbed,

as firm fixed effects in levels drop out in the first differences specification. In addition, we make the empirical specification even more demanding by adding firm-level fixed effects to the estimation equation in first differences, allowing for firm specific time trends. Historically, import tariffs have fallen, while productivity has increased at the industry level. These correlated trends should not be interpreted as causal evidence of a response of productivity to import competition, so we only interpret deviations from the trend as causal evidence for our mechanism.²⁸

Finally, all standard errors are clustered at the industry level, in the spirit of Bertrand et al. (2004).²⁹

Non-parametric regressions. The response of firm productivity to decreased import tariffs might be highly non-linear with respect to a firm's initial productivity. In order to check this, we also implement non-parametric versions of the above regressions for both types of firms:

$$\Delta TFP_{ist} = \beta_1 \Delta IMP_{st} + \sum_p \beta_p (Perc93_{pi} \cdot \Delta IMP_{st}) + \text{yearFE} + \text{firmFE} + \eta_{it}, \quad (3.2)$$

where $Perc93_{pi}$ are dummy variables for firm i 's position in different percentiles p of the initial productivity distribution. We experiment with different percentiles, using halves, terciles, quartiles and quintiles. If the response was indeed highly non-linear, the non-parametric estimation would yield qualitatively different results compared to the regressions imposing linearity.

Pooled regressions. Our main specification is a pooled regression of family and non-family firms with triple interaction terms that allow for differential effects of import competition depending on a firm's management type (family vs. non-family) and the initial productivity. The resulting regression equation is:

$$\begin{aligned} \Delta TFP_{ist} = & \beta_1 \Delta IMP_{st} + \beta_2 (\Delta IMP_{st} \cdot TFP93_i) + \beta_3 (\Delta IMP_{st} \cdot FAM93_i) \\ & + \beta_4 (\Delta IMP_{st} \cdot TFP93_i \cdot FAM93_i) + \text{yearFE} + \text{firmFE} + \eta_{ist}, \end{aligned} \quad (3.3)$$

Note that this is a fully saturated model, as the remaining interaction terms are soaked up by the firm fixed effects. This regression is very similar to the separate regressions for family and non-family firms, and allows us to show a large number of robustness checks in an easy and

²⁸Autor et al. (2016) have also pointed out this problem and add industry fixed effects to their specification in growth rates to address this problem. Note, however, that our results do not depend on firm fixed effects, as shown in the Online Appendix.

²⁹We can also cluster at the firm level, but prefer to show the more conservative standard errors derived from clustering at the industry level.

space-saving way.

Robustness checks. In order to analyze the robustness of our results, we conduct a number of alternative specifications using the pooled regression as our basis.

First, we use alternative measures for tariffs and productivity to re-estimate equation (3.3). With respect to alternative tariff measures, we take one of two approaches. In the first approach, we aggregate product*country-level tariffs to the Spanish industries using one-year, lagged trade shares rather than trade shares from the initial year. Alternately, we simply use tariffs against China, which changed the most over our time period compared to tariffs against other countries due to China's WTO accession. Furthermore, we use different productivity measures as the outcome variable. For example, we omit the correction for input and output prices in obtaining the Levinsohn-Petrin productivity estimate. In addition, we use the residuals from a simple OLS regression with firm and year fixed effects and simple labor productivity (value added divided by employment).

Second, we use propensity score matching (PSM) techniques (nearest neighbor matching and inverse propensity score re-weighting) to correct for the possibly endogenous selection of firms into family firms and non-family firms. The potential concern is that family firms and non-family firms differ in various observable characteristics that might drive the productivity changes we observe. Therefore, although we use a time-invariant dummy for family management (and ownership), the estimates might still be biased if we do not deal with endogenous selection. In both methods, we use firm's initial TFP, sales, employment, exporting status and the existence of foreign plants as observables to control for selection, and the results are robust to using only a subset of these observables. As a result of the matching, family firms and non-family firms are distributed more equally across initial TFP in our regressions, as shown in Figure A.3 for the example of nearest neighbor matching (we match to the 5 nearest neighbors).

Third, there is the worry that the productivity improvements are only due to a selection effect, i.e., firms with the lowest initial productivity have to increase productivity in order to survive, and this is not true for firms with the highest initial productivity. As a result, we observe productivity increases among firms with the lowest initial productivity, as only the most successful such firms survive. In order to understand whether this is an issue, we first check for differential exit rates between family and non-family firms. We then use an exit dummy (which becomes 1 in the year the firm exits) as a dependent variable in the regression to see whether there are different exit probabilities between family and non-family firms and between firms with different initial productivity levels that arise due to increased import competition.

Fourth, we want to make sure that productivity improvements are not only driven by firms that replace their family managers by professional managers. We do this by estimating a regression that excludes firms that permanently switch from family management to

professional management.

Fifth, since most trade liberalization episodes are bilateral and increase trade in both directions, increased import competition often coincides with increased export opportunities. Our estimates might therefore suffer from omitted variable bias and pick up productivity changes caused by increased exporting opportunities rather than increased import competition (e.g., as in Lileeva and Trefler, 2010; Bustos, 2011, even though they do not differentiate between family and non-family firms). Note at first that this is unlikely as we use firm-level deflators for output in our TFP estimation. Nonetheless, in a robustness check, we control for the full interactions with tariffs other countries impose on trade originating from the EU, EXP_{st} . We aggregate this measure in the way that we use to aggregate import tariffs to the industry-year level and again use the negative tariff as the measure for export opportunities. Beyond this, we also use firm-level exports as a dependent variable to check whether there are any differential changes (between family and non-family firms).

Finally, there is the possibility that a reduction in import tariffs also makes it easier to import inputs, and that this shows up in the TFP estimation (e.g., Amiti and Konings, 2007). Again, we do not think this is very likely, because our TFP estimation procedure corrects for changing input prices by applying firm-specific deflators to input prices. Furthermore, the productivity enhancement effect due to better access to imported inputs (i.e., more varieties as documented in Goldberg et al., 2010) is usually found in firms from developing countries (e.g., India, Mexico, Indonesia and China), and Spain is a developed economy. Also, supply chains have been found to be more regional (i.e. within the EU in the case of Spain) than global, so import tariffs against goods coming from outside the EU shouldn't have mattered much for Spain in terms of the access to imported inputs (Baldwin, 2013). In any case, we run our triple difference regression by including the change in input tariffs $INTAR_{st}$ (and its interaction terms with the initial productivity and initial status of family management) to show that our main findings still exist even after taking into account the effect of reduced input tariffs on firm productivity. Furthermore, we also use firm-level imports and even firm-level imports of technology as the dependent variable to verify that there is no differential access to imported inputs between family and non-family firms that is driven by a reduction in import tariffs.

Mechanism. In additional regressions, we try to better understand the mechanism driving our result. We do this by checking a few additional outcome variables that are related to innovation, to see how managers adjust productivity. For example, we test whether firms adopt new machinery (consistent with improvement in physical technology) or whether they adopt new organizational methods (consistent with changes in management quality) in their production processes when they update their productivity as a result of increased import competition. Other than process innovation, we also check whether R&D activities, patents, or product innovation respond in the same way as TFP. Furthermore, we can test whether family ownership rather than family management explains our result. Finally, we check whether the

results are different for owner-entrepreneurs/startups versus multigenerational family firms or family firms run by heirs, approximating those types of family firms by age and number of family managers.

4 Empirical results

We start by dividing the sample into family-managed and professionally-managed firms and estimate the effect on these two samples separately using equation (3.1). Results are given in Table B.2. Column (1) shows that there is a positive, but insignificant effect of import competition on the average productivity of family firms. Column (4) shows a similarly positive, but insignificant result for non-family firms. Interestingly, when we allow for the effect of import competition to differ by initial productivity, we find significant productivity responses. Column (2) shows that family firms with an initially low productivity respond to import competition by increasing their productivity. This response fades out and turns negative, however, as the initial productivity of the firm becomes larger. In contrast, there is no effect for non-family firms, as shown in column (5). In columns (3) and (6) we add industry*year fixed effects as an even more demanding specification. In this specification, we can no longer identify the main effect on import competition, but it is reassuring to know that the effects on the interaction terms remain of similar magnitude and significance.

Regression equation (3.1) imposes a linear relationship between initial productivity and productivity changes after an import competition shock. The estimation might disguise a non-linear or non-monotonic relationship in the data. In order to see whether this is the case, we implement a non-parametric version of the regression equation by estimating equation (3.2), which allows for different productivity responses per initial productivity percentile. Table B.3 shows the results, again separately for family and non-family firms. In columns (1) and (5), we estimate the effect differently for the lower and upper half of firms in the initial productivity distribution, and we repeat the estimates for terciles, quartiles, and quintiles in columns (2) to (4) and (6) to (8).

The empirical pattern is consistent: None of the coefficients in the regressions for non-family firms have significant effects, whereas it is clearly visible that, in response to import competition, the percentiles with the lowest initial productivity increase productivity significantly, and the percentiles with the highest initial productivity reduce it significantly. In between, the effect decreases monotonically. Furthermore, the results suggest that the effect is indeed linear for family firms. Figure A.4 shows the effects graphically for the case of quartiles.

In Table B.4 we move to the pooled estimation given in regression equation (3.3) that estimates the effects jointly for family and non-family firms in a triple differences framework. We add the interaction terms step by step. In column (1) we estimate the average effect of

increased import competition on productivity changes: On average, increased competition led to productivity increases, consistent with some other papers in the literature (e.g., Bloom et al., 2016), but the average effect is not significant. In column (2), it appears that the productivity increases might be more prevalent in firms with initially low productivity, and in column (3) it appears that non-family firms are increasing productivity by more, but none of the effects are significant.

The full picture is again revealed only when looking at column (4) with all the interaction terms: Import competition causes productivity increases, but only for family firms with an initially low productivity level, as $\beta_3 > 0$ and statistically significant. Family firms with higher initial productivity levels increase their productivity less (or even decrease their productivity), because $\beta_4 < 0$ and statistically significant. In column (5) we allow for industry*year fixed effects to absorb any industry-year specific heterogeneity that might be correlated with import competition. Taking this step leaves us unable to identify the main effect of import competition, but it is reassuring to see that all the interaction terms remain almost unchanged.³⁰

Table B.4 does not show the heterogeneous effects across the observed initial productivity distribution, so we plot the predicted change in productivity due to import competition over the full range of observed values of the initial TFP distribution in Figure A.5. The effect on family firms is depicted by the solid black line and the effect on non-family firms is given by the gray line (the dashed lines give the 95% confidence intervals).

The magnitude of the effect is sizable. A 1 percentage point reduction in the import tariff leads to a TFP increase of 3.8% for the firms in the sample with the lowest initial productivity and to a TFP decrease of 4.9% for the firms in the sample with the highest initial productivity. Over the sample period, the import tariff fell on average by 0.3 percentage points per year, which would be associated with TFP changes ranging from 1.1% to -1.5% (among family firms). A large annual import tariff change (95th percentile), however, would be associated with larger TFP changes between 6.8% and -8.8%.³¹

4.1 Robustness checks

In Table B.5 we conduct our first set of robustness checks. In columns (2) and (3) we check whether our findings are robust to different ways of aggregating the tariffs. In column (2) we

³⁰We also tested whether there are responses to lagged changes in import tariffs by including both contemporaneous and lagged difference in import tariffs (and their interaction terms); the results are available in the Online Appendix. Our results suggest that the response is immediate and that firms do not respond to changes that are in the past. Although firms respond immediately, the response is permanent and is not reversed in the following period. Specifically, the sum of the coefficients in front of the interaction terms between the family dummy and contemporaneous (and lagged difference in import tariffs) is 9.683*** (3.598). Moreover, the sum of the coefficients on the two triple interaction terms is -0.762*** (0.270). Thus, the effect is still present in longer horizon.

³¹Note that the average import tariff fell by 4 percentage points over the entire sample period, between 1993 and 2007. The marginal effect for family and non-family firms at the lowest observed TFP value is not statistically different (p-value of 0.36), whereas it is statistically different at the highest observed TFP value (p-value of 0.0005).

use the one-year, lagged import share of each product within an industry instead of the 1993 share to aggregate product level tariffs up to the industry level. In column (3) we use only tariffs on Chinese imports, as those were the largest important tariff changes in the sample period. The magnitudes of the coefficients change slightly, but the main findings are robust across the alternative tariff specifications.

In columns (4) to (6) we check whether our findings are robust to alternative measures of productivity. In column (4) we omit the price adjustment in our TFP estimate, i.e., we use Levinsohn-Petrin revenue based productivity, *Lev Pet R*, instead of quantity based productivity. The effects are almost unchanged, which shows that quantity based productivity increases are driving the results, rather than markup changes. In column (5) we use TFP estimates that are residuals from a simple fixed effects (firm and year fixed effects) regression instead of the Levinsohn-Petrin procedure. Finally, in column (6) we use labor productivity (i.e., value added per worker) instead of TFP as dependent variable. In line with other papers in the literature (e.g., Beveren, 2012), our estimates are not sensitive to the exact productivity estimation method.

Next we report estimation results using propensity score matching (PSM) techniques to correct for the endogenous selection into family firms and non-family firms. Table B.6 shows results for nearest neighbor matching, and Table B.7 shows results for the more efficient inverse propensity score re-weighting method. In both tables we can see that the estimated coefficients for family-managed firms are very similar to the results reported in Table B.4. This shows that even after we tease out observable differences between family and non-family firms due to possibly endogenous selection, the differential impact of decreased import tariffs on firm productivity is still there.

There is the worry that the productivity improvements that we observe are only driven by a selection effect. I.e., firms with the lowest initial productivity have to increase productivity in order to survive, and this is not true for firms with the highest initial productivity. As a result, we observe productivity increases among firms with the lowest initial productivity, as only the most successful such firms survive. However, our results are not driven by the selection effect. First of all, it is reassuring to see that the annual exit rates for family firms and non-family firms are not statistically different, as Figure A.6 shows. We report regression results that relate exits to import competition in Table B.8. As the second column indicates, the reduction in import tariffs does not generate a differential impact on the exit rate between family and non-family firms, or between firms with initially low or high probability. Therefore, we can exclude the explanation that there are differential probabilities of exiting (after import tariffs go down), which could potentially drive our results.

Column (3) of Table B.8 checks whether the observed productivity improvements are driven by firms that replaced their family managers by professional managers. In order to do this, we exclude firms that are initially family managed, but then permanently switch

to professional management. It is reassuring to see that the results are not driven by those switchers, even though we lose 21% of our observations. If anything, our findings seem to become stronger in magnitude. Overall, switches between family and non-family firms cannot be used to explain our empirical findings.³²

Finally, we look at our robustness checks related to exports and imports. There is the possibility that a reduction in import tariffs also makes it easier to import inputs, and that this shows up in the TFP estimation (e.g., Amiti and Konings, 2007). In a similar spirit, if reductions in import tariffs are correlated with reductions in export tariffs which induce exporting, an increased tendency to export might be showing up in the TFP estimation. In Table B.9, we run regression equation (3.3) by treating the change in log imports, a dummy for whether firms start to import technology, and log exports as the dependent variable, but none of these variables change differentially, so there is no evidence that our measure of import competition is correlated with better access to imported inputs or export markets. In Table B.10 we use an alternative test by controlling directly for “export tariffs”, i.e. tariffs other countries impose on trade originating from the EU, and “input tariffs”, i.e. tariffs that the EU imposes on imports from other countries, using the input shares from Spanish input-output tables to get a measure of input tariffs for each industry. Neither export tariffs in column (1) nor input tariffs in column (3) affect our estimated effect. In columns (2) and (4) we add industry-specific year effects, and again the results are robust to this inclusion.

4.2 Mechanism

How are managers adjusting productivity after an import competition shock? We look at outcomes related to innovation to understand this, starting with process innovation. The survey reports two types of process innovation separately: Whether the firm adopts new organizational methods, or new machinery in the production process. Table B.11 shows supportive evidence that changes in management practices are driving the TFP results: According to column (3) the least productive family firms, which according to our main analysis are the ones increasing TFP, are also implementing new organizational methods after competition increases. In line with the TFP result, this effect falls as a family firm’s initial productivity increases, and there is no observed change for non-family firms. This pattern does not hold for changes in physical technologies in the form of new machinery, as column (2) shows. It is interesting to see that managers change the productivity of their firm by changing organizational methods which is a type of management practice, rather than by investing in new machinery.

Our finding here is consistent with Schmitz Jr (2005), who studied increased competition

³²In the Online Appendix, we also show that import competition neither influences the number of family managers nor the probability of being a family-managed firm, for firms with either initially low or high productivity.

in the U.S. iron ore industry and found that productivity improvements were brought about by new management practices. These organizational improvements included giving workers more competencies and reorganizing work schedules in order to reduce redundancies in production processes.³³

We also investigate how firm-level R&D activities and product innovation responded to reductions in import tariffs, and the estimation results are reported in Table B.12. Since relatively few firms do R&D in our data set (a common finding in many countries), we investigate the change in the extensive margin of doing R&D first. Column (2) shows no significant effects, suggesting that the change in the probability of doing R&D does not differ significantly between family and non-family firms. When we focus on the intensive margin (i.e., by only looking at firms with non-zero R&D), a pattern opposite to our productivity results appears, as shown by column (3). In short, changes in R&D activities do not seem to be driving our productivity changes, as opposed to the previously reported changes in management practices. In addition, columns (4) and (5) show that changes in the number of patents and in the probability of doing product innovation also do not differ significantly between family and non-family firms after a decrease in import tariffs. These findings confirm our previous argument that changes in physical technologies are *not* responsible for the productivity improvements we observe, rather, it is process innovation driven by managerial changes in organizational methods.

In order to understand the potential mechanism explaining our results, we want to understand whether family management or family ownership is driving the results. Family management is correlated with family ownership, and family-owned firms might have different incentives compared to non-family-owned businesses for undertaking innovation (e.g., due to differential tax incentives, different types of assets, different political connections, or different time horizon of running the business). In Table B.13, we test whether family management (or family ownership) is driving our results, by restricting the sample to family-owned firms. Now β_1 and β_2 yield the effect for family-owned, but professionally-managed firms (as the dummy for family manager is zero), and β_3 and β_4 yield the result for family-owned and family-managed firms *relative* to family-owned but professionally-managed firms. Table B.13 conducts the main specification in column (1), and then also the same robustness checks as in Tables B.4 and B.5.³⁴ Productivity improvements are only observed in family-owned and family-managed firms, but not in family-owned and professionally-managed

³³In the Online Appendix, we also explore whether different types of employment (e.g., full time, part time and temporary employment) changed differently in family and non-family firms depending on their initial productivity after import tariffs went down. We found no significant effects in either of those variables.

³⁴The sample size is reduced because our indicator of family ownership is only available after 2006. Assuming that family ownership is relatively stable over time, we use the maximum of this measure between 2006 and 2010 (to maximize sample size, as this measure can be missing) as time invariant measure of family ownership for each firm. Since some of the firms in 1993 do not exist anymore in 2006 or after, the sample size is reduced for this analysis.

firms. This finding shows that increases in productivity are driven by differences in manager characteristics, rather than differences in firm characteristics related to ownership.

Finally, we check whether the results are different for owner-entrepreneurs/startups versus multigenerational family firms or family firms run by heirs, as those type of managers might have different incentives. We cannot directly observe these characteristics in the data, but we observe the age of the firm and the number of family managers working in the firm. The older a firm, the more likely it is that it is run by a heir or second or third generation family manager. Alternatively, the more family managers are working in the company, the less likely it is to be a typical owner-entrepreneur or startup, and more likely to be a multigenerational family firm. Table B.14 regresses productivity changes on changes in import competition for the sample of family firms only, as in the main text, but then splits the sample further up into young (below median, 13 years) and old (above median) firms in 1993. The effect is stronger and significant for the older rather than younger firms. In regressions using finer age groups the effect typically became strong and significant at around 14 years of firm age, which seems a plausible time for a second generation to start taking over family firms.

As an alternative test, Table B.14 splits the sample up into family firms which have just one family manager versus those which have more than one family manager in 1993 (most family firms with more than one family manager have two family managers, very few have more than two; for a histogram of family managers see the Online Appendix). The effect is stronger and significant for the firms with more than one family manager.

Overall, within family firms, results are stronger for family firms with more than just 1 family manager, and for old firms rather than for young firms. This suggests that our results are not driven by owner-entrepreneurs/startups, but rather by multigenerational family firms or family firms run by heirs, which might be more likely to exhibit the preferences in our model.

5 Model

In this section we present a model that rationalizes our main empirical findings: After a reduction in import tariffs, mainly family-managed firms respond with productivity changes. The family firms in the *left* tail of the initial productivity distribution (i.e., initially unproductive firms) *increase their productivity*, whereas those in the *right* tail of the productivity distribution (i.e., initially productive firms) *reduce it*.

We start with a static partial equilibrium model with heterogeneous firms and endogenous productivity, i.e. the firm's managers have the possibility to exert effort and increase the productivity of the firm. The key element of the model in this paper is that we allow managers to have heterogeneous preferences with respect to firm profits and private benefits and effort cost. This generates differential productivity responses to a change in the competitiveness of

the market.

Our model is very general and just distinguishes between two types of managers: We assume that compared to P type managers, F type managers both derive relatively more utility from private benefits and relatively more disutility from private effort relative to utility from firm profits.

From our reading of the literature on family firms, we interpret family managers as more closely corresponding to the F type manager in our model. On the one hand, family managers have been described to be able to derive various amenities and private benefits from their firms. Examples include the pleasure of being one's own boss, flexible work hours, but also the use of firm resources for personal purposes, the opportunity to use the firm to address family issues (e.g., finding a prestigious job for a low-ability offspring), empire building, or eponymy (Demsetz and Lehn, 1985; Bertrand and Mullainathan, 2003; Hurst and Pugsley, 2011; Bandiera et al., 2014a; Belenzon et al., 2014).

On the other hand, family managers - at least on average - seem to derive higher disutility from exerting effort for the firm: In their study of manager diaries, Bandiera et al. (2011) and Bandiera et al. (2014b) found that, in contrast to professional managers, family managers care more about leisure and non-monetary private benefits that the firm offers and less about money. They explain that this is consistent with a wealth effect, i.e., family managers are wealthier (e.g., because they own the firm or they have inherited wealth) and therefore care more about leisure.³⁵

The larger preference for leisure and private benefits has often been reported to be true for heirs (Holtz-Eakin et al. (1993); Morck et al. (2000); Villalonga and Amit (2006); Bennedsen et al. (2007)), which is in line with our empirical findings that the effect is stronger in older firms and firms with more family members. This indicates that the family manager in our model probably represents a second generation family manager better than an owner-entrepreneur.³⁶

5.1 Setup

As in Melitz (2003), firms draw a random initial productivity, ϕ . The initial productivity draw is fixed throughout the model, and its cumulative density function (CDF) is assumed to be $G(\phi)$. Firm profits are positively related to the exogenous productivity draw.

³⁵Effort could alternatively be interpreted as the skills of employees that managers hire rather than as the manager's own effort: Family managers might have a preference for hiring family members (in any role, be it top managers, middle managers, or workers), even if they have lower skills than non-family members. Our model which gives family managers a higher disutility from exerting effort is therefore consistent with family managers preferring to hire less skilled employees.

³⁶In any case, one point worth mentioning here is that we are *not* claiming that family managers are lazier or worse than professional managers in any sense (e.g., related to welfare). For us it only matters that they have different preferences and maximize different utility functions. In fact, family managers might generate more utility from managing their firm in equilibrium (due to the existence of higher private benefits), even though their actions might be less aligned to maximizing financial profits of the firms.

Managers have to exert effort, β , in order to operate their firms, and this effort choice affects ex post firm productivity endogenously.

Managers have to exert effort, β , in order to operate their firms, and this effort choice affects ex post firm productivity endogenously. The profit of the firm, π , taking into account the effort of the managers, is given by:

$$\pi = \eta\phi\beta - \left(f - a\beta + \frac{1}{2}\beta^2 \right).$$

The first term, η , is an exogenous market competitiveness parameter that decreases when import competition increases.³⁷ Firm profits decrease when competitiveness increases. Effort affects firm profits in two ways: First, it increases *realized productivity*, $\phi\beta$, of the firm. Since empirically we can only observe realized productivity, but not the productivity draw, our comparative statics will always be derived with respect to the former. Second, exerting effort also reduces (or increases) the fixed cost of production, f , with decreasing returns to effort: $a\beta - \frac{1}{2}\beta^2$.³⁸ The firm has to pay the resulting fixed cost, $(f - a\beta + \frac{1}{2}\beta^2)$, in order to survive and exits if profits are negative. Note that after the manager exerts effort, exit is not chosen by either the owner or the manager. Market forces the firm to exit, when its profits are negative.

The manager derives utility from both firm profit and private benefits and costs. Private benefits, \bar{U} , include non-monetary benefits the firm offers (e.g., various above mentioned amenities), which disappear when the manager has to leave the firm, for example, when the firm exits.³⁹ Private costs include the disutility of providing effort (e.g., by reducing the leisure of the manager).⁴⁰ Overall, the manager's utility is given by:

$$U = \begin{cases} \alpha_g \left[\eta\phi\beta - \left(f - a\beta + \frac{1}{2}\beta^2 \right) \right] + d_g(\bar{U} - \beta) & \text{if firm exists} \\ 0 & \text{if firm exits,} \end{cases}$$

where α_g and d_g denote the importance of firm profits and private benefits and cost respectively for a manager of type g .⁴¹ Note that weight α_g measures how much the manager cares about maximizing the profits of the firm. This might be because the manager receives profit shares, but the formulation is more general and includes more than just monetary compensation. The outside option of the manager is assumed to be zero if the firm goes

³⁷One can also think of $\eta(P, Y)$ as a function of the price level P and overall market size Y in a constant elasticity of substitution (CES) type framework. For example, in a standard Melitz (2003) model with CES preferences, we have $\eta(P, Y) := YP^{\sigma-1}\lambda^{1-\sigma}\frac{1}{\sigma}$, with λ denoting the constant markup and σ the elasticity of substitution.

³⁸We include this negative quadratic term in the fixed cost to ensure that the realized fixed cost is non-negative (under some parameter assumptions, see Assumption 3 which we discuss later). Note that we can also allow for decreasing returns to managerial effort in the variable profits term.

³⁹Note that the disappearance of private benefits when the firm exits can also be interpreted as the switching cost of finding another job, as in Schmidt (1997).

⁴⁰Note that we can also allow for convex effort cost.

⁴¹In Appendix F, we show that the specific functional form of the private benefits does not matter for our theoretical results.

bankrupt and she has to leave.

There are two types of managers with different preferences: F -type managers (family managers) and P -type managers (professional managers). We assume that F -type managers care *relatively less* about firm profits and *relatively more* about private benefits than P -type managers:

Assumption 1.

$$\frac{d_F}{\alpha_F} > \frac{d_P}{\alpha_P}$$

Several points are worth mentioning before proceeding. First, β measures the manager's effort that goes into increasing firm profits, rather than her pure working hours.⁴² Second, in Assumption 1, we do not take a stand on whether α is larger or smaller for F -type managers. Similarly, we also do not take a stand on whether the private benefit, $d_F \bar{U}$, is bigger or smaller than $d_P \bar{U}$.⁴³ Our assumption on the difference between F -type and P -type managers is about the *relative* importance of private benefits to profits only, not about the importance of either component. Finally, we do not assume that F -type managers have on average worse initial productivity draws than P -type managers; the initial productivity distributions are the same. However, due to different effort choices made by different types of managers we get an endogenously different distribution of *realized* productivity, which we will discuss later.

The manager's objective function is her utility function. If the firm exists, the manager's effort is determined by:

$$\begin{aligned} \max_{\beta} \quad & \alpha_g \left[\eta \phi \beta - \left(f - a\beta + \frac{1}{2}\beta^2 \right) \right] + d_g(\bar{U} - \beta) \\ \text{s.t.} \quad & \eta \phi \beta - \left(f - a\beta + \frac{1}{2}\beta^2 \right) \geq 0. \end{aligned} \quad (5.1)$$

We call the inequality $\eta \phi \beta - \left(f - a\beta + \frac{1}{2}\beta^2 \right) \geq 0$ the *non-bankruptcy constraint*, i.e., profits are non-negative and the firm survives.

Without loss of generality, we normalize α_P and α_F to one. For further exposition, we further simplify the assumptions to $d_P = 0$, i.e., P -type managers only care about firm profits. The full model with $d_F > d_P > 0$ is presented in Appendix E. With these additional assumptions, Assumption 1 simplifies to:

⁴²Work hours might be a poor measure of actual effort, if managers spend it inefficiently. In Bandiera et al. (2011) and Bandiera et al. (2014b), β can be interpreted as the working time inside the firm which benefits the firm most. More generally, β could also be interpreted as the effort other family member workers or even all workers put in because the manager makes them work harder or less hard.

⁴³Note that we could also allow \bar{U} to differ across the two types of managers. In this case, we only need to add the assumption $\min\{\bar{U}_F, \bar{U}_P\} > \sqrt{2f}$ for our results to go through. We discuss this assumption in Appendix G.

Assumption 2.

$$d_F > d_P = 0.$$

Finally we make the following assumption that ensures that the realized fixed cost after effort provision, $f - a\beta + \frac{1}{2}\beta^2$, is non-negative for all non-negative effort choices:

Assumption 3.

$$2f > a^2.$$

5.2 Effort choice

Since the **P-type manager** does not care about private benefits, her effort when the firm earns non-negative profits (i.e., when the initial productivity draw is larger than the *exit cutoff*, $\bar{\phi}_P$) is

$$\beta_P(\phi) = \eta\phi + a \quad \text{if } \phi \geq \bar{\phi}_P \equiv \frac{\sqrt{2f} - a}{\eta}. \quad (5.2)$$

The optimal effort level is the level that maximizes firm profits. It is an increasing function of the initial productivity draw, as a bigger initial productivity draw increases the marginal benefit of exerting effort.

If the initial productivity draw is smaller than the exit cutoff, $\bar{\phi}_P$, (which in the case of the P-type manager is also the *zero profit cutoff*), the manager would have negative utility with the optimal effort function (5.2). So below the cutoff, $\bar{\phi}_P$, a P-type firm (i.e., the firm managed by a P-type manager) exits and the P-type manager exerts no effort. The effort choice of the P-type manager at the exit cutoff is:

$$\beta_P(\bar{\phi}_P) = \sqrt{2f} \quad (5.3)$$

Next, we analyze the **F-type manager**. Since the F-type manager cares about both firm profits and private benefits, the optimal effort is

$$\beta_F(\phi) = \eta\phi + (a - d_F) \quad \text{if } \phi \geq \bar{\phi}_F \equiv \frac{(2f + d_F^2)^{\frac{1}{2}} - a}{\eta}. \quad (5.4)$$

We denote $\bar{\phi}_F$ as the *zero profit cutoff* for F-type firms since firm profits are strictly positive if the initial productivity draw is above this cutoff. The value of this cutoff can be obtained from $(\eta\bar{\phi}_F + a)\beta_F(\bar{\phi}_F) - \frac{1}{2}\beta_F(\bar{\phi}_F)^2 = f$, which leads to $\beta_F(\bar{\phi}_F) = (2f + d_F^2)^{\frac{1}{2}} - d_F \in (0, \sqrt{2f})$. Note that $\bar{\phi}_F > \bar{\phi}_P$, i.e., the zero profit cutoff is bigger for F-type firms than for P-type firms. When profits are strictly positive, the effort level of the F-type manager also increases with the initial productivity draw, as they are complements.

However, the F-type firm (i.e., the firm managed by an F-type manager) does not necessarily exit below the zero profit cutoff $\bar{\phi}_F$: For the F-type manager whose initial productivity draw

is slightly smaller than $\bar{\phi}_F$, both the firm and the manager can achieve a Pareto improvement compared to exiting by increasing the managerial effort above the level defined in equation (5.4), since the initial productivity draw is not too low and the effort level in equation (5.4) does not maximize firm profits. In equilibrium, it is optimal for those managers to exert effort at the level that makes their firms break even when their productivity draws are slightly below $\bar{\phi}_F$. This effort level will be higher than the level defined in equation (5.4). In this case the firm makes zero profits, but the F -type manager gets the private benefit, \bar{U} .⁴⁴ As long as $d_F(\bar{U} - \beta) > 0$, the F -type manager prefers to exert effort to make sure the firm survives. Specifically, the optimal effort for the F -type manager if $\phi < \bar{\phi}_F$ is obtained by setting firm profits equal to zero:

$$\left[(\eta\phi + a)\beta(\phi) - \frac{1}{2}\beta(\phi)^2 \right] = f,$$

which yields the solution:

$$\beta_F(\phi) = (\eta\phi + a) - \sqrt{(\eta\phi + a)^2 - 2f} \quad \text{if } \phi < \bar{\phi}_F \quad (5.5)$$

Finally, we have to take into account the F -type manager's participation constraint. The payoff of the manager must fall when ϕ decreases, which is implied by the revealed preferences argument. Therefore, we only need to look at the F -type manager who is at the exit cutoff. We know that when $\phi = \bar{\phi}_P$, $\beta_F(\bar{\phi}_P) = (2f)^{\frac{1}{2}}$, and the firm makes zero profits. Moreover, when $\phi = \bar{\phi}_P$, it is impossible to improve firm profits by adjusting the effort since the effort already maximizes firm profits. Therefore, if $\bar{U} \geq (2f)^{\frac{1}{2}}$, the F -type manager prefers to stay in the firm when her productivity draw is above or equal to $\bar{\phi}_P$ and quits the firm otherwise.⁴⁵ Throughout the paper, we assume that $\bar{U} \geq (2f)^{\frac{1}{2}}$ and show that our theoretical results hold under milder assumptions in Appendix G. The following proposition summarizes the effort choice of the manager

Proposition 1 (Optimal effort choice). *Suppose Assumptions 2 and 3 hold. For F -type managers with productivity draws above $\bar{\phi}_F (> \bar{\phi}_P)$, the optimal effort choice is*

$$\beta_F(\phi) = \eta\phi + a - d_F.$$

⁴⁴The purpose of deviating from the optimal effort level in equation (5.4) is to ensure the survival of the firm and obtain the private benefit, U . Thus, any further upward deviation from the effort level under which the firm breaks even is sub-optimal for the manager.

⁴⁵Under the assumption that $\bar{U} \geq (2f)^{\frac{1}{2}}$, both types of managers with an initial productivity draw that is slightly below $\bar{\phi}_P$ still want their firms to survive (and thus, to continue receiving private benefits). They therefore would consider covering the firm's negative profits using their own wealth outside the firm. We assume, however, that this is not possible. In practice, it is likely that a manager is either financially constrained (e.g., professional managers), or that her wealth mainly resides inside the firm (e.g., owner-managers), which makes such an action very unlikely.

When $\phi \in [\bar{\phi}_P, \bar{\phi}_F]$, the optimal effort is

$$\beta_F(\phi) = (\eta\phi + a) - \sqrt{(\eta\phi + a)^2 - 2f}.$$

For P -type managers with productivity draws above $\bar{\phi}_P$, the optimal effort choice is

$$\beta_P(\phi) = \eta\phi + a.$$

All managers and firms with an initial productivity draw lower than $\bar{\phi}_P$ choose to exit. The effort of the P -type manager increases in ϕ . The effort of the F -type manager decreases first and increases afterwards with ϕ (i.e., the relationship is “U”-shaped).

Proof. We have already shown how both manager types choose their optimal effort. The relationship between the initial productivity draw and the optimal effort choice holds because $\beta'_P(\phi) > 0$, and $\beta'_F(\phi) > 0$ for $\phi \geq \bar{\phi}_F$, and $\beta'_F(\phi) < 0$ for $\phi \in [\bar{\phi}_P, \bar{\phi}_F]$. \square

Figure A.7 graphs the optimal effort choices of F -type and P -type managers, as well as realized productivity as a function of the initial productivity draw.

The above proposition illustrates that there are two different ways in which F -type managers are incentivized to exert effort. When the initial productivity draw is high, they exert effort in order to increase the marginal profitability of the firm. For further exposition, we label these managers as the *unconstrained managers*. When the initial productivity draw is low (but not extremely low), F -type managers exert effort in order to make their firms break even and stay in the market. We label these managers as the *constrained managers*. The following proposition characterizes the optimal effort choice and its implications further:

Proposition 2 (Cross-sectional predictions). *First, conditional on the initial productivity draw, non-exiting P -type firms have higher managerial effort and realized productivity. Second, non-exiting P -type firms have higher average realized productivity and managerial effort compared with non-exiting F -type firms. Third, the realized productivity of P -type firms, $\beta_P(\phi)\phi$, increases in ϕ . Fourth, the realized productivity of F -type firms, $\beta_F(\phi)\phi$, increases in ϕ for $\phi \geq \bar{\phi}_F$. Finally, the realized productivity of F -type firms, $\beta_F(\phi)\phi$, decreases first and increases afterwards in ϕ when $\phi \in [\bar{\phi}_P, \bar{\phi}_F]$. In particular, when a^2 approaches $2f$, the interval in which $\beta_F(\phi)\phi$ decreases in ϕ , shrinks to zero.*

Proof. See Appendix C. \square

Proposition 2 has several implications. P -type managers always exert more effort than F -type managers. As a result, it is more difficult for F -type firms to survive than for P -type firms, conditioning on the initial productivity draw. However, at the exit cutoff, F -type firms have the same level of realized productivity and managerial effort as P -type firms: When it

comes to exiting the market, *F*-type managers are disciplined well and behave no worse than *P*-type managers. Figure A.7 illustrates this.

Our model predicts that the (weighted and unweighted) *average* realized productivity of *F*-type managers is larger than that of *P*-type managers. Note that this result is an implication of our theory and not an assumption, as both types of firms draw their initial productivity from the same distribution, and this prediction is also consistent with the data, as can be seen in Table B.1 (and many other papers in the literature on family firms). Intriguingly, our model does not just predict the average productivity difference in the cross-section correctly, but even the all first four moments of the difference in the log productivity distribution between family and non-family firms: mean, variance, skewness and kurtosis, as we show in the Online Appendix.

In what follows, we consider the parameter range in which a^2 is close to $2f$, which rules out the non-intuitive special case in which realized productivity decreases in the initial productivity draw. For a more detailed discussion on the difference in the productivity distribution of *F*-type firms and *P*-type firms, see Appendix D.

5.3 Impact of import competition on productivity

In this subsection we analyze how stiffer import competition affects the realized productivity of *F*-type firms and *P*-type firms differently. Specifically, we conduct a comparative statics exercise of a decrease in η (i.e., an increase in import competition) on managerial effort and firm productivity. We use subscripts “*before*” and “*after*” to denote variables before and after a reduction in import tariffs. Note that we will focus on comparative statics with respect to relatively small tariff changes, which are defined in the following assumption:

Assumption 4.

$$\frac{\eta_{after}}{\eta_{before}} > \frac{(2f)^{\frac{1}{2}} - a}{(2f)^{\frac{1}{2}} - a + d_F},$$

where parameters η_{before} and $\eta_{after} (< \eta_{before})$ denote the market competitiveness before and after the reduction in import tariffs.

A larger increase in import competition would generate an uninteresting case in which all constrained (*F*-type) managers exit, and therefore the exit threat does not play a role for productivity improvements. Given that the exit rates are small in our empirical results, we think it is more interesting to focus on the other case here.⁴⁶ The following propositions state formally how stiffer import competition affects *F*-type firms and *P*-type firms differently:

⁴⁶Note that empirically, the annual changes in import tariffs did not lead to extreme changes in market size or exit rates. While the changes were large over the course of the entire 20 years, the annual changes were not.

Proposition 3 (Comparison across F-type firms with different initial productivity). *After import competition increases, the initially least productive surviving F-type firms increase productivity, whereas the initially most productive surviving F-type firms decrease productivity.*

Proof. See Appendix C. □

The least productive surviving F-type firms increase productivity, as stiffer import competition incentivizes their managers to exert more effort to ensure the survival of their firms (i.e., by just earning non-negative profits). On the contrary, the most productive surviving F-type firms decrease productivity as the marginal return to effort falls (due to shrinking market size) and they are not worried about survival.

Proposition 4 (Comparison between F-type and P-type firms). *When import competition increases, the increase in log productivity for the least productive F-type firm is larger than that for the least productive P-type firm, while the reduction in log productivity for the most productive F-type firm is also larger than that for the most productive P-type firm.*

Proof. See Appendix C. □

Our model predicts opposite patterns for the change in log productivity within the least productive (surviving) firms and within the most productive (surviving) firms. First, among the least productive surviving firms, F-type firms increase log productivity relative to P-type firms since the former firms and the latter firms increase and decrease productivity (and managerial effort) under stiffer import competition respectively. Second, both F-type firms and P-type firms decrease productivity after intensified import competition if their initial productivity is high. In addition, conditional on the initial productivity draw, they reduce productivity by the same degree. However, F-type firms have lower realized productivity than P-type firms, conditioning on the initial productivity draw. Therefore, the decrease in log realized productivity (i.e., the percentage decrease) is larger for F-type firms than for P-type firms, conditioning on the initial productivity draw (or initially realized productivity).⁴⁷

Proposition 5 (Average productivity). *When import competition increases, the average log productivity of F-type firms can either increase or decrease, and it can either increase or decrease relative to P-type firms.*

Proof. See Appendix C. □

⁴⁷When we condition on the initially realized productivity, the decrease in log productivity is larger for F-type firms as well. The bigger the initial productivity draw, the larger the firm's productivity decrease since the initial productivity draw and the market size are complements (for the determination of the optimal effort). This is true for both unconstrained F-type firms and unconstrained P-type firms. As a result, F-type firms that have the same initial productivity (or log productivity) as P-type firms must receive a bigger initial productivity draw than P-type firms. Therefore, conditional on initial productivity (or log productivity), the most productive (surviving) F-type firms decrease log productivity by more than the most productive (surviving) P-type firms after import competition increases.

Among *F*-type firms (and *P*-type firms in the general case of our model), there are firms that decrease productivity and firms that increase productivity under stiffer import competition. Overall, it is not clear how the average productivity of *F*-type firms changes when import tariffs are reduced.⁴⁸

Summarizing the predictions, Figures A.8 and A.9 show changes in managerial effort and log realized productivity after a reduction in import tariffs as functions of the initial productivity draw and the initial productivity. The second graph of Figure A.9 shows the prediction most closely related to our empirical specifications, as it is related to the initial productivity.

Figure A.5 bears quite a striking resemblance to its theoretical counterpart in Figure A.9: For the lowest initial values of TFP in our sample, the effect of import competition on productivity is positive for family firms, in line with Proposition 3. This is reversed for family firms at the high end of the initial productivity spectrum: For those firms, import competition leads to a decrease in productivity, again in line with Proposition 3. This is in contrast to non-family firms, which do not respond to import competition at all. This is consistent with Proposition 4: The magnitude of the change in productivity is larger for family firms than non-family firms on both tails of the productivity distribution.

The analysis of the general model in which both *P*-type and *F*-type managers receive private benefits are presented in Appendix E. In this generalized model, *P*-type managers receive private benefits when their firm survives and bear effort cost when working as well. However, *P*-type managers put less weight on those private benefits and effort cost compared to *F*-type managers. This generalization does not change the predictions presented above. In particular, it is still true that after import competition increases, unproductive family firms increase productivity relative to unproductive non-family firms, conditioning on the initial productivity. The key to understanding this result is that if a *P*-type manager is constrained, then an *F*-type manager with the same productivity draw must be constrained as well. Since the constrained manager increases effort more (or decreases effort less) compared with the unconstrained manager with the same initial productivity draw (after import competition increases), the least productive family firms increase productivity relative to the least productive non-family firms, conditioning on the initial productivity.

5.4 Additional empirical evidence for model

The model can rationalize our key empirical findings about how productivity responds to import competition. Furthermore, in contrast to alternative explanations that we are aware of,

⁴⁸Empirically, it is worthwhile noting that the average effect on productivity, as estimated in column (3) of Table B.4, is insignificant for both family and non-family firms. This is consistent with Proposition 5, which predicts an indeterminate average effect.

the model matches additional empirical patterns.⁴⁹

First, as we have shown in Table B.13, the driving feature of the model revolves around the characteristics of the manager of the firm rather than the owner of the firm, so explanations that are based on the latter are not consistent with the data (e.g. tax incentives, political connection, asset mixes, or investment horizons that differ for family owned vs non family owned firms).

Second, as we have shown in Table B.11, productivity improvements are generated by the introduction of new organizational methods rather than by investments (like new machinery or increased R&D), which is a typical managerial task and more costly to the manager (in terms of effort) than to the firm (in terms of dollars spent) compared to alternative ways to improve measured productivity, like markup changes, employment reductions, or a better access to imported materials or technology. This is consistent with including private effort cost of managerial effort as explanation for our findings.

Third, as we have shown in Tables B.14 and B.15, the results are stronger for family firms with more than just 1 family manager, and for old firms rather than for young firms. This suggests that our results are not driven by owner-entrepreneurs/startups, but rather by multigenerational family firms or family firms run by heirs, which are more likely to exhibit the preferences in our model.

6 Conclusion

In this paper, we use rich, firm-level data from Spain and changes in EU imposed import tariffs between 1993 and 2007 to study how stiffer import competition affects productivity of family firms (as opposed to non-family firms). We find that family-managed firms with initially low productivity show significant productivity increases after a reduction of import tariffs, and this effect falls with the initial productivity of the family-managed firm. This is in contrast to non-family firms, whose productivity is barely affected by import competition. Furthermore, we show that our findings are driven by family management rather than family ownership and by improvements in organizational methods rather than improvements in physical technologies. In addition, we find that our results are driven by older family

⁴⁹Two alternative explanations are inconsistent with the data (not shown in paper, results available upon request): Initially unproductive firms could increase productivity by engaging in quality upgrading, possibly using better inputs. This might be more likely for family firms, as their products are often niche products and they would like to escape competition by focusing on a different, higher quality niche. While in our data, initially unproductive family firms seem to use higher quality inputs because their input prices increase, they do not manage to translate this into higher markups, as output prices do not change. So their markups fall, and this channel goes against the productivity increase that we find. A second alternative channel of seeing productivity increases could be that family firms, when hit by import competition, increase productivity by laying off their potentially inefficient family member workers, which they often have. However, in the data, there is no significant change in the number of family member workers as a result of import competition.

firms, and by those with more than one family manager, i.e. by multigenerational, inherited businesses rather than the typical owner-entrepreneur or startup.

In the theoretical part of the paper, we propose a model featuring heterogeneity in manager's preferences in order to rationalize the empirical findings documented above. We assume that family managers (i.e., heirs of family business founders rather than owner-entrepreneurs) have different preferences compared to professional managers, caring about private benefits and costs more compared to professional managers. The model predicts that only managers who care about private benefits and cost respond to import competition, and the response is larger the more they care (i.e., family managers). Furthermore, the direction of the productivity change depends on the firm's initial position in the productivity distribution, consistent with our empirical findings. The model explains that initially unproductive family managers increase their productivity because they want to ensure survival of the firm, whereas initially productive family managers reduce their effort because they are discouraged by a shrinking market size.

Nevertheless, much remains to be explored. Given the increasing availability of panel data on management practices, using management survey data (e.g., the World Management Survey as in Bloom and van Reenen, 2007) can provide more direct evidence on how increased import competition affects firm productivity through affecting management quality. From the theoretical point of view, incorporating the partial equilibrium model presented in this paper into a general equilibrium trade model could help us understand how the difference in manager's preferences affects gains in aggregate productivity and welfare after trade liberalization.

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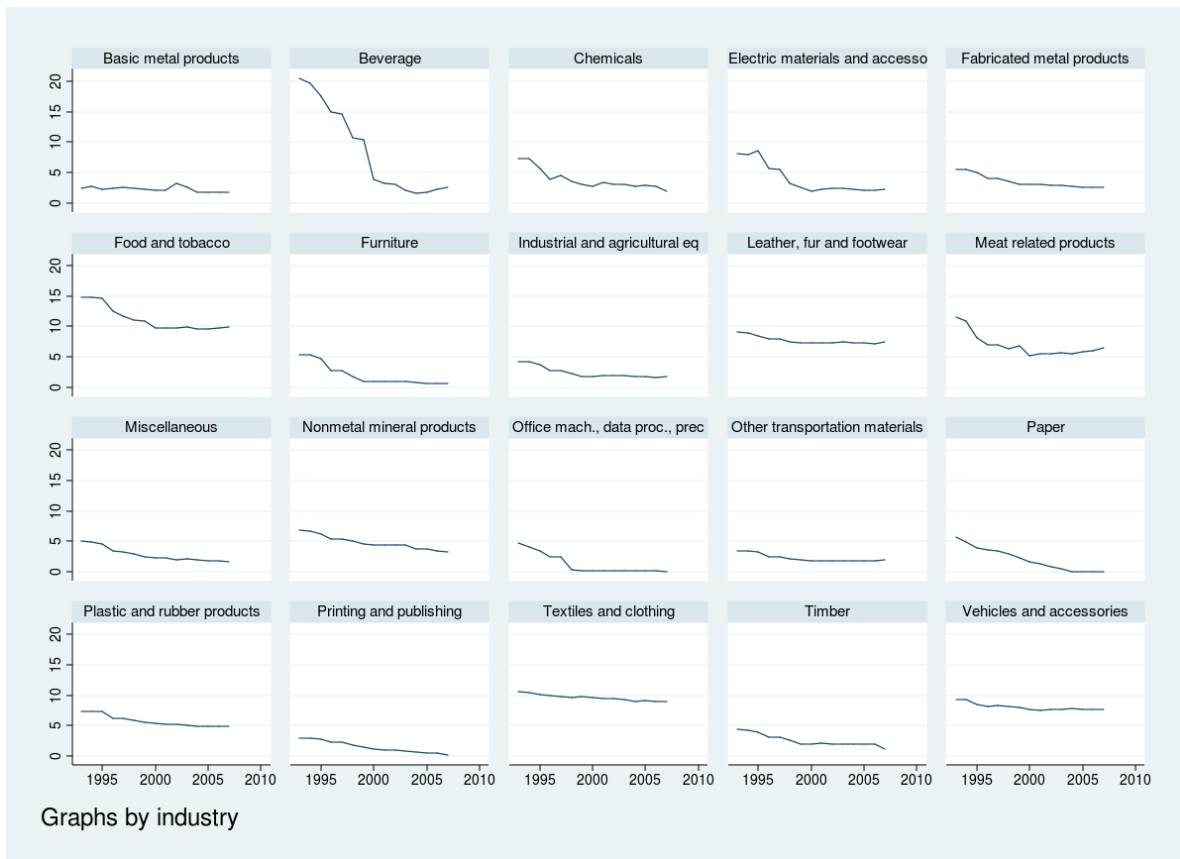
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Appendix

A Figures

Figure A.1: EU import tariffs over time



Source: TRAINS database (provided by UNCTAD), accessed by World Integrated Trade Solution (WITS), wits.worldbank.org

Figure A.2: Log sales distribution of Spanish manufacturing firms, 1994

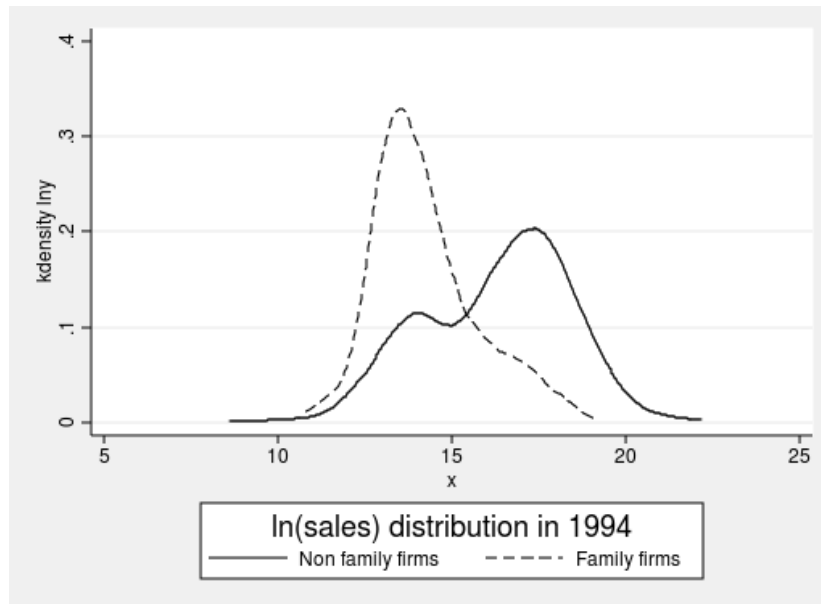


Figure A.3: TFP distribution after nearest neighbor matching

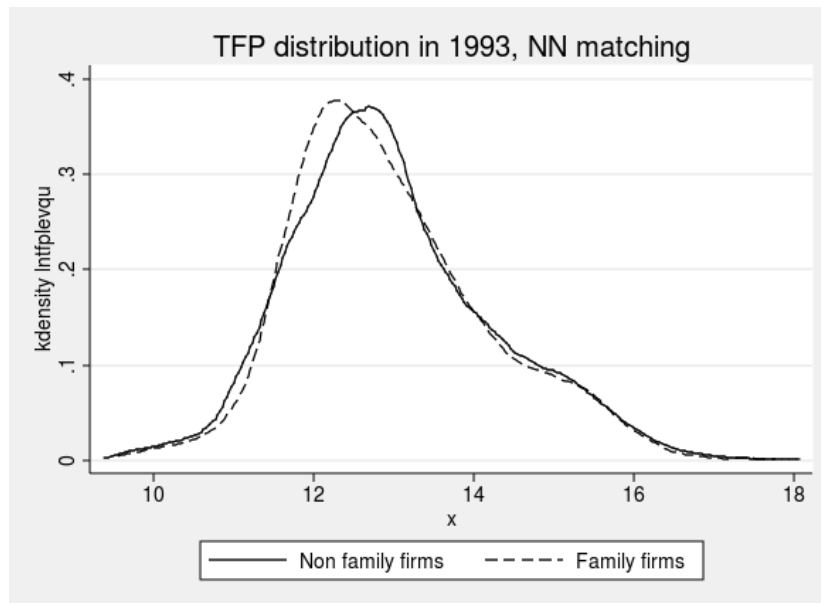


Figure A.4: Effect of import competition: Non-parametric estimation

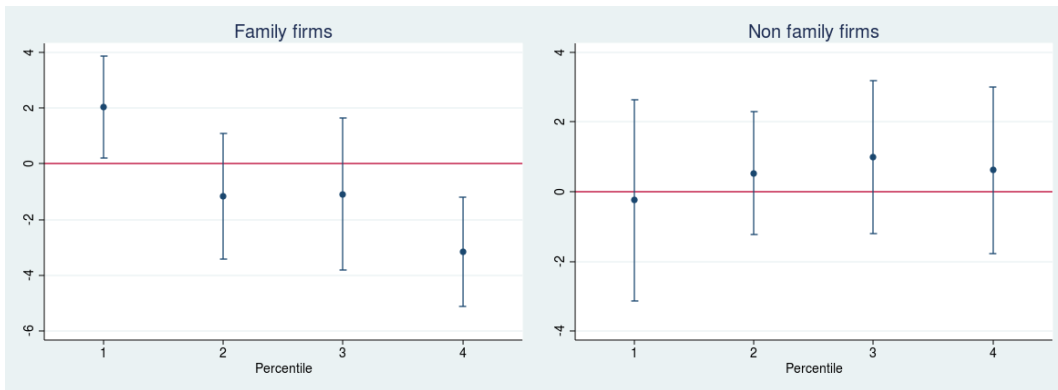


Figure A.5: Effect of import competition - graph

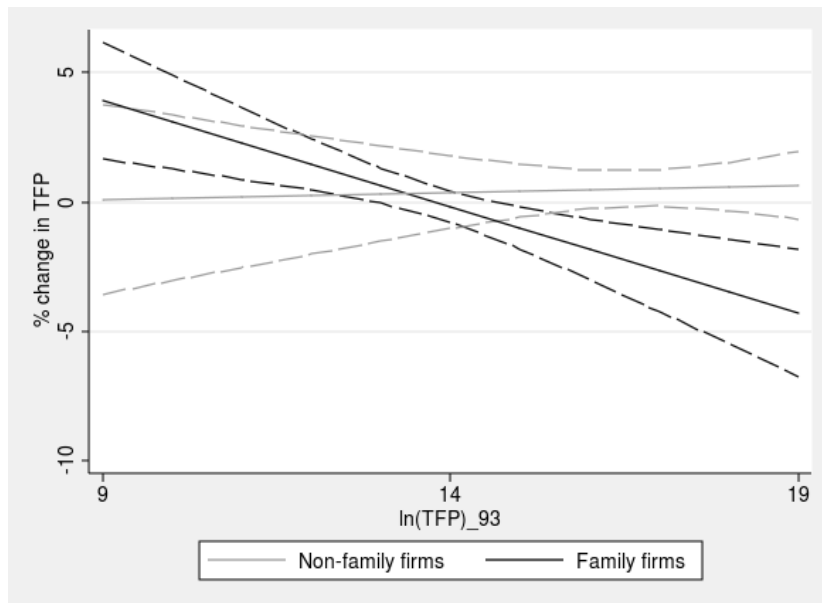


Figure A.6: Exit rate of family firms and non-family firms



Figure A.7: Effort and realized productivity across firms

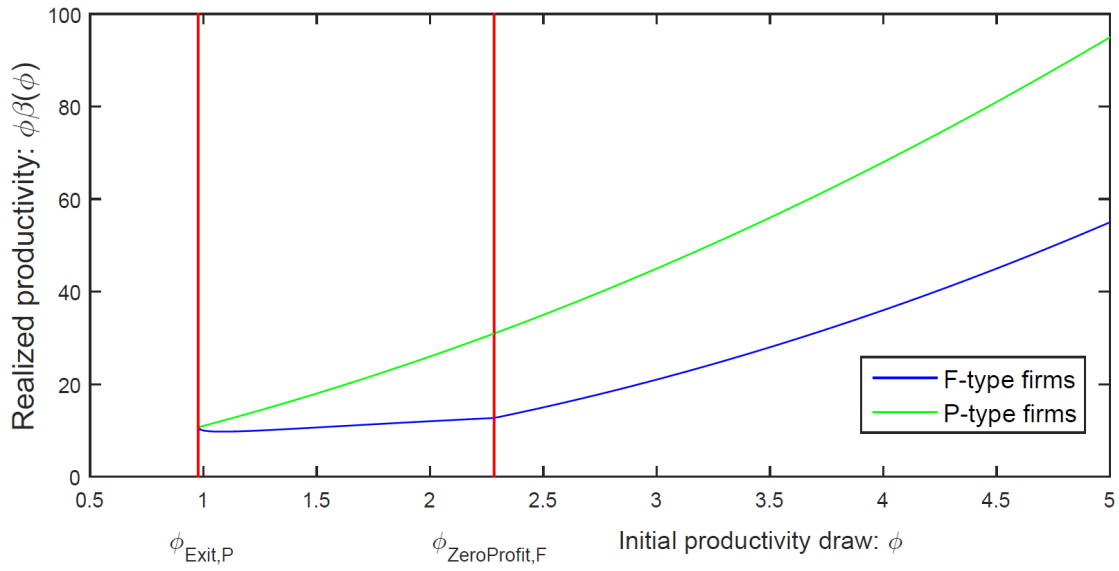
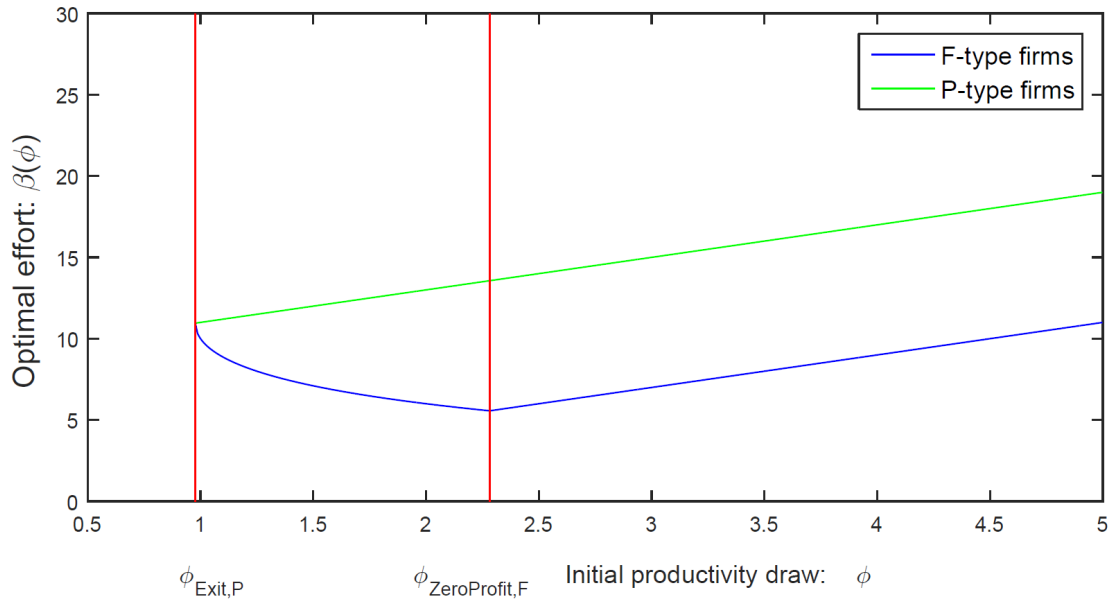


Figure A.8: Effect of increased import competition on effort and realized productivity

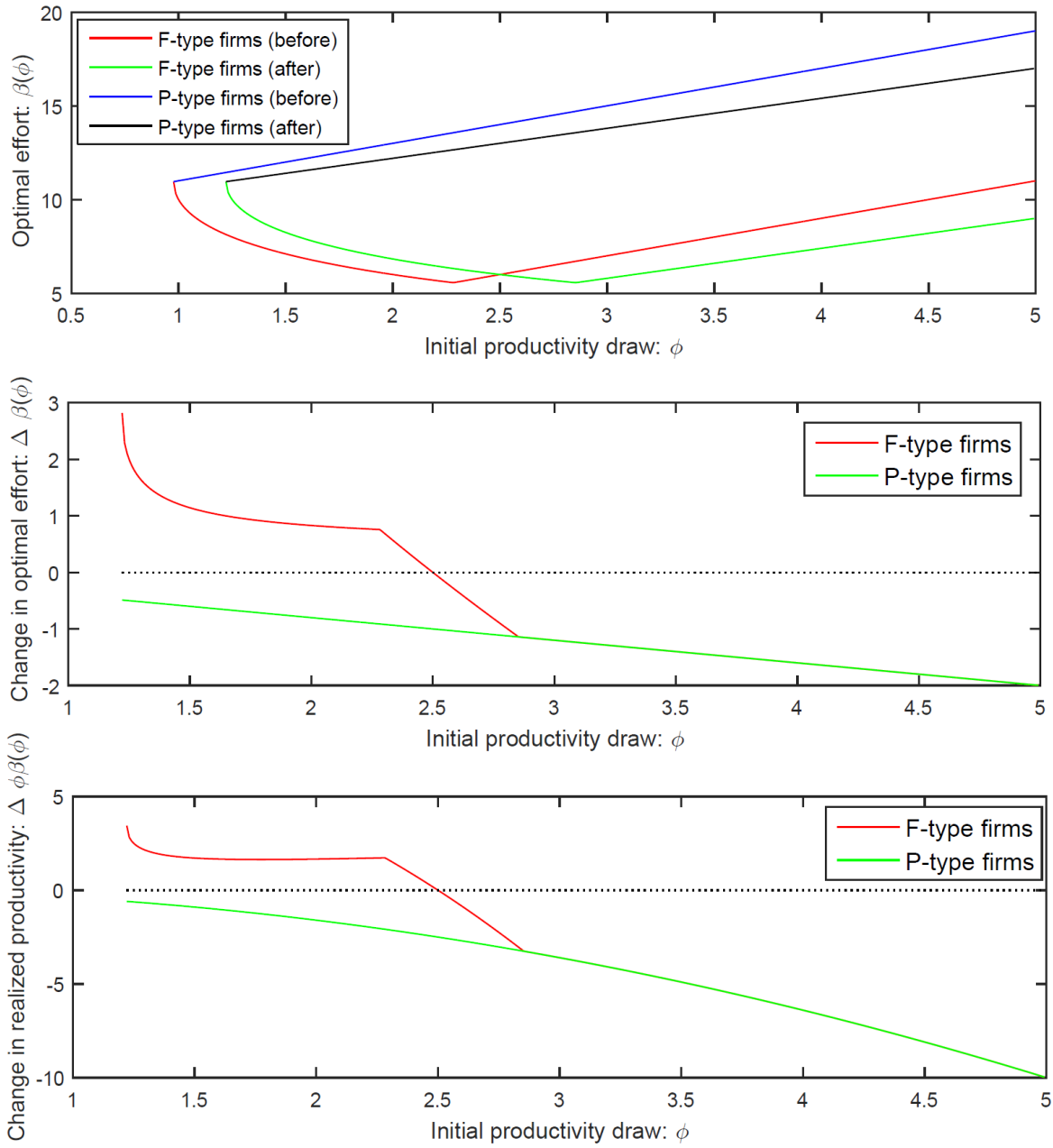
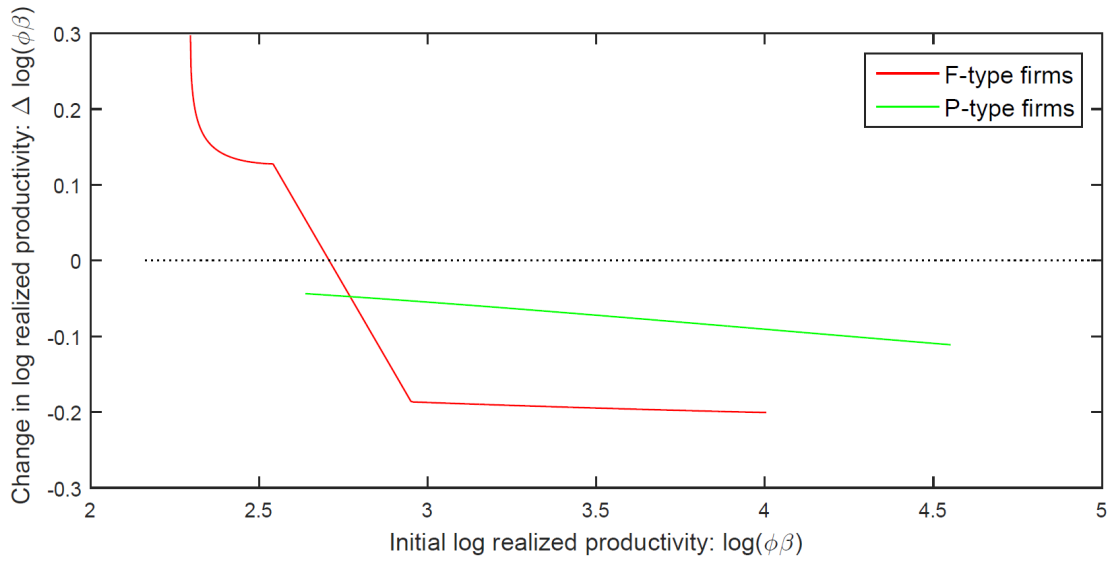
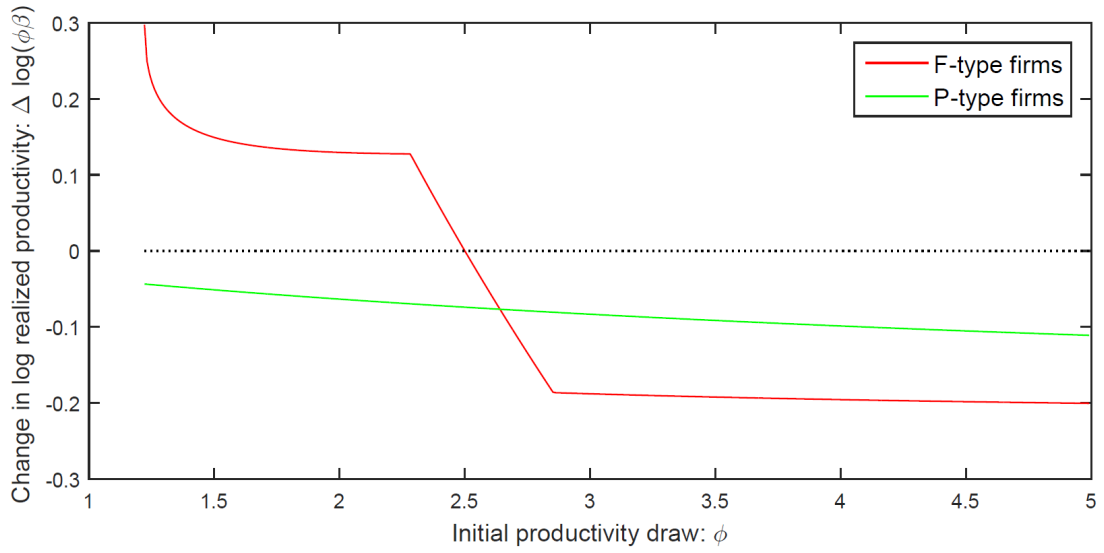


Figure A.9: Effect of increased import competition on log realized productivity



B Tables

Table B.1: Descriptive statistics of Spanish manufacturing firms

	Family firms	Non-family firms	Difference
N (firm-year)	10,092 (41%)	14,651 (59%)	
Sales, million EUR	10.05 (0.30)	100.80 (3.24)	90.75***
Employment	70.21 (1.43)	388.08 (8.03)	317.87***
ln(TFP)	13.35 (0.01)	14.75 (0.01)	1.40***
R&D expenses, thousand EUR	96.79 (7.06)	1,424.68 (97.86)	1,327.89***

Table B.2: Effect of import competition - separate regressions

	(1)	(2)	(3)	(4)	(5)	(6)
Sample:	Family firms	Family firms	Family firms	Non-family firms	Non-family firms	Non-family firms
Dep var:	ΔTFP_{ist}	ΔTFP_{ist}	ΔTFP_{ist}	ΔTFP_{ist}	ΔTFP_{ist}	ΔTFP_{ist}
ΔIMP_{st}	0.152 (0.341)	11.492*** (3.913)		0.351 (0.730)	-0.366 (4.955)	
$\Delta IMP_{st} \cdot TFP93_i$		-0.831*** (0.280)	-0.731** (0.328)		0.048 (0.293)	0.112 (0.318)
Observations	6,078	6,078	6,078	7,800	7,800	7,800
Number of firmid	612	612	612	812	812	812
Firm FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes		yes	yes	
Ind*Year FE			yes			yes

Notes: * p<0.05, ** p<0.01, *** p<0.001. Standard errors in parentheses are clustered by NACECLIO industries.

Table B.3: Effect of import competition - non-parametric regressions

Dep var: ΔTFP_{ist}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample:	Family firms	Family firms	Family firms	Family firms	Non-family firms	Non-family firms	Non-family firms	Non-family firms
ΔIMP_{st}	1.330** (0.679)	1.752** (0.846)	2.035** (0.931)	2.073** (0.857)	0.045 (1.298)	0.305 (1.334)	-0.242 (1.473)	0.687 (1.338)
$\Delta IMP_{st} \cdot Perc2$	-1.728** (0.740)	-0.908 (0.995)	-1.165 (1.142)	-0.458 (1.334)	0.488 (0.998)	0.128 (0.781)	0.531 (0.897)	-1.771** (0.871)
$\Delta IMP_{st} \cdot Perc3$		-2.597*** (0.964)	-1.083 (1.392)	-0.277 (1.223)		0.001 (1.041)	0.986 (1.121)	0.569 (1.031)
$\Delta IMP_{st} \cdot Perc4$			-3.152*** (0.995)	-2.416 (1.585)			0.621 (1.218)	-0.401 (0.843)
$\Delta IMP_{st} \cdot Perc5$				-3.509*** (0.984)				-0.383 (1.228)
Observations	6,078	6,078	6,078	6,078	7,800	7,800	7,800	7,800
Number of firmid	612	612	612	612	812	812	812	812
Nr of percentiles	2	3	4	5	2	3	4	5
Firm FE	yes	yes	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes	yes	yes

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors in parentheses are clustered by NACECLIO industries.

Table B.4: Effect of import competition - pooled regression

	(1)	(2)	(3)	(4)	(5)
	ΔTFP_{ist}	ΔTFP_{ist}	ΔTFP_{ist}	ΔTFP_{ist}	ΔTFP_{ist}
ΔIMP_{st}	0.306 (0.460)	0.378 (0.645)	3.096 (2.727)	-0.385 (4.808)	
$\Delta IMP_{st} \cdot TFP93_i$			-0.193 (0.172)	0.054 (0.288)	0.174 (0.287)
$\Delta IMP_{st} \cdot FAM93_i$		-0.193 (0.659)		11.679*** (4.459)	10.914*** (3.744)
$\Delta IMP_{st} \cdot TFP93_i \cdot FAM93_i$				-0.875*** (0.283)	-0.810*** (0.232)
Observations	13,878	13,878	13,878	13,878	13,878
Number of firmid	1,424	1,424	1,424	1,424	1,424
Firm FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	
Ind*Year FE					yes

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors in parentheses are clustered by NACECLIO industries.

Table B.5: Robustness checks - pooled regression

	(1)	(2)	(3)	(4)	(5)	(6)
Dep var: ΔTFP_{ist}	Baseline	Alt. tariff measures		Alt. TFP measures		
Method:	Lev Pet Q	Lev Pet Q	Lev Pet Q	Lev Pet R	FE	Lab prod
ΔIMP_{st}	-0.385 (4.808)	1.026 (4.273)	-3.629 (2.749)	-1.167 (3.878)	1.186 (7.140)	-13.968 (15.689)
$\Delta IMP_{st} \cdot TFP93_i$	0.054 (0.288)	-0.045 (0.257)	0.229 (0.169)	0.201 (0.432)	-0.023 (0.551)	1.540 (1.510)
$\Delta IMP_{st} \cdot FAM93_i$	11.679*** (4.459)	10.707*** (3.683)	9.488** (4.415)	9.995*** (3.147)	10.765* (5.627)	39.833* (22.069)
$\Delta IMP_{st} \cdot TFP93_i \cdot FAM93_i$	-0.875*** (0.283)	-0.807*** (0.233)	-0.673** (0.302)	-1.305*** (0.420)	-1.000** (0.440)	-3.957* (2.147)
Observations	13,878	13,878	13,878	13,896	14,120	14,377
Number of firmid	1,424	1,424	1,424	1,427	1,446	1,487
Firm FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Tariffs	1993 weights	t-1 weights	only China tariffs	1993 weights	1993 weights	1993 weights

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors in parentheses are clustered by NACECLIO industries.

Table B.6: Pooled regression - nearest neighbor matching (5 nearest neighbors)

Dep var: ΔTFP_{ist}	(1)	(2)	(3)	(4)	(5)
ΔIMP_{st}	-0.132 (0.576)	-0.116 (0.912)	6.043 (3.732)	0.378 (5.120)	
$\Delta IMP_{st} \cdot TFP93_i$			-0.454* (0.245)	-0.032 (0.335)	0.348 (0.368)
$\Delta IMP_{st} \cdot FAM93_i$		-0.034 (0.840)		10.283* (5.314)	11.998** (4.817)
$\Delta IMP_{st} \cdot TFP93_i \cdot FAM93_i$				-0.765** (0.380)	-0.898** (0.338)
Observations	11,572	11,572	11,572	11,572	11,572
Number of firmid	1,187	1,187	1,187	1,187	1,187
Firm FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	
Ind*Year FE					yes

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors in parentheses are clustered by NACECLIO industries.

Table B.7: Pooled regression - inverse propensity score re-weighting

Dep var: ΔTFP_{ist}	(1)	(2)	(3)	(4)	(5)
ΔIMP_{st}	-0.034 (0.619)	-0.037 (1.027)	5.152 (4.592)	-0.749 (5.900)	
$\Delta IMP_{st} \cdot TFP93_i$			-0.383 (0.308)	0.058 (0.377)	0.344 (0.406)
$\Delta IMP_{st} \cdot FAM93_i$		0.005 (0.988)		11.515** (4.493)	11.731*** (4.553)
$\Delta IMP_{st} \cdot TFP93_i \cdot FAM93_i$				-0.854*** (0.283)	-0.874*** (0.287)
Observations	13,846	13,846	13,846	13,846	13,846
Number of firmid	1,421	1,421	1,421	1,421	1,421
Firm FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	
Ind*Year FE					yes

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors in parentheses are clustered by NACECLIO industries.

Table B.8: Endogenous exits or change in management

	(1)	(2)	(3)
	ΔTFP_{ist}	$\Delta Exit$	ΔTFP_{ist}
ΔIMP_{st}	-0.385 (4.808)	0.105 (0.369)	-0.487 (4.902)
$\Delta IMP_{st} \cdot TFP93_i$	0.054 (0.288)	-0.010 (0.027)	0.056 (0.292)
$\Delta IMP_{st} \cdot FAM93_i$	11.679*** (4.459)	-0.158 (0.356)	16.268** (7.035)
$\Delta IMP_{st} \cdot TFP93_i \cdot FAM93_i$	-0.875*** (0.283)	0.014 (0.026)	-1.243** (0.522)
Observations	13,878	13,295	10,915
Number of firmid	1,424	1,356	1,131
Firm FE	yes	yes	yes
Year FE	yes	yes	yes
Sample			excl fam firm switchers

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors in parentheses are clustered by NACECLIO industries.

Table B.9: Importing and exporting

	(1)	(2)	(3)	(4)
	ΔTFP_{ist}	$\Delta \ln(\text{imp})_{it}$	imported tech dummy	$\Delta \ln(\text{exp})_{it}$
ΔIMP_{st}	-0.385 (4.808)	-32.488 (36.509)	1.141 (2.954)	-29.223 (20.574)
$\Delta IMP_{st} \cdot TFP93_i$	0.054 (0.288)	2.008 (2.312)	-0.073 (0.233)	1.991 (1.336)
$\Delta IMP_{st} \cdot FAM93_i$	11.679*** (4.459)	49.017 (39.278)	-6.397 (7.594)	47.134 (47.329)
$\Delta IMP_{st} \cdot TFP93_i \cdot FAM93_i$	-0.875*** (0.283)	-2.992 (2.716)	0.450 (0.597)	-3.033 (3.268)
Observations	13,878	8,427	14,088	8,613
Number of firmid	1,424	959	1,440	966
Firm FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors in parentheses are clustered by NACECLIO industries.

Table B.10: Controlling for export tariffs and input tariffs

Dep var: ΔTFP_{ist}	(1)	(2)	(3)	(4)
	Export tariffs		Input tariffs	
ΔIMP_{st}	-0.621 (4.773)		0.943 (4.702)	
$\Delta IMP_{st} \cdot TFP93_i$	0.069 (0.286)	0.181 (0.287)	-0.035 (0.284)	0.055 (0.282)
$\Delta IMP_{st} \cdot FAM93_i$	11.123** (4.506)	10.357*** (3.883)	12.498*** (4.474)	11.948*** (3.738)
$\Delta IMP_{st} \cdot TFP93_i \cdot FAM93_i$	-0.835*** (0.287)	-0.769*** (0.243)	-0.948*** (0.288)	-0.899*** (0.234)
ΔEXP_{st}	0.769 (0.821)			
$\Delta EXP_{st} \cdot TFP93_i$	-0.048 (0.056)	-0.028 (0.056)		
$\Delta EXP_{st} \cdot FAM93_i$	1.101** (0.528)	1.199** (0.575)		
$\Delta EXP_{st} \cdot TFP93_i \cdot FAM93_i$	-0.078** (0.039)	-0.087** (0.043)		
$\Delta INTAR_{st}$			10.010*** (2.499)	
$\Delta INTAR_{st} \cdot TFP93_i$			-0.557*** (0.198)	-0.589** (0.245)
$\Delta INTAR_{st} \cdot FAM93_i$			4.291 (4.616)	4.285 (4.773)
$\Delta INTAR_{st} \cdot TFP93_i \cdot FAM93_i$			-0.380 (0.319)	-0.382 (0.330)
Observations	13,878	13,878	13,878	13,878
Firm FE	yes	yes	yes	yes
Year FE	yes		yes	
Ind*Year FE		yes		yes

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors in parentheses are clustered by NACECLIO industries. *INTAR* denotes a weighted average of import tariffs of the inputs of an industry, where input shares are constructed from the Spanish IO tables. *EXP* denotes the weighted average of tariffs that other countries impose on imports from the EU.

Table B.11: Mechanism: Effort-related changes, not changes in (physical) machines

	(1)	(2)	(3)
		<i>Process innovation</i>	
	ΔTFP_{ist}	New machinery dummy	New organizational methods dummy
ΔIMP_{st}	-0.385 (4.808)	-0.489 (8.314)	3.009 (4.369)
$\Delta IMP_{st} \cdot TFP93_i$	0.054 (0.288)	-0.030 (0.588)	-0.217 (0.320)
$\Delta IMP_{st} \cdot FAM93_i$	11.679*** (4.459)	-10.417 (10.994)	16.109** (7.374)
$\Delta IMP_{st} \cdot TFP93_i \cdot FAM93_i$	-0.875*** (0.283)	0.714 (0.802)	-1.233** (0.580)
Observations	13,878	13,596	13,596
Number of firmid	1,424	1,446	1,446
Firm FE	yes	yes	yes
Year FE	yes	yes	yes

Notes: * p<0.05, ** p<0.01, *** p<0.001. Standard errors in parentheses are clustered by NACECLIO industries.

Table B.12: Mechanism: R&D, patents, and product innovation

	(1)	(2)	(3)	(4)	(5)
		<i>R&D</i>		<i>Patents</i>	<i>Product Innovation</i>
	ΔTFP_{ist}	Change in R&D Dummy	Change in log R&D expenses	Change in the number of patents	Change in product innovation dummy
ΔIMP_{st}	-0.385 (4.808)	-3.100 (3.606)	94.809*** (34.357)	65.689*** (22.426)	-12.391** (6.249)
$\Delta IMP_{st} \cdot TFP93_i$	0.054 (0.288)	0.183 (0.261)	-5.795*** (2.237)	-4.074** (1.594)	0.814** (0.402)
$\Delta IMP_{st} \cdot FAM93_i$	11.679*** (4.459)	7.995 (6.729)	-123.798*** (46.733)	199.800 (190.026)	-8.045 (12.633)
$\Delta IMP_{st} \cdot TFP93_i \cdot FAM93_i$	-0.875*** (0.283)	-0.569 (0.469)	7.953** (3.115)	-15.976 (14.799)	0.801 (0.929)
Observations	13,878	13,972	4,725	14,088	23,413
Number of firmid	1,424	1,436	600	1,438	1,693
Firm FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes

Notes: * p<0.05, ** p<0.01, *** p<0.001. Standard errors in parentheses are clustered by NACECLIO industries.

Table B.13: Mechanism: Family management, not family ownership

Dep var: ΔTFP_{ist} Method:	(1)		(2)		(3)		(4)		(5)		(6)	
	Baseline Lev Pet Q		Alt. tariff measures Lev Pet Q		Lev Pet Q		Lev Pet R		Alt. TFP measures FE		Lev Pet R	Lab prod
ΔIMP_{st}	-13.583 (13.878)		-12.432 (12.644)		-18.981** (7.796)		-12.785 (8.309)		-21.186 (15.203)		-12.785 (8.309)	-31.914 (25.517)
$\Delta IMP_{st} \cdot TFP93_i$	0.800 (0.931)		0.750 (0.851)		1.227** (0.539)		1.439 (1.019)		1.621 (1.233)		1.439 (1.019)	3.118 (2.414)
$\Delta IMP_{st} \cdot FAM93_i$	26.054* (14.323)		24.694** (12.159)		19.091* (10.791)		21.212*** (6.822)		37.433** (14.980)		21.212*** (6.822)	56.656* (29.223)
$\Delta IMP_{st} \cdot TFP93_i \cdot FAM93_i$	-1.707* (0.972)		-1.654** (0.826)		-1.306* (0.760)		-2.492*** (0.846)		-3.004** (1.231)		-2.492*** (0.846)	-5.624** (2.807)
Observations	4,286		4,286		4,286		4,286		4,324		4,286	4,479
Number of firmid	314		314		314		314		315		314	329
Firm FE	yes		yes		yes		yes		yes		yes	yes
Year FE	yes		yes		yes		yes		yes		yes	yes
Tariffs	1993		t-1		only China		1993		1993		1993	1993
	weights		weights		tariffs		weights		weights		weights	weights

Notes: * p<0.05, ** p<0.01, *** p<0.001. Standard errors in parentheses are clustered by NACECLIO industries.

Table B.14: Effects by age of family firm

Dep var: ΔTFP_{ist}	(1)	(2)	(3)
Sample: only family firms			
Firm age in 1993, years:	All	0-13	14+
ΔIMP_{st}	11.492*** (3.913)	11.557 (9.213)	15.357*** (5.612)
$\Delta IMP_{st} \cdot TFP93_i$	-0.831*** (0.280)	-0.861 (0.725)	-1.103*** (0.377)
Observations	6,078	2,889	3,189
Number of firmid	612	301	311
Firm FE	yes	yes	yes
Year FE	yes	yes	yes

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors in parentheses are clustered by NACECLIO industries.

Table B.15: Effects by nr of family managers

Dep var: ΔTFP_{ist}	(1)	(2)	(3)
Sample: only family firms			
Nr of family managers in 1993:	All firms	1	>1
ΔIMP_{st}	11.492*** (3.913)	2.503 (4.100)	22.073*** (7.011)
$\Delta IMP_{st} \cdot TFP93_i$	-0.831*** (0.280)	-0.235 (0.277)	-1.531*** (0.492)
Observations	6,078	3,340	2,738
Number of firmid	612	341	271
Firm FE	yes	yes	yes
Year FE	yes	yes	yes

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors in parentheses are clustered by NACECLIO industries.

C Proofs

First of all, since the managerial effort is the only endogenous part of productivity, we only need to show how the managerial effort changes when import tariffs fall (i.e., η decreases).

C.1 Proof for Proposition 2

Part one and two are true, since $\beta_P(\phi; \eta) > \beta_F(\phi; \eta)$ for any $\phi > \bar{\phi}_P$ and $\beta_P(\phi; \eta) = \beta_F(\phi; \eta)$ when $\phi = \bar{\phi}_P$. Part three is true, since $\beta_P(\phi; \eta)$ increases in ϕ . Part four is true, since $\beta_F(\phi; \eta)$ increases in ϕ for $\phi \geq \bar{\phi}_F$. For the final part of this proposition, we need to show that $T(\phi) \equiv \phi[(\eta\phi + a) - \sqrt{(\eta\phi + a)^2 - 2f}]$ decreases first and increases afterwards in ϕ for $\phi \in [\bar{\phi}_P, \bar{\phi}_F]$. Differentiation shows that

$$\frac{d[\log(T(\phi))]}{d\phi} = \frac{1}{\phi} + \frac{\beta'_F(\phi)}{\beta_F(\phi)} = \frac{1}{\phi} - \frac{\eta}{\sqrt{(\eta\phi + a)^2 - 2f}}.$$

Therefore, $dT(\phi)/d\phi > 0$ if and only if

$$\sqrt{(\eta\phi + a)^2 - 2f} > \eta\phi$$

or

$$T_1(\phi) \equiv \sqrt{(\eta\phi + a)^2 - 2f} - \eta\phi > 0.$$

Since $T_1(\phi)$ increases in ϕ , we have $dT(\phi)/d\phi < 0$ if and only if

$$\phi_0 > \phi \geq \bar{\phi}_P,$$

where $\phi_0 \equiv \frac{2f - a^2}{2\eta a}$ and $dT(\phi)/d\phi \geq 0$ if and only if

$$\bar{\phi}_F \geq \phi \geq \phi_0.$$

Note that ϕ_0 approaches $\bar{\phi}_P$ when a^2 approaches $2f$. As a result, the interval in which $\beta_F(\phi)\phi$ decreases in ϕ shrinks to zero when a^2 approaches $2f$.

C.2 Proof for Proposition 3

For the least productive (surviving) F -type firms, we have two cases to consider. If $\frac{\eta_{after}}{\eta_{before}} > \frac{(2f)^{\frac{1}{2}} - a}{(2f + d_F^2)^{\frac{1}{2}} - a}$, then $\bar{\phi}_F(\eta_{before}) > \bar{\phi}_P(\eta_{after})$. For $\phi \in [\bar{\phi}_F(\eta_{before}), \bar{\phi}_P(\eta_{after})]$, the effort choice of F -type manager is dictated by equation (5.5) both before and after the reduction in import

tariffs (i.e., the constrained manager), and

$$\frac{d\beta_F(\phi; \eta)}{d\eta} = \phi \left[1 - \frac{C(\phi, \eta)}{\sqrt{C^2(\phi, \eta) - 2f}} \right] < 0,$$

where $C(\phi, \eta) \equiv \eta\phi + a$. Therefore, the least productive surviving F -type firms improve productivity. Next, if $\frac{(2f)^{\frac{1}{2}} - a}{(2f + d_F^2)^{\frac{1}{2}} - a} \geq \frac{\eta_{after}}{\eta_{before}} > \frac{(2f)^{\frac{1}{2}} - a}{(2f)^{\frac{1}{2}} + d_F - a}$, we have $\bar{\phi}_F(\eta_{before}) \leq \bar{\phi}_P(\eta_{after})$. For an F -type firm with the productivity draw of $\bar{\phi}_P(\eta_{after})$, its manager's effort level is $\sqrt{2f}$ after the reduction in import tariffs. Before the reduction, the manager's effort level is

$$\beta_F(\bar{\phi}_P(\eta_{after}), \eta_{before}) = [(2f)^{\frac{1}{2}} - a] \frac{\eta_{before}}{\eta_{after}} + a - d_F < \sqrt{2f} = \beta_F(\bar{\phi}_P(\eta_{after}), \eta_{after}),$$

which is implied by Assumption 4. Since the change in the managerial effort and realized productivity is continuous in ϕ , it must be true that the least productive surviving F -type firms improve productivity in both cases.

For the most productive (surviving) F -type firms, equation (5.4) indicates that $\bar{\phi}_{F,before} < \bar{\phi}_{F,after}$. When the initial productivity draw is above $\bar{\phi}_{F,after}$ (i.e., the most productive surviving F -type firms), F -type managers are unconstrained both before and after the reduction in import tariffs. Therefore, their effort is determined by equation (5.4). Since $\frac{d\beta_F(\phi; \eta)}{d\eta} = \phi > 0$ for these F -type managers, their effort and their firms' productivity go down when import competition increases.

C.3 Proof for Proposition 4

First, conditional on the initial productivity (or log productivity), the least productive (surviving) F -type firms increase log productivity relative to the least productive (surviving) P -type firms, since the former firms and the latter firms increase and decrease productivity (and managerial effort) under stiffer import competition respectively.

Second, both F -type firms and P -type firms decrease productivity (and managerial effort) when their initial productivity draw is above $\bar{\phi}_{F,after}$. For $\phi > \bar{\phi}_{F,after}$, if a F -type firm has the same productivity (or log productivity) as a P -type firm, it must be the case that $\phi_1 > \phi_2 > \bar{\phi}_{F,after}$, where ϕ_1 and ϕ_2 are the F -type firm's and the P -type firm's initial productivity draws respectively. This is because F -type firms always have lower realized productivity, conditioning on the initial productivity draw. For a P -type firm:

$$\begin{aligned}
& \log(\beta_P(\phi_2)\phi_2)_{after} - \log(\beta_P(\phi_2)\phi_2)_{before} \\
&= \log(\beta_P(\phi_2; \eta_{after})) - \log(\beta_P(\phi_2; \eta_{before})) = \log \left[\frac{\eta_{after}\phi_2 + a}{\eta_{before}\phi_2 + a} \right] < 0.
\end{aligned}$$

For a F -type firm:

$$\begin{aligned}
& \log(\beta_F(\phi_1)\phi_1)_{after} - \log(\beta_F(\phi_1)\phi_1)_{before} = \log(\beta_F(\phi_1; \eta_{after})) - \log(\beta_F(\phi_1; \eta_{before})) \\
&= \log \left[\frac{\eta_{after}\phi_1 + a - d_F}{\eta_{before}\phi_1 + a - d_F} \right] < \log \left[\frac{\eta_{after}\phi_1 + a}{\eta_{before}\phi_1 + a} \right] < \log \left[\frac{\eta_{after}\phi_2 + a}{\eta_{before}\phi_2 + a} \right],
\end{aligned}$$

since $\phi_1 > \phi_2$ and $\eta_{after} < \eta_{before}$. Therefore, conditional on the initial productivity (or the initial productivity draw), the most productive (surviving) F -type firms decrease log productivity more than the most productive (surviving) P -type firms.

C.4 Proof for Proposition 5

The change in average productivity (or log productivity) is ambiguous for F -type firms, since some of them increase productivity while the others decrease productivity. In the model presented in the main text, all P -type firms decrease productivity when import competition increases, since $\frac{d\beta_P(\phi; \eta)}{d\eta} = \phi > 0$. However, in Appendix E, in which P -type managers also care about the private benefits, the least productive P -type firms increase productivity when import competition increases. In short, the change in average productivity of P -type firms is indeterminate in the general case as well. Finally, since the least productive F -type firms (and the most productive F -type firms) increase (and decrease) log productivity relative to the least productive P -type firms (and the most productive P -type firms), we do not know how the average log productivity of F -type firms changes compared with P -type firms.

D Discussion of productivity distributions

Other than Proposition 2, the model generates an even more refined prediction for the productivity distribution of F -type firms and P -type firms:

Proposition 6. *The distribution of realized productivity of F -type firms has a thicker tail of firms with extremely low productivity (compared with the distribution of P -type firms) since there are more constrained firms among F -type firms.*

Proof. When $\bar{\phi}_F \geq \phi \geq \bar{\phi}_P$, $\beta_F(\phi)\phi$ increases slower than (or even decreases in) ϕ since $\beta_F(\phi)$ decreases with ϕ when ϕ falls into this range. When $\phi \geq \bar{\phi}_F$, $\beta_F(\phi)\phi$ increases faster than ϕ , since $\beta_F(\phi)$ increases with ϕ when ϕ falls into this range. For P -type firms, $\beta_P(\phi)\phi$ always increases faster than ϕ . Therefore, the distribution of realized productivity of F -type firms has a thicker tail of firms with extremely low productivity compared with P -type firms. \square

The above additional prediction can be used to rationalize the major finding in Hsieh and Klenow (2009) if we treat F -type firms and P -type firms as family firms and non-family firms respectively. As the managerial effort decreases with the initial productivity draw when managers are constrained, realized productivity increases slower with the initial draw when firms have the low initial productivity draws. As a result, realized productivity barely varies among firms with constrained managers, and these firms are the least productive ones among active firms. Since there are more such firms among family firms, the distribution of realized productivity (and firm size) for family firms has not only a smaller mean, but also a thicker left tail of extremely unproductive firms. One key finding from Hsieh and Klenow (2009) is that, compared with the US, the productivity distribution of firms in India and China has not only a smaller mean, but also a thicker left tail of extremely unproductive firms. Since there are probably more family firms in developing countries, our model can be used to explain this finding.

The change in average productivity (or log productivity) is ambiguous for F -type firms (and for P -type firms), since some of them increase productivity while the others decrease productivity.

E Private benefits for P -type managers

In this subsection, we consider the case in which both F -type managers and P -type managers care about private benefits, although P -type managers care less about these benefits. We show that our qualitative results are unchanged in this alternative setup. First, the derivation of the optimal effort and realized productivity is the same for P -type managers as for F -type managers except that P -type managers put a smaller weight on the private benefits in their objective function. We define the exit cutoff $\bar{\phi}_{exit}$ (i.e., the cutoff on ϕ below which both F -type managers and P -type managers choose to exit from the firm) and the zero profit cutoffs $\bar{\phi}_g$ (i.e., the cutoff on ϕ above which the firm run by either F -type managers or P -type managers earns positive profits) as follows:

$$\bar{\phi}_{exit} = \frac{(2f)^{\frac{1}{2}} - a}{\eta}$$

and

$$\bar{\phi}_g = \frac{(2f + d_g^2)^{\frac{1}{2}} - a}{\eta} \quad \text{with } g \in \{F, P\}.$$

Note that since $\bar{\phi}_{exit} = \bar{\phi}_P$ in the main text, we do not define the exit cutoff separately in the main text. In order to shorten our proofs in this section, we divide the effort choice function of the manager into two categories: $\beta_{g,1}(\phi)$ for constrained managers and $\beta_{g,2}(\phi)$ for unconstrained managers where $g \in \{F, P\}$.

Proposition 7. *Suppose Assumptions 1 and 3 hold. For F -type firms with productivity draws above $\bar{\phi}_F$, the optimal effort choice is*

$$\beta_F(\phi) = \beta_{F,2}(\phi) \equiv \eta\phi + a - d_F.$$

When $\phi \in \{\bar{\phi}_{exit}, \bar{\phi}_F\}$, the optimal effort is

$$\beta_F(\phi) = \beta_{F,1}(\phi) \equiv (\eta\phi + a) - \sqrt{(\eta\phi + a)^2 - 2f}.$$

For P -type firms with productivity draws above $\bar{\phi}_P$, the optimal effort choice is

$$\beta_P(\phi) = \beta_{P,2}(\phi) \equiv \eta\phi + a - d_P.$$

When $\phi \in \{\bar{\phi}_{exit}, \bar{\phi}_P\}$, the optimal effort is

$$\beta_P(\phi) = \beta_{P,1}(\phi) \equiv (\eta\phi + a) - \sqrt{(\eta\phi + a)^2 - 2f}.$$

For firms with productivity draws below $\bar{\phi}_{exit}$, managers (and firm owners) choose to exit. For F -

type firms (and P -type firms), realized productivity decreases in ϕ when $\phi < \min\{\frac{2f-a^2}{2\eta a}, \bar{\phi}_F\}$ (and $\phi < \min\{\frac{2f-a^2}{2\eta a}, \bar{\phi}_P\}$) and increases in ϕ afterwards.

Proof. We have proved this proposition for F -type managers in the main text. Since P -type managers care about both firm profit and the private benefits now, the derivation for them follows exactly the same logic as for F -type managers. \square

For the three empirical predictions stated in the main text, Propositions 3 and 5 can be proved using the same approaches as in Appendix C. Now, we prove Proposition 4.

E.1 Proof for Proposition 4

First of all, the proof for the comparison between the most productive F -type firms and the most productive P -type firms (i.e., firms with $\phi > \bar{\phi}_{F,after} (> \bar{\phi}_{P,after})$) is the same as in Appendix C, as they are unconstrained managers in the current setup as well. For the least productive surviving managers, we want to show that F -type firms with the productivity draw of $\bar{\phi}_{exit,after}$ increase log productivity more than P -type firms with the productivity draw of $\bar{\phi}_{exit,after}$. There are three cases to consider in total:

- Case one: $\bar{\phi}_{exit,after} \leq \bar{\phi}_{P,before}$:

$$\begin{aligned} & \beta_{P,after}(\bar{\phi}_{exit,after}) - \beta_{P,before}(\bar{\phi}_{exit,after}) = \beta_{P,1}(\bar{\phi}_{exit,after}, \eta_{after}) - \beta_{P,1}(\bar{\phi}_{exit,after}, \eta_{before}) \\ & = \beta_{F,1}(\bar{\phi}_{exit,after}, \eta_{after}) - \beta_{F,1}(\bar{\phi}_{exit,after}, \eta_{before}) = \beta_{F,after}(\bar{\phi}_{exit,after}) - \beta_{F,before}(\bar{\phi}_{exit,after}). \end{aligned}$$

- Case two: $\bar{\phi}_{F,before} \geq \bar{\phi}_{exit,after} > \bar{\phi}_{P,before}$:

$$\beta_{P,after}(\bar{\phi}_{exit,after}) - \beta_{P,before}(\bar{\phi}_{exit,after}) = \beta_{P,1}(\bar{\phi}_{exit,after}, \eta_{after}) - \beta_{P,2}(\bar{\phi}_{exit,after}, \eta_{before}).$$

$$\beta_{F,after}(\bar{\phi}_{exit,after}) - \beta_{F,before}(\bar{\phi}_{exit,after}) = \beta_{F,1}(\bar{\phi}_{exit,after}, \eta_{after}) - \beta_{F,1}(\bar{\phi}_{exit,after}, \eta_{before}).$$

We know

$$\beta_{F,1}(\bar{\phi}_{exit,after}, \eta_{after}) = \beta_{P,1}(\bar{\phi}_{exit,after}, \eta_{after})$$

and

$$\beta_{F,1}(\bar{\phi}_{exit,after}, \eta_{before}) = \beta_{P,1}(\bar{\phi}_{exit,after}, \eta_{before}) < \beta_{P,2}(\bar{\phi}_{exit,after}, \eta_{before})$$

Thus, we must have

$$\beta_{P,after}(\bar{\phi}_{exit,after}) - \beta_{P,before}(\bar{\phi}_{exit,after}) < \beta_{F,after}(\bar{\phi}_{exit,after}) - \beta_{F,before}(\bar{\phi}_{exit,after}).$$

- **Case three:** $\bar{\phi}_{exit,after} > \bar{\phi}_{F,before}$:

$$\beta_{P,after}(\bar{\phi}_{exit,after}) - \beta_{P,before}(\bar{\phi}_{exit,after}) = \beta_{P,1}(\bar{\phi}_{exit,after}, \eta_{after}) - \beta_{P,2}(\bar{\phi}_{exit,after}, \eta_{before}).$$

$$\beta_{F,after}(\bar{\phi}_{exit,after}) - \beta_{F,before}(\bar{\phi}_{exit,after}) = \beta_{F,1}(\bar{\phi}_{exit,after}, \eta_{after}) - \beta_{F,2}(\bar{\phi}_{exit,after}, \eta_{before}).$$

We know

$$\beta_{F,1}(\bar{\phi}_{exit,after}, \eta_{after}) = \beta_{P,1}(\bar{\phi}_{exit,after}, \eta_{after})$$

and

$$\beta_{F,2}(\bar{\phi}_{exit,after}, \eta_{before}) < \beta_{P,2}(\bar{\phi}_{exit,after}, \eta_{before}).$$

Thus, we must have

$$\beta_{P,after}(\bar{\phi}_{exit,after}) - \beta_{P,before}(\bar{\phi}_{exit,after}) < \beta_{F,after}(\bar{\phi}_{exit,after}) - \beta_{F,before}(\bar{\phi}_{exit,after}).$$

In total, we have

$$\beta_{P,after}(\bar{\phi}_{exit,after}) - \beta_{P,before}(\bar{\phi}_{exit,after}) \leq \beta_{F,after}(\bar{\phi}_{exit,after}) - \beta_{F,before}(\bar{\phi}_{exit,after})$$

for all possible cases. Therefore, the least productive F -type firms increase productivity more than the least productive P -type firms, when import tariffs go down. Since F -type firms have (weakly) lower realized productivity, it is also true that the least productive (surviving) F -type firms increase log productivity (i.e., productivity in percentage terms) more than the least productive (surviving) P -type firms, when import tariffs go down.

Figures H.1 and H.2 show how the effort choice and log realized productivity change after a reduction in import tariffs.

F Functional form of the private benefits

In this subsection, we show that our theoretical results continue to hold when the cost function of exerting effort is convex (as opposed to a linear function in the main text). Specifically, we consider that the effort cost takes the following form of $\frac{\beta^2}{2}$. The objective function of the manager now becomes

$$U = \begin{cases} \alpha_g \left[\eta \phi \beta - (f - a\beta + \frac{1}{2}\beta^2) \right] - \frac{d_g}{2} \beta^2 & \text{if firm exists} \\ 0 & \text{if firm exits,} \end{cases}$$

where $d_g > 0$ for $g \in \{F, P\}$. First, we still normalize $\alpha_g = 1$. As a result, the solution for the optimal effort is

$$\beta_g(\phi) = \frac{\eta\phi + a}{1 + d_g}, \quad (\text{F.1})$$

where d_g is assumed to be bigger than one (i.e., managers care also about private benefits and cost), if the zero profit condition does not bind. Next, the zero profit cutoff is calculated as

$$\bar{\phi}_g = \frac{\sqrt{\frac{f(1+d_g)^2}{\frac{1}{2}+d_g}} - a}{\eta} \text{ with } g \in \{F, P\}.$$

Note that the level of effort that maximizes firm profits is

$$\beta_{FB}(\phi) = \eta\phi + a. \quad (\text{F.2})$$

Third, we still assume that the outside option for the manager is small enough such that the manager with the initial draw of $\bar{\phi}_{exit} \equiv \frac{(2f)^{\frac{1}{2}} - A}{\eta}$ strictly prefers working as a manager. Finally, similar to Assumption 4, we still assume that the increase in market competitiveness is not too big across two adjacent years. Based on these assumptions, we show that our theoretical results derived in the main text continue to hold. Similar to Section E, we divide the effort choice function of the manager into two categories as well: $\beta_{g,1}(\phi)$ for constrained managers and $\beta_{g,2}(\phi)$ for unconstrained managers where $g \in \{F, P\}$.

Proposition 8. *Suppose Assumptions 2 and 3 hold. For F-type firms with productivity draws above $\bar{\phi}_F (> \bar{\phi}_{exit})$, the optimal effort choice is*

$$\beta_F(\phi) = \beta_{F,2}(\phi) \equiv \frac{\eta\phi + a}{1 + d_F}.$$

When $\phi \in [\bar{\phi}_{exit}, \bar{\phi}_F]$, the optimal effort is

$$\beta_F(\phi) = \beta_{F,1}(\phi) \equiv (\eta\phi + a) - \sqrt{(\eta\phi + a)^2 - 2f}.$$

For P-type firms with productivity draws above $\bar{\phi}_P (> \bar{\phi}_{exit})$, the optimal effort choice is

$$\beta_P(\phi) = \beta_{P,2}(\phi) \equiv \frac{\eta\phi + a}{1 + d_P}.$$

When $\phi \in [\bar{\phi}_{exit}, \bar{\phi}_P]$, the optimal effort is

$$\beta_P(\phi) = \beta_{P,1}(\phi) \equiv (\eta\phi + a) - \sqrt{(\eta\phi + a)^2 - 2f}.$$

For managers and firms with the initial draws below $\bar{\phi}_{exit}$, both of them choose to exit. For both F-type

managers and P-type managers, the managerial effort decreases first and increases afterwards with ϕ (i.e., it is “U”-shaped).

Proof. The proof is the same as the proof for Proposition 1. □

Proposition 9. *Conditional on the initial productivity draw, P-type firms have higher managerial effort and realized productivity:*

$$\beta_F(\phi) < \beta_P(\phi); \quad \phi\beta_F(\phi) < \phi\beta_P(\phi).$$

Second, P-type firms have higher average realized productivity and managerial effort compared with F-type firms in equilibrium. Third, $\beta_{g2}(\phi)\phi$ increases in ϕ for $\phi \geq \bar{\phi}_g$ where $g \in \{F, P\}$. Finally, $\beta_{g1}(\phi)\phi$ decreases first and increases afterwards in ϕ where $g \in \{F, P\}$. In particular, when a^2 approaches $2f$, the interval in which $\beta_{g1}(\phi)\phi$ decreases in ϕ shrinks to zero.

Proof. The proof is the same as the proof for Proposition 2. □

Proposition 10. *After import competition increases, the least productive surviving F-type firms improve log productivity, and the most productive surviving F-type firms decrease log productivity.*

Proof. The proof is the same as the proof for Proposition 3. □

Proposition 11. *After import competition increases, the increase in log productivity is larger for the least productive F-type firms than for the least productive P-type firms, and the reduction in log productivity is also larger for the most productive F-type firms than for the most productive P-type firms.*

Proof. For the least productive surviving firms, the proof follows from Appendix E.1. For firms with the productivity draw above $\bar{\phi}_{F,after}$ (i.e., the most productive surviving firms), the change in log realized productivity is

$$\log(\beta_{after}(\phi)\phi) - \log(\beta_{before}(\phi)\phi) = \log \left[\frac{\eta_{after}\phi + a}{\eta_{before}\phi + a} \right].$$

If an F-type firm and an P-type firm have the same initial (log) productivity, the F-type one must have a bigger ϕ . This directly implies that the decrease in log productivity is bigger for the F-type firm than for the P-type firm. □

Proposition 12. *After import competition increases, average productivity of F-type firms can either increase or decrease. The change in average productivity of P-type firms is also indeterminate in the general case where P-type managers care about the private benefits as well.*

Proof. The change in average productivity (or log productivity) is ambiguous for F -type firms (and for P -type firms), since some of them increase productivity while the others decrease productivity. \square

Finally, note that after import competition increases, the exit rate is same for F -type firms as for P -type firms, as the exit cutoff is the same for F -type firms as for P -type firms.

G Discussion of the assumption on private benefits

In this subsection, we argue that our theoretical results do not crucially depend on the assumption about \bar{U} . We assume that $d_F > d_P > 0$ and make the following assumption to ensure that there are both constrained and unconstrained managers at least among F -type managers in equilibrium:

$$\bar{U} \geq (2f + d_F^2)^{\frac{1}{2}} - d_F.$$

We argue that as long as the above inequality is satisfied, all our results go through. First, since we still have both constrained and unconstrained managers at least among F -type managers, the previous results on the optimal managerial effort and realized productivity are unchanged. Second, after import tariffs go down, the least productive surviving F -type firms improve productivity since the constrained managers still have to exert more effort in order to make their firms exactly break even. Third, after import tariffs go down, the most productive surviving F -type firms decrease productivity since the marginal returns to effort decreases for unconstrained F -type managers. The ambiguous results on the change of average productivity still holds, as long as there are two types of managers (i.e., the constrained ones and the unconstrained ones) in equilibrium. Finally, (conditional on the initial productivity) results on the comparison between F -type firms and P -type firms are unchanged, since the value of \bar{U} only affects results related to the extensive margin. In total, our theoretical results do not hinge on the assumption of \bar{U} stated in the main text of the paper.

H Figures for Appendix

Figure H.1: Effect of increased import competition on effort and realized productivity

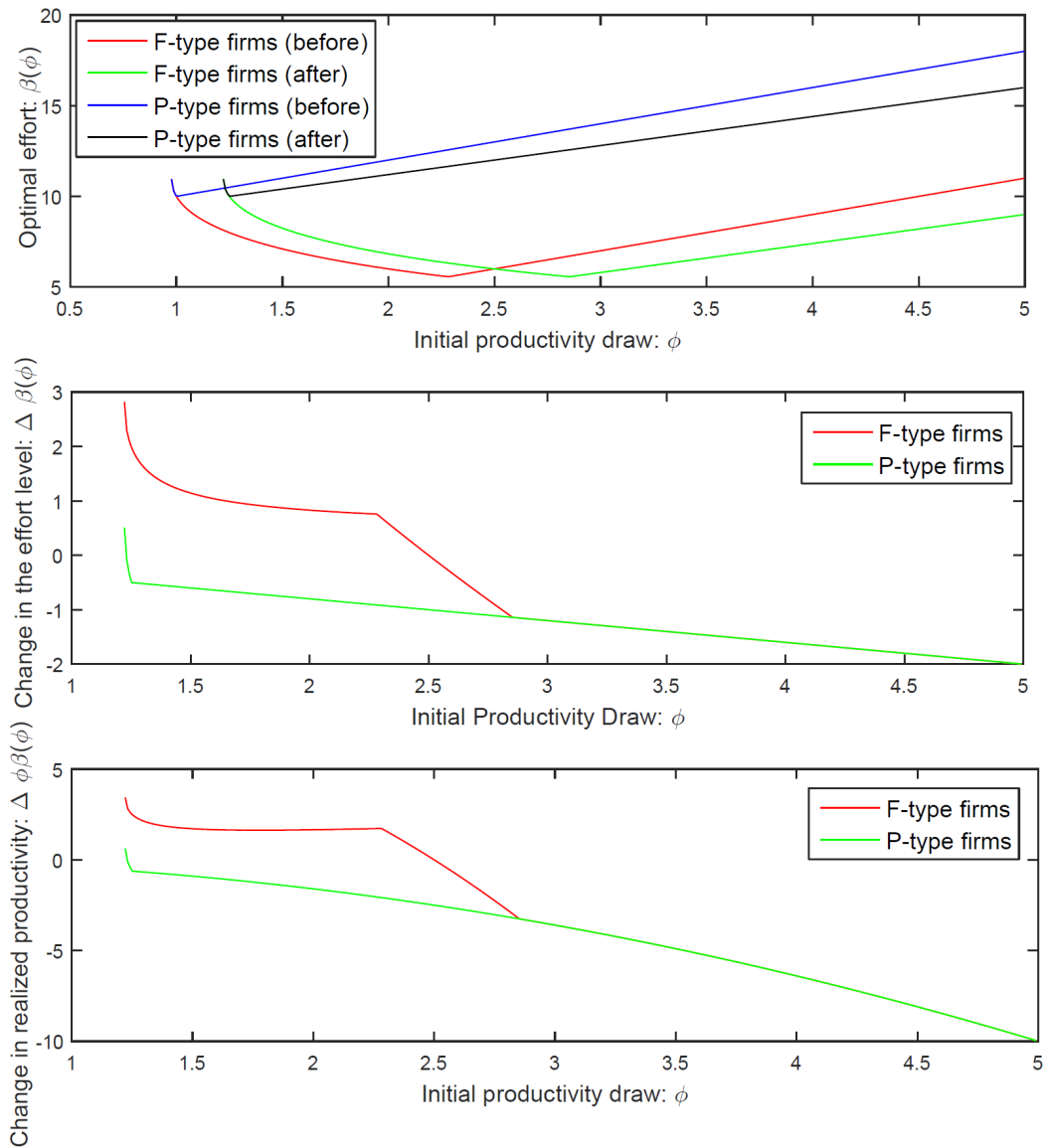


Figure H.2: Effect of increased import competition on log realized productivity

