Heterogeneous Trade Elasticity and Managerial Skills*

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Abstract

This paper investigates the role played by firms' managerial skills on the heterogeneous reaction of exporters to common exogenous changes in their international competitiveness (here captured by changes in real exchange rate). Relying on a simple theoretical framework, we show that firms with a larger share of managers have higher profits and market power and are able to adjust their markup more when faced with a competitiveness shock. We test this prediction relying on detailed firm-product-destination level export data from France for the period 1995-2007 matched with specific information on the share of managers within the firm. Our findings show that managerial intensive firms have larger exporter price elasticity to real exchange rate variations. A 10% depreciation of the real exchange rate makes firms with sample-average managerial intensity charging 0.5% higher export price. This effect is 60% larger for exporters with one standard deviation higher managerial intensity. These findings are robust to controlling for alternative explanations based on differences across firms in productivity, product performance, quality and marginal costs.

Keywords: Exchange rate pass-through, heterogeneous pricing-to-market, managerial skills.

JEL Classification: F12, F14 and F31.

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1 Introduction

Real exchange rate (RER) shocks have a weak effect on aggregate trade flows and import and export prices (Goldberg and Knetter, 1997, Goldberg and Campa, 2010, Hooper et al., 2000), in particular if compared to other price shifter shocks such as tariffs (Ruhl, 2008). This low reaction of exports to exchange rate shocks has also been documented at the microeconomic level. Berman et al. (2012), Fitzgerald and Haller (2014), Fitzgerald and Haller (2018) and Fontagné et al. (2018) found that the average elasticity of a firm export volumes to an exchange depreciation is around 0.5-0.8. Since high performing firms are those that explain most of the variation of aggregate trade flows (Bernard et al., 2007 , Freund and Pierola, 2015, Gaubert and Itskhoki, 2021, Fernandes et al., Forthcoming), the heterogeneity of trade elasticities – inversely related to firm performance – helps to explain this macroeconomic puzzle.

There is now a growing literature that relates the incomplete exchange rate pass-through to firm-level characteristics (Berman et al., 2012, Chatterjee et al., 2013, Amiti et al., 2014, Bernini and Tomasi, 2015, Chen and Juvenal, 2016, Auer and Chaney, 2009, Auer et al., 2018).[1] These studies show that the elasticities of firms' export price to real exchange rate are heterogeneous across firms and depend on firm performance (productivity, input and export quality, marginal costs and imported input intensity). Firms that perform relatively better than others in terms of productivity are able to absorb more changes in exchange rates in their markups. Thereby, their export volumes are less sensitive to real exchange rate movements, which contributes to the observed low elasticity of aggregate exports to exchange rate. Similarly, firms selling high-quality products face lower demand elasticity, a higher degree of pricing-to-market, and hence a smaller response of export volumes to a real depreciation.

However, firms are heterogeneous also in another dimension: managerial intensity. Managers play an important role on enhancing firm efficiency and profitability by reducing coordination costs and improving the organisation of different stages of the production process (Bao et al., 2022; Bloom et al., 2021). Therefore, firms with higher managerial intensity may ensure a smoother adjustment to marginal costs shocks, and hence a heterogeneous reaction to common RER shocks. Yet, whether there is a role for firm managerial intensity in shaping firms' pricing-to-market strategies and their incomplete real exchange rate pass-through remains an unexplored issue in the literature. The aim of this paper is to fill this gap by studying this channel and test its empirical

[1] See Burstein and Gopinath (2014) for a survey of the exchange rate pass-through literature.

relevance beyond the competing explanations based on firm productivity, product heterogeneity, output quality and marginal costs. We argue that firms with a larger share of managers are able to adjust more their markups when they face a real exchange rate shock. To our knowledge, this paper is the first to document the impact of exchange rate movements on firms' export prices depending on their managerial intensity. Specifically, the new channel we highlight in the present paper echoes the previous studies suggesting that firms with greater managerial skills (Bloom and Van Reenen, 2007; Mion et al., 2022) or in skill-intensive sectors (Burstein and Vogel, 2017) are more profitable and have higher market power and thereby, are able to absorb more cost-shocks in their prices. Caliendo et al. (2020) rely on matched employer-employee Portuguese data and present evidence that adding a layer of management increases firm' efficiency measured by quantity-based productivity. Bloom and Van Reenen (2007) rely on micro-data of manufacturing firms in the US, France, Germany and the UK and show that managerial practices are positively associated with not only firm-level productivity, sales growth and survival rates, but also to firm' profitability. Bloom et al. (2021) show that better managed firm are more likely to export, earn higher export revenue and sell more products at destination. Using Portuguese matched employer-employee data, Mion et al. (2022) show that the presence of managers with some knowledge of the target destination doubles the firm's probability of entering in that market.

We present a simple theoretical framework of firm heterogeneity and variable markups based on the work of Melitz and Ottaviano (2008) to rationalize the mechanism through which firms' managerial intensity affects the exporter price elasticity to real exchange rate variations. The main prediction of this model is that managerial intensive firms, that are able to earn more profits and have higher markups, will absorb more exchange rate shocks in their export prices conditional on differences across firms in labor productivity (the inverse of marginal costs). We present empirical evidence confirming this prediction. Importantly, we show that this within-firm managerial intensity channel is still present when we control for the firm productivity and product performance mechanism (Berman et al., 2012, Chatterjee et al., 2013) as well as the quality channel (Bernini and Tomasi, 2015 and Chen and Juvenal, 2016), the marginal cost mechanism (Amiti et al., 2014).[2]

[2]Other channels through which the managerial intensity of the firm affects firms' pricing-to-market decisions are related to firm productivity and output quality. The literature on managerial practices shows a positive effects of managerial skills on firm productivity (Bloom and Van Reenen, 2007, Bloom and Van Reenen, 2011, Bloom et al., 2013 and Caliendo et al., 2020). Moreover, Verhoogen (2008), Brambilla et al. (2012) and Bas and Paunov (2021) present evidence on skill-quality complementarity while the skill-biased technical change channel suggests that more skill intensive firms are also more productive ones (Burstein et al., 2013, Burstein and Vogel, 2017). We

We test this relationship using longitudinal employer-employee data from the *Déclaration Annuelle des Données Sociales* (DADS) and French trade flows from the French Customs Data for the period 1995-2007. The DADS allows us to construct the share of managers within the firm depending on workers' occupation. We define firms' managerial intensity as the share of sales managers and technical executives over total workers within the firm in the initial year of the sample, 1995. We match this measure with the firm-product-destination country export data from French Customs for the period 1995-2007. The final dataset provides information on the unit values (here used as a proxy of the free-on-board export price) at firm-product-destination country-year level and the share of managers at the firm level in the initial year. The real exchange rate between France and the destination country is defined as the product between the ratio of consumer price index (foreign over domestic) and the nominal exchange rate, and therefore varies by destination-year.[3] We restrict our sample to Extra-Eurozone destinations, to focus on markets that feature a sufficient variation in the real exchange rate during the period 1995-2007.

Our identification strategy exploits variation of export prices within firm-product-destination over time as well as exogenous changes in real exchange rate across years for a given destinations (i.e. *within* identification), and allows reactions to common real exchange rate shocks to depend on the initial managerial intensity of the firm. Firm-product-destination and year fixed effects reduces the omitted variable concerns. We always control for the heterogeneous effects of real exchange rate movements depending on firm labor productivity (measured by firm value added *per* workers, excluding managers) and firm-product performance measured by the rank of the product in the firms' total exports to a destination in a year. This allows us to take into account alternative mechanisms emphasized in the literature by Berman et al. (2012), according to whom more productive firms adjust more their export prices and by Chatterjee et al. (2013) and Chen and Juvenal (2016), according to whom firms adjust more export prices of their core products when they faced a real exchange rate shock. In order to strengthen the validity of the new source of heterogeneous pricing-to-market behavior that is identified in this paper, we conduct a series of robustness checks against alternative channels, including the potential variability of firms' responses to changes in the import-side RER movements and product quality. Additionally, we test the robustness of our results using alternative proxies of a firm's managerial intensity. The findings from these checks support the validity of the identified source of heterogeneity.

show that our explanation is robust to controlling for both the productivity and the quality channel.

[3]Therefore, an increase in the exchange rate means a depreciation.

Our findings show that exchange rate pass-through for export prices is incomplete, and depends on firm managerial intensity. The average pass-through of real exchange rate on export prices is 95%: for a 10% depreciation of the real exchange rate, the average exporting firm increases its export price (in euro) by 0.5 percent. Firms with higher managerial intensity have a larger elasticity of exporter price to a real exchange shock. For firms with one standard deviation higher managerial intensity the export price elasticity increases from 5% to almost 8% suggesting a 60% increase in the extent of pricing to market.

This result complements the findings in the literature. Relying on a similar sample of French exporting firms during the period 1995-2005, Berman et al. (2012) show that for a 10% exchange rate depreciation, the average French exporting firm raises its export price by 0.8% so that the average pass-through is 92%. They also show that more productive firms increase their export prices more when facing a real exchange rate depreciation. Using data from Argentinean exports of wines and objective measures of quality ratings, Chen and Juvenal (2016) also find an incomplete and large pass-through of real exchange rate on export prices: at 81% for a 10% depreciation of the real exchange rate. In response to a depreciation in the real exchange rate: exporters change their prices more for higher quality products.

Our paper contributes to this growing literature on incomplete pass-through and pricing-to-market depending on firm performance. Beyond the contribution by Berman et al. (2012) discussed above, Amiti et al. (2014) use Belgian firm-product-level customs data on exports and imports and show that large and importing firms have a real exchange rate pass-through of around 50 percent, while small firms that do not source intermediate goods from abroad have almost a complete real exchange rate pass-through. Chatterjee et al. (2013) rely on customs firm-product data for Brazil during the period 1997-2006 and find that within firms, pricing-to-market is stronger for the products that have a lower marginal cost within the firm production. When Brazilian exporters face a real exchange rate depreciation, they increase markups but this effect is lower for least productive products within the firm (with higher firm-product- marginal costs). The present paper contributes to this literature by proposing a new channel through which firm performance also affects firms' pricing-to-market and the incomplete pass-through: the intensity in managerial skills within the firm. We show that this within-firm managerial intensity channel is still present when we control for the firm productivity, product performance and marginal cost mechanisms.

A distinct, although related, literature focuses on the role of product quality as a key deter-

minant of firms' pricing-to-market decisions in order to explain the incomplete pass-through of real exchange rate into firm prices. Relying on product-country level data on import and retail prices Antoniades and Zaniboni (2016), Auer and Chaney (2009) and and Auer et al. (2018) investigate the relationship between pass-through and product quality relying on different measures of product quality such as hedonic quality indices, data on prices and unit values. They find evidence that pass-through into prices falls with quality. Bernini and Tomasi (2015) and Chen and Juvenal (2016) investigate the role of product quality on firms' pricing-to-market using customs firm-product level data. Bernini and Tomasi (2015) rely on Italian firm level data for the period 2000-2006 and the methodology developed by Chatterjee et al. (2010) to identify how imported input and export product quality affect the pass-through of real exchange rate into prices. Their main findings show that imported input quality is less sensitive to exchange rate variations and have a weaker effect in reducing exchange rate pass-through into the export price of high-quality varieties. Chen and Juvenal (2016) and Chen and Juvenal (2020) rely on customs data for Argentinean wine exporters and expert ratings for wine producers to proxy the quality of products for the period 2002-2009. They also find a heterogeneous response of firms' export prices depending on product quality to RER changes (Chen and Juvenal, 2016) and to distance and tariffs changes (Chen and Juvenal, 2020). They show that pricing-to-market increases with the quality of the wines and so the pass-through decreases with product quality. We go one step further and contribute to this literature by providing empirical evidence on the heterogeneous pricing-to-market behavior depending on a new channel: firm managerial intensity. We provide evidence that managerial skills matters to explain the heterogeneous response of exporters to RER changes when we control for the heterogeneous effects of output quality.

The remainder of this paper is organized as follows. The next section presents a simple framework that rationalizes the main channel through which managerial skills affects the exporter price elasticity. Section 3 describes the data used in our empirical analysis and presents descriptive evidence on the relationship between real exchange rate movements and firm's managerial intensity. Section 4 presents the empirical identification strategy and the main findings. Section 5 presents robustness tests. The last section concludes.

2 Theoretical Motivation

This section presents a simple theoretical framework based on the model of Melitz and Ottaviano (2008) – MO hereafter – to rationalize the channels through which managerial skills affect firms' pricing-to-market. We extend the heterogeneous firms' trade model of MO to include heterogeneous managerial skills and see how firms with different levels of managerial intensity react to a common change in their international competitiveness, here approximated by changes in real exchange rate. Given a common improvement in the international competitiveness of domestic firms (i.e. depreciation of the real exchange rate), those equipped with a higher managerial ability benefit the most as they face larger price elasticity.

We base our analysis on the quasi-linear demand system with horizontal product differentiation that allows for endogenous markups.[4] The inverse demand for each variety exported to country j is: $p_j/\epsilon_j = \alpha - \gamma q_j^c - \beta Q_j$, where ϵ_j is the nominal exchange rate between the home country and country j, q_j is the individual consumption of a variety and Q_j is total consumption in country j.

There is a continuum of firms i, each producing a different variety, in monopolistic competition. Production of final good requires managers and labor, l. Firm productivity, θ_i, is a function of marginal costs c_i (as in MO) and firm' managerial ability λ_i. Managers contribute to firm productivity by reducing coordination costs, synchronising production targets across different stages of production, and therefore increase the overall efficiency of the firm through a better organisation of the production process across inputs. Bao et al. (2022) and Bloom et al. (2021) also assume that managerial ability affects the productivity of firms. In Bloom et al. (2021) good management lowers the unit input requirement by optimizing inventory control and monitoring production targets. Bao et al. (2022) develop a theoretical model where firm total factor productivity depends on managerial ability and firm type productivity combined by a CES functional form. In our case, we also assume that firm efficiency is determined by λ_i, the managerial ability of a firm. In the empirical analysis, we proxy managerial ability by the share of managers within a firm, i.e. managerial *intensity*. In the data, we do not observe directly either the ability of managers or all their compensations (bonuses, stock options, etc.). Under the assumption of perfect competitive

[4]Preferences over goods are described by the quasi-linear quadratic utility function: $U = q_0^c + \alpha \int_{i\in\Omega} q_i^c di - \frac{1}{2}\gamma \int_{i\in\Omega} (q_i^c)^2 di - \frac{1}{2}\beta \left(\int_{i\in\Omega} q_i^c di\right)^2$,where $\alpha, \gamma, \beta > 0$; q_0^c is the consumption of the numeraire good ($q_0^c > 0$) and q_i^c is the consumption level of each variety of the differentiated good. The substitution between the differentiated varieties and the numeraire is captured by α and β parameters, while γ represents the degree of product differentiation between the varieties. The maximization of the quasi-linear quadratic utility function subject to the consumer's budget constraint gives the optimal linear demand.

labor market for managers, the last manager that the firm hires is paid to its marginal productivity that reflects managerial ability. In this setting, the total number of managers that the firm hires results from an optimal decision made by the firm and thereby, the managerial intensity of a firm also reflects the ability of its managers. Figure A1 in appendix shows that firms with higher managerial intensity are more profitable (i.e. larger gross operating profit per worker). As a robustness check, in the empirical analysis we also use a proxy for the ability of managers in the firm based on their *residual* wage – see 4.2 for more details.

As in MO, the quantity of output produced by a firm i is determined by a linear production function in labor $q = \theta_i l$ that depends on firm-specific productivity θ_i, i.e. the number of units of output per worker. We add to MO by simply assuming that the managerial ability of the firms λ_i increases the overall productivity of the firm by boosting the productivity of workers as follows:

$$\theta_i = \frac{\lambda_i}{c_i} \tag{1}$$

with c_i indicating the marginal cost of production. In firms that have better managers (high λ_i), workers are more productive (high θ_i) because managers guarantee a smoother and more efficient organization of the production process. After profit maximization, the optimal export quantity, price, markups and profits set by a firm i are determined by:

$$q_j(c_i, \lambda_i) = \frac{Lw\tau_j}{2\epsilon_j\gamma}\left[\frac{1}{\theta^*} - \frac{c_i}{\lambda_i}\right] \tag{2}$$

$$p_j(c_i, \lambda_i) = \frac{\tau_j w}{2}\left[\frac{1}{\theta^*} + \frac{c_i}{\lambda_i}\right] \tag{3}$$

$$\mu_j(c_i, \lambda_i) = \frac{\tau_j w}{2}\left[\frac{1}{\theta^*} - \frac{c_i}{\lambda_i}\right] \tag{4}$$

$$\pi_j(c_i, \lambda_i) = \frac{Lw\tau_j^2}{4\epsilon_j\gamma}\left[\frac{1}{\theta^*} - \frac{c_i}{\lambda_i}\right]^2 \tag{5}$$

Here, $\frac{1}{\theta^*} = \frac{ci^*}{\lambda_i^*} = \frac{\epsilon_j(\alpha - \beta Q_j)}{w_j\tau_j}$ represents the firm efficiency threshold, at which operating export profits in market j become zero. τ_j indicates the trade variable (iceberg) costs faced by firms when exporting to country j and w is the wage in home country. As clearly emerges from eq. (3), firms with lower cost do not pass on all of the cost differential to consumers by lowering prices

(incomplete pass-through), they have market power. Firms with greater managerial ability (λ_i) are also able to grasp higher profits and markups – see eq. (5).

Common exogenous shocks to the international competitiveness of domestic firm can be modelled as changes in the *real* exchange rate $e_j = (\epsilon_j w_j)/w$, with w_j indicating the wage in country j.[5] From eq. (3), the elasticity of export prices to real exchange rate is positive and increases with firm managerial ability:

$$\eta_{p_j(\lambda_i)} = \frac{dp_j(\lambda_i)}{de_j}\frac{e_j}{p_j(\lambda_i)} = \frac{\frac{\lambda_i}{c_i}}{\frac{\lambda_i}{c_i} + \theta^*} \tag{6}$$

Firms with higher managerial ability have larger export price elasticity to real exchange rate variations. The underlying intuition is that firms with better managers, by having larger markups, are able to charge higher prices in presence of a common depreciation shock. Note also that the elasticity of export prices to real exchange rate also increases with firm efficiency measured by the inverse of marginal costs ($1/c$) – as showed in Berman et al. (2012).

3 Data and descriptive evidence

3.1 Data

Our analysis relies on three main sources of data. First, we use the French Customs Data from the *Direction Générale des Douanes et des Droits Indirects* (DGDDI) to obtain information on export values (in euro) and quantities (volume in tons) of each French firm into a given destination j, product p (6-digit of the Harmonized System HS) in the period 1995-2007. This database is quasi-exhaustive of the universe of exporting French firms, and allows us to compute export unit values by taking the ratio of the value of exports over the quantity of the HS6 product shipped by a firm in a given destination-year.[6] Here we use export unit values as proxy for the free-on-board product export price of firms. The aggregation bias concern is reduced here because we calculate export price at HS 6-digit (and destination) level.

The second main dataset is the *Déclaration Annuelle des Données Sociales* (DADS Postes).

[5] w is the wage paid by firms in the origin country, France.

[6] Although reporting of firms having trade values below 39,000 euros (within the EU destination) or 1,000 euros (extra-EU destinations) is not mandatory, there are in practice many observations below these thresholds. We restrict our sample period until 2007 to exclude the financial crisis period that affected the pricing decisions of French exporters.

This is an administrative dataset of matched employer-employee information collected by the INSEE (*Institut National de la Statistique et des Études Économiques*). It contains information on the employment at the level of the firm, and the occupation category of its workers (2-digit of the PCS classification). The data are based on mandatory reports of gross earnings, completed by employers to comply with French payroll taxes. All wage-paying individuals and legal entities established in France are required to file payroll declarations.[7] The DADS dataset allows us to construct three different measures of firm managerial intensity based on workers' occupation as explained in detail in next section.

The third source of data provides macroeconomic variables. GDP and the real exchange rate are computed from the Penn World Tables. The real exchange rates between France and the destination country are computed as the average yearly nominal exchange rate times the ratio of consumer price indexes, foreign over domestic; thus, an increase in the real exchange rate here indicates depreciation. The price indexes as well as the nominal exchange rates come from the Penn World tables and the IMF's International Financial Statistics. Price indexes are expressed as indexes that take a value of 1 in 1995 for each country. In order to exploit the variation of real exchange rate across destinations and over time, we restrict our sample to non-Eurozone destinations as in Berman et al. (2012).

The final dataset has information on: (i) unit values set by each French firm on each HS6-destination country combination and time, (ii) firm level managerial intensity and (iii) the real exchange rate between France and the destination country in each year. Finally, we restrict our observations to firms for which the declared main activity belongs to manufacturing. This notably excludes wholesalers. Table A1 in the Online Appendix shows the firm-HS6 product-destination observations, as well as the number of firms in our estimation sample by year.

3.2 Definition of variables

The first important step is defining managers within the workforce of French firms. Workers are classified based on the French "Occupations and Socio-occupational Categories" (*Professions*

[7]Following Harrigan et al. (2023), we perform some cleaning on DADS data. First, we keep only full time workers and drop filling errors (0/NA in hours worked, in net salary or in sector code). Second, we drop firms that are in the following juridical categories: 4, 7, 9, governed by public law; flag occupations in Public Services (52, 45 and 33) and Agriculture (10, 12 and 13), Priests and Religious (44), missing (00 and 69).

et Categories Socio-Professionnelles,PCS).[8] We rely on the occupation classification at 2-digit as in Harrigan et al. (2023), and define firms' managerial workers as those workers classified as sales managers and technical executives. Sales managers correspond to the PCS 2-digit code 37 ("*Cadres administratifs et commerciaux d'entreprise*") and technical executives to the PCS 2-digit code38 ("*Ingénieurs et cadres techniques d'entreprise*"). Our measure of managerial intensity is the share of firm's managerial workers (sales managers and technical executives) over total labor in the initial year 1995. We fix the managerial intensity of a firm in the initial year to avoid concerns that may raise from the endogenous hiring of managers in the period of analysis.

In a robustness test, we rely on an alternative definition of managerial skills based on the Occupational Information Network (O*NET) classification, developed under the sponsorship of the US Bureau of Labor Statistics, in order to identify STEM occupations (Science, Technology, Engineering, and Mathematics). This allows us to distinguish managerial skills from workers related to R&D activities.[9] STEM occupations are labeled within O*NET based on the type of tasks performed, which allows us to distinguish: (i) R&D workers over total employees; (ii) managers workers over total employees; (iii) technicians workers over total employees; and (iv) sales responsible over total employees. Occupation specific shares (i)-(iv) are our alternative proxies for the occupational structure of firms. Last, we make use of the ISCO classification to identify highly skilled workers which include managers along with professionals and technicians.

Table 1 shows descriptive statistics on firm' managerial intensity. We report yearly information for those firms that feature positive export flows to non-Eurozone area destinations, because these are the observations used in econometric analysis. We have 306,612 firm-year observations with non-missing information on employment in the period 1995-2007. The median number of employees in our sample is 23 while the average is 96, suggesting a very skewed distribution of firm size. The average share of managers in our estimation sample is 10% (i.e. chief executive officer plus chief technical officer). Interestingly, the share of managers among French firms grew

[8] `https://www.insee.fr/fr/metadonnees/pcs2003/categorieSocioprofessionnelle/10?champRecherche=true`.

[9] The list of the 923 occupations in the O*NET classification can be found at `https://www.onetonline.org/find/stem?t=0`. To map O*NET to PCS classes is carried out via the following intermediate steps (1) SOC19 to SOC10 (O*NET) (`https://www.onetcenter.org/taxonomy/2019/walk.html`) (2) SOC10 to ISCO08 using David Autor's maps, available on his webpage, (3) ISCO08 to ISCO88 to PCS03 using the R package *SocialPosition* available on CRAN; (4) PCS03 to PCS82 - combination of the use of the *SocialPosition* package plus manual adjustment for some missing entries. There are 14 entries that failed to be linked between PCS03 in SOC19 (corresponding to 15 PCS82), i.e. around 3%. This is due to step 4. In addition, there are 6% PCS82 codes without corresponding PCS03 and therefore without SOC19. These have been filled manually.

0.3% over the period 1995-2007. Managers (as per the STEM definition) account on average for 2% of the workforce of firms, and this share increased by 0.2% in the period 1995-2007.

Table 1: Descriptive statistics

Variable		Obs	Mean	Median	Std. Dev
Firm Level					
# Employees		306,612	96	23	602
Δ # Employees%		220,870	0.5%	0%	37%
Export Value (mln)		306,612	3.82	0.08	0.4
Δ Export Value %		220,870	0.5%	0%	37%
Managerial intensity					
Share of managers					
	Managers (CEO+CTO)	306,612	10.6%	6.25%	14.7%
	Managers (CEO)	306,612	4.6%	0.5%	9.6%
	Managers (STEM)	175,841	1.9%	0.4%	3.9%
Δ Share of managers					
	Managers (CEO+CTO)	220,870	0.3%	0%	10%
	Managers (CEO)	220,870	0.2%	0%	14.4%
	Managers (STEM)	121,080	0.2%	0%	3.9%

Notes: Authors' computation from French custom data matched with DADS, 1995-2007. The summary statistics are computed on the sample used for the estimation. The sample includes only transactions to non-Eurozone. The growth rates in export sales represents the percentage change in export value for firms within a destination-HS6 market. Because of the churning of exporters within products and destinations the export growth rate is defined for a smaller number of observations (only for exporters that export HS6 in a destination country in 2 consecutive periods). The growth rate in managerial intensity represents the percentage change within firms over subsequent time periods.

3.3 Descriptive evidence

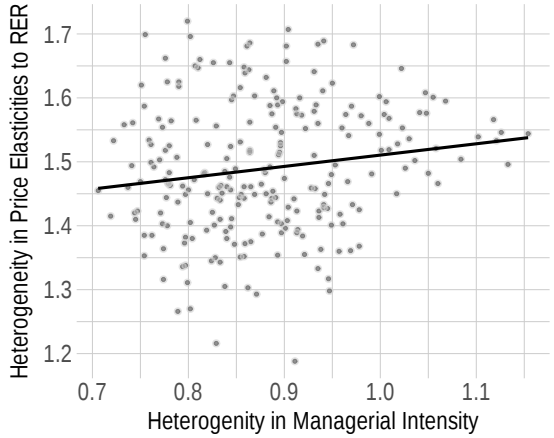
This section provides a first illustration of the relationship between firms' managerial skills and firms' export price elasticities. Figure 1 shows two interesting pieces of evidence. First, the heterogeneity of firms' export price elasticities positively correlates with the variation in their managerial intensity (see Figure 1 panel a). Each point in Figure 1 panel (a) represents a destination-market combination. The horizontal axis reports the coefficient of variation in the managerial intensity of firms exporting into a given destination-year combination. The vertical axis reports the coefficient of variation of firms' export price in a given destination-year, normalised by the yearly percentage variation in the real exchange rate in that destination-year. To avoid composition effects (and improve the readability of the figure) in the scatter plot in Figure 1 panel (a), we select the top-40 non-Eurozone destinations for France in terms of export value over the sample period. Each data point thus represents a year and one of the top 40 destination markets. The positive slope of

the linear fit suggests that the larger the heterogeneity of firms' managerial ability, proxied by managerial intensity, the greater the heterogeneity in the response of firms' export prices to RER variations. This descriptive evidence suggests that there is a link between the variability of firms' reactions to real exchange rate changes and the variability in managerial intensity.

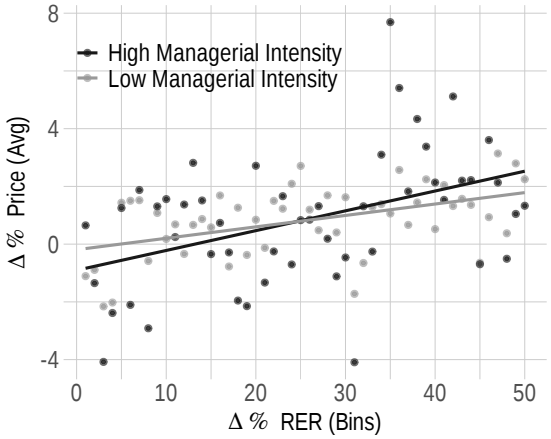
The panel (b) of Figure 1 shows the heterogeneous reaction of firms' export price to RER variation based on their managerial intensity. We split the sample of destination-year combinations into 50 bins of RER variation (horizontal axis) and calculate the price variation of firms (vertical axis) belonging into each bin of RER variation. We do so for high *vs* low manager intensive firms. Figure 1 panel (b) shows that firms having high (low) managerial intensity are more (less) sensitive to changes in RER. We explore more systematically these stylised facts in Section 4.

In the simple theoretical setting presented above, a firm's managerial ability, represented by managerial intensity, influences the firm's export price elasticity by enhancing market power and increasing profits. To provide empirical evidence supporting this relationship, we examine the correlation between managerial intensity and firm profitability, as depicted in Figure A1 in the Appendix. We divide the sample into 50 bins based on firms' gross operating profits and plot the average managerial intensity for each bin. The figure clearly illustrates that firms with higher managerial intensity also exhibit higher profits.

Figure 1: Heterogeneity in Trade Elasticities and Managerial Intensity



(a) Price elasticity to RER and managerial intensity.



(b) Change in price and RER: high *vs* low managerial intensity.

Notes. In Panel (a), we map the coefficient of variation in firms' managerial intensity (horizontal axis) to the coefficient of variation in firms' price change (expressed as a percentage) in response to RER changes in the same export destination-year (vertical axis). For Panel (b), we divide the variation in market's RER into 50 distinct bins. Then, we plot the average percentage change in firms' prices (vertical axis) for each bin of RER variation (horizontal axis). We execute this for firms with both high and low managerial intensity, i.e., firms with a share of managers above or below the sector's average at the NACE 2-digit level.

4 Identification strategy and results

This section discusses the identification strategy we adopt to test the effect of firms' managerial intensity on their pricing-to-market. In our simple theoretical setting, firms' managerial intensity captures managerial ability under the assumption of a perfectly competitive labor market for managers. In this case, the firm hires managers till the last one hired gets a compensation equal to its managerial ability (marginal productivity) and thereby the share of managers within a firm reflects also the ability of managers. If firms with a larger endowment of managers in the workforce are able to set larger markups and achieve more profits, within-firm managerial intensity will also be a key determinant of the heterogeneous pass-through of a change in cost into prices as highlighted in the simple framework presented in Section 2. So, this section tests whether firms with larger availability of managerial skills have larger exporter price elasticity to real exchange rate variations. We use the share of managers over total employment within the firm as the

empirical counterpart of parameter λ_i in our simple theoretical framework, and show evidence on how French exporting firms adjust their export prices to variations in the real exchange rate in their destination markets, depending on the firm's managerial intensity. To avoid the concern of endogenous adjustment of firm's managerial composition to export behavior we use the managerial intensity of firms in the initial year, 1995. Importantly, in all specifications we control for the heterogeneous effect of labor productivity used here as a proxy for the empirical counterpart of the labor unit requirements (i.e. $1/c_i$ in the theoretical framework). This, along with a very demanding set of fixed effects, reduces considerably the omitted variable bias and allows us to conclude on the *causal* effect of real exchange rate movements on firms' pricing-to-market behavior depending on their managerial skills. We estimate the following specification:

$$\ln p_{ipjt} = \alpha_1 \ln RER_{jt} + \alpha_2 \ln RER_{jt} \times M_{i,95} + X_{ipjt} + \theta_{ipj} + \mu_t + \nu_{ipjt} \tag{7}$$

where firms are indexed by i, products by p, destination country by j, time by t. The main outcome variable, $\ln p_{ipjt}$, is the logarithm of firm-product-destination export unit values; and $M_{i,95}$ is our proxy of firm's managerial intensity in the initial year 1995. RER_{jt} is the real exchange rate between France and the destination country in year t defined as the price of the euro (domestic currency) in units of the destination country' foreign currency.[10] We expect a positive sign of the coefficient of the real exchange rate on prices (α_1), as a result of incomplete pass-through: exporting firms increase their prices in euro when the real exchange rate depreciates. According to our theoretical framework, firms with a high endowment (quality) of managers are able to adjust their markups to exchange rate shocks more than less managers endowed firms. Thus, we also expect a positive sign of the interaction term between the real exchange rate and firms' managerial intensity (α_2). We normalize our measures of managerial intensity and labor productivity to have zero mean and standard deviation equal to 1 to simplify the interpretation of results and the quantification of the effect of managerial intensity. So, the parameter α_1 attached to the real exchange rate variable indicates the impact of RER shocks on firms having sample-average level of managerial intensity.

The set of control variables includes: (i) the interaction between RER_{jt} and the labor productivity of the firm in 1995 ($Productivity_{i,95}$), and (ii) the product rank variable ($Rank_{ipjt}$). The interaction between RER_{jt} and the initial labor productivity of the firm controls for the

[10] An increase in the RER_{jt} accordingly means a depreciation of the real exchange rate.

heterogeneous effect of labor productivity on pricing-to-market – a specific mechanism already showed in Berman et al. (2012). Importantly, we do not consider managers in the calculation of labor productivity since we want to disentangle the effect of managerial intensity from the effect of labor unit requirements in the production process (as in the theoretical framework discussed in section 2). Thereby, a firm's labor productivity is measured by value added over the total workers (excluding managers), and it is used as the empirical counterpart of the unit labor requirements.[11] The product rank $Rank_{ipjt}$ controls for time-varying performance of a given product into a given market for a given firm. We follow the literature (Mayer et al., 2014 and Bernard et al., 2011) and compute the product rank within a given firm-destination-year combination, as the rank of a product p exported by firm i into a given destination j at time t on the total exports of the firm into that destination and year. The product rank variable, $Rank_{ipjt}$ is then normalized so that the product with a highest export value (this is the core product exported by a firm to a destination) has rank 0 and the products coming after in the rank have rank values larger than 0.[12] We expect a negative coefficient on the rank product indicating that products with higher performance have higher prices. In some specifications we also add the interaction term between rank product and real exchange rate to control for the heterogeneous pricing-to-market behavior of firms based on differences across firm-product-destination in marginal costs. This measure allows us to control for the performance of the firm-product-destination, in addition to a firm's labor productivity, highlighted in the previous literature to explain the heterogeneous pricing-to-market strategies of firms (Chatterjee et al., 2013 and Chen and Juvenal, 2016).

All estimations include firm-product-destination fixed effects, θ_{ipj}, capturing all the unobservable time-invariant characteristics of the firm, product, and destination that may affect the pricing behaviour of firms. Namely, θ_{ipj} fixed effects capture differences across destination markets in terms of average import demand (size of destination country and total expenditure) and distribution costs, as well as differences across firm-product pairs in terms of unobserved product quality and efficiency level. Importantly, fixed effects θ_{ipj} capture any firm-specific characteristics that may potentially affect the pricing strategy of the firm (i.e. average productivity, size, managerial capability, etc).[13] Also, any unobserved firm-product-destination characteristics, such

[11]Information on the value added of French firms is obtained by matching our sample with balance sheet data on French firms from FICUS/FARE data.

[12]Product coming second in the rank get rank value equal to 1; product coming third in the rank get value 2, and so on.

[13]Firm fixed effects capture the initial productivity and managerial intensity of the firm, this is the reason why $M_{i,95}$ and $Productivity_{i,95}$ are included in the estimations only in the interaction terms.

as the average demand of a country for a given variety, is captured by fixed effects. Year fixed effects μ_t capture aggregate business cycle factors affecting the pricing strategy of firms and any France-wide policies affecting the hiring strategy of firms. We therefore exploit the pure *within* variation in explaining the pricing strategy of firms: how *changes* in RER_{jt} affect a *changes* in the pricing behaviour of a firm with given managerial intensity. The large sets of fixed effects considerably reduce the omitted variable concern, and the plausibly exogenous *changes* in RER eliminate any reverse causality concern. We can therefore conclude on the causal effect of RER shocks on the export pricing strategy of firms with different managerial intensity. Finally, in a set of robustness checks, we explicitly control for the destination-product-specific demand shock by including destination-HS2-year fixed effects. In this case, we focus only on cross-firm differences in the $RER_{jt} \times M_{i,95}$ interaction. We cluster standard errors at the destination-year level as this is the actual variation in the RER shock.

4.1 Baseline results

This section presents the main findings on how exchange rate movement affects French exporters in their pricing-to-market behavior, with a focus on the role of the within-firm managerial intensity in shaping trade elasticities. Table 2 presents the baseline estimation results of equation 7 using the logarithm of firm-product-destination unit values as a dependent variable. Table 2 shows strong evidence of the positive effect of RER movement on the pricing of exporters. In line with expectations, French exporting firms increase their price after a real exchange rate depreciation. In our baseline specification in column (1), abstracting from the role of managerial intensity, we find a large pass-through of real exchange rate changes to export price (implying a low level of pricing-to-market): a 10% exchange rate depreciation leads the average exporter to raise its export price (in euro) by 0.5% so that the average pass-through is 95%. This finding is similar to the ones of Berman et al. (2012) who rely on a similar sample of French exporting firms between 1995-2005, and to Fontagné et al. (2018) for 1995-2010.

In columns (2) to (4) of Table 2, we focus on the role of the managerial intensity in shaping the pricing-to-market behavior of firms controlling for the specific effect of labor productivity and product performance highlighted in the literature. In line with our theoretical framework, the interaction term between real exchange rate and managerial intensity is always positive and significant. Our results show that the export price elasticity to real exchange rate is higher for

managerial intensive firms. The interaction term between real exchange rate and initial firm labor productivity has also positive and significant effect on export prices (column 2). This confirms the findings obtained in the previous literature, showing that more productive firms react to a real exchange rate depreciation by relatively increasing their export prices more (Berman et al., 2012). Column (3) includes the firm product performance measure, the firm-product rank variable at the destination level, and column (4) controls for the heterogeneous effect of real exchange variations depending on this firm-product performance. Importantly, the effect of managerial intensity is stronger than the effect of firm productivity and product performance on pricing-to-market. These findings suggest that conditional on labor productivity and product performance, firms with larger managerial intensity have larger pricing-to-market.

In the middle part of Table 2 we propose a quantification of our findings, and report the percentage change in the export price (i.e. export price elasticity) due to a 10 percent RER depreciation for respectively firms having average and one standard deviation above the average managerial intensity. The export price elasticity increases from 5% (for firms with average managerial intensity) to 8% (for firms that are managerially intensive), suggesting a 60% increase in the export price elasticity for a 10 percent RER depreciation.

In this paper we focus on pricing-to-market strategies of exporting firms, in the Appendix Table A2 we present the results for the estimates of real exchange variations on the logarithm of firm-product-destination export volumes and export values that corroborated previous findings in the literature. As expected, after a depreciation of the real exchange rate at destination, exporting firms increase their export volumes. This effect is lower for firms with a higher managerial intensity. This finding suggests that firms with a larger share of managers adjust their volumes less and their markups (export prices) more when facing a real exchange rate shock. This result is in line with the previous literature that finds the elasticity of export volume to a real exchange rate change decreasing with firm performance (Berman et al., 2012, Amiti et al., 2014 and Bernini and Tomasi, 2015). Comparing the coefficients of the interaction term between RER and managerial intensity in Table A2 with those in Table 2 suggest that the heterogeneous reaction of French exporters depending on managerial intensity to RER depreciation is larger on quantity than on prices (in absolute terms). Results in the last column of Table A2 show that the interaction term between RER and managerial intensity is not significant on export values since the heterogeneous effect of RER depending on managerial intensity on export prices and on quantity offset each other.

Table 2: RER and the export price of firms.

Dep var:	Ln(export price)			
	(1)	(2)	(3)	(4)
RER_{jt} (ln)	0.050***	0.028*	0.028*	0.052***
	(0.014)	(0.015)	(0.015)	(0.015)
RER_{jt} (ln) × $M_{i,95}$		0.028***	0.028***	0.030***
		(0.009)	(0.009)	(0.009)
RER_{jt} (ln) × $Productivity_{i,95}$		0.016**	0.016**	0.017**
		(0.008)	(0.008)	(0.008)
$Rank_{ipjt}$			-0.001***	-0.001***
			(0.000)	(0.000)
RER_{jt} (ln) × $Rank_{ipjt}$				-0.002***
				(0.001)
	Quantification			
	Price elasticity to 10% RER ↑ for firms:			
with avg $M_{i,95}$	0.5	0.28	0.28	0.52
with one s.d. $M_{i,95}$ above avg	-	0.56	0.56	0.82
Firm-Product-Destination FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	3576648	3576648	3576648	3576648
R^2	0.909	0.908	0.908	0.908
Adj. R^2	0.881	0.881	0.881	0.881
Cluster	jt	jt	jt	jt

Note: The dependent variable is the logarithm of the firm-product-destination export unit value (value over volume) in year t. In column (2) to (4) firm managerial intensity and productivity are normalised to have zero mean and SD equal to 1. The rank product variables are computed by firm-destination-year, and normalized such that the core product has rank 0. Robust standard errors clustered by country-destination. ***p<0.1; **p<0.05; *p<0.01.

4.2 Alternative explanations and complementarity in price setting

We already distinguished in our baseline estimations the heterogeneous effect on firms' pricing-to-market that arises from differences across firms in unit labor cost requirements, measured by labor productivity, from managerial intensity. We also controlled in the previous estimations for

the heterogeneous effects of real exchange rate movements depending on the best (core) product of the firm by including the interaction between RER and the rank of the product in the firm's total exports to a destination in a year. This latter control allows us to take into account the role of output quality at the product level as emphasized by Chatterjee et al. (2013), Bernini and Tomasi (2015) and Chen and Juvenal (2016). However, three other alternative mechanisms (i.e., confounding factors) may concur to explain the heterogeneous pricing-to-market behavior of firms.

First, we check whether our previous results are driven by heterogeneous changes in marginal costs of imported inputs that firms might face when there are variations of RER. This is the channel emphasized in Amiti et al. (2014). In order to capture this mechanism, we compute a firm specific import RER variable. Namely, we calculate the weighted average of RER across all the import sources of a given firm i at time t. Weights are based on the share of the total firm's imports coming from a given sourcing country in the initial year in which the firm imports from that origin country. In order to avoid multicollinearity with the RER on the export side (our main variable of interest), we exclude from the set of source countries considered in the calculation of import RER the specific export destination market j.[14] The import RER has been constructed such that an increase of the firm level import RER means an appreciation of the euro, and thereby imports become less costly.

Second, we investigate the role of firm level output quality in the heterogeneous response of firms to RER movements. Since we are interested in disentangling the different responses of exporting firms to RER depending on within-firm managerial intensity relative to the quality channel highlighted by Chen and Juvenal (2016), we control for the heterogeneous reaction to RER changes depending on the average quality of all products exported by firms in the initial year those get exported. We measure firm-level output quality by relying on the methodology proposed by Khandelwal et al. (2013). Namely, we estimate quality as a demand shifter that corresponds to the residual of an OLS estimation of the quantity and unit value (multiplied by the elasticity of substitution) on country-time fixed effects (to control for price index and income at destination) and product fixed effects (to control for variation across products since prices and quantities are not comparable across products). The estimated quality is a function of the residual of such estimation re-scaled by the elasticity of substitution (minus one).[15] We estimate

[14]For example, if we consider the exports of firm i into the US market at time t, we do not consider US specific RER in calculating the *import* RER for firm i.

[15]See Khandelwal et al. (2013) section C for more details on quality measure estimations.

firm-product-destination quality of exported products by 2-digit sectors computed using French trade flows, using the elasticity of substitution estimated in Broda et al. (2006). Next, we take the average of output quality across all products and destinations reached by the firm in the initial year and interact this measure with the RER. Our results are robust when using alternative trade elasticities computed by Fontagné et al. (2022).

Table 3 presents the results. The estimating sample controlling for both the firm-level import RER and firm's quality is slightly smaller than our baseline sample because some exporting firms do not import their inputs and thus the import RER variable has missing values. Thereby, in order to compare coefficients we first replicate in column (1) the baseline estimation without the additional controls for those alternative explanations. The coefficients of interest on the RER and the interaction term between the RER and firms' managerial intensity are of the same magnitude as the ones presented in column (4) of Table 2. Next, we control for the marginal costs channel in column (2). Results suggest that firms that faced reductions in their marginal costs associated to imported inputs have larger pricing-to-market when there is a depreciation of the RER relative to the destination market. More importantly, the channel highlighted in this paper on managerial intensity as one of the main mechanisms driving pricing-to-market due to exogenous changes in RER remains robust and stable. Finally, we include in column (3) the interaction term between real exchange rate and the initial level of firm-quality, the positive sign confirms the findings obtained in the previous literature: firms producing high-quality products react to a real exchange rate depreciation by increasing relatively more their export prices (Bernini and Tomasi, 2015 and Chen and Juvenal, 2016). Our results on the interaction term of RER and initial firm level managerial intensity, $RER_{jt} \times M_{i,95}$, remain robust and stable. Coefficients are of a similar magnitude to those presented in our baseline specification in Table 2 suggesting that the within-firm managerial intensity channel we highlight is not driven by an output quality channel.

Table 3: Testing for alternative explanations.

Dep var:	Ln(export price)		
	(1)	(2)	(3)
RER_{jt} (ln)	0.051***	0.057***	0.062***
	(0.015)	(0.015)	(0.015)
RER_{jt} (ln) × $M_{i,95}$	0.029***	0.027***	0.023**
	(0.009)	(0.009)	(0.010)
RER_{jt} (ln) × $Productivity_{i,95}$	0.014**	0.014*	0.014**
	(0.007)	(0.007)	(0.007)
$Rank_{ipjt}$	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)
RER_{jt} (ln) × $Rank_{ipjt}$	-0.002***	-0.002***	-0.002***
	(0.001)	(0.001)	(0.001)
$ImportRER_{ijt}$		0.007***	0.007***
		(0.002)	(0.002)
RER_{jt} (ln) × $ImportRER_{ijt}$		0.015**	0.015**
		(0.006)	(0.006)
RER_{jt} (ln) × $Quality_{i,tmin}$			0.010***
			(0.002)
	Quantification		
	Price elasticity to 10% RER ↑ for firms:		
with avg $M_{i,95}$ → + one s.d. (+Δ%)	0.07 → 0.09 (+36%)	0.07 → 0.09 (+31%)	0.07 → 0.09 (+26%)
with avg $Productivity_{i,95}$ → + one s.d. (+Δ%)	0.05 → 0.06 (+17%)	0.06 → 0.07 (+15%)	0.06 → 0.07 (+14%)
with avg $ImportRER_{ijt}$ → + one s.d. (+Δ%)		0.05 → 0.07 (+22%)	0.06 → 0.07 (+20%)
with avg $Quality_{i,tmin}$ → + one s.d. (+Δ%)			0.06 → 0.08 (+34%)
Firm-Product-Destination FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	3275671	3275671	3275671
R^2	0.908	0.908	0.907
Adj. R^2	0.881	0.880	0.879
Cluster	jt	jt	jt

Notes: The dependent variable is the logarithm of the firm-product-destination export unit value (value over volume) in year t. The import RER is the import weighted firm level RER, where weights are the share of total imports coming from a certain origin, except those imports coming from the destination country. Quality is the average quality of all products and destinations reached by the firm in the initial year. Quality is estimated using the methodology in KSW. Robust standard errors clustered by country-destination. ***p<0.1; **p<0.05; *p<0.01

Third, we use an alternative measure of firms' managerial ability (i.e. parameter λ_i) and approximate the ability of managers with their residual wage from Mincerian wage regression. The idea is getting closer to the theoretical framework and use a (coarse) proxy of the ability of managers in the firm rather that the simple (but precisely measures) measure of firm managerial

intensity used so far. Namely, we first estimate a worker-level Mincerian wage regression using the workers' gender, age, age squared as controls, as well as firm, occupation and sector fixed effects. The residual of this Mincerian wage regression captures the wage component based on *unobservable* workers' characteristics, here used as a proxy for their *ability*. Then, we calculate the average residual wage (i.e. ability) of top-1, top-2 and top-5 manager workers in each firm-year. Finally, we interact the ability of the top-1, top-2 and top-5 manager workers in each firm in the initial year with the RER variable. Managerial tasks are typically sub-modular, so what really matters for the overall quality of the managerial team's production is the quality of the top-managers.[16] For this reason we use the average ability of top-n managers as a proxy for the managerial ability of the firm. Results in Table 4 show that our results are robust and stable when using such an alternative measure of firms' managerial ability. The similarity between point estimates in Table 4 and 2 suggests that our baseline proxy for λ_i (i.e. managerial intensity) is isomorphic with proxy for managerial ability in Table 4.

[16]Managerial tasks are problem-solving intensive, sub-modular in nature, and therefore what matters is the presence of high-quality managers in the team. In problem-solving tasks what matters is the presence of a good worker (manager) that solves the problem, no matter whether other employers work on the same issue.

Table 4: RER and the export price of firms - Managerial Ability.

Dep var:	Ln(export price)		
	(1)	(2)	(3)
RER_{jt} (ln)	0.038***	0.037***	0.037**
	(0.014)	(0.014)	(0.014)
RER_{jt} (ln) × $Productivity_{i,95}$	0.027***	0.026***	0.026***
	(0.007)	(0.007)	(0.007)
RER_{jt} (ln) × $MAbilityTOP1_{i,95}$	0.018***		
	(0.004)		
RER_{jt} (ln) × $MAbilityTOP3_{i,95}$		0.019***	
		(0.004)	
RER_{jt} (ln) × $MAbilityTOP5_{i,95}$			0.018***
			(0.004)
$Rank_{ipjt}$	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)
RER_{jt} (ln) × $Rank_{ipjt}$	-0.002***	-0.002***	-0.002***
	(0.001)	(0.001)	(0.001)
Constant	3.175***	3.175***	3.175***
	(0.004)	(0.004)	(0.004)
Observations	3509241	3509241	3509241
R^2	0.907	0.907	0.907
Adj. R^2	0.880	0.880	0.880
Cluster	jt	jt	jt

Notes: The dependent variable is the logarithm of the firm-product-destination export unit value (value over volume) in year t. Managerial Ability is computed as the average residual of a Mincer equation, where the hourly wage of workers is regressed on individual characteristics (occupation type, gender, age, age^2) and firms characteristics (department, industry and all time-invariant via a firm-FE) for TOP1, TOP3 and TOP5 managers (PCS 37 and 38) in terms of their managerial ability in 1995. The Robust standard errors are clustered by country-destination. ***p<0.1; **p<0.05; *p<0.01

The recent literature on strategic price complementarity across firms highlights that firms adjust their prices taking into account the price decision of its competitors. Relying on micro-level dataset for the Belgian manufacturing sector on domestic prices, Amiti et al. (2019) analyze firms' price responses to changes in competitor prices and show strategic complementarities in

price setting across firms. Their findings suggest that, holding their marginal costs constant, firms increased their prices in response to an increase in the prices of their competitors. We take into account this mechanism by including in our export price estimation the price of its competitors in each market, $Price_{-ijt}$. This price is computed as the average price of all firms exporting from the same industry (NACE 2-digit) to a given destination and year excluding the export price of the specific firm i. Results are presented in Table 5. Our findings show that French exporting firms react by increasing their prices when their competitors raised their prices - as in Amiti et al. (2019) for Belgian firms. Our variable of interest is robust and stable to this control, and our results are not driven by systematic differences across firms on their competitors price strategy.[17]

[17]These results are also robust when we compute the price of competitors as the average price of other firms selling the same HS6 product in the destination market year.

Table 5: RER and the export price of firms - Control for the price of competitors.

Dep var:	Ln(export price)		
	(1)	(2)	(3)
RER_{jt} (ln)	0.051***	0.028*	0.052***
	(0.015)	(0.016)	(0.016)
$Price_{-ijt}$ (ln)	0.019***	0.019***	0.019***
	(0.002)	(0.002)	(0.002)
RER_{jt} (ln) $\times$ $M_{i,95}$		0.032***	0.034***
		(0.009)	(0.009)
RER_{jt} (ln) $\times$ $Productivity_{i,95}$		0.011	0.013
		(0.008)	(0.008)
$Rank_{ipjt}$			-0.001***
			(0.000)
RER_{jt} (ln) $\times$ $Rank_{ipjt}$			-0.002***
			(0.001)
Firm-Product-Destination FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	3278247	3278247	3278247
R^2	0.905	0.904	0.904
Adj. R^2	0.875	0.875	0.875
Cluster	jt	jt	jt

Notes: The dependent variable is the logarithm of the firm-product-destination export unit value (value over volume) in year t. In column (2) to (4) firm managerial intensity and productivity are normalised to have zero mean and SD equal to 1. $Price_{-ijt}$ is computed as the average price of all firms exporting the same HS6 to a destination and year excluding the export price of firm i. The robust standard errors are clustered by country-destination. ***p<0.1; **p<0.05; *p<0.01

5 Robustness tests

This section carries out some sensitivity tests to check the robustness of our baseline results to alternative ways of defining our proxies of firm managerial intensity, symmetry in RER movement and alternative set of fixed effects.

So far, we relied on firm managerial intensity measure based on the French "Occupations and Socio-occupational Categories" (PCS at 2-digit code) and computed the share of firm's sales managers and technical executives over total labor. In this section, we use an alternative definition of managers from O*NET classification based on occupations. Therefore, we match each workers' occupation code with the O*NET classification in order to identify STEM occupations (Science, Technology, Engineering, and Mathematics) and distinguish managerial skills from workers related to R&D activities, engineers and sales workers as in table 1. We present evidence on the heterogeneous effect of real exchange rate changes on export prices depending on managerial, R&D, engineering, and sales workers' intensity. These worker categories are expressed as a share of the total firm's workforce.[18] Table 6 presents the results. Estimates suggest that our previous findings are robust to using this alternative measure of managerial intensity. Moreover, the results in Table 6 indicate that the effect of managers and R&D workers on the heterogeneous pricing-to-market is higher compared to engineers, technicians and sales workers. These findings confirm that firms with better managerial skills and those related to innovation activities are able to absorb more cost-shocks in their export prices since they have higher markups and are able to adjust them more compared with firms with lower managerial skills. As a further sensitivity check on the definition of managerial intensity, in Table A3 we exclude Chief Technical Officers (code 37 of the PCS French occupation classification) from the calculation of the managerial intensity, and use only Chief Executive Offices (code 38 of the PCS French occupation classification). Results are robust to this alternative definition of managers.

[18]Notice that the initial share of each category of occupation in the total employment of the firm is absorbed by the firm-destination-product fixed effect, which leads to introducing only the interaction terms with the exchange rate.

Table 6: RER and the export price of firms - Decomposing STEM workforce.

Dep var:	Ln(export price)			
	(1)	(2)	(3)	(4)
RER_{jt} (ln)	0.048***	0.036**	0.036**	0.056***
	(0.015)	(0.015)	(0.015)	(0.015)
RER_{jt} (ln) × Manag. $sh_{i,95}$	0.032***	0.028***	0.028***	0.023***
	(0.006)	(0.006)	(0.006)	(0.007)
RER_{jt} (ln) × R&D $sh_{i,95}$	0.036***	0.033***	0.033***	0.035***
	(0.012)	(0.013)	(0.013)	(0.012)
RER_{jt} (ln) × Engin. $sh_{i,95}$	-0.004	-0.006	-0.006	0.001
	(0.007)	(0.007)	(0.007)	(0.008)
RER_{jt} (ln) × Sales Rep. $sh_{i,95}$ (ln)	0.003	-0.002	-0.002	-0.006
	(0.009)	(0.010)	(0.010)	(0.009)
RER_{jt} (ln) × $Productivity_{i,95}$		0.037***	0.037***	0.038***
		(0.009)	(0.009)	(0.009)
$Rank_{ipjt}$			-0.001***	-0.001***
			(0.000)	(0.000)
RER_{jt} (ln) × $Rank_{ipjt}$				-0.002***
				(0.001)
Firm-Product-Destination FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	2369106	2369106	2369106	2369106
R^2	0.906	0.906	0.906	0.906
Adj. R^2	0.878	0.877	0.877	0.878
Cluster	jt	jt	jt	jt

Notes: The dependent variable is the logarithm of the firm-product-destination export unit value (value over volume) in year t. All skills shares and firm productivity are normalised to have mean 0 and SD equals to 1. The grouping of the STEM occupations has been carried out using the ONET Classification, and performing a matching with French occupations. The Robust standard errors clustered by country-destination. ***p<0.1; **p<0.05; *p<0.01

In our baseline estimation, in order to reduce the endogeneity concern, we use measures of skill intensity in the initial year of the sample (i.e. 1995). This implies the restriction of the estimation sample to those firms that are present in 1995, and a potential sample selection issue. Our results are robust when we compute the managerial intensity in the first year in which the firm appears

in the estimating sample.[19]

So far we made the implicit assumption that the pricing-to-market reaction of firms to RER movements are symmetric in the case of appreciation *vs* depreciation. In Table A4 we explicitly test whether this is verified in the data. We disentangle RER movement into depreciation (i.e. dummy equal to one if $\Delta RER > 0$) and appreciation (i.e. dummy equal to one if $\Delta RER < 0$), and interact our RER variable with these dummies. By doing so, we are able to estimate the effect of RER movements on the pricing-to-market of firms in case of appreciation or depreciation of the real exchange rate. We also interact the two RER movements by our baseline managerial intensity variable. Results in Table A4 show that the pricing-to-market reaction to RER movement are symmetric: appreciation and depreciation have the same elasticity both on average and by managerial intensity of firms.

Finally, in Table A5 we explicitly control for destination-sector-year unobserved specific shocks (i.e. import demand shock) by including destination-HS2-year fixed effects.[20] Our results are robust to this further check reducing even further any residual omitted variable concerns.

6 Conclusion

This paper sheds light on a new and unexplored mechanism through which firm performance affects the heterogeneous reaction of exporters to real exchange rate changes. We look at the specific effect of firms' managerial intensity in shaping heterogeneous pricing-to-market decisions of exporting firms. Relying on detailed firm-product-destination level export data from France matched with specific information on firms' skill composition by occupation for the period 1995-2007, we find that firms with greater managerial intensity react to a depreciation of the real exchange rate by increasing more their export prices (markups) conditional on differences across firms in labor productivity, product performance, quality and marginal costs. These findings support the predictions of a simple theoretical framework with firm heterogeneity and variable markups, which posits that firms with higher managerial intensity are able to secure more profits, market shares, and markups, thereby adjusting their export prices more when faced with a real exchange rate shock.

[19] These results are available upon request.

[20] Notice that RER variable is captured by destination-HS2-year fixed effects, so only its interaction with managerial intensity can be identified.

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A Appendix tables (For Online Publication)

Table A1: Estimating sample

Year	# Obs	Exports (bln)	# Firms	# HS6	# Countries
1995	465,171	72.05	26847	4745	130
1996	524,562	74.90	28319	4771	130
1997	559,189	89.06	28907	4775	130
1998	577,523	92.14	29354	4765	130
1999	581,399	93.82	29408	4769	130
2000	600,253	106.80	29298	4764	130
2001	598,694	106.69	29284	4791	130
2002	661,138	113.45	29534	4798	130
2003	613,576	108.89	28467	4751	130
2004	644,385	112.97	29104	4783	130
2005	629,575	108.87	27870	4769	130
2006	650,276	122.78	28554	4766	130
2007	739,276	128.96	27961	4819	130

Notes: Authors' computation from French custom data, 1995-2007. Export values are in millions. The sample includes only transactions to non-Eurozone, for a fixed set of country, i.e. all non-Eurozone countries to which France exported in 1995.

Table A2: RER and the export quantity and value of firms

Dep var:	Ln(export quantity)		Ln(export value)	
	(1)	(2)	(3)	(4)
RER_{jt} (ln)	0.270***	0.299***	0.320***	0.328***
	(0.036)	(0.036)	(0.033)	(0.031)
RER_{jt} (ln) $\times$ $M_{i,95}$		-0.047***		-0.014
		(0.014)		(0.012)
Firm-Product-Destination FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	3576648	3576648	3576648	3576648
R^2	0.857	0.857	0.801	0.812
Adj. R^2	0.814	0.813	0.742	0.756
Cluster	jt	jt	jt	jt

Notes: The dependent variable in columns (1) and (2) is the logarithm of the firm-product-destination export quantity (tons) in year t, while it is the export value (euro) for columns (3) and (4). Firm managerial intensity is normalised to have zero mean and SD equal to 1. The Robust standard errors clustered by country-destination. ***p<0.1; **p<0.05; *p<0.01

Table A3: Exclusion of Chief Technical Officers.

Dep var:	Ln(export price)			
	(1)	(2)	(3)	(4)
RER_{jt} (ln)	0.050***	0.042***	0.042***	0.063***
	(0.014)	(0.015)	(0.015)	(0.014)
RER_{jt} (ln) $\times$ $M_{i,95}$		0.023***	0.023**	0.010
		(0.009)	(0.009)	(0.009)
$Rank_{ipjt}$			-0.001***	-0.001***
			(0.000)	(0.000)
RER_{jt} (ln) $\times$ $Productivity_{i,95}$				0.031***
				(0.008)
RER_{jt} (ln) $\times$ $Rank_{ipjt}$				-0.002***
				(0.001)
Firm-Product-Destination FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	3576648	3576648	3576648	3576648
R^2	0.908	0.908	0.908	0.908
Adj. R^2	0.881	0.881	0.881	0.881
Cluster	jt	jt	jt	jt

Note: The dependent variable is the logarithm of the firm-product-destination export unit value (value over volume) in year t. In column (2) to (4) firm managerial intensity and productivity are normalised to have zero mean and SD equal to 1. The rank product variables are computed by firm-destination-year, and normalized such that the core product has rank 0. Robust standard errors clustered by country-destination. ***p<0.1; **p<0.05; *p<0.01.

Table A4: Disentangling Appreciation vs Depreciation.

Dep var:	Ln(export price)	
	(1)	(2)
RER_{jt} (ln) $\times D^{Depr}$	0.050***	
	(0.015)	
RER_{jt} (ln) $\times D^{Appr}$	0.050***	
	(0.016)	
RER_{jt} (ln) $\times D^{Appr} \times M_{i,95}$		0.057***
		(0.010)
RER_{jt} (ln) $\times D^{Depr} \times M_{i,95}$		0.049***
		(0.010)
RER_{jt} (ln) $\times D^{Appr} \times Productivity_{i,95}$		0.010
		(0.010)
RER_{jt} (ln) $\times D^{Depr} \times Productivity_{i,95}$		0.030***
		(0.008)
RER_{jt} (ln) $\times D^{Depr} \times Rank_{ipjt}$		-0.003***
		(0.001)
RER_{jt} (ln) $\times D^{Appr} \times Rank_{ipjt}$ _appr		-0.002***
		(0.001)
Firm-Product-Destination FE	Yes	Yes
Year FE	Yes	Yes
Observations	3576648	3576648
R^2	0.908	0.908
Adj. R^2	0.881	0.881
Cluster	jt	jt

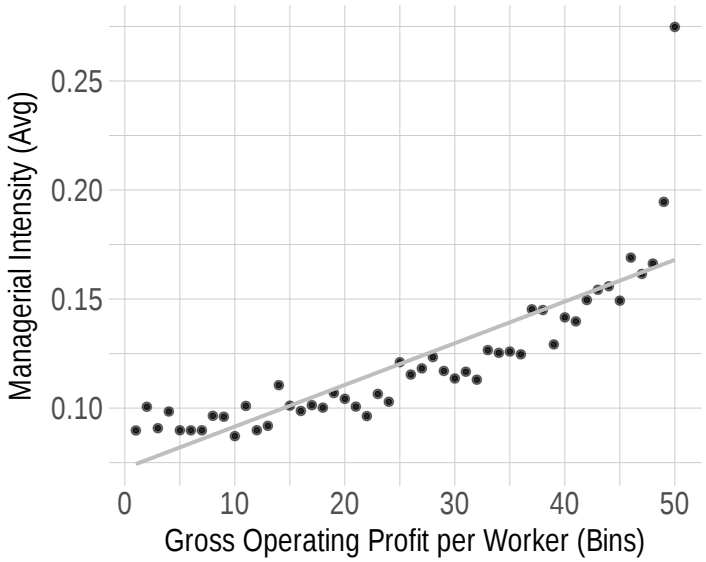
Note: The dependent variable is the logarithm of the firm-product-destination export unit value (value over volume) in year t. In column (1) and (2) firm managerial intensity and productivity are normalised to have zero mean and SD equal to 1. The rank product variables are computed by firm-destination-year, and normalized such that the core product has rank 0. Robust standard errors clustered by country-destination. ***p<0.1; **p<0.05; *p<0.01.

Table A5: Control for Demand Shock

Dep var:	Ln(export price)		
	(1)	(2)	(3)
RER_{jt} (ln) × $M_{i,95}$	0.018*	0.018*	0.019*
	(0.010)	(0.010)	(0.010)
RER_{jt} (ln) × $Productivity_{i,95}$	0.014*	0.014*	0.016*
	(0.008)	(0.008)	(0.008)
$Rank_{ipjt}$		-0.001***	-0.001***
		(0.000)	(0.000)
RER_{jt} (ln) × $Rank_{ipjt}$			-0.002***
			(0.000)
Firm-Product-Destination FE	Yes	Yes	Yes
HS2-Year-Destination FE	Yes	Yes	Yes
Observations	3555876	3555876	3555876
R^2	0.911	0.911	0.911
Adj. R^2	0.881	0.881	0.881
Cluster	jt	jt	jt

Note: The dependent variable is the logarithm of the firm-product-destination export unit value (value over volume) in year t. In column (1) to (3) firm managerial intensity and productivity are normalised to have zero mean and SD equal to 1. The rank product variables are computed by firm-destination-year, and normalized such that the core product has rank 0. Robust standard errors clustered by country-destination. ***p<0.1; **p<0.05; *p<0.01.

Figure A1: Managerial Intensity and Profitability.



Notes: We bin firms' operating profits per worker into 50 bins. We plot the average managerial intensity (vertical axis) for each bin in gross operating profits per worker (horizontal axis).