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INVITED REVIEW

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International managerial skill and big Colombian exporting firms' performance, 2006–2014

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Abstract

This paper uses a sample of the biggest private Colombian exporting firms to propose and estimate a two-step methodology for measuring international managerial skill and calculating its impact on international firm performance. The first step quantifies the managerial team's organisational capital contribution to rise firms' export proficiency through the average of a regression residuals group conformed by export unit value residuals for differentiated products (multiplying by −1 the price competition products' residuals) and export quantity residuals for homogeneous products. The second step results indicate that: (i) international managerial quality has a significant and robust positive effect on export value, (ii) better managers in the international market do not increase the number of products exported but upgrade export basket's quality and (iii) export value elasticity relative to international managerial quality is around 5 times larger than export value elasticity relative to exogenous global demand shocks.

KEYWORDS

exporting, firm's performance, international experience, management practices, quality versus price competition

[Correction added on 14 July 2024, after first online publication: The title of the article has been revised in this version.]

1 | INTRODUCTION

The managerial economics literature has faced for many years the methodological challenge of measuring executive talent accurately. Although this challenge has been somewhat addressed in recent decades by a variety of specialised management surveys[1] and econometric methodologies developed for this purpose, there is still a literature gap in international management.

On the one hand, none of management surveys inquire into specific management practices involved in the international market segment; although the World Management Survey (WMS)[2] and the German Management and Organisational Practices Survey (GMOP)[3] ask about export share relative to operating income and obtain basic information about firm activity abroad, these surveys do not distinguish between firms' management practices for selling goods in the international and the local markets. Thus, the papers that relate management quality and firms' trade outcomes with large samples[4] (Bloom et al., 2021; Görg & Hanley, 2017) use scores obtained from the WMS and GMOP, not specific to the international market, as management quality proxy variables. On the other hand, statistical methodologies that measure managerial quality through managers wage's residuals (Johansen, 2013; Meier & O'Toole, 2002) or firm efficiency's residuals (Demerjian et al., 2012) have not been adapted to the international market.

However, international management is a research topic that should be analysed in more depth, as some economic hypotheses suggest that exporting firms have incentives to export goods that differ from those they sell in the local market. For example, the *Alchian–Allen* theorem states that the demand for high-quality goods relative to low-quality substitutes will rise if the transaction costs per unit are constant because the high-quality goods become relatively cheaper. Miljkovic and Gomez (2019) found this theorem to be valid for Brazilian coffee exports, and there is also anecdotical evidence for Colombian coffee exports.[5] On a larger scale, Hummels and Skiba (2004) proved the *Alchian–Allen* theorem's validity with disaggregated bilateral trade data for six importing countries with all exporters. Therefore, exporting firms' managers could have incentives to adjust managerial practices to promote selling high-quality goods abroad and low-quality goods in the local market and could implement different managerial practices for each type of goods.

Also, *learning by exporting* (LBE) hypothesis indicates that when firms start exporting or raise their export value, their productivity is increased through various mechanisms: learning processes from foreign customers and rivals, improving product's quality, shipment size

[1]Including the World Management Survey, which is the biggest survey around the globe to measure managerial practices in a consistent way for 20,000 manufacturing firms in 34 countries (Bloom & Van Reenen, 2007), the Management and Organisational Practices Survey by the US Census Bureau (Buffington et al., 2017), the German Management and Organisational Practices Survey (Broszeit et al., 2019), and the National Survey on Productivity and Competitiveness of Micro, Small, and Medium-size Enterprises in Mexico (Bloom et al., 2022).

[2]See World Management Survey questionnaire: Manufacturing Survey Instrument (worldmanagementsurvey.org).

[3]See German Management and Organisational Practices Survey questionnaire: infas_Fragebogen_Morg_5078_20141020_.indd (iab.de).

[4]Export management has been analysed with case studies whose sample size tend to be small; the median sample of the 16 most influential empirical articles about this subject is 202 firms, based on Leonidou et al.'s (2010) classification (see Table A1).

[5]Colombia is the third-largest exporting coffee country in the world; however, the majority of the high-quality Colombian coffee is exported such that Colombian inhabitants drink low-quality coffee: https://www.bbc.com/mundo/noticias-america-latina-51622198.

adjustment (De Loecker, 2013), adopting new technologies and acquiring important information about foreign markets (Tse et al., 2017). Although literature has shown mixed results about LBE existence,[6] the evidence that favour its existence is not conclusive in two aspects: (i) what mechanism drives LBE,[7] and (ii) whether the productivity gains and knowledge acquired in the international market through LBE can be implemented in the overall managerial practices and general production processes, or if the upgrade occurs only in the firms' international market segment.

Additionally, managers who excel in the local market do not necessarily export efficiently because exporting requires further skills and knowledge. In this sense, the managerial practices involved in the production and distribution of products exported could differ from the managerial practices for selling goods in the local market. However, the current repertoire of specialised management surveys does not measure these differences and econometric methodologies are similarly scarce. To the best of the author's knowledge, Sala and Yalcin (2014) is the only paper that measures managerial skills in the international market, constructing a 'managerial input' proxy variable based on the firm manager's past experience in exporting firms obtained from Denmark employer-employee database.

This paper contributes to the literature by proposing an additional methodology for estimating managerial quality specifically in the international market and for calculating its impact on international firm outcomes. The methodology consists of a two-step procedure, in which export unit value and export quantity are first decomposed into their predicted and residual components. The second step uses a sophisticated aggregation of these residuals at firm-year level as the main independent variable in international firm performance regressions.[8] More specifically, international managerial quality is calculated through the average of a regression residuals group conformed by detailed export unit value residuals for differentiated products (multiplied by −1 for those products that compete internationally by price[9]) and detailed export quantity residuals for homogeneous products.

The metric to identify international managerial quality differs according to Rauch's (1999) product classification because firms are more likely to compete via quantity for the homogeneous products, which have 'referenced prices' or are 'traded on organised exchanges', while they are more likely to compete via price for the differentiated products. Also, the residuals computation for the differentiated products differs according to the competition type, since managers attempt to sell cheaper the products that compete by price and upgrade quality (sell more expensive) the products that compete by quality.

This empirical approach adds two innovations to the management literature that measure managerial quality through regression residuals. First, the first step dependent variables are export unit value and export quantity, not firm efficiency or manager's wage as in the traditional academic literature, since the aim of the paper is to measure managerial skills in the international

[6]Wagner (2007) indicates that empirical evidence underlines self-selection into exporting market mechanisms (i.e. only the more productive firms are able to export), but there is no conclusive proof that exports enhance productivity. Nevertheless, later studies like De Loecker (2013) for Slovenia, Tse et al. (2017) for China, and Fernandes and Isgut (2015) for Colombia report LBE existence.

[7]De Loecker (2013) identifies strategic decisions that are pertinent to innovativeness, production capability, and human capital, while Hovhannisyan and Mendez (2019) focus on workers' training aspect.

[8]Chen et al. (2017) provide a literature review of the two-step procedure implementation in the empirical accounting and finance research.

[9]An expanded version of Baldwin and Ito's (2011) methodology to classify products that compete in the international market by price and quality is explained and calculated.

market (Section 2 provides the theoretical framework and Section 4 discusses the methodology). Second, the disaggregated residual computation according to the product and competition type is novel in the empirical literature.

In addition, this methodology presents one advantage in relation to the management surveys: it could be replicated for other countries without survey collection costs because it just requires to merge customs and financial statements databases. Also, it presents two advantages in relation to Sala and Yalcin (2014): (i) it is calculated based on firms' outcome data (export prices and export quantity), not manager's international experience, considering that an experienced manager could lead that one firm start exporting (Sala & Yalcin, 2014) but inefficiently and (ii) the number of second step dependent variables is larger, permitting to analyse the international managerial quality impact on several international firm performance variables. Additionally, the second step covariates include a firm-specific external market conditions variable, allowing to evaluate international firm performance at both levels (external environment and the internal level) contributing to fill another export performance literature gap.[10]

The disadvantages of this methodology are that it is not possible to calculate international managerial quality for non-exporting firms (therefore, this paper does not contribute to the self-selecting into exporting literature) and that the international managerial quality is calculated based on regression residuals, consequently, it is measured with some error degree (although several methodological attempts are made to reduce it). Also, the international managerial quality refers to the managerial skills related to exporting not importing.

This paper proceeds as follows. The next section includes the theoretical framework, Section 3 describes the data, Section 4 defines the international managerial quality calculation and the two-step econometric specification (explaining how the potential model misspecification, measurement error and sampling error derived from this methodology are minimised), Section 5 presents the results and Section 6 concludes.

2 | THEORETICAL FRAMEWORK

Bloom et al. (2021) developed the most recent theoretical model to describe trade and management dynamics. The model assumes that: (i) firms produce differentiated goods which sell in local markets and potentially export abroad, (ii) each firm receives an exogenous managerial ability $\varphi \in (0, \infty)$— which is assumed to be equivalent to TFP—from distribution $g(\varphi)$ and (iii) each firm receives an i.i.d firm-product-specific expertise level vector $\lambda_i \in (0, \infty)$ from distribution $z(\lambda)$. In addition, the parameter δ measures the degree to which good management lowers input requirements *(production efficiency)* and θ reflects the management's magnitude of skill to enhance firms' capacity to produce higher-quality goods *(quality capacity)*. Additionally, the model makes some standard assumptions about representative consumers' demand for variety and foreign countries' expenditure for each good. The firms' profit maximisation leads to the next optimal export price p_{ij} and optimal export quantity x_{ij} for each differentiated product exported i and destination country j:

$$p_{ij}^{*} = \frac{\tau_j \left(\varphi \lambda_i\right)^{\theta-\delta}}{\alpha} \tag{1}$$

[10]Following the literature recommendation: 'Export performance should be assessed at two broad levels – the external environment level and the internal level. However, there is a lack of agreement on the domains and measurement of the determinants of export performance' (Coelho et al., 2008, p. 363).

$$x_{ij}^{*} = R_j P_j^{\sigma-1}\left(\frac{\alpha}{\tau_j}\right)^{\tau_j}\left(\varphi\lambda_i\right)^{\delta\sigma-\theta} \quad (2)$$

where τ_j is country j's iceberg trade cost, R_j is country j's aggregate expenditure, P_j is country j's quality-adjusted ideal price index and σ is the elasticity of substitution across products (1/1-α). The difference between θ and δ will determine the optimal export price charged by the firm. If $\theta = 0$ and $\delta > 0$, effective management improves the firm's efficiency but not product quality and the optimal price p_{ij}^{*} will decrease. If $\theta > 0$ and $\delta = 0$, management improves only product quality and the optimal price p_{ij}^{*} will increase. When $\theta > 0$ and $\delta > 0$ both management mechanisms are active, and the optimal export price p_{ij}^{*} will vary according to which parameter is larger. Finally, firms sell higher quantities x_{ij}^{*} if $\delta\sigma > \theta$.

Examples of management policies that increase production efficiency (δ) include 'optimising inventory control, synchronising and monitoring production targets across manufacturing stages, reducing wastage, incentivising workers, and so on'. (Bloom et al., 2021, p. 447). The strategies that upgrade quality capacity (θ) cover 'tighten quality control, ensure the compatibility of specialized inputs, facilitate complex assembly, and minimise costly mistakes'. (Bloom et al., 2021, p. 447). Intuitively, the managerial knowledge stock that enables the successful implementation of these strategies is what the academic literature has referred as organisational capital, a non-traditional intangible asset that has been broadly defined.[11]

The methodology of this paper does not estimate any Bloom et al. (2021) endogenous parameter $\left(p_{ij}^{*}, x_{ij}^{*}\right)$, but it incorporates the production efficiency and quality capacity theoretical concepts into the international managerial quality calculation. This paper assumes that, first, efficient managerial teams: (i) identify if products exported are homogeneous or differentiated according to Rauch (1999) product classification and (ii) identify if differentiated products compete in the international market by price or quality (see Baldwin & Ito, 2011). Then, efficient managerial teams: (iii) expand firms' export proficiency implementing *production efficiency* policies that lead to minimise the export price of the differentiated products that compete by price and (iv) expand firms' export proficiency by implementing *quality capacity* policies that lead to maximise the quality (ergo, the export price) of the differentiated products that compete by quality, via organisational capital improvements.

It is made an additional assumption to analyse homogeneous products' patterns: (v) managerial team focus on rising homogeneous products' export quantity, instead of export price since the international market for those goods behaves in a more competitive way (either because the good has a 'referenced price' or is 'traded on an organised exchange'). For this reason, production efficiency would be the mechanism that operates for these type of goods ($\theta = 0, \delta > 0$). According to Equation 2, the larger the production efficiency (δ), the larger the export quantity $\left(x_{ij}\right)$.

These assumptions follow the sign of the correlation between the three parameters $\left(p_{ji}, \theta, \delta\right)$ described in the optimal price Equation 1 and the sign of the correlation between the three parameters $\left(x_{ji}, \theta, \delta\right)$ described in the optimal quantity Equation 2, but they differ

[11]On the one hand, Dessein and Prat (2022) define organisational capital as an intangible productive asset that can be produced only with input from the firm's top management leadership, including: (i) relational contracts, (ii) corporate culture, (iii) firm-specific human capital or (iv) firm capabilities. On the other hand, Black and Lynch (2005) define organisational capital as the firm's organisational structure that contributes to its productive capacity, including workforce training, employee voice, and work design (including the use of cross-functional processes).

from the original Bloom et al. (2021) approach, who considered and estimated δ and θ as exogeneous firm-invariant structural parameters. It is suggested for future research to extend Bloom et al. (2021) theoretical model assuming that firm-product-specific expertise level vector $\lambda_i \epsilon (0, \infty)$ is an endogenous factor that could be enhanced due to organisational capital investment by the managerial team.

3 | DATA

The sample used in this paper is a merge of the next two public Colombian datasets[12]:

3.1 | Customs data

Export (import) information disaggregated at product [Colombian external tariff subheading—10 digit][13]—country destination (origin)—firm id level. Data include traded value (FOB for exports and CIF for imports) and traded quantity (units[14] and kilograms). The information is provided by the Colombian National Administrative Statistics Department (DANE by its acronym in Spanish). Import and export values were deflated based on the US GDP deflator (2014 is the base year).

3.2 | Big private firms' financial statements

The Corporate Information Integrated System (SIIS by its acronym in Spanish) reports the financial statements (balance sheet, income statement and cash flow) for the firms supervised by the Colombian Companies Superintendence. The principal criterion to supervise a firm is that its total assets or operating income exceeds 30,000 current legal Colombian minimum wages. The reported financial statements are validated by tax auditors, according to articles 37, 38 and 39 from law 222 of 1995. The limitation of this dataset is that it does not include number of employees, so operating expenses are used as a proxy variable.[15] The information used in this dataset was deflated using an industry-specific annual Producer Price Index (PPI) reported by the Colombian Central Bank (2014 is the base year).

Figures 1 and 2 show the historical participation of big private Colombian exporting firms relative to total exporting firms. On an annual average, big private exporting firms represent

[12]Data was downloaded in February 2021. It was deleted from the sample firms close to bankruptcy (firms whose equity was smaller than 0, or whose debt ratio (liabilities/assets) is larger than 1, or whose return on assets (profit/assets) is smaller than −1).

[13]From the common nomenclature classification system of the Andean Community. See: ForeignTradeCorrelatives_DANE_03.pdf.

[14]The unit of measurement varies according to the product: number of items (55%), kilogram (38%), squared meters (4%), pairs (1%), cubic meters (0.7%), litres (0.4%), thousands (0.16%), carats (0.16%), among others.

[15]The Colombian government shared the Colombian employer-employee dataset (PILA, by its acronym in Spanish) for the big private Colombian exporting firms included in this paper with an anonymous firm-id to guarantee anonymisation. Therefore, it was not possible to merge it with the databases described above. The payroll database would allow for remuneration and supply labour data to be included in the analysis (e.g. wages and worked/vacation days).

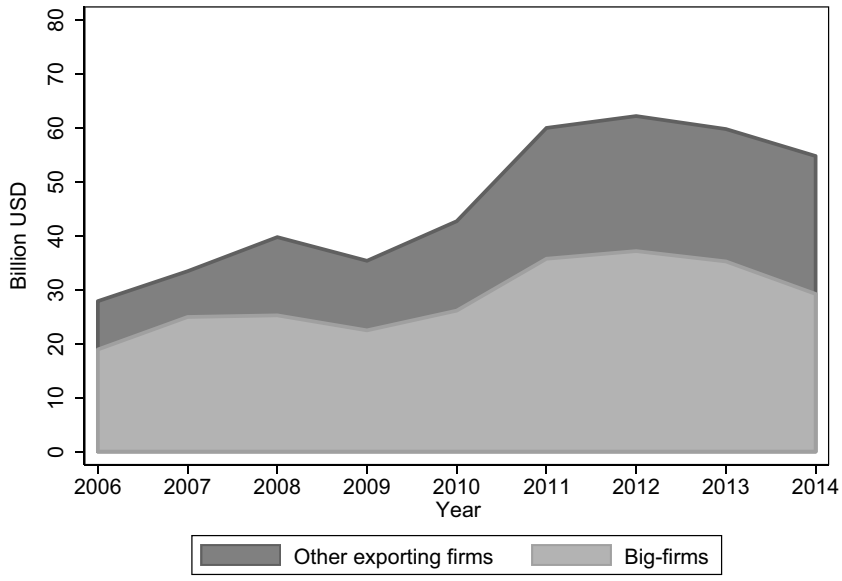

FIGURE 1 Colombian export value disaggregated by firm size. *Source*: Colombian National Administrative Statistics Department (DANE by its acronym in Spanish), Colombian Companies Superintendence and authorial calculations. [Colour figure can be viewed at wileyonlinelibrary.com]

43% of total exporting firms (around 3434 of 7920 firms[16] per year) and 61%[17] of total export value (around US$28,322 million of US$46,211 million per year). Also, big private Colombian exporting firms export higher values, export more products, export more products to more countries and report lower export concentration than other exporting firms (see Table A2). Additionally, big private exporting firms have larger fixed assets, greater operating income, more non-tangible assets and higher TFP than big private non-exporting firms (see Table A3).

4 | METHODOLOGY

In general, three methodological approaches have been implemented in the academic literature to measure managerial quality. In the first place, it is assigned one numerical value to each questionnaire's answer from specialised management surveys like WMS and GMOP and then, the results are aggregated—unweighted average of the responses—obtaining total and/or disaggregated (monitoring, incentives and targets components) management scores (Bloom et al., 2021; Görg & Hanley, 2017). In the second place, two-step methodologies calculate the managerial quality in the first step using managers' wage residuals (Johansen, 2013; Meier & O'Toole, 2002) or firm efficiency's residuals (Demerjian et al., 2012), and then, it is included as

[16]Exporting IDs which identify low-magnitude transactions made by individuals (not firms) were excluded from the customs dataset. These observations were identified with the next criteria: (i) observations whose export's id had less than 9 digits, consequently, it is not a firm id (*NIT*) or (ii) export's id whose first three digits do not belong to the next interval [800, 900]. None of the big private exporting firms are classified in these criteria.

[17]Eighty one percent excluding the largest Colombian exporting firm (*Ecopetrol*). The financial statements dataset does not include *Ecopetrol's* information because its ownership has public and private participation.

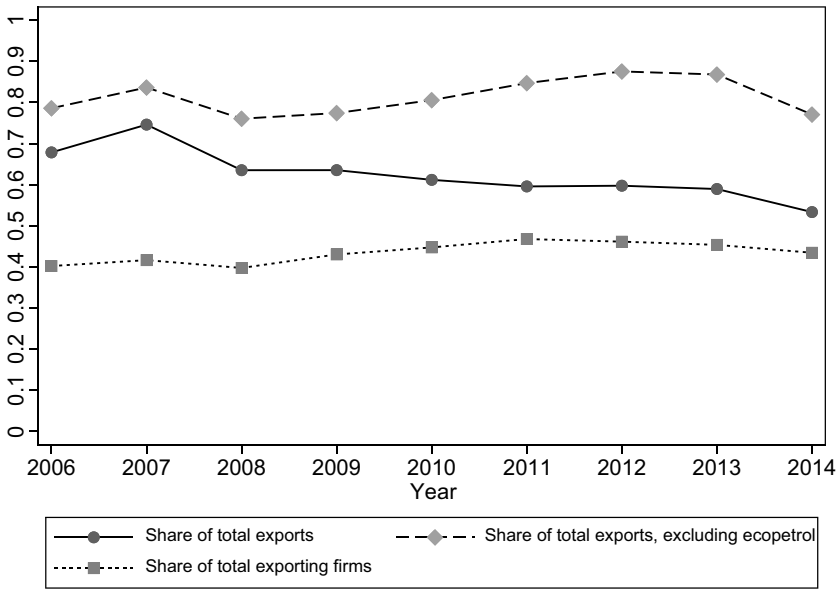

FIGURE 2 Shares of big private exporting firms relative to total exporting firms. *Source*: Colombian National Administrative Statistics Department (DANE by its acronym in Spanish), Colombian Companies Superintendence and authorial calculations. [Colour figure can be viewed at wileyonlinelibrary.com]

an explanatory variable in a second step regression, in which the range of dependent variables cover return on assets, stock returns, profit rate, among others. This two-step methodological approach has been widely implemented in the literature: 'residuals or transformed residuals, proxying for constructs such as accrual quality, discretionary accruals, managerial ability, etc. are commonly used as independent variables of interest in regression models' (Chen et al., 2017, p. 8).

A third group could be defined just for Sala and Yalcin (2014), who calculate the international managerial quality based on the manager's past experience in exporting firms obtained from a detailed manufacturing Denmark employer-employee database. They track if the external promoted managers (new workers in the first 5 places in the firms' wage distribution) have ever held a similar position in an exporting firm in the past, creating an 'externally promoted managers with exporting experience' dummy variable. They hypothesise that this international experience is related to the 'embedded tacit knowledge that companies are interested in acquiring'. (Sala & Yalcin, 2014, p. 1072). Their findings indicate that managerial resources are as important as productivity and fixed costs in the likelihood that firms start exporting.

This paper could be classified as a hybrid between the second group (two-step empirical approach) and the third group (the methodology aims to measure managerial quality in the international market). As it was explained in the theoretical framework (Section 2), the key assumption is that efficient managerial teams categorise products exported in three groups and implement distinct managerial policies in each group in order to maximise firms' export proficiency: (i) *production efficiency* policies focused on exporting cheaper differentiated products that compete internationally on price, (ii) *quality capacity* policies focused on rising quality (ergo, the export price) of differentiated products that compete internationally

on quality and (iii) *production efficiency* policies focused on exporting larger homogeneous products' quantity.

Under this theoretical assumption, the international managerial quality is empirically computed as the average of a regression residuals group conformed by export unit value's differentiated products (multiplied by −1 for products that compete internationally on price) and export quantity residuals for homogeneous products. This residual set measures the export unit value and export quantity fractions not attributable to a set of explanatory variables and detailed fixed effects, which plausibly works as an accurate proxy variable of the managerial team's organisational capital contribution to increase firms' export proficiency. The international managerial quality obtained from this residual set is firm-specific, not manager-specific, consequently, it does not measure the organisational capital contribution to rise export proficiency by one manager (e.g. CEO), but the whole managerial team.

The empirical methodology steps are described as follows. First, the markets are classified as price or quality competition based on an expanded version of Baldwin and Ito (2011) methodology. Second, it explains the international managerial quality calculation. Third, international firm performance regressions (second step) are defined and it is described how the potential econometric issues derived from this two-step approach (model misspecification, measurement error and sampling error) are addressed and minimised.

4.1 | Product classification (price or quality competition)

Baldwin and Ito (2011) classify products based on an export unit value (*EUV*) regression for each HS 6-digit product, in which the destination country's GDP, GDP per capita, the distance between exporter and importer and year fixed effects are included as explanatory variables, using COMTRADE, CEPII and World Development Indicators data for each of the world's top 8 exporters plus Australia. The distance coefficient will indicate if the product competes internationally by price or quality. The theoretical foundation relies on the traditional heterogeneous firm trade models, which hold that firms with higher productivity produce cheaper goods (Melitz, 2003), and on the qualitative heterogeneous firm trade models, which predict that firms with higher productivity sell more expensive goods. As it is profitable to serve more remote destinations for the more productive firms, the distance will indicate if the good is competing by price (negative distance coefficient) or by quality (positive distance coefficient).

Initially, it is estimated the next export unit value regression for each product as in Baldwin and Ito (2011):

$$ln(EUV)_{pkt} = \beta_o + \beta_1 ln\ distance_{kt} + \beta_2 ln\ GDP_{kt} + \beta_3 ln\ GDPpc_{kt} + \partial_t + \in_{pkt} \quad (3)$$

where subscript p denotes Colombian external tariff subheading 10-digit, t the year, k the destination country and ∂_t the year fixed effects. Export unit value (*EUV*) is defined as the total export value expressed in real f.o.b dollars divided by total units of physical quantity.[18]

[18]It uses the natural units of the products instead of kilograms: 'Consider the example of HS 8802.40.00.40, Aeroplanes weighing at least 15,000 kg. Larger aeroplanes are more expensive, but might not be more expensive per kilogram, so it is more meaningful to define the unit value of an airplane as "dollars per plane" rather than "dollars per kilogram of plane"' (Harrigan et al., 2015, p. 103).

Colombian data characteristics allow that the unit of observation for each regression (Colombian external tariff subheading 10-digit—destination country—year) has a higher disaggregation level than Baldwin and Ito (2011) aggregation (HS 6-digit—destination country—year), which improves the classification accuracy because the product category does not bundle price and quality products. However, it also raises the challenge of sample size: the median sample per regression is just 20 observations[19] and the sample is insufficient to run the regressions for 10% of the products.

Therefore, an innovative classification product algorithm was implemented to categorise those products which could not be classified with the initial criterion (products whose distance coefficient was not statistically significant at 10% or the sample was insufficient to run the regression). First, Equation 3 is estimated for broader product aggrupation (when *p* denotes *Nandina* subheading 8-digit and *p* denotes HS subheading 6-digit),[20] and then, the products are classified according to the regression of the respective narrower product aggrupation in which the distance coefficient was statistically significant. If the null distance coefficient's statistical significance or insufficient sample persists, it is assigned the competition mode of the products that belong to their HS heading 4-digit or their HS chapter 2-digit. As a last resort, it is assigned the competition mode of all products.

For example, the classification product algorithm works in the next way for the second most important Colombian product exported 'thermal coal'. Initially, it is estimated Equation 3 in which *p* denotes the Colombian external tariff subheading 10-digit (2701120010 'thermal coal'). If the distance coefficient is not statistically significant or the sample is insufficient to run the regression, it is estimated in Equation 3 in which *p* denotes *Nandina* 8-digit (27011200 '*Bituminous coal*'). If the distance coefficient is still not statistically significant or the sample is still insufficient to run the regression, then, it is estimated Equation 3 in which *p* denotes HS subheading 6-digit (270112 '*Bituminous coal*'). If the product is still not classified, it is assigned the product competition mode of the HS 4-digit 2701 heading 'Coal, briquettes, ovoids and similar solid fuels manufactured from coal'. If there are missing values, it is assigned the product competition mode of the HS 2-digit 27 chapter 'Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes'. Finally, it is assigned the competition mode of all products if none of the previous steps allowed to classify the product.

In total, 17% of the products were classified at the most disaggregated regression at the Colombian external tariff subheading 10-digit, 1% at *Nandina* 8-digit and 9% at the HS subheading 6-digit. Then, 40% of the products were assigned the competition mode of their HS heading 4-digit, 28% the competition mode of their respective HS chapter 2-digit, and 5% the competition mode of all products (Table 1). The consolidated results indicate that 60% of the products compete by quality and 40% by price. Under this classification, the annual average percentage of the export value of products that compete by quality relative to total export value is 37% for the big private Colombian exporting firms (36% for the rest of the exporting firms), and the trend decreased during the analysed time horizon (2006–2014) for both types of firms (Figure 3).[21]

[19]The median number of destination countries per product exported per year is just 4.

[20]A very small percentage of the definitions of units is not consistent within broader market aggrupation: Nandina 8 digit ($n = 1$, 0.015%), HS 6 subheading digit ($n = 15$, 0.30%).

[21]As Comtrade does not report information disaggregated at 10 digits, it is not possible to replicate this methodology for other countries and compare results.

TABLE 1 Product classification (price or quality competition).

Classification method (first option)		
Aggrupation level per regression	**Number of products classified**[a]	**Percentage of products classified**
Colombian external tariff subheading 10-digit	1175	16.63%
Nandina[b] subheading 8-digit	71	1%
HS subheading 6-digit	643	9.10%
Classification method (second option)		
Aggrupation level to calculate mode competition	**Number of products classified**	**Percentage of products classified**
HS heading 4-digit	2821	39.93%
HS chapter 2-digit	1972	27.91%
Whole sample	383	5.42%
Product classification		
Classification	**Number of products classified**	**Percentage of products classified**
Price competition	2831	40.07%
Quality competition	4234	59.93%
Total	7065	100.00%

[a]The products classified as price (quality) competition are those whose distance coefficient is negative (positive) and statistically significant ($p < .1$) in Equation 3.

[b]Common nomenclature classification system of the Andean Community.

4.2 | International managerial quality calculation

In the first place, the baseline export unit value (EUV) and quantity (Q) regressions are estimated as follows:

$$ln(EUV)_{pfkt} = \beta_o + \beta_1 ln\ GDP_{kt} + \beta_2 ln\ GDPpc_{kt} + \beta_3 tf_{p*kt} + \Gamma X_{ft} + \theta New_{pfkt} + \partial_p + \partial_f + \partial_k + \partial_t + \in_{pfkt} \quad (4)$$

$$ln(Q)_{pfkt} = \beta_o + \beta_1 ln\ GDP_{kt} + \beta_2 ln\ GDPpc_{kt} + \beta_3 tf_{p*kt} + \Gamma X_{ft} + \theta New_{pfkt} + \partial_p + \partial_f + \partial_k + \partial_t + w_{pfkt} \quad (5)$$

where subscript p denotes Colombian external tariff subheading product 10-digit, p^* is the HS subheading product 6-digit, f the firm, k the destination country and t the year. Export unit value (EUV) is defined as export value expressed in real f.o.b dollars divided by units of physical quantity (Q). $ln\ GDP_{kt}$ and $ln\ GDPpc_{kt}$ are GDP and GDP per capita of destination country k in year t (in logarithm). $Tariff_{p*kt}$ is[22] the ad-valorem import tariff imposed by destination country k on product p^*. The vector of firm-level covariates X_{ft} includes log fixed assets, log operating expenses, log non-tangible assets,[23] mark-up and TFP calculated based

[22]Source of tariff dataset is Feodora Teti's Global Tariff database (Teti, 2020). Product level aggregation is HS 6-digit.

[23]Firm-level variables were calculated as Log $(x+1)$ in order to include firms that report \$0 in some variables, particularly, non-tangible assets.

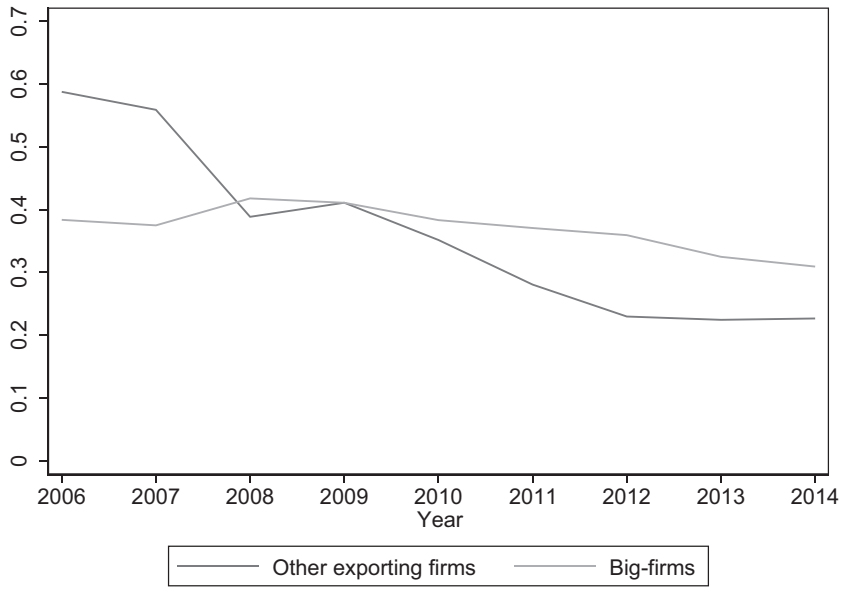

FIGURE 3 Export value of products that compete by quality relative to total export value. *Source*: Colombian National Administrative Statistics Department (DANE by its acronym in Spanish), Colombian Companies Superintendence and authorial calculations. The product classification follows the methodology explained in Section 4.1. [Colour figure can be viewed at wileyonlinelibrary.com]

on Levinsohn and Petrin's (2003) methodology.[24] New_{ftkp} includes three mutually exclusive dummies which adjust the learning cost of extensive margin expansions in year t relative to t-1: (i) if it is a new product p exported to an 'old' country destination k, (ii) if it is an 'old' product p exported to a new country destination k or (iii) if it is a new product p exported to a new country destination k. Finally, ∂_k is the destination country fixed effects, ∂_p the product fixed effects, ∂_f the firm fixed effects and ∂_t the year fixed effects. Robust standard errors are clustered at the country destination-year level. The results of these regressions are shown in column 1 of Tables 2 and 3.

Then, a modified residuals' vector $\hat{v}_{pkft}$ is defined in Equation 6, based on the residuals from export unit value (Equation 4) and quantity (Equation 5) regressions, so that its scale is positively correlated with the international managerial quality (the larger $\hat{v}_{pkft}$, the larger the international managerial quality). For the differentiated products that compete internationally by price (*p1*), the lower the export unit value residuals $\hat{\epsilon}_{p1kft}$, the better the managerial team's production efficiency policies to export cheaper those products, consequently, those residuals are multiplied by $-1\left(\hat{\epsilon}_{p1kft} * -1\right)$. For the differentiated products that compete internationally by quality (*p2*), the higher the residuals $\hat{\epsilon}_{p2kft}$, the better the managerial team's quality capacity policies to upgrade the quality (ergo, the export price) of those products, consequently, those residuals $\left(\hat{\epsilon}_{p2kft}\right)$ are not modified.

On the other hand, firms that export homogeneous goods (*p3*) could face challenges in differentiating the export price because the product either has a 'reference price' or it is 'traded in an organised exchange' (see Rauch, 1999). Assuming that the international market for the homogeneous products is highly competitive and exporters are price takers, the managerial team

[24]TFP was calculated with the *prodest* Stata command (Mollisi & Rovigatti, 2018). See Table A4 for results.

TABLE 2 Export unit value regression.

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	**Log (export unit value)**					
Log GDP	−0.112					
	(0.212)					
Log GDPpc	0.161					
	(0.227)					
Applied tariff (ad-valorem component)	−0.00203*	0.000893				
	(0.00104)	(0.00148)				
Log real stock non-tangible assets (USD)	0.00115	0.000642	0.000349	0.000271	0.000239	0.000283
	(0.00108)	(0.000869)	(0.000847)	(0.000841)	(0.000959)	(0.000960)
Log real stock property, plant and equipment (USD)	−0.000513	−0.00168	0.00392	0.00215	0.00779	0.00706
	(0.00998)	(0.00695)	(0.00666)	(0.00256)	(0.00774)	(0.00769)
Log real operating expenses (USD)	−0.0304*	−0.0253*	−0.0125	0.00110	−0.0187	−0.0194
	(0.0176)	(0.0131)	(0.0133)	(0.00810)	(0.0157)	(0.0159)
Mark-up (operating income/sales cost)	0.00114	0.00189	−0.000443	−0.000414	4.20e-05	5.24e-05
	(0.000747)	(0.00424)	(0.000629)	(0.000620)	(0.000333)	(0.000334)
Dummy new product in *t*	−0.0194	0.00974	−0.000299	−0.00181	0.00328	0.00349
	(0.0126)	(0.0124)	(0.0131)	(0.0131)	(0.0143)	(0.0143)
Dummy new destination in *t*	0.0961***	0.0560***	0.0116	0.0129	0.00358	0.00373
	(0.0135)	(0.0148)	(0.0191)	(0.0189)	(0.0197)	(0.0197)
Dummy new product-destination in *t*	0.0585**	0.0273	0.0516	0.0506	0.0508	0.0515
	(0.0269)	(0.0309)	(0.0364)	(0.0364)	(0.0368)	(0.0368)
TFP[a]	0.189**	0.0907	0.0741		0.0373	0.0264
	(0.0880)	(0.0753)	(0.0622)		(0.0768)	(0.0758)

(Continues)

TABLE 2 (Continued)

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Log (export unit value)					
Firm efficiency[b]					−0.0635	
					(0.0829)	
Managerial quality[c]						−0.167**
						(0.0830)
Observations	438,937	367,970	276,462	279,755	233,646	233,646
R-squared	.732	.904	.938	.938	.941	.941
Country destination fixed effects	Yes	No	No[r]	No[r]	No[r]	No[r]
Product fixed effects	Yes	No	No[r]	No[r]	No[r]	No[r]
Year fixed effects	Yes	No	No[r]	No[r]	No[r]	No[r]
Firm fixed effects	Yes	No	No[r]	No[r]	No[r]	No[r]
Product-firm fixed effects	No	Yes	No[r]	No[r]	No[r]	No[r]
Product-country destination fixed effects	No	Yes	No[r]	No[r]	No[r]	No[r]
Product-year fixed effects	No	Yes	No[r]	No[r]	No[r]	No[r]
Country destination-year fixed effects	No	Yes	No[r]	No[r]	No[r]	No[r]
Firm-destination fixed effects	No	Yes	No[r]	No[r]	No[r]	No[r]
Product-firm-country destination fixed effects	No	No	Yes	Yes	Yes	Yes
Product-year-country destination fixed effects	No	No	Yes	Yes	Yes	Yes

Note: Export unit value is defined as export value expressed in real f.o.b dollars divided by units of physical quantity. Robust standard errors clustered at country-year level in parentheses. ***$p < .01$; **$p < .05$; *$p < .1$.

Abbreviation: No[r], redundant fixed effects.

[a]Calculated based on Levinsohn and Petrin (2003) methodology (Table A4).

[b]Relative to the most efficient firm in each industry-year. It was calculated assuming decreasing returns to scale based on Demerjian et al. (2012).

[c]Residual of a Tobit regression of firm efficiency on a set of firm-level explanatory variables (Demerjian et al., 2012; Table A5).

TABLE 3 Quantity regression.

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	**ln (export quantity)**					
Log GDP	−0.538					
	(0.449)					
Log GDPpc	0.828*					
	(0.493)					
Applied tariff (ad-valorem component)	−0.00917***	−0.000605				
	(0.00222)	(0.00196)				
Log real stock non-tangible assets (USD)	−0.00480***	−0.00100	0.000683	0.000653	0.00125	0.00122
	(0.00179)	(0.00170)	(0.00182)	(0.00187)	(0.00206)	(0.00206)
Log real stock property, plant and equipment (USD)	0.117***	0.114***	0.123***	0.0135**	0.119***	0.120***
	(0.0168)	(0.0110)	(0.0119)	(0.00648)	(0.0147)	(0.0149)
Log real operating expenses (USD)	−0.0275	0.138***	0.180***	0.193***	0.209***	0.210***
	(0.0258)	(0.0217)	(0.0228)	(0.0300)	(0.0278)	(0.0277)
Mark-up (operating income/sales cost)	0.00158	−0.0328***	−0.00118	−0.000170	−0.00128	−0.00129
	(0.00211)	(0.00914)	(0.00105)	(0.000875)	(0.00111)	(0.00111)
Dummy new product in *t*	−1.373***	−0.251***	−0.273***	−0.273***	−0.328***	−0.329***
	(0.0259)	(0.0243)	(0.0257)	(0.0256)	(0.0268)	(0.0268)
Dummy new destination in *t*	−0.819***	−0.336***	−0.419***	−0.427***	−0.436***	−0.436***
	(0.0275)	(0.0286)	(0.0356)	(0.0353)	(0.0355)	(0.0356)
Dummy new product-destination in *t*	−1.183***	−0.313***	−0.623***	−0.628***	−0.683***	−0.683***
	(0.0437)	(0.0541)	(0.0729)	(0.0727)	(0.0806)	(0.0807)
TFP[a]	1.741***	1.893***	2.053***		1.944***	1.960***
	(0.226)	(0.142)	(0.151)		(0.194)	(0.195)

(Continues)

TABLE 3 (Continued)

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	ln (export quantity)					
Firm efficiency[b]					0.162	
					(0.177)	
Managerial quality[c]						0.209
						(0.165)
Observations	438,937	367,970	276,462	279,755	233,646	233,646
R-squared	.640	.886	.927	.927	.931	.931
Country destination fixed effects	Yes	No	No[r]	No[r]	No[r]	No[r]
Product fixed effects	Yes	No	No[r]	No[r]	No[r]	No[r]
Year fixed effects	Yes	No	No[r]	No[r]	No[r]	No[r]
Firm fixed effects	Yes	No	No[r]	No[r]	No[r]	No[r]
Product-firm fixed effects	No	Yes	No[r]	No[r]	No[r]	No[r]
Product-destination fixed effects	No	Yes	No[r]	No[r]	No[r]	No[r]
Product-year fixed effects	No	Yes	No[r]	No[r]	No[r]	No[r]
Destination-year fixed effects	No	Yes	No[r]	No[r]	No[r]	No[r]
Firm-destination fixed effects	No	Yes	No[r]	No[r]	No[r]	No[r]
Product-firm-destination fixed effects	No	No	Yes	Yes	Yes	Yes
Product-year-destination fixed effects	No	No	Yes	Yes	Yes	Yes

Note: Quantity refers to units of physical quantity. Robust standard errors clustered at country-year level in parentheses. ***$p < .01$, **$p < .05$, *$p < .1$.

Abbreviation: No[r], redundant fixed effects.

[a]Calculated based on Levinsohn and Petrin (2003) methodology (Table A4).

[b]Relative to the most efficient firm in each industry-year. It was calculated assuming decreasing returns to scale based on Demerjian et al. (2012).

[c]Residual of a Tobit regression of firm efficiency on a set of firm-level explanatory variables (Demerjian et al., 2012; Table A5).

can encourage the export quantity, not export price. Thus, quantity regression residuals from Equation 5 are included in the modified residuals' vector; the higher the residuals $\widehat{w}_{p3kft}$, the better the managerial team production efficiency policies to export larger homogeneous products' quantity, consequently, those residuals $\left(\widehat{w}_{p3kft}\right)$ are not modified.

In this order of ideas, the international managerial quality is calculated as the simple average of the modified residuals $\widehat{v}_{pkft}$ for each exporting firm f in year t (Equation 7):

$$\widehat{v}_{pkft} = \begin{cases} \widehat{\in}_{p1kft} * (-1) & \text{where } p1 \text{ are differentiated products that compete by price} \\ \widehat{\in}_{p2kft} & \text{where } p2 \text{ are differentiatied products that compete by quality} \\ \widehat{w}_{p3kft} & \text{where } p3 \text{ are homogeneous products} \end{cases} \quad (6)$$

$$International\ managerial\ quality\ (IMQ)_{\mathrm{ft}} = \frac{\sum_{pk=1}^{n} \widehat{v}_{pkft}}{n} \quad (7)$$

where n is the number of products exported-destination country pairs of each exporting firm f in each year t.

For modified residuals $\widehat{v}_{pkft}$ to be a suitable international managerial quality proxy variable, export unit value and quantity's (*EUV-Q*) regressions should be well specified for this purpose, which is fulfilled if: (i) irrelevant explanatory variables are not included, (ii) all relevant variables are included and (iii) no explanatory variable should contain any international managerial quality component because it would create a bias in $\widehat{v}_{pkft}$ as *IMQ* proxy variable.

For this reason, column 2 in Tables 2 and 3 adds double fixed effects (FE) interactions between destination country, product, year and firm FE to the *EUV-Q* regressions and column 3 has the triple FE interactions. These double and triple FE account for the unobserved characteristics of combinations between product, year, destination country and firm, which are orthogonal to managerial team's control and impact on the export unit value and export quantity. However, these FE do not absorb the international managerial quality variation because neither are defined as the combination of firm FE with a time-changing variable FE.

For example, product-year FE in column 2 are included because of large unit value and quantity differences between products: 'they take out all observed and unobserved global factors that might change the relative unit values [and quantities] over time. For instance, if the relative price [and quantity] of computers to pencils goes down [up] in year t due to technological progress or changes in demand, this effect will be absorbed by the product-year fixed effect' (Harding & Javorcik, 2012, p. 970). Besides, it controls for the quantity's unit differences across products. As another example, the firm-product-destination country FE in column 3 controls for the firms' capabilities in exporting product p to destination country k (Bao et al., 2021). In general, the specification error of the *EUV-Q* regressions due to the omission of relevant explanatory variables is reduced in columns 2 and 3.

Column 4 in Tables 2 and 3 keeps the fixed effects of column 3 but omits TFP. As briefly explained above, one of the disadvantages of this methodology is that the inclusion of variables that could contain international managerial quality components in the *EUV-Q* regressions, like TFP, raises a trade-off. On the one hand, TFP inclusion could make the *EUV-Q* regressions' residuals an underestimated *IMQ* proxy variable because TFP could contain an unknown *IMQ* fraction. On the other hand, TFP exclusion could make the *EUV-Q* regressions' residuals an overestimated *IMQ* proxy variable because *EUV-Q* regressions' residuals would capture other TFP components

non-related with *IMQ*. The same trade-off occurs with *firm efficiency*[25] in column 5 and with *managerial quality* -calculated based on traditional firm efficiency residual methodology (Demerjian et al., 2012; see Table A5)- in column 6. Since TFP, firm efficiency and managerial quality components cannot be split, none *EUV-Q* column reduces the model misspecification to zero. The feasible methodological solution is to calculate one international managerial quality variable for each *EUV-Q* column and then estimate different second step regressions for each international managerial quality.[26]

As robustness checks, the international managerial quality is also calculated as the modified residuals' median, so that its calculation is less sensitive to outliers (products exported in which the managerial team contributed in a very high or very low proportion to rise firms' export proficiency). Also, the international managerial quality is calculated as the modified residuals' average but standardising $\hat{\in}_{pkft}$ and $\hat{w}_{pkft}$ in order to increase the residual sets' comparability. In the baseline specification, both residual sets' mean is 0 and both residual sets are measured in natural logarithm units. The limitation is that higher log export quantity residual dispersion[27] could lead to *IMQ* weights in higher proportion to the effective managerial team policies to export higher homogeneous products' quantity than effective managerial team policies to modify the differentiated products' unit value. Nevertheless, Section 5 shows that second step results are robust across different ways to compute the international managerial quality (modified residuals' simple average, modified residuals' median and modified residuals' simple average standardising *EUV-Q* residuals).

From the author's point of view, international managerial quality obtained from the third *EUV-Q* regressions (*IMQ*3) is the most accurate *IMQ* since *EUV-Q* econometric specifications include TFP, which is one of the most relevant *EUV-Q* explanatory variables even if it contains an unknown *IMQ* fraction. Therefore, *IMQ*3 is the baseline *IMQ* from now on. Figure 4 shows binned scatter plots between *IMQ* on the *x* axis and 11 firms' outcomes on the *y* axis. Statistical significance of *IMQ* coefficients in simple regressions show that *IMQ* has a positive and significant correlation with export value, quality exports share in value (export value of products that compete in the international market by quality relative to total differentiated products' export value) and quality exports share in number (number of products that compete in the international market by quality exported relative to total number of differentiated products exported).

The other *IMQ* coefficients show a null statistically significant correlation between *IMQ* with the number of products exported, number of exports' destination countries, number of products exported-destination countries, Herfindahl–Hirschman Index (HHI; squaring the share of each product-destination country observation in total annual firms' exports and then summing the obtained numbers), differentiated products export share and profit rate. Also, there is a null statistically significant correlation between *IMQ* and imported-related variables (simple average of imported inputs' unit value and imported inputs share relative to sales cost).

[25]It was calculated based on Data Envelopment Analysis (DEA), which is an optimisation procedure which allows to measure firms' efficiency when converting inputs into outputs (Demerjian et al., 2012). For this calculation, it was assumed decreasing returns to scale. The inputs included were sales cost, operating expenses, change in property, plant, equipment, and change in non-tangible assets. The output was operating income. The calculation was done for each industry (ISIC 3 digit)-year. See Table A6 for descriptive statistics.

[26]Dimensionality reduction techniques, like principal components, are not implemented because principal component regression's coefficients could present biases since the eigenvector's weights depend on X and not on the dependent variable, among other reasons (Artigue & Smith, 2019; Hadi & Ling, 1998).

[27]SD of UV residuals=0.6, SD of Q residuals=1.01. Range of UV residuals=16.22, Range of Q residuals=17.73.

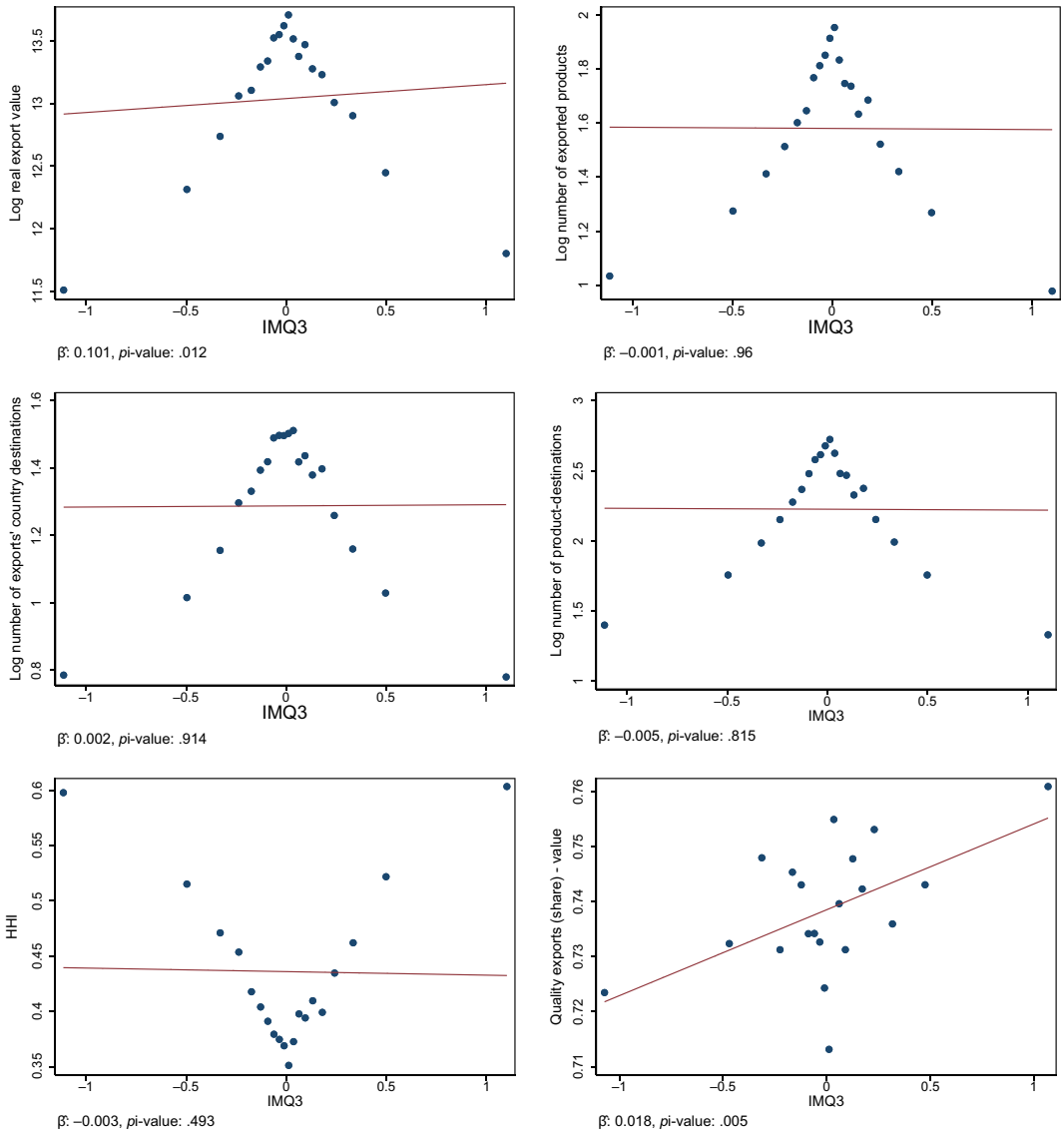

FIGURE 4 Binned scatter plots between international managerial quality 3 and international firm performance measures. *Note*: Profit rate is defined as operating profit relative to operating income. *Quality exports (share)—value* is defined as export value of goods that compete in the international market by quality relative to total differentiated products' export value. *Quality exports (share)—number* is defined as the number of products that compete in the international market by quality exported relative to a total number of differentiated products exported. The *Herfindahl–Hirschman Index (HHI)* is calculated by squaring the share of each product-destination country observation in total annual firms' exports and then summing the obtained numbers. The number of the international managerial quality (*IMQ*3) denotes the column of the unit value and quantity regressions from which the residuals to calculate *IMQ* are obtained (see Tables 2 and 3, and Equations 4–7). [Colour figure can be viewed at wileyonlinelibrary.com]

Surprisingly, Figure 5 shows that *IMQ* is not statistically correlated with most of the explanatory variables included in its calculation (operating expenses, fixed assets, non-tangible assets, TFP and firm efficiency). This null correlation between *IMQ* and firm size measures indicates

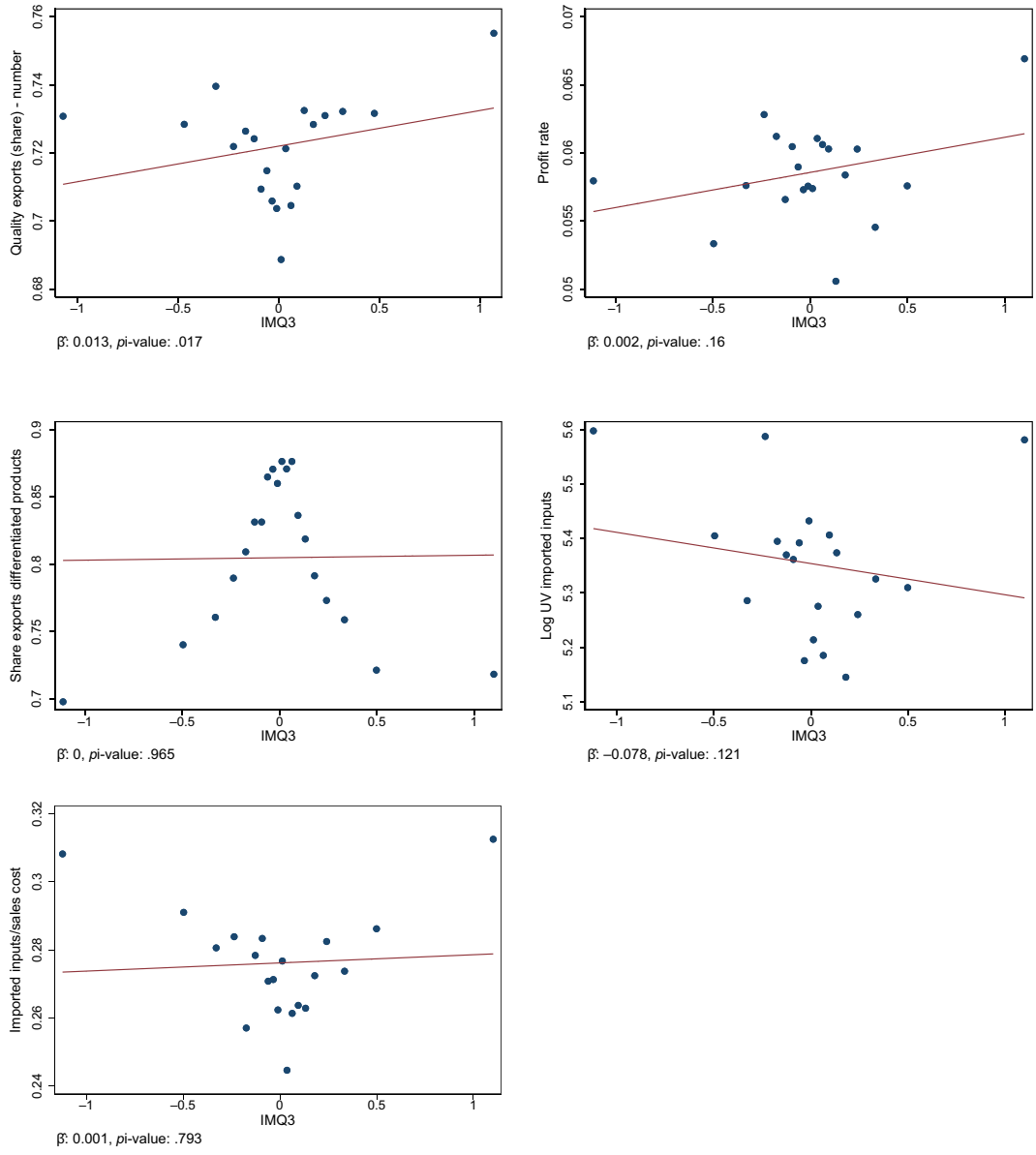

FIGURE 4 (Continued)

that the metric developed in this paper does not increase simply because the firm is bigger. On the contrary, the metric identifies that, compared with bigger firms, smaller firms could have better international managerial quality.

4.3 | International firm performance regression

The international firms' performance baseline regression is defined as follows:

$$Y_{ft} = \beta_0 + \beta_1 IMQ_{ft} + \beta_1 GD_{ft} + \Gamma X_{ft} + \partial_f + \partial_{st} + u_{ft} \quad (8)$$

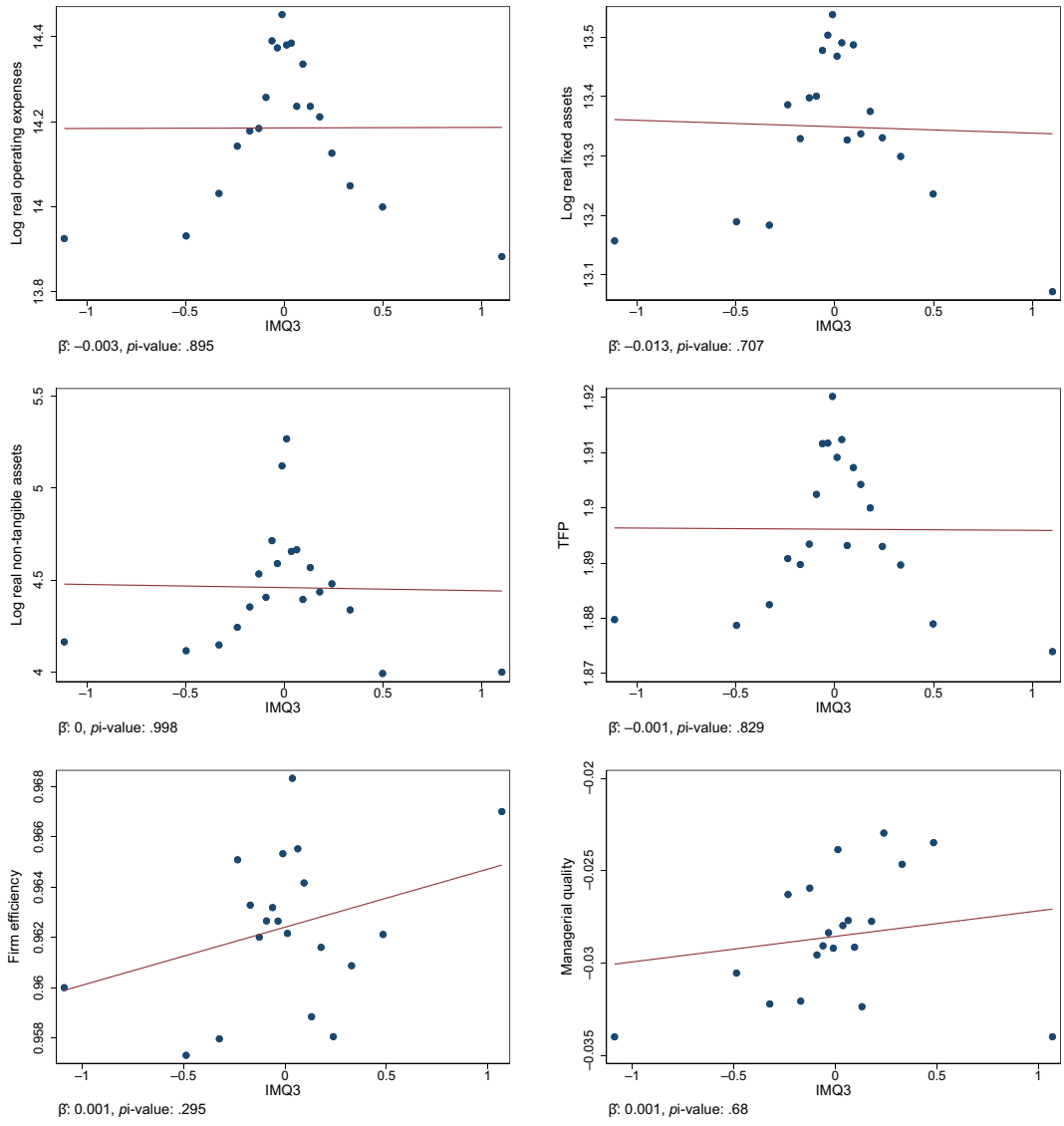

FIGURE 5 Binned scatter plots between international managerial quality 3 and explanatory variables. *Note*: The number of the international managerial quality (*IMQ*3) denotes the column of the unit value and quantity regressions from which the residuals to calculate *IMQ* are obtained (see Tables 2 and 3, and Equations 4–7). TFP is calculated based on Levinsohn and Petrin (2003) methodology (Table A4). Firm efficiency is calculated based on Demerjian et al. (2012); the variable is measured relative to the most efficient firm in each industry (ISIC 3-digit) for each year, and it was calculated assuming decreasing returns to scale. Managerial quality is calculated as the residual of a Tobit regression of firm efficiency on a set of firm-level explanatory variables (Demerjian et al., 2012; Table A5). [Colour figure can be viewed at wileyonlinelibrary.com]

where firm outcomes Y cover the 11 dependent variables as previously defined and graphed: (i) log real export value, (ii) log number of products exported, (iii) log number of export's destination countries, (iv) log number of products exported-destination countries pairs, (v) Herfindahl–Hirschman Index (HHI) for exports, (vi) quality exports share (value), (vii) quality exports share (number), (viii) profit rate, (ix) differentiated commodities export share, (x) log simple average of imported inputs' unit value and (xi) imported inputs share relative to sales cost. IMQ_{ft} is the international managerial quality described in Equation 7 calculated with the residuals from the third *EUV-Q* regressions

(column 3 of Tables 2 and 3). X_{ft} is a vector of firm-level characteristics including log fixed assets, log non-tangible assets, log operating expenses[28] and TFP clean of the international management component.[29]

GD_{ft} measures the magnitude that the global market demands for the products exported by each firm. It is defined as $GD_{ft} = \ln\left(\sum_{kp} ID_{kpt} * share\_exp_{fpk,t=0}\right)$, where $share\_exp_{fpk,t=0}$ is the share of product p (HS 6-digit) exported to country k in total exports of firm f in its first sample year ($t=0$), and ID_{kpt} is the total import value from country k of product p in year t excluding Colombian exports.[30] By construction, it is exogeneous from manager decision. The inclusion of this objective international market condition variable defined at the firm level permits to estimate international firm performance sensitivity to international market conditions of the products that firms export. ∂_f is firm fixed effects and ∂_{ts} is industry (ISIC 3 digit) -year fixed effects, which absorb annual industry shocks allowing comparisons within industry-year. Robust standard errors are clustered at the firm level. Table A6 presents descriptive statistics for all dependent and independent variables included in the regressions.

The main coefficient of interest $\widehat{\beta_1}$ is consistent if *IMQ* is strictly exogenous (*IMQ* at a given time period is uncorrelated with the error term at any given time period). That is, *IMQ* should capture a resilient international managerial quality component not affected by present or past shocks in non-observable international firm performance determinants u_{ft}. Although it is difficult to fully satisfy this condition since there is no exogeneous *IMQ* variation, the Wooldridge test does not reject the null hypothesis of *IMQ* strict exogeneity[31] for all 11 dependent variables (*pi*-values $>.1$[32]) and Figure 6 shows that *IMQ* is non-statistically correlated with observable international demand shocks GD_{ft}. Therefore, $\widehat{\beta_1}$ identifies a strong correlation between *IMQ* and the dependent variables (not necessarily causal claims) in the worst scenario.

Two econometric issues emerge from this specification. First, *IMQ* could be measured with error because it is a proxy variable constructed from regression residuals. For this reason, baseline firm performance regression (Equation 8) includes *IMQ*3, which is the international managerial quality variable calculated with the *EUV-Q* regressions that, as previously explained, could have the lowest specification error. In terms of *IMQ* coefficient's statistical significance and magnitude, Jennings et al. (2023) found that a combination of one variable with measurement error and fixed effects with a higher absorption level[33] could distort inferences (falsely rejecting a true null hypothesis). As the absorption rate of fixed effects described in Equation 8 with the international managerial qualities is on average 10%[34] – way below the 90% threshold identified by Jennings et al. (2023)-, the *IMQ* coefficient's statistical significance is reliable. Also, Jennings

[28]As it was explained above, firm-level variables were calculated as Log $(x+1)$ in order to include firms that report \$0 in any variable, particularly non-tangible assets.

[29]It is calculated as the residual of a regression of TFP on international managerial quality as in Bloom et al. (2021).

[30]The results are robust when $Log\ global\ demand\ exp_{ft} = \sum_{kp}\left(ln\left(ID_{kpt}\right) * share\_exp_{fpk,t=0}\right)$.

[31]It is added $\delta\ IMQ_{ft+1}$ to Equations 8 and then it is tested under the null hypothesis $Ho: \delta = 0$.

[32]*P*i-value of the Wooldridge test for strict exogeneity for the 11 dependent variables as cited and ordered above are: 0.27, 0.10, 0.57, 0.34, 0.17, 0.46, 0.29, 0.92, 0.87, 0.51, 0.99.

[33]The absorption rate is defined as the *R*-squared from a regression of the independent variable of interest on fixed effects. In this case, international managerial quality on firm and industry–year fixed effects.

[34]All absorption rates of the fixed effects described in Equation 8 with the international managerial qualities are below 30% (29.5%, 6.2%, 6%, 6.2%, 6.5%, 6.5%).

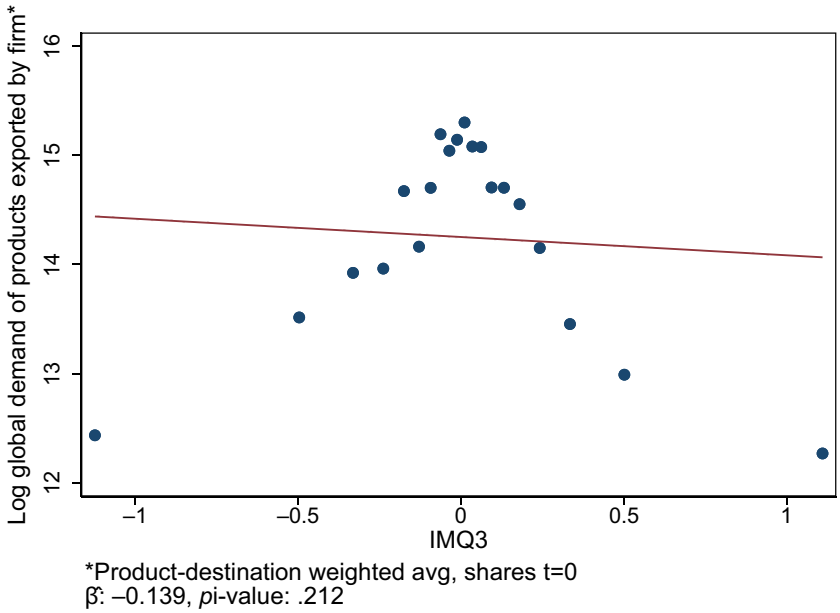

FIGURE 6 Binned scatter plot between international managerial quality and exogenous global demand shocks. *Note*: The *y* axis variable is defined as $GD_{ft} = ln\left(\sum_{kp} ID_{kpt} * share\_exp_{fkp,t=0}\right)$, where $share\_exp_{fkp,t=0}$ is the share of product *p* (HS 6-digit) exported to country *k* in total exports of firm *f* in its first sample year, and ID_{kpt} is the import value from country *k* of product *p* in year *t* excluding Colombian exports. International managerial quality in *x* axis is defined as in Equation 7. [Colour figure can be viewed at wileyonlinelibrary.com]

et al. (2023) show that the attenuation effect could vanish or even flip to a positive bias if the *IMQ*'s measurement error is correlated with the explanatory variables *X*. As it is non-possible to determine empirically the existence of this correlation, the *IMQ* coefficient is interpreted assuming null attenuation effect.

Second, the standard errors could be understated because the independent variable of interest (*IMQ*) is a generated regressor and is, therefore, subject to sampling error. Although Chen et al. (2023) prove that the standard error bias does not occur when the generated regressor is calculated based on residuals and absolute residuals, *IMQ* is generated based on a particular residuals' calculation which varies according to the product's type and competition's type, as it was explained before. Consequently, $\widehat{\beta_1}$'s standard error is calculated through pairs cluster bootstrapping in order to correct the potential standard error bias, following the procedure explained by Chen et al. (2023) covering the first and second step regressions.[35] These standard errors act as a robustness check of the baseline standard errors clustered at the firm level.

Additionally, the firm's equity was added as an additional dependent variable in order to check that *IMQ* does not have a statistically significant effect on variables that theoretically should not affect (placebo).

[35]'(1) create a bootstrap sample by randomly drawing with replacement K clusters from the original sample (....); (2) estimate the first-step regression using the bootstrap sample; (3) use the first-step regression output to obtain the generated regressor; (4) estimate the second step regression using the bootstrap sample and the generated regressor, and store all the coefficient estimates; (5) repeat this process a large number of times; (6) record the variance of the collected coefficient estimates' (Chen et al., 2023, p.545).

5 | RESULTS

Table 4 shows the international firms' performance regression results (Equation 8). Column 1 indicates that a 1% increase in international managerial quality (*IMQ*3) raises the firm's export value by 0.1193%. This magnitude is economically considerable; the back-in-the-envelope calculation indicates that one standard deviation increase in the international managerial quality (0.4484) would boost the firms' exports annual growth rate 1.73 times (0.045 relative to 0.0260).[36] On the contrary, international managerial quality does not impact significatively any extensive margin measure (columns 2–5), contradicting previous empirical findings (Bloom et al., 2021).

This null *IMQ*3 effect on extensive margin measures should be interpreted within a framework in which better-managed firms do not export more quantity of products but rise both quality export shares (export value and number, see columns 6 and 7), implying exports' replacement (products that compete by quality over products that compete by price). In terms of magnitude, column 6 coefficient (0.0125) indicates that one standard deviation increase in the international managerial quality of firms that export differentiated goods (0.4354) would boost the firms' quality export share (value) annual growth 5.6 times (0.004499 relative to 0.0008033)[37]. This considerable magnitude points out managers as a fundamental pillar to boost high-quality products' exports, which could foster long-run economic growth: 'countries that latch on to higher productivity goods will perform better' (Hausmann et al., 2007, p. 3). Also, this finding is suggesting evidence in favour of the *Alchian–Allen* theorem described in the introduction.[38]

International managerial quality has also a positive and significant effect on profit rate (column 8). Its magnitude (0.0025) indicates that one standard deviation increase in the international managerial quality (0.4480) would boost the firms' profit rate in 0.00095,[39] which is around one fifth of the average annual profit rate's downward trend (−0.0044). Consequently, *IMQ* is a relevant profit rate determinant even that exports account on average for 20% of the operating income. Besides, *IMQ* impacts negatively and statistically significatively the imported inputs' unit value and does not affect the import input share (columns 10 and 11), which could be explained by better internationally managed firms importing more quantity of cheaper substitute inputs.

Most of the results described so far hold up different robustness checks relative to the *IMQ* calculation: (i) *IMQ* calculated with residuals $\widehat{\in}_{pkft}$ and $\widehat{w}_{pkft}$ obtained from different export unit value and quantity regressions (*IMQ*1, *IMQ*2, *IMQ*4, *IMQ*5 and *IMQ*6[40], see Table 4), (ii) *IMQ* calculated based on the median, instead of the simple average, of the modified residuals (Table A8), (iii) *IMQ* calculated based on the modified residuals' simple average in which $\widehat{\in}_{pkft}$ and $\widehat{w}_{pkft}$ are standardised (Table A9). The statistical significance of the coefficients is also robust when standard errors are calculated based on the pairs cluster bootstrapping procedure for both steps described by Chen et al. (2023); Table 5 shows the results with 2500 replications.[41] Finally, none *IMQ* has a significative effect on firms' equity (placebo) as expected.

[36] $1.73 = (((1+0.4484)^{0.119})-1)/0.0260$.

[37] $5.62 = (0.0125 * \ln(1+0.4354))/0.0008033$.

[38] However, its formal proof would require collecting detailed freight data and performing specific econometric analysis.

[39] $0.00095 = 0.00259 * \ln(1+0.4480)$.

[40] The number of the international managerial quality (IMQ) denotes the column of the unit value and quantity regressions from which the residuals to calculate IMQ are obtained (see Tables 2 and 3, and Equations 4–7).

[41] Second stage sample size is on average 69% of the baseline specification's sample size. This lower sample size is explained because some firms' observations in the customs data are not selected when the clustered bootstrapped samples with replacement are generated in the first step, which leads to a lower number of firms in the second step.

TABLE 4 International managerial quality impact on international firms' performance.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Variables	**Log export value**	**Log No. products exported**	**Log No. destination countries**	**Log No. products-destination**	**HHI[a]**	**Quality exports (share) - value[b]**	**Quality exports (share) – number[c]**	**Profit rate[d]**	**Share export differentiated commodities[e]**	**Log average UV imported inputs**	**Import value share[f]**	**Equity (P*)**
*IMQ*1	0.170***	−0.0375***	−0.00266	−0.0358***	−9.12e-05	0.0125***	0.00843***	0.00127*	−0.00572***	0.0132	−0.00181*	0.00361
	(0.0153)	(0.00578)	(0.00354)	(0.00613)	(0.00193)	(0.00230)	(0.00215)	(0.000710)	(0.00185)	(0.0143)	(0.00102)	(0.00329)
Observations	23,738	23,738	23,738	23,738	23,738	21,550	21,550	23,642	23,738	19,377	19,377	23,738
*IMQ*2	0.142***	−0.0202**	0.00574	−0.0180*	0.00110	0.0104***	0.00475	0.00200*	−0.00222	−0.0446	0.000765	0.000707
	(0.0222)	(0.00829)	(0.00634)	(0.00926)	(0.00313)	(0.00327)	(0.00295)	(0.00117)	(0.00218)	(0.0290)	(0.00180)	(0.00552)
Observations	20,361	20,361	20,361	20,361	20,361	18,644	18,644	20,299	20,361	16,563	16,563	20,361
*IMQ*3	0.119***	−0.00388	0.0115	−0.00144	−0.00241	0.0125***	0.00781**	0.00259*	−0.00322	−0.0794**	0.00158	0.00152
	(0.0219)	(0.00877)	(0.00719)	(0.00978)	(0.00348)	(0.00385)	(0.00331)	(0.00133)	(0.00232)	(0.0342)	(0.00196)	(0.00643)
Observations	18,931	18,931	18,931	18,931	18,931	17,474	17,474	18,879	18,931	15,378	15,378	18,931
*IMQ*4	0.127***	−0.00316	0.0143**	0.00173	−0.00264	0.0121***	0.00789**	0.00292**	−0.00291	−0.0784**	0.00130	0.00399
	(0.0217)	(0.00875)	(0.00726)	(0.00980)	(0.00346)	(0.00385)	(0.00330)	(0.00135)	(0.00233)	(0.0343)	(0.00198)	(0.00648)
Observations	18,941	18,941	18,941	18,941	18,941	17,482	17,482	18,889	18,941	15,387	15,387	18,941
*IMQ*5	0.113***	−0.00271	0.0114	−2.27e-05	−0.00350	0.0147***	0.00929**	0.00185	−0.00275	−0.0778**	0.00186	−0.000842
	(0.0227)	(0.00984)	(0.00772)	(0.0109)	(0.00393)	(0.00438)	(0.00372)	(0.00144)	(0.00253)	(0.0384)	(0.00214)	(0.00640)
Observations	15,604	15,604	15,604	15,604	15,604	14,450	14,450	15,561	15,604	12,873	12,873	15,604
*IMQ*6	0.113***	−0.00264	0.0114	4.08e-05	−0.00350	0.0147***	0.00926**	0.00189	−0.00274	−0.0779**	0.00186	−0.000860
	(0.0227)	(0.00984)	(0.00772)	(0.0109)	(0.00393)	(0.00438)	(0.00371)	(0.00144)	(0.00253)	(0.0384)	(0.00213)	(0.00640)
Observations	15,604	15,604	15,604	15,604	15,604	14,450	14,450	15,561	15,604	12,873	12,873	15,604
X	Log GD (global demand of products exported by firm—product-destination weighted avg, shares $t=0$), log fixed assets, log non-tangible assets, log operating expenses and TFP clean of the international management component[g]											

(Continues)

TABLE 4 (Continued)

Variables	(1) Log export value	(2) Log No. products exported	(3) Log No. destination countries	(4) Log No. products-destination	(5) HHI[a]	(6) Quality exports (share) - value[b]	(7) Quality exports (share) – number[c]	(8) Profit rate[d]	(9) Share export differentiated commodities[e]	(10) Log average UV imported inputs	(11) Import value share[f]	(12) Equity (P*)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors clustered at firm level in parentheses. The number of the international managerial quality (*IMQ*) denotes the column of the unit value and quantity regressions from which the residuals to calculate *IMQ* are obtained (see Tables 2 and 3, and Equations 4–7). ***$p < .01$, **$p < .05$, *$p < .1$.

Abbreviations: *P**, placebo test; UV, unit value.

[a]Calculated by squaring the share of each product-destination country observation in total firms' exports by year and then summing the obtained numbers.

[b]Export value of products that compete in the international market by quality relative to total differentiated products' export value.

[c]Number of products that compete in the international market by quality exported relative to total number of differentiated products' exported.

[d]Operating profit relative to operating income.

[e]Differentiated products' export value relative to total export value.

[f]Imported inputs relative to sales cost.

[g]TFP (excluding int management component) is the residual of a regression of TFP on international managerial quality.

TABLE 5 International managerial quality impact on international firms' performance (bootstrap standard errors).

Variables	(1) Log real export value	(2) Log No. products exported	(3) Log No. destination countries	(4) Log No. products-destination countries	(5) HHI exports[a]	(6) Quality exports (share) – value[b]
*IMQ*3	0.113***	−0.004	0.008	−0.003	−0.002	0.011***
	(0.0237)	(0.0097)	(0.0078)	(0.0108)	(0.0037)	(0.0041)
X	Log GD (global demand of products exported by firm – product-destination weighted avg, shares $t=0$), log fixed assets, log non-tangible assets, log operating expenses and TFP clean of the international management component[g]					
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Average number of observations second step	13,025	13,025	13,025	13,025	13,025	11,945
Share number of observations relative to the baseline sample size	0.69	0.69	0.69	0.69	0.69	0.68
Average number of observations first step	440,652	440,652	440,652	440,652	440,652	440,652
Share number of observations relative to the baseline sample size	1.59	1.59	1.59	1.59	1.59	1.59
Number of replications	2500	2500	2500	2500	2500	2500

Variables	(7) Quality exports (share) – number[c]	(8) Profit rate[d]	(9) Share export differentiated goods[e]	(10) Log average UV imported inputs	(11) Imported value share[f]	(12) Equity (P^*)
*IMQ*3	0.007**	0.003**	−0.003	−0.081**	0.001	0.003
	(0.0034)	(0.0015)	(0.0026)	(0.0369)	(0.0022)	(0.0070)

(Continues)

TABLE 5 (Continued)

Variables	(7) Quality exports (share) – number[c]	(8) Profit rate[d]	(9) Share export differentiated goods[e]	(10) Log average UV imported inputs	(11) Imported value share[f]	(12) Equity (*P**)
X	Log GD (global demand of products exported by firm – product-destination weighted avg, shares $t=0$), log fixed assets, log non-tangible assets, log operating expenses and TFP clean of the international management component[g]					
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Average number of observations second step	11,945	12,980	13,025	10,592	10,592	13,025
Share number of observations relative to the baseline sample size	0.68	0.69	0.69	0.69	0.69	0.69
Average number of observations first step	440,652	440,652	440,652	440,652	440,652	440,652
Share number of observations relative to the baseline sample size	1.59	1.59	1.59	1.59	1.59	1.59
Number of replications	2500	2500	2500	2500	2500	2500

Note: Bootstrap standard error in parentheses calculated based on the pairs cluster bootstrap procedure for both steps described by Chen et al. (2023). Cluster: firm level. ***$p<.01$, **$p<.05$, *$p<.1$.

Abbreviations: *P**, placebo test.

[a]Calculated by squaring the share of each product-destination country observation in total annual firms' exports by year and then summing the obtained numbers.

[b]Export value of products that compete in the international market by quality relative to total differentiated products' export value.

[c]Number of products that compete in the international market by quality exported relative to total number of differentiated products exported.

[d]Operating profit relative to operating income.

[e]Export value of differentiated products relative to total export value.

[f]Imported inputs relative to sales cost.

[g]TFP (excluding int management component) is the residual of a regression of TFP on international managerial quality.

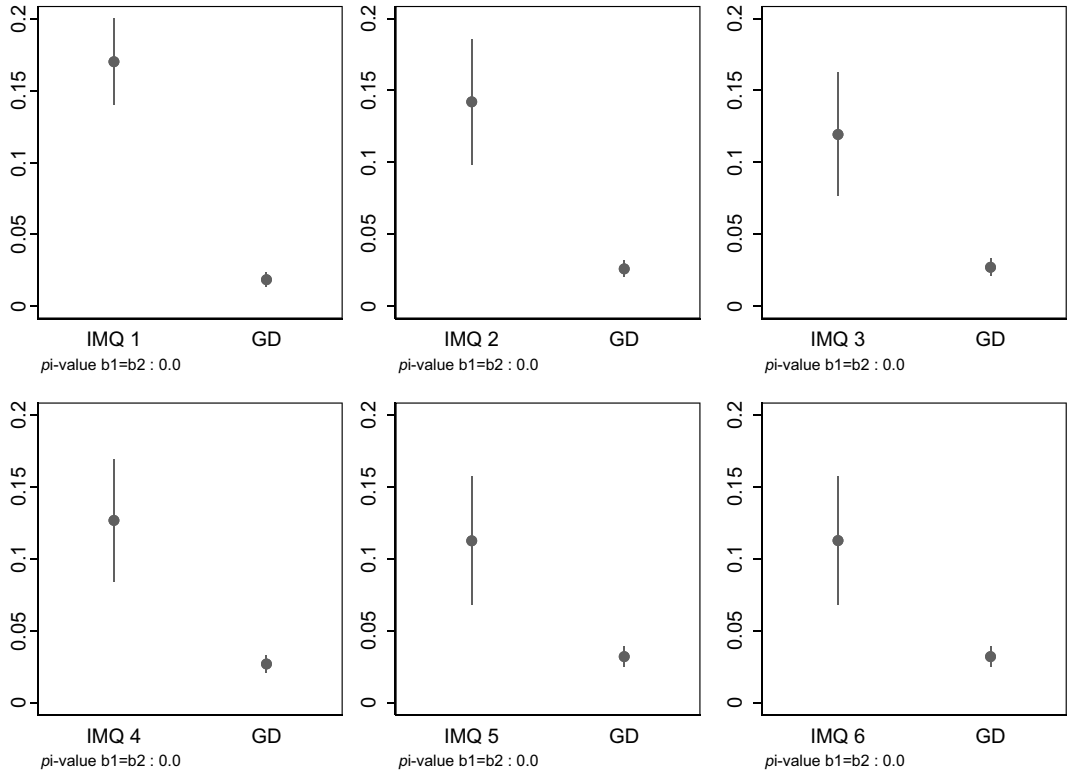

FIGURE 7 International managerial quality and global demand shocks impact on export value. *Note* 1. This graph shows the 95% confidence intervals of the international managerial quality coefficient (β_1) and global demand (GD) of products exported by the firm coefficient (β_2) on log real export value. $\Gamma X_{ft} + \partial_f + \partial_{st}$ are included as other explanatory variables in the regressions (see Equation 8). *Note* 2. Global demand of products exported by firm (GD) is defined as: $GD_{ft} = ln\left(\sum_{kp} ID_{kpt} * share\_exp_{fpk,t=0}\right)$, where $share\_exp_{fpk,t=0}$ is the share of product p exported to country k in total exports of firm f in its first sample year, and ID_{kpt} is the imported value from country k of product p in year t excluding Colombian exports. *Note* 3. The number of the international managerial quality (*IMQ*) denotes the column of the unit value and quantity regressions from which the residuals to calculate *IMQ* is obtained (see Tables 2 and 3, and Equations 4–7). [Colour figure can be viewed at wileyonlinelibrary.com]

In comparative terms, non-tangible assets are the variable that determines in lower proportion the international firm performance among those included in the vector X (Table A7), suggesting that non-traditional intangible assets -such as the organisational capital measured in *IMQ*- is a more relevant international firms' performance determinant than traditional non-tangible assets measured in the financial statements. Nonetheless, this result could underestimate the intangible asset effect because of the limitations in their measurement (Crouzet et al., 2022). In fact, 59% of the big private Colombian exporting firms report null intangible assets.

Also, Figure 7 shows that *IMQ* coefficients are statistically five (5) times larger than the coefficients that measure the magnitude that the global market demands for the products exported by the firm. This result indicates that endogenous international managerial quality improvements can boost export value in a higher magnitude than exogenous improvements in international market conditions. This finding is robust to different international managerial quality definitions.

Future research could incorporate a managerial team objective function into theoretical models which optimise organisational capital investment depending on the product exported

type (differentiated and homogeneous) and competition type (quality and price); this would allow optimal managerial team behaviour to be derived. One first step could be to extend Bloom et al. (2021) theoretical model endogenising the firm-product-specific expertise level vector $\lambda_i \epsilon (0, \infty)$. In addition, it is suggested to include imports in the theoretical analysis in order to analyse the transmission mechanisms driven by the counter-intuitive negative *IMQ* effect on imported input quality.

6 | CONCLUSION

Big exporting firms have incentives to implement different managerial practices for selling goods in the international and local markets. However, specialised management surveys do not include questions about those differences and statistical methodologies to measure international managerial skills are similarly scarce. In order to fill this literature gap, this paper proposes a two-step methodology to measure firms' managerial practices quality specifically geared to the international market and to calculate its impact on international firm performance.

Based on some theoretical elements from Bloom et al. (2021), the Rauch (1999) product classification and an extended Baldwin and Ito (2011) methodology to classify international products' competition type (price or quality), it is assumed that managerial teams categorise products exported in three groups and implement different managerial practices on each group in order to rise firms' export proficiency: (i) *quality capacity* policies aimed at upgrading the quality (ergo, the export price) of the differentiated products that compete on quality, (ii) *production efficiency* policies aimed at exporting cheaper the differentiated products that compete on price and (iii) *production efficiency* policies aimed at exporting higher homogeneous products' quantity.

Under this theoretical assumption, international managerial quality is empirically calculated as the average of a residuals group conformed by export unit value regressions residuals for differentiated products (multiplied by −1 for products that compete on price) and quantity regression residuals for homogeneous goods. In a second step, the international managerial quality is included as explanatory variable in international firms' performance regressions. Specific econometric issues associated with two-step estimations (model misspecification, measurement error and sampling error) are discussed and minimised.

Three conclusions emerge from the research. First, higher international managerial quality impacts positively on the firm's export value and profit rate. Second, better managerial team in the international market do not increase the number of products exported but rise both quality export shares (number and value), indicating that they upgrade the export baskets' quality replacing products that compete on price by products that compete on quality. These results challenge traditional policy recommendations of increasing exports' extensive margin but support traditional policy recommendations of upgrading exports' quality. Finally, endogenous international managerial quality improvement is around 5 times more relevant than exogeneous favourable international shocks to boost firms' exports. In conclusion, the managerial team constitutes a fundamental pillar to lift the international firm performance.

It is suggested for future research to develop a theoretical model to describe these empirical findings. Also, it is recommended to correlate *IMQ* with compensation data to assess if better managers—measured under the methodology proposed herein—receive higher remuneration, and to estimate globalisation market and non-market returns (see Keller & Olney, 2021). Furthermore, it is suggested to deep into the non-traditional intangible assets' measurement (such as organisational capital and the firm's culture and structure), which could be more relevant to international

firm performance determinants than traditional intangible assets measured in the financial statements. Lastly, it is suggested that specialised management quality surveys, like WMS and GMOP, include questions about international managerial practices and whether (and how) firms learn by exporting.

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APPENDIX A

TABLE A1 Literature review—16 most influential business export empirical research.

Num	Paper	Title	Country	Sample
1	Bilwey and Tesar (1977)	The export behaviour of smaller-sized Wisconsin manufacturing firms	US	423 small and medium-sized Wisconsin manufacturing firms
2	Bonaccorsi (1992)	On the relationship between firm size and export intensity	Italy	Nationwide sample of manufacturing firms
3	Cavusgil (1984b)	Differences among exporting firms based on their degree of internationalisation	US	70 midwestern manufacturers(personal interviews with the executives)
4	Cavusgil and Nevin (1981)	Internal determinants of export marketing behaviour—An empirical investigation	US	A sample of 816 firms was systematically selected from the 4701 manufacturing firms listed in the classified directory of Wisconsin Manufacture
5	Bello and Gilliland (1997)	The effect of output controls, process controls and flexibility on export channel performance	US	A series of 20 in-depth field interviews were conducted with export executives ($n = 375$)
6	Reuber and Fischer (1997)	The influence of management team's international experience on internationalisation behaviours of SMEs	Canada	Firms to be contacted were identified from a directory of Canada's premier software product firms. The directory listed 164 firms
7	Cooper and Kleinschmidt (1985)	The impact of export strategy on export sales performance	Canada	Managers of 142 firms in the Canadian electronics industry were personally interviewed to obtain data on export strategies and performance
8	Wiedersheim et al. (1978)	Pre-export activity—The first step in internationalisation	Australia	The investigation involved a survey of 75 Australian manufacturing firms in five different city locations
9	Cavusgil (1984a)	Organisational characteristics associated with export activity	US	A total of 816 companies had been systematically selected from the 4701 companies listed in the classified directory of manufacturers in Wisconsin, U.S.A.

TABLE A1 (Continued)

Num	Paper	Title	Country	Sample
10	Cavusgil et al. (1993)	Product and promotion adaptation in export ventures—An empirical investigation	US	In-depth personal interviews were conducted in the midwestern United States (Illinois, Indiana, Michigan, Ohio and Wisconsin) ($n = 202$)
11	Dicthl et al. (1990)	International orientation as a precondition for export success	Germany	104 firms (interviews with managers)
12	Cavusgil and Naor (1987)	Firm and management characteristics as discriminators of export marketing activity	US	The sampling frame consisted of 795 firms listed in the 1978 Maine Marketing Directory
13	Kujawa and Simpson (1974)	The export decision process: An empirical inquiry	UK	The sample was drawn from the 2047 units selected from UK manufacturing firms through a random stratified procedure
14	Denis and Depelteau (1985)	Market knowledge diversification and export expansion	Canada	The researchers had access to a data bank of 331 small and middle-sized manufacturing firms located in Quebec
15	Madsen (1989)	Successful export marketing management: Some empirical evidence	Denmark	82 manufacturing firms participated in the survey
16	Reid (1984)	Information acquisition and export entry decision in small firms	Canada	89 small indigenous enterprises in Ontario

Source: Leonidou et al. (2010). The 'sample' column was added by the author.

TABLE A2 Annual average descriptive statistics—big exporting firms and other exporting firms (2006–2014).

Variable	Big exporting firms	Other exporting firms	*p*i-value Coefficient[a]
Simple average export value per firm (real USD Dollars)	8,233,714	4,115,623	.000
Median export value per firm (real USD Dollars)	201,658	40,700	
Average HHI per firm	0.535	0.677	.000
Median HHI per firm	0.481	0.711	
Average number of products exported per firm	7.7	4.4	.000
Median number of products exported per firm	3.1	2.0	
Average number of exports' country destinations per firm	4.6	2.2	.000
Median number of exports' country destinations per firm	2	1	
Average number of products – country destinations per firm	17.96	7.22	.000
Median number of products – country destinations per firm	5	2.1	
Average number of firms	3434	4487	

Source: Colombian National Administrative Statistics Department (DANE by its acronym in Spanish), Colombian Companies Superintendence and authorial calculations. The export value was deflated based on the US GDP deflator.

[a]Regression was estimated for each variable on a dummy indicating if the firm is big exporting plus year fixed effects. The pi-value of the dummy variable coefficient is reported.

TABLE A3 Annual average descriptive statistics—big exporting firms and big non-exporting firms (2006–2014).

Variable	Big exporting firms	Big non-exporting firms	*p*i-value Coefficient[a]
Simple average property plant equipment (real USD dollars) per firm	7,210,654	1,251,854	.000
Median property plant equipment (real USD dollars) per firm	506,531	155,069	
Simple average non-tangible assets (real USD dollars) per firm	936,579	321,977	.000
Median non-tangible assets (real USD dollars) per firm	0	0	
Simple average operating expenses (real USD dollars) per firm	5,893,036	1,123,319	.000
Median operating expenses (real USD dollars) per firm	1,090,400	260,321	
Simple average TFP	1.887	1.824	.000
Median TFP	1.846	1.765	
Average number of firms	3434	20,490	

Source: Colombian Companies Superintendence and authorial calculations. The variables used in this dataset were deflated using an industry-specific annual Producer Price Index (PPI) reported by the Colombian Central Bank. TFP calculated with Levinsohn and Petrin (2003) methodology using '*prodest*' Stata command (Table A4).

[a]A regression was estimated for each variable on a dummy indicating if the firm is 'big exporting' plus industry-year fixed effects. The *p*i-value of the dummy variable coefficient is reported.

TABLE A4 TFP estimation.

Variables	(1) Log real operating income (USD)
Log real operating expenses (USD)	0.344***
	(0.00398)
Log real property, plant and equipment (USD)	0.0363***
	(0.00576)
Log real sales cost (USD)	0.556***
	(0.00941)
Observations	159,872
Number of groups	29,656

Note: TFP calculation based on Levinsohn and Petrin (2003) methodology and *prodest* Stata command (Mollisi & Rovigatti, 2018). *Free variable* is operating expenses, *state variable* is property plant and equipment and *proxy variable* is sales cost. The sample includes the biggest private Colombian firms (exporting and non-exporting). ***$p < .01$, **$p < .05$, *$p < .1$.

TABLE A5 Managerial quality estimation (traditional *firm efficiency* methodology).

Variables	(1) Firm efficiency (theta)[a]
Log real total assets (USD)	0.00262***
	(0.000398)
Market share[b]	0.689***
	(0.0501)
Free cash flow[c]/assets	0.00442***
	(0.000736)
Industry (ISIC 3 digit) fixed effects	Yes
Year fixed effects	Yes
Observations	24,802

Note: Robust standard errors in parentheses. ***$p < .01$, **$p < .05$, *$p < .1$.Tobit regression in which the dependent variable (firm efficiency) is left censored in 0 and right censored in 1. Managerial quality is the residual of this regression.

[a]Firm efficiency is measured with Data Envelopment Analysis (DEA), which is an optimisation procedure which allows to measure firms' efficiency when converting inputs into outputs (Demerjian et al., 2012). It is measured relative to the most efficient firm in each industry (ISIC 3 digit) in each year. For this calculation, it was assumed decreasing return to scale, the inputs included were sales cost, operating expenses, change in property, plant, equipment and change in non-tangible assets, and the output was operating income. See Table A6 for descriptive statistics.

[b]Firm operating income/industry operating income.

[c]Free Cash Flow = Operating income—CAPEX—Debt payment.

TABLE A6 Firm-level variables descriptive statistics (baseline regression sample).

Variable	Mean	p50	SD	Min	Max	*N*
International managerial quality 1	0.028	0.004	0.794	−7.026	7.359	18,882
International managerial quality 2	0.001	0.000	0.476	−5.836	5.786	18,594
International managerial quality 3	0.000	0.000	0.448	−4.986	5.043	18,931
International managerial quality 4	0.000	0.000	0.450	−4.979	5.076	18,931
International managerial quality 5	0.000	0.000	0.433	−4.342	5.046	15,641
International managerial quality 6	0.000	0.000	0.433	−4.342	5.046	15,641
ln (unit value)	3.347	2.837	2.769	−5.080	13.218	18,931
ln (export quantity)	8.759	8.775	3.239	−1.204	20.542	18,931
Log real export value (USD)	13.030	12.943	2.485	1.566	21.929	18,931
Log No. products exported	1.674	1.609	1.134	0.000	5.889	18,931
Log No. exports' country destinations	1.320	1.386	0.963	0.000	4.025	18,931
Log No. products-country destinations	2.306	2.303	1.342	0.000	7.030	18,931
HHI exports	0.418	0.336	0.288	0.014	1.000	18,931
Quality exports (share) – value	0.727	0.978	0.379	0.000	1.000	17,560
Quality exports (share) – number	0.710	0.778	0.307	0.000	1.000	17,560
Export value/operating income	0.202	0.081	0.266	0.000	1.000	18,931
Import value/sales cost	0.413	0.307	0.361	0.000	1.000	18,931
Profit rate	0.064	0.066	0.103	−0.989	0.854	18,885
Log global demand of products exported by firm (GD)	14.305	16.083	6.859	−6.420	26.696	18,931
Log real stock property, plant and equipment (USD)	13.411	13.362	2.145	3.527	22.898	18,931
Log real stock non-tangible assets (USD)	4.660	0.000	5.854	0.000	19.710	18,931
Log real operating expenses (USD)	14.283	14.126	1.591	6.490	19.946	18,931
Share 'differentiated goods' exports	0.794	1.000	0.361	0.000	1.000	18,931
Share 'referenced price' goods exports	0.130	0.000	0.296	0.000	1.000	18,931
Share 'organised trade exchange' goods exports	0.043	0.000	0.190	0.000	1.000	18,931
Share 'non-classified' goods exports	0.034	0.000	0.146	0.000	1.000	18,931
Firm efficiency	0.972	0.985	0.047	0.498	1.000	16,109
Managerial quality	−0.026	−0.013	0.085	−1.036	0.203	16,109
TFP	1.900	1.860	0.196	1.627	3.461	18,931
TFP 1 (excluding int management component)	0.008	−0.033	0.195	−0.277	1.569	18,882
TFP 2 (excluding int management component)	0.003	−0.037	0.194	−0.271	1.564	18,594
TFP 3 (excluding int management component)	0.004	−0.036	0.196	−0.270	1.565	18,931

TABLE A6 (Continued)

Variable	Mean	p50	SD	Min	Max	*N*
TFP 4 (excluding int management component)	0.004	−0.036	0.196	−0.271	1.564	18,931
TFP 5 (excluding int management component)	0.004	−0.036	0.195	−0.275	1.560	15,641
TFP 6 (excluding int management component)	0.004	−0.036	0.195	−0.275	1.560	15,641

Note 1: Global demand of products exported by firm (GD) is defined as: $GD_{ft} = ln\left(\sum_{kp} ID_{kpt} * share\_exp_{fpk,t=0}\right)$, where $share\_exp_{fpk,t=0}$ is the share of product p exported to country k in total exports of firm f in its first sample year, and ID_{kpt} is the imported value from country k of product p in year t excluding Colombian exports.

Note 2: The number of the international managerial quality (*IMQ*) denotes the column of the unit value and quantity regressions from which the residuals to calculate *IMQ* are obtained (see Tables 2 and 3, and Equations 4–7).

Note 3: Methodology to classify products that compete in the international market by price or quality is explained in Section 4.1.

Note 4: TFP calculation based on Levinsohn and Petrin (2003) methodology and the *prodest* Stata command (Mollisi & Rovigatti, 2018). See Table A4.

Note 5: TFP (excluding int management component) is the residual of a TFP regression on international managerial quality.

Note 6: Firm-level variables are defined as Log $(x+1)$ in order to include firms that report $0 in some variables, particularly, non-tangible assets.

TABLE A7 International managerial quality 3 impacts on international firms' performance.

Variables	(1) Log export value	(2) Log No. products exported	(3) Log No. destination countries	(4) Log No. products-destination	(5) HHI[a]	(6) Quality exports (share) – value[b]	(7) Quality exports (share) – number[c]	(8) Profit rate[d]	(9) Share export differentiated commodities[e]	(10) Log average UV imported inputs	(11) Import value share[f]	(12) Equity (P*)
*IMQ*3	0.119***	−0.00388	0.0115	−0.00144	−0.00241	0.0125***	0.00781**	0.00259*	−0.00322	−0.0794**	0.00158	0.00152
	(0.0219)	(0.00877)	(0.00719)	(0.00978)	(0.00348)	(0.00385)	(0.00331)	(0.00133)	(0.00232)	(0.0342)	(0.00196)	(0.00643)
Log global demand of products exported by firm (product-destination weighted avg, $t=0$)	0.0269***	0.0167***	0.0162***	0.0242***	−0.00520***	−0.000746	−3.97e-06	1.19e-05	−0.000108	0.00758*	−0.000449	−0.000645
	(0.00311)	(0.00156)	(0.00126)	(0.00171)	(0.000518)	(0.000540)	(0.000510)	(0.000174)	(0.000437)	(0.00455)	(0.000288)	(0.00104)
Log real stock property, plant and equipment (USD)	0.221***	0.0499***	0.0545***	0.0832***	−0.00824**	−0.00344	−0.00117	0.0123***	−0.00387	0.322***	−0.00575*	0.191***
	(0.0242)	(0.0124)	(0.00976)	(0.0137)	(0.00361)	(0.00344)	(0.00310)	(0.00220)	(0.00271)	(0.0434)	(0.00342)	(0.0126)
Log real stock non-tangible assets (USD)	0.00663**	0.00392***	0.00305***	0.00408**	−0.000795*	6.77e-05	−3.07e-05	0.000132	−0.000118	0.00425	−0.000150	0.00622***
	(0.00264)	(0.00151)	(0.00113)	(0.00162)	(0.000439)	(0.000470)	(0.000450)	(0.000180)	(0.000391)	(0.00448)	(0.000302)	(0.00115)
Log real operating expenses (USD)	0.346***	0.132***	0.104***	0.171***	−0.0207***	−0.00288	0.00372	−0.0157***	0.00654	0.251***	0.0293***	0.169***
	(0.0423)	(0.0207)	(0.0168)	(0.0240)	(0.00630)	(0.00552)	(0.00532)	(0.00561)	(0.00451)	(0.0803)	(0.00723)	(0.0243)
TFP (excluding int management component)[g]	3.529***	0.753***	0.608***	1.108***	−0.0677*	−0.0114	−0.0285	0.179***	−0.0551	1.389***	−0.188***	1.141***
	(0.289)	(0.129)	(0.105)	(0.150)	(0.0402)	(0.0438)	(0.0362)	(0.0299)	(0.0356)	(0.467)	(0.0482)	(0.142)
Observations	18,931	18,931	18,931	18,931	18,931	17,474	17,474	18,879	18,931	15,378	15,378	18,931
R-squared	.913	.864	.886	.893	.763	.871	.807	.630	.914	.699	.898	.970

TABLE A7 (Continued)

Variables	(1) Log export value	(2) Log No. products exported	(3) Log No. destination countries	(4) Log No. products-destination	(5) HHI[a]	(6) Quality exports (share) – value[b]	(7) Quality exports (share) – number[c]	(8) Profit rate[d]	(9) Share export differentiated commodities[e]	(10) Log average UV imported inputs	(11) Import value share[f]	(12) Equity (P*)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors in parentheses clustered at the firm level. ***$p < .01$, **$p < .05$, *$p < .1$. The number of the international managerial quality (*IMQ*) denotes the column of the unit value and quantity regressions from which the residuals to calculate *IMQ* are obtained (see Tables 2 and 3, and Equations 4–7).

Abbreviations: *P**, placebo test; UV, unit value.

[a]Calculated by squaring the share of each product-destination country observation in total firms' annual exports and then summing the obtained numbers.

[b]Export value of products that compete in the international market by quality relative to total differentiated products' export value.

[c]Number of products that compete in the international market by quality exported relative to total number of differentiated products exported.

[d]Operating profit relative to operating income.

[e]Export value of differentiated products relative to total export value.

[f]Imported inputs relative to sales cost.

[g]TFP (excluding int management component) is the residual of a TFP regression on international managerial quality.

TABLE A8 International managerial quality impact on international firms' performance (modified residuals' median).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Variables	**Log export value**	**Log No. products exported**	**Log No. destination countries**	**Log No. products-destination**	**HHI[a]**	**Quality exports (share) – value[b]**	**Quality exports (share) – number[c]**	**Profit rate[d]**	**Share export differentiated commodities[e]**	**Log average UV imported inputs**	**Import value share[f]**	**Equity (P*)**
*IMQ*1	0.164***	−0.0312***	−0.00132	−0.0300***	−0.000512	0.0122***	0.00800***	0.00150**	−0.00450**	0.00574	−0.00163*	0.00518
	(0.0151)	(0.00564)	(0.00353)	(0.00600)	(0.00191)	(0.00224)	(0.00207)	(0.000702)	(0.00181)	(0.0141)	(0.000985)	(0.00331)
Observations	23,738	23,738	23,738	23,738	23,738	21,550	21,550	23,642	23,738	19,377	19,377	23,738
*IMQ*2	0.153***	−0.0181**	0.00748	−0.0132	0.00108	0.0119***	0.00505*	0.00242**	−0.000892	−0.0540*	0.000774	0.00578
	(0.0232)	(0.00865)	(0.00650)	(0.00959)	(0.00325)	(0.00343)	(0.00305)	(0.00121)	(0.00222)	(0.0291)	(0.00182)	(0.00560)
Observations	20,361	20,361	20,361	20,361	20,361	18,644	18,644	20,299	20,361	16,563	16,563	20,361
*IMQ*3	0.135***	−0.00304	0.0162**	0.00365	−0.00282	0.0124***	0.00688**	0.00308**	−0.00293	−0.0771**	0.00151	0.00539
	(0.0232)	(0.00926)	(0.00753)	(0.0103)	(0.00369)	(0.00416)	(0.00350)	(0.00139)	(0.00239)	(0.0342)	(0.00201)	(0.00680)
Observations	18,931	18,931	18,931	18,931	18,931	17,474	17,474	18,879	18,931	15,378	15,378	18,931
*IMQ*4	0.141***	−0.00296	0.0187**	0.00621	−0.00298	0.0122***	0.00716**	0.00334**	−0.00261	−0.0769**	0.00122	0.00747
	(0.0230)	(0.00924)	(0.00760)	(0.0103)	(0.00367)	(0.00415)	(0.00349)	(0.00142)	(0.00239)	(0.0341)	(0.00204)	(0.00682)
Observations	18,941	18,941	18,941	18,941	18,941	17,482	17,482	18,889	18,941	15,387	15,387	18,941
*IMQ*5	0.126***	−0.00351	0.0132	0.00239	−0.00326	0.0157***	0.00899**	0.00237	−0.00227	−0.0780**	0.00187	0.00270
	(0.0244)	(0.0104)	(0.00811)	(0.0116)	(0.00421)	(0.00474)	(0.00393)	(0.00153)	(0.00255)	(0.0386)	(0.00216)	(0.00682)
Observations	15,604	15,604	15,604	15,604	15,604	14,450	14,450	15,561	15,604	12,873	12,873	15,604
*IMQ*6	0.126***	−0.00343	0.0131	0.00245	−0.00325	0.0157***	0.00895**	0.00239	−0.00227	−0.0780**	0.00188	0.00268
	(0.0244)	(0.0104)	(0.00810)	(0.0116)	(0.00421)	(0.00474)	(0.00392)	(0.00153)	(0.00255)	(0.0387)	(0.00216)	(0.00682)
Observations	15,604	15,604	15,604	15,604	15,604	14,450	14,450	15,561	15,604	12,873	12,873	15,604
X	Log GD (global demand of products exported by firm - product-destination weighted avg, shares $t=0$), log fixed assets, log non-tangible assets, log operating expenses and TFP clean of the international management component[g]											

TABLE A8 (Continued)

Variables	(1) Log export value	(2) Log No. products exported	(3) Log No. destination countries	(4) Log No. products-destination	(5) HHI[a]	(6) Quality exports (share) – value[b]	(7) Quality exports (share) – number[c]	(8) Profit rate[d]	(9) Share export differentiated commodities[e]	(10) Log average UV imported inputs	(11) Import value share[f]	(12) Equity (P*)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors clustered at firm level in parentheses. The number of the international managerial quality (*IMQ*) denotes the column of the unit value and quantity regressions from which the residuals to calculate *IMQ* are obtained (see Tables 2 and 3, and Equations 4–7). ***$p < .01$, **$p < .05$, *$p < .1$. *P**: placebo test. UV: Unit value.

[a]Calculated by squaring the share of each product-destination country observation in total firms' exports by year and then summing the obtained numbers.

[b]Export value of products that compete in the international market by quality relative to total differentiated products' export value.

[c]Number of products that compete in the international market by quality exported relative to total number of differentiated products exported.

[d]Operating profit relative to operating income.

[e]Export value of differentiated products relative to total export value.

[f]Imported inputs relative to sales cost.

[g]TFP (excluding int management component) is the residual of a regression of TFP on international managerial quality.

TABLE A9 International managerial quality impact on international firms' performance (modified residuals' average - standardised *EUV* and *Q* residuals).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Variables	**Log export value**	**Log No. products**	**Log No. destination countries**	**Log No. products-destination**	**HHI[a]**	**Quality exports (share) – value[b]**	**Quality exports (share) – number[c]**	**Profit rate[d]**	**Share export differentiated commodities[e]**	**Log average UV imported inputs**	**Import value share[f]**	**Equity (P*)**
*IMQ*1	0.203***	−0.0510***	−0.00391	−0.0497***	0.000721	0.0178***	0.0116***	0.00161	−0.00257	0.0155	−0.00219	0.00450
	(0.0219)	(0.00856)	(0.00515)	(0.00906)	(0.00283)	(0.00320)	(0.00297)	(0.00103)	(0.00246)	(0.0201)	(0.00153)	(0.00478)
Observations	23,738	23,738	23,738	23,738	23,738	21,550	21,550	23,642	23,738	19,377	19,377	23,738
*IMQ*2	0.0845***	−0.0212***	0.00192	−0.0204***	0.00205	0.00822***	0.00347	0.00151	0.000328	−0.0385*	0.000415	−0.000480
	(0.0177)	(0.00679)	(0.00508)	(0.00756)	(0.00254)	(0.00237)	(0.00217)	(0.000937)	(0.00169)	(0.0233)	(0.00145)	(0.00426)
Observations	20,361	20,361	20,361	20,361	20,361	18,644	18,644	20,299	20,361	16,563	16,563	20,361
*IMQ*3	0.0535***	−0.00648	0.00460	−0.00612	−0.000917	0.00728***	0.00423**	0.00163*	−0.000801	−0.0561**	0.00105	0.000495
	(0.0138)	(0.00571)	(0.00462)	(0.00634)	(0.00225)	(0.00227)	(0.00194)	(0.000851)	(0.00141)	(0.0219)	(0.00125)	(0.00403)
Observations	18,931	18,931	18,931	18,931	18,931	17,474	17,474	18,879	18,931	15,378	15,378	18,931
*IMQ*4	0.0563***	−0.00636	0.00576	−0.00500	−0.000980	0.00716***	0.00431**	0.00178**	−0.000705	−0.0557**	0.000916	0.00133
	(0.0137)	(0.00570)	(0.00464)	(0.00635)	(0.00225)	(0.00226)	(0.00193)	(0.000856)	(0.00141)	(0.0220)	(0.00125)	(0.00405)
Observations	18,941	18,941	18,941	18,941	18,941	17,482	17,482	18,889	18,941	15,387	15,387	18,941
*IMQ*5	0.0507***	−0.00646	0.00484	−0.00625	−0.00125	0.00861***	0.00525**	0.00121	−0.000400	−0.0550**	0.000959	−0.00121
	(0.0143)	(0.00640)	(0.00493)	(0.00709)	(0.00254)	(0.00254)	(0.00212)	(0.000930)	(0.00151)	(0.0243)	(0.00135)	(0.00416)
Observations	15,604	15,604	15,604	15,604	15,604	14,450	14,450	15,561	15,604	12,873	12,873	15,604
*IMQ*6	0.0508***	−0.00641	0.00485	−0.00620	−0.00126	0.00861***	0.00524**	0.00123	−0.000394	−0.0551**	0.000965	−0.00123
	(0.0143)	(0.00640)	(0.00493)	(0.00709)	(0.00254)	(0.00254)	(0.00212)	(0.000930)	(0.00151)	(0.0243)	(0.00135)	(0.00415)
Observations	15,604	15,604	15,604	15,604	15,604	14,450	14,450	15,561	15,604	12,873	12,873	15,604
X	Log GD (global demand of products exported by firm - product-destination weighted avg, shares $t=0$), log fixed assets, log non-tangible assets, log operating expenses and TFP clean of the international management component[g]											

TABLE A9 (Continued)

Variables	(1) Log export value	(2) Log No. products	(3) Log No. destination countries	(4) Log No. products-destination	(5) HHI[a]	(6) Quality exports (share) – value[b]	(7) Quality exports (share) – number[c]	(8) Profit rate[d]	(9) Share export differentiated commodities[e]	(10) Log average UV imported inputs	(11) Import value share[f]	(12) Equity (P*)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors clustered at firm level in parentheses.***$p < .01$, **$p < .05$, *$p < .1$. The number of the international managerial quality (*IMQ*) denotes the column of the unit value and quantity regressions from which the residuals to calculate *IMQ* are obtained (see Tables 2 and 3, and Equations 4–7). *P**: placebo test. UV: Unit value.

[a]Calculated by squaring the share of each product-destination country observation in total annual firms' exports by year and then summing the obtained numbers.

[b]Export value of products that compete in the international market by quality relative to total differentiated products' export value.

[c]Number of products that compete in the international market by quality exported relative to total number of differentiated products exported.

[d]Operating profit relative to operating income.

[e]Export value of differentiated products relative to total export value.

[f]Imported inputs relative to sales cost.

[g]TFP (excluding int management component) is the residual of a regression of TFP on international managerial quality.