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Abstract

This paper examines the relationship between digitalization and firms' participation in international trade in the Middle East and North Africa (MENA) region using World Bank Enterprise Surveys. We construct a firm-level digitalization index based on three observable practices: website ownership, receipt of electronic payments, and applications for fixed broadband connections. Binary logit estimates show a positive and statistically significant association between digitalization and international trade participation. In the full specification, a one-unit increase in the index is associated with a 19.89 percentage-point higher probability of participation. We then estimate a multinomial logit model distinguishing four mutually exclusive trade configurations: Domestic, Import only, Export only, and Two-way trader. The results reveal substantial heterogeneity across these configurations. Digitalization is most strongly associated with Two-way trader status. Wald tests show that the corresponding coefficient is significantly higher than for Import only firms, while the difference relative to Export only firms is not statistically significant. The evidence therefore supports H3 only partially. An IV-Probit specification provides a complementary sensitivity analysis but does not establish a definitive causal relationship. Finally, the positive association between digitalization and international trade participation is also observed across five other world regions, suggesting that the MENA pattern forms part of a broader empirical regularity.

Keywords: Digitalization, Firm heterogeneity, Global sourcing, International trade participation, MENA
JEL Classifications: F1, O1, L1

ملخص

تدرس هذه الورقة البحثية العلاقة بين الرقمنة ومشاركة الشركات في التجارة الدولية في منطقة الشرق الأوسط وشمال أفريقيا باستخدام مسوح المؤسسات التابعة للبنك الدولي. ونقوم ببناء مؤشر للرقمنة على مستوى الشركة يعتمد على ثلاث ممارسات قابلة للملاحظة: امتلاك موقع إلكتروني، واستلام المدفوعات الإلكترونية، وتقديم طلبات الحصول على اتصالات النطاق العريض الثابت. تُظهر تقديرات نموذج اللوجيت الثنائي وجود ارتباط إيجابي وذي دلالة إحصائية بين الرقمنة والمشاركة في التجارة الدولية. وفي التوصيف الكامل، ترتبط زيادة المؤشر بمقدار وحدة واحدة بارتفاع احتمال المشاركة بمقدار 19.89 نقطة مئوية. ثم نقوم بتقدير نموذج اللوجيت متعدد الحدود لتمييز أربعة أنماط تجارية متنافية: محلي(Domestic) مستورد فقط(Import only) مصدّر فقط(Export only) متداول في الاتجاهين(Two-way trader) وتكشف النتائج عن تباين كبير عبر هذه الأنماط، حيث ترتبط الرقمنة بأقوى صورة بوضع "المتداول في الاتجاهين". وتُظهر اختبارات فالد (Wald) أن المعامل المقابل أعلى بشكل ملحوظ مقارنة بالشركات المستوردة فقط، بينما لا يُعد الفارق كبيراً من الناحية الإحصائية مقارنة بالشركات المصدّرة فقط؛ وبذلك تدعم الأدلة الفرضية الثالثة (H3) جزئياً فقط. يوفر توصيف "IV-Probit" تحليلاً مكملاً للحساسية، لكنه لا يثبت علاقة سببية حاسمة. وأخيراً، يُلاحظ هذا الارتباط الإيجابي بين الرقمنة والمشاركة في التجارة الدولية في خمس مناطق أخرى حول العالم، مما يشير إلى أن نمط منطقة الشرق الأوسط وشمال أفريقيا يمثل جزءاً من انتظام تجريبي أوسع نطاقاً.

1. Introduction

Over the past few decades, the organization of international trade has been transformed by the fragmentation of production, accompanied by increased reliance on foreign sourcing. Firms can now import, export, or combine both margins. The literature highlights the selection of larger and more productive firms into foreign markets (Melitz, 2003; Bernard et al., 2007), as well as the frictions specific to foreign sourcing (Antràs et al., 2017). Bernard et al. (2018) further document complementarities between importing and exporting decisions.

Digitalization can reduce the search, monitoring, verification, and coordination costs associated with transactions conducted at a distance (Goldfarb and Tucker, 2019). Existing studies associate Internet use and online presence with access to foreign markets (Freund and Weinhold, 2004; Clarke, 2008; Carballo et al., 2022) and, more recently, with the identification of foreign suppliers (Shen et al., 2025). Digitalization may therefore operate both upstream and downstream.

However, the strength of this relationship may vary across economies. Imbruno et al. (2025) show that the effects of digital connectivity on entry into exporting differ according to the level of development and absorptive capacity. This issue is particularly relevant in the MENA region, where the diffusion of digital technologies coexists with more limited use of certain tools for economic purposes and substantial disparities in adoption across firms (Gévaudan et al., 2022; European Investment Bank et al., 2022).

Despite these advances, two gaps remain. Research on digitalization and trade has largely focused on exporting, although informational, transactional, and organizational difficulties also affect foreign sourcing. Moreover, examining importing and exporting decisions separately does not distinguish firms that are active on both margins, even though this dual presence intensifies the search and coordination needs that digital tools may help address.

The research question is therefore the following: how is digitalization associated with the participation of firms in the MENA region in international trade, and does this relationship vary according to firms' trade configuration? We classify as internationally active any firm that relies on foreign sourcing and/or exports directly or indirectly. We then distinguish four mutually exclusive statuses: Domestic, Import only, Export only, and Two-way trader.

This article makes three contributions. First, it brings digitalization and trade configurations together within a unified empirical framework. We jointly estimate the four statuses using a multinomial logit model and test whether the relationship is stronger for Two-way traders. The analysis links the complementarities identified by Bernard et al. (2018) to the determinants of global sourcing studied by Antràs et al. (2017) and Shen et al. (2025).

Second, we propose a firm-level measure of digitalization based on the World Bank Enterprise Surveys (WBES). The index is constructed from three observable digital practices: website ownership, receipt of electronic payments, and application for a fixed broadband connection. It summarizes the extensive adoption of these practices, while component-by-component estimates identify those with which trade participation is most strongly associated.

Third, the MENA region constitutes the main empirical setting. The analysis draws on approximately 5,400 firms across eleven economies and subsequently compares the estimates with those obtained for five other regional groups. This comparison indicates whether the pattern observed in MENA is region-specific or forms part of a broader empirical regularity.

The results reveal a positive and statistically significant association between digitalization and participation in international trade. In the full specification, a one-unit increase in the index is associated with a 19.89 percentage-point higher probability of participation. The magnitude nevertheless varies across trade configurations: the association is particularly pronounced for Two-way traders, and the difference relative to Import only firms is statistically significant at conventional levels. Each of the three components of the index is associated with higher trade participation, while the international comparison yields an association of the same sign across all six regional groups considered.

These findings highlight the value of jointly examining digitalization and firms' trade configurations. They also underscore the need to distinguish digital practices actually observed at the microeconomic level from the mere aggregate availability of digital infrastructure.

The remainder of the article is organized as follows. Section 2 reviews the literature and develops the research hypotheses. Section 3 describes the data, variable construction, and empirical strategy. Section 4 discusses the main estimates, the instrumental-variable analysis, the multinomial logit model, and the regional comparison. Section 5 concludes.

2. Literature review and hypothesis development

Participation in international trade depends both on firm-specific characteristics and on the costs associated with accessing foreign markets and relying on foreign sourcing. Digitalization may alter some of these costs, but its role should be distinguished across different configurations of internationalization. The literature therefore points to three related dimensions: firm selection into international trade, the reduction in informational and transactional frictions enabled by digital technologies, and the empirical identification challenges surrounding this relationship, before leading to the formulation of the research hypotheses.

2.1. International trade participation: selection, trade configurations, and the regional context

The heterogeneous-firm literature places productivity and fixed entry costs at the core of participation in international trade. In Melitz's (2003) model, only sufficiently productive firms can bear the costs of entering foreign markets. Bernard et al. (2007) empirically confirm that internationally active firms are, on average, larger and more productive. The same selection logic applies to foreign sourcing: relying on foreign suppliers requires firms to identify, assess, and manage suppliers located abroad. Antràs et al. (2017) accordingly show that firms self-select into global sourcing according to their productivity and that their sourcing choices across countries are interdependent.

Bernard et al. (2018) document that large internationally active firms jointly determine their choices of suppliers, products, production locations, and destinations: importing and exporting are complementary rather than independent decisions. A firm operating both upstream and downstream therefore represents a distinct configuration characterized by greater search, information, and coordination requirements.

This distinction is particularly relevant in the MENA region. Existing studies document persistent obstacles to access to foreign markets, particularly those related to logistics costs, trade barriers, and customs inefficiencies (Bhattacharya and Wolde, 2010; Jaud and Freund, 2015; Arezki et al., 2020; Ficarra et al., 2022). In some hydrocarbon-exporting economies, specialization in natural resources may constrain diversification of the tradable sector (Cherif and Hasanov, 2014). At the same time, several economies in the region remain highly dependent on foreign sourcing, including Morocco, Tunisia, Jordan, and Lebanon (OECD, 2021). Taken together, these characteristics justify examining international participation through both margins, importing and exporting.

Following Melitz (2003) and Bernard et al. (2007), the empirical analysis controls for productivity and firm size, together with financial constraints that may limit firms' ability to bear the fixed costs of internationalization (Manova, 2013). Other firm and manager characteristics are included as additional controls in the empirical strategy.

2.2. Digitalization, reduction in transaction costs, and firm-level measurement

Digital technologies can alter several costs associated with transactions conducted at a distance. Goldfarb and Tucker (2019) distinguish search, transportation, monitoring, and verification costs that may be affected by the diffusion of digital technologies. Applied to international trade, this logic implies that reductions in search, information, and coordination costs may facilitate the identification of partners and the management of international transactions. Aker and Mbiti (2010) emphasize that digital technologies can reduce information and transaction costs in developing economies, a mechanism extended by Claessens and Rice (2026), who highlight the potential of

new payment technologies to reduce certain costs and delays associated with cross-border transactions.

Empirical studies have primarily focused on foreign markets. Freund and Weinhold (2004) establish a positive association between Internet diffusion and international trade, while Clarke (2008), using firm-level data from low- and middle-income countries, identifies a positive association between Internet access and access to foreign markets. Carballo et al. (2022) show that an online business platform that reduces informational frictions is associated with improved access to foreign markets, particularly for firms initially lacking an online presence and for less familiar destinations.

The same mechanism may, however, operate on the foreign-sourcing side. Building on the search costs associated with global sourcing described by Antràs et al. (2017), Shen et al. (2025) show that "internetization" is associated with an improved ability to identify foreign suppliers and to diversify sourcing origins.

The role of digitalization nevertheless depends on the context in which it is adopted. Imbruno et al. (2025) find that improvements in bilateral digital connectivity are associated with an increase in the number of exporters in developed economies, whereas this relationship may differ in developing economies when absorptive capacities are weaker. In the MENA region, Gévaudan et al. (2022) describe a "digital paradox" characterized by the coexistence of the diffusion of certain digital uses and more limited exploitation of technologies for economic purposes, while European Investment Bank et al. (2022) document substantial disparities in adoption across firms.

Our measure therefore focuses on digital practices observed at the firm level. The three components capture complementary functions: online presence, electronic transactions, and engagement with connectivity infrastructure. The approach is deliberately parsimonious relative to more detailed technology surveys, but it enables direct comparison of digital practices across a large number of firms.

2.3. Endogeneity and hypotheses

Interpreting the relationship between digitalization and participation in international trade remains subject to an endogeneity problem. Unobserved productive, organizational, or managerial characteristics may be simultaneously associated with digital adoption and internationalization. Reverse causality is also possible: firms already active in foreign markets may have stronger incentives to adopt digital technologies. This possibility is consistent with learning mechanisms induced by internationalization, as discussed notably by De Loecker (2013) and Wagner (2012), as well as with the identification difficulty highlighted by Clarke and Wallsten (2006) in their analysis of the relationship between the Internet and trade.

The instrumental-variable analysis introduced later exploits the leave-one-out average digitalization of other firms located in the same subnational unit. Excluding the firm's own value removes the mechanical correlation with the instrument but is not sufficient to establish the exclusion restriction. As Manski (1993) emphasizes, individual behavior and group-average characteristics are difficult to disentangle when group members share a common environment. In our setting, infrastructure, available skills, or agglomeration externalities may simultaneously influence local digitalization and trade participation. The IV-Probit is therefore used as a sensitivity analysis for endogeneity rather than as a strategy intended to establish a definitive causal relationship.

The preceding theoretical arguments lead to a first hypothesis. If digitalization reduces the search, information, and coordination costs involved in transactions with foreign partners, its adoption should be positively associated with firms' participation in international trade.

- H1 — An increase in the digitalization index is associated with a higher probability of participating in international trade.

The different components of digitalization may nevertheless exhibit distinct relationships with participation. An application for a fixed broadband connection represents a particular case: it signals an attempt to adopt digital infrastructure, but it may also indicate that the firm was not yet connected at the time of the application. No sign is therefore imposed a priori. The expected positive sign of the aggregate index consequently reflects the combination of the selected practices and does not imply that each individual component must exhibit an association of the same sign.

- H2a — An application for a fixed broadband connection is associated with the probability of participating in international trade, with no a priori prediction regarding the sign.

By contrast, website ownership and the use of electronic payments directly correspond to practices that may reduce informational or transactional frictions.

- H2b — Website ownership is positively associated with the probability of participating in international trade.
- H2c — Receipt of electronic payments is positively associated with the probability of participating in international trade.

Finally, if the usefulness of digital tools increases with the search, information, and coordination costs generated by simultaneous upstream and downstream activity, the relationship between digitalization and trade status should be particularly strong for Two-way traders.

- H3 — The coefficient associated with digitalization is higher for the Two-way trader status than for the Import only and Export only statuses.

This final hypothesis is evaluated using the coefficients from the multinomial logit model through Wald tests of equality between the coefficient associated with Two-way trader and those estimated for Import only and Export only. Average marginal effects complement this comparison by quantifying its magnitude in probability terms. Interpretation of the multinomial model remains conditional on the independence of irrelevant alternatives (IIA) assumption, whose empirical validity is examined in the results section.

3. Data and methodology

3.1. Data and sample

To analyze the relationship between digitalization and participation in international trade, we use firm-level data from the World Bank *Enterprise Surveys* (WBES). These surveys provide harmonized information on firm characteristics, digital practices, performance, and trade activities.

The analysis relies on a main sample covering the MENA region and an international comparison sample. The MENA sample comprises 5,453 firms across eleven economies, whose composition is presented in Table A1. The comparative analysis includes 59,428 observations across six regional groups; the countries included, subject to data availability, are reported in Table A5.

For the MENA region, the selected surveys were conducted between 2023 and 2026. As each firm is observed only once, the data constitute a cross-section pooling several survey waves and do not allow the same units to be followed over time. Missing responses and categories such as *Don't know* are treated as missing values and excluded whenever the corresponding variable enters the estimation. As with any self-reported survey, the WBES may be subject to measurement error or reporting differences; nevertheless, their harmonized questionnaire provides a common framework for comparison across firms.

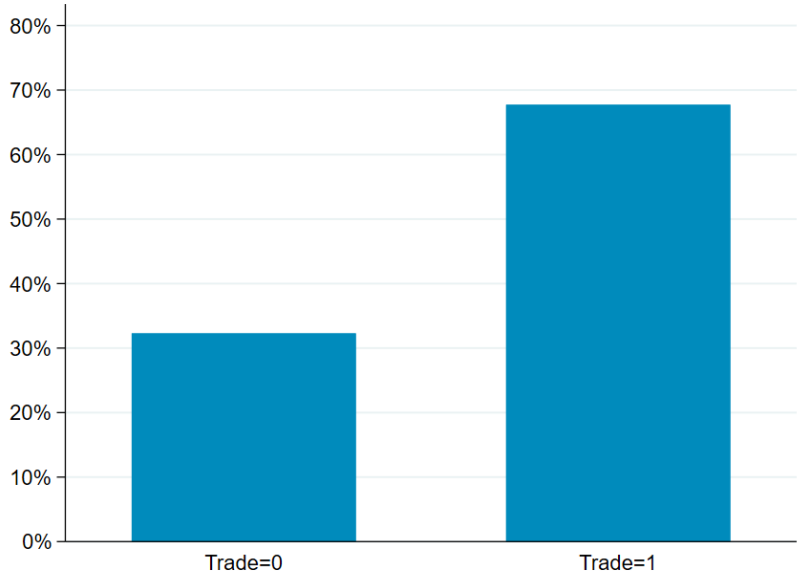
3.2. International trade participation

Two indicators are constructed from the available information on foreign sourcing and exports. The first captures participation in international trade:

$$\text{Trade}_i = \begin{cases} 1 & \text{if Import}_i = 1 \text{ or Export}_i = 1, \\ 0 & \text{if Import}_i = 0 \text{ and Export}_i = 0. \end{cases}$$

Importing corresponds to the direct import of material inputs of foreign origin, whereas exporting covers sales made directly or indirectly abroad. Among the 5,372 observations for which this indicator can be constructed, 67.7% of firms participate in international trade. Figure 1 shows the distribution of the sample between firms participating and not participating in international trade.

Figure 1. Distribution of firms by international trade participation



Source : Authors' calculations based on WBES.

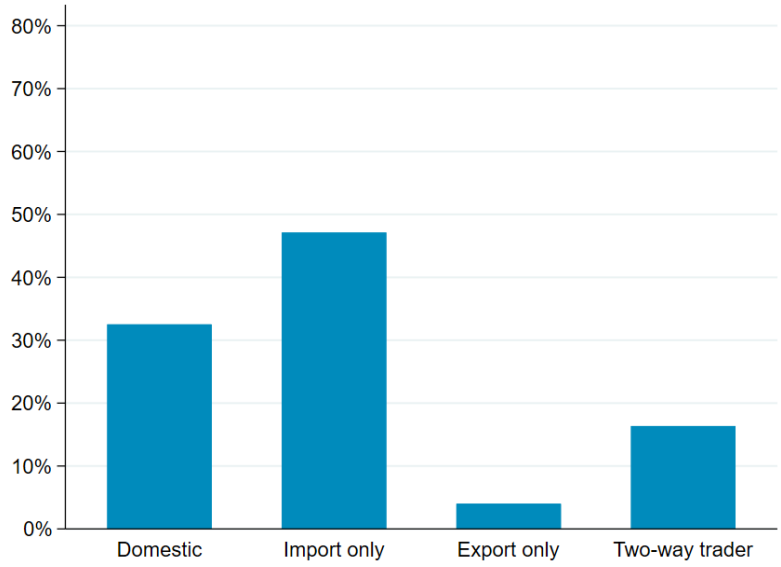
The second indicator, TradeStatus_i, distinguishes four mutually exclusive configurations:

$$\text{TradeStatus}_i = \begin{cases} 0 & \text{Domestic,} \\ 1 & \text{Import only,} \\ 2 & \text{Export only,} \\ 3 & \text{Two-way trader.} \end{cases}$$

Among the 5,332 observations for which complete trade status can be determined, Import only is the most frequent category, followed by Domestic, Two-way trader, and Export only. This distribution supports distinguishing firms active on both margins from those engaged only in importing or exporting. Figure 2 shows the distribution of the sample across the four international trade statuses4.

[4] Because Trade_i is based on a disjunctive rule, it remains identifiable when only one observed component is equal to 1, even if the other is missing because of a "Don't know" response or a refusal, whereas TradeStatus_i requires both Import_i and Export_i to be observed simultaneously. The 40 additional observations for Trade_i therefore correspond to participating firms for which only one of the two components is observed. The number of firms engaged in neither importing nor exporting is identical under the two measures, namely 1,734; only the denominators differ, which explains the rates of 32.28% and 32.52% for this same subgroup.

Figure 2. Distribution of firms by international trade status



Source: Authors' calculations based on WBES.

3.3. Digitalization index

Digitalization is measured using three binary components available in the WBES. BB_i indicates whether a firm applied for a fixed broadband connection during the two years preceding the survey. This variable therefore does not capture actual ownership of a connection, but rather an attempt to gain access to this infrastructure. WS_i indicates whether the firm owns its own website, while EP_i takes the value 1 when at least part of the payments received by the firm is made electronically. These three indicators respectively capture engagement with connectivity infrastructure, online presence, and electronic transactions.

They are aggregated using an unweighted arithmetic mean[5]:

$$\text{DIG}_i = \frac{BB_i + WS_i + EP_i}{3}. \quad (1)$$

Equal weighting avoids privileging any component in the absence of a theoretical justification for differential weights. Because the three components capture distinct functions, the index is complemented by component-by-component estimates (column 6 of Table 1).

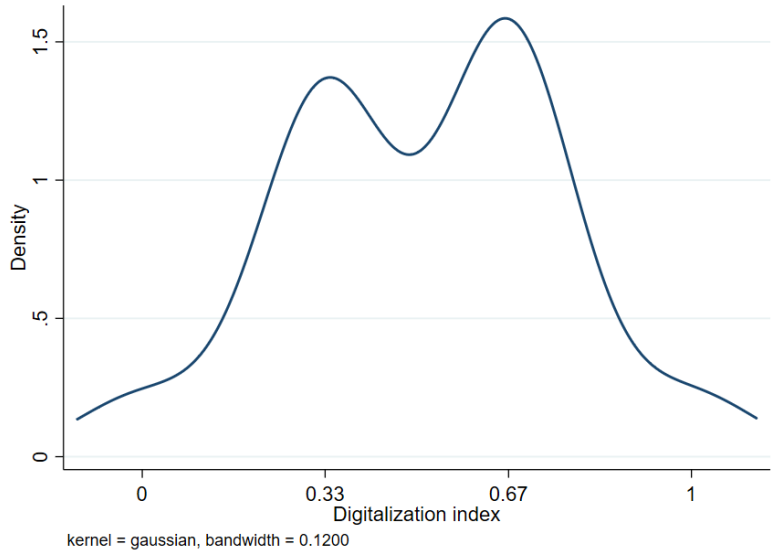
[5] For robustness purposes, we also construct an alternative digitalization index using Multiple Correspondence Analysis (MCA) applied to the three components defined above. Estimates based on this factor index yield qualitatively similar conclusions to those obtained with the unweighted index, both for the probability of international trade participation and for the different TradeStatus_i categories. To keep the presentation concise, these results are not reported but are available from the authors upon request.

By construction,

$$\mathrm{DIG}_i \in \left\{0, \frac{1}{3}, \frac{2}{3}, 1\right\}.$$

The index therefore captures the extensive adoption of observable digital practices rather than the technological intensity of each practice. The marginal effects associated with DIG_i measure the average marginal change in the predicted probability of international trade participation associated with a change in the index.

Figure 3. Kernel density of the digitalization index



Source: Authors' calculations based on WBES.

Figure 3 provides a smoothed representation of the distribution of DIG_i. Kernel density estimation is used solely as a descriptive representation of the distribution of DIG_i, without assuming that the index is intrinsically continuous.

3.4. Empirical strategy

The empirical strategy consists of two stages. The first estimates, using a binary logit model, the probability that a firm participates in international trade. The second uses a multinomial logit model to examine the configuration taken by that participation.

The main specification is:

$$P(\mathrm{Trade}_i = 1 \mid \mathrm{DIG}_i, X_i) = \Lambda(\beta_0 + \beta_1 \mathrm{DIG}_i + X_i'\gamma + \delta_c + \lambda_s). \qquad (2)$$

where

$$\Lambda(z) = \frac{1}{1 + e^{-z}},$$

DIG_i denotes the digitalization index, X_i the vector of controls, δ_c country fixed effects, and λ_s sector fixed effects. All estimations use heteroskedasticity-robust standard errors.

Columns (1) to (5) of Table 1 progressively add controls and fixed effects, while column (6) replaces the DIG_i index with its three components. This progression allows the stability of the estimated relationship to be assessed without reproducing in the text the content of each table column.

The vector X_i includes the logarithm of labor productivity, measured as real annual sales per permanent full-time worker; the manager's sector experience and gender; the logarithm of the WBES firm-size category; and firm age and its square. A measure of the subnational financial environment is also included. It corresponds to the *leave-one-out* proportion of other firms in the same subnational unit that consider access to finance a major or very severe obstacle. Groups with fewer than ten observations are excluded from the calculation. Variable construction and descriptive statistics are reported in Table A3.

The results are reported as average marginal effects (AME). For a regressor x_k, they are defined as:

$$\text{AME}_k = \frac{1}{N}\sum_{i=1}^{N} \frac{\partial P(\text{Trade}_i=1|\text{DIG}_i, X_i)}{\partial x_{ki}}. \quad (3)$$

Potential endogeneity of DIG_i is examined using an IV-Probit specification. The instrument corresponds to the average digitalization of other firms in the same subnational unit, excluding firm i:

$$\text{DIG}_{ir}^{LOO} = \frac{\sum_{\substack{j \in r \\ j \neq i}} \text{DIG}_j}{N_r - 1}. \quad (4)$$

where r denotes the subnational unit and N_r the number of firms with a valid digitalization index in that unit.
The first-stage equation is:

$$\text{DIG}_i = \pi_0 + \pi_1 \text{DIG}_{ir}^{LOO} + X_i'\pi + \delta_c + \lambda_s + \nu_i. \quad (5)$$

The empirical relevance of the instrument is assessed using the coefficient π_1 and the corresponding first-stage test. The structural equation is then estimated using IV-Probit:

$$P(\text{Trade}_i = 1 \mid \text{DIG}_i, X_i) = \Phi(\beta_0 + \beta_1 \text{DIG}_i + X_i'\gamma + \delta_c + \lambda_s). \quad (6)$$

where Φ denotes the cumulative distribution function of the standard normal distribution and DIG_i is treated as potentially endogenous. The Wald test of exogeneity examines the null hypothesis that DIG_i is exogenous. With one instrument for one potentially endogenous regressor, the equation is exactly identified, and no overidentification test can directly assess the exclusion restriction. Consistent with the discussion in Section 2.3, the IV-Probit is therefore interpreted as a sensitivity analysis.

Finally, because the four categories of $\mathrm{TradeStatus}_i$ are unordered, we estimate a multinomial logit model with *Domestic* as the reference category. For $j \in \{1,2,3\}$,

$$P(\mathrm{TradeStatus}_i = j \mid \mathrm{DIG}_i, X_i) = \frac{\exp(\beta_{0j}+\beta_{1j}\mathrm{DIG}_i+X_i'\gamma_j+\delta_{cj}+\lambda_{sj})}{1+\sum_{k=1}^{3}\exp(\beta_{0k}+\beta_{1k}\mathrm{DIG}_i+X_i'\gamma_k+\delta_{ck}+\lambda_{sk})}. \quad (7)$$

The multinomial model includes the controls from the main specification, except for the quadratic age term. Average marginal effects are calculated separately for each of the four outcomes:

$$\mathrm{AME}_{kj} = \frac{1}{N}\sum_{i=1}^{N}\frac{\partial P(\mathrm{TradeStatus}_i=j|\mathrm{DIG}_i,X_i)}{\partial x_{ki}}. \quad (8)$$

The Wald tests reported in Section 4 test equality between the coefficient associated with *Two-way trader* and those estimated for *Import only* and *Export only* in order to evaluate H3. Collinearity diagnostics, reported in Table A4, reveal no concerning problems, with variance inflation factors remaining below 5. Given the cross-sectional nature of the data, the conventional estimates are interpreted as conditional associations rather than causal effects.

4. Results and discussion

4.1. Digitalization and international trade participation

Table 1 reports the average marginal effects from binary logit models estimating the probability that a firm participates in international trade. Standard errors are robust to heteroskedasticity.

Table 1. Average marginal effects on international trade participation

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Digitalization Index	0.2032***	0.1049***	0.1881***	0.1124***	0.1989***	
	(7.14)	(4.09)	(8.30)	(4.38)	(8.87)	
Website Ownership						0.0729***
						(5.77)
Electronic Payments						0.0690***
						(4.96)
Fixed Broadband Application						0.0509***
						(3.00)
Log of Labor Productivity		0.0979***	0.0212***	0.0976***	0.0185***	0.0183***
		(21.14)	(4.42)	(20.12)	(3.80)	(3.78)
Manager's Sector Experience		0.0002	0.0016**	0.0001	0.0014**	0.0014**
		(0.28)	(2.53)	(0.14)	(2.36)	(2.36)
Female Top Manager		-0.0237	0.0294	-0.0231	0.0238	0.0238
		(-0.83)	(1.26)	(-0.82)	(1.04)	(1.04)
Log of Firm Size Category		0.1365***	0.1279***	0.1298***	0.1091***	0.1075***
		(9.46)	(9.81)	(8.56)	(7.87)	(7.73)
Log of Firm Age		0.1545***	0.1199***	0.1446***	0.1016***	0.0995***
		(4.25)	(3.53)	(4.00)	(3.07)	(3.01)
(Log of Firm Age)²		-0.0297***	-0.0209***	-0.0276***	-0.0167**	-0.0164**
		(-4.10)	(-3.13)	(-3.82)	(-2.56)	(-2.52)
Local Financial Constraint		-0.3684***	-0.3146***	-0.3696***	-0.2619***	-0.2603***
		(-10.45)	(-5.10)	(-10.10)	(-4.37)	(-4.33)
Observations	4,814	4,552	4,552	4,538	4,538	4,538
Sector fixed effects	No	No	No	Yes	Yes	Yes
Country fixed effects	No	No	Yes	No	Yes	Yes

Source: Authors' calculations based on WBES. *Note:* Robust z-statistics are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

The sign and statistical significance of the digitalization index remain stable across all specifications, although its magnitude varies substantially. The marginal effect is 20.32 percentage points in column (1) and falls to 10.49 points after firm characteristics are introduced in column (2). It reaches 18.81 points with country fixed effects, 11.24 points with sector fixed effects only, and 19.89 points in the full specification; all five estimates are significant at the 1% level. However, the change between columns (1) and (2) coincides with a decline in the number of observations from 4,814 to 4,552, so the effect of adding controls cannot be separated from that of the change in the estimation sample. Holding the sample constant between columns (2) and (3), the introduction of country fixed effects is associated with an increase from 10.49 to 18.81 points. Sector fixed effects subsequently reduce the sample to 4,538 observations because of categories with perfect prediction. Robustness therefore concerns primarily the sign and statistical significance of the relationship rather than the invariance of its magnitude.

This result supports H1: more digitalized firms have a higher probability of participating in international trade. It is consistent with the mechanisms involving reductions in search, coordination, monitoring, and verification costs discussed by Goldfarb and Tucker (2019), as well as with the relationship between the Internet and trade documented by Freund and Weinhold (2004) and Clarke (2008). The analysis nevertheless extends this literature to practices observed at the firm level and to a definition of participation encompassing both margins, in line with Antràs et al. (2017) and Shen et al. (2025).

Column (6) distinguishes the three components of the index. Website ownership is associated with a 7.29 percentage-point higher probability of participation, significant at the 1% level, thereby supporting H2b and consistent with the role of online presence examined by Carballo et al. (2022). For electronic payments, the corresponding difference is 6.90 percentage points and is significant at the same level. H2c is therefore supported, in line with the arguments concerning information and transaction costs developed by Aker and Mbiti (2010) and the payment technologies analyzed by Claessens and Rice (2026).

Applying for a fixed broadband connection is positively associated with participation, with a difference of 5.09 percentage points, also significant at the 1% level. H2a, for which no sign was imposed a priori, is therefore resolved in the positive direction. However, this variable captures an action undertaken during the two years preceding the survey rather than actual ownership of a connection. Its interpretation must also account for potential simultaneity if firms already engaged in international trade apply for a connection in response to their commercial needs. The sum of the three effects, 19.28 percentage points, is close to the 19.89 points associated with the index in the full specification. This proximity constitutes an internal consistency check rather than a formal decomposition of the model.

The controls reproduce several regularities from the heterogeneous-firm literature. Labor productivity remains positively and significantly associated with participation across all specifications, although its marginal effect falls from 9.79 percentage points in column (2) to 2.12 points with country fixed effects and then to 1.85 points in the full specification. Fixed effects may absorb part of the cross-country differences embedded in real sales per worker. The sign remains consistent with Melitz (2003) and Bernard et al. (2007). The manager's sector experience becomes positive and significant once country fixed effects are introduced, in line with Sala and Yalcin (2015). Firm size remains positively associated with participation, age retains a concave profile, and the manager's gender is not statistically associated with participation in the binary logit model for the MENA region (Table 1).

The local financial constraint is associated with a 26.19 percentage-point lower probability of participation in the full specification. This result is consistent with Manova (2013), who emphasizes that financial constraints may limit firms' ability to bear the fixed costs, payment delays, and working-capital requirements associated with internationalization.

4.2. Endogeneity and forms of international trade participation

Simultaneous determination between digitalization and international trade cannot be ruled out: firms already active abroad may have stronger incentives to adopt digital technologies, while unobserved organizational characteristics may be related to both phenomena. This difficulty is

consistent with Clarke and Wallsten (2006), as well as with the mechanisms of reverse causality and learning by exporting discussed by De Loecker (2013) and Wagner (2012).

Table 2 examines this issue using an IV-Probit specification.

Table 2. Instrumental-variable estimates of international trade participation

Variables	(1) First Stage	(2) IV-Probit
Local Digitalization (Leave-One-Out)	0.487***	
	(4.01)	
Digitalization Index		3.177***
		(3.68)
Log of Labor Productivity	0.019***	0.024
	(5.50)	(0.68)
Manager's Sector Experience	0.001***	0.002
	(2.89)	(0.68)
Female Top Manager	0.016	0.026
	(0.98)	(0.25)
Log of Firm Size Category	0.106***	0.150
	(13.07)	(0.84)
Log of Firm Age	-0.011	0.389***
	(-0.50)	(2.80)
(Log of Firm Age)²	-0.000	-0.060**
	(-0.01)	(-2.17)
Local Financial Constraint	-0.162**	-0.135
	(-2.24)	(-0.23)
Country fixed effects	Yes	Yes
Sector fixed effects	Yes	Yes
Observations	4,566	4,538
First-stage F-statistic on excluded instrument	16.09	—
Wald test of exogeneity, $\chi^2(1)$	—	4.10
p-value of exogeneity test	—	0.0429

Source: Authors' calculations based on WBES. *Note:* Robust t-statistics in column (1) and robust z-statistics in column (2) are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

In the first stage, the leave-one-out average digitalization of other firms in the same subnational unit is positively related to the individual digitalization index. The coefficient on the instrument is 0.487, with t = 4.01, while the first-stage F-statistic on the excluded instrument is 16.09. Its empirical relevance appears acceptable relative to the conventional benchmark, although that benchmark originates primarily from the linear IV framework. The Wald test of exogeneity yields $\chi^2(1) = 4.10$ and $p = 0.0429$; the null hypothesis of exogeneity is therefore rejected at the 5% level, although only marginally. In the IV-Probit model, the coefficient on the digitalization index remains positive and significant at the 1% level, at 3.177. This value, however, pertains to the latent probit equation and cannot be interpreted directly in percentage points of probability.

The instrumental-variable estimates nevertheless require cautious interpretation. While productivity, firm size, and the financial constraint are strongly significant in the full binary logit specification, their z-statistics fall to 0.68, 0.84, and -0.23, respectively, in the IV-Probit model; only the age terms remain statistically significant. The first stage also relies on 4,566 observations, compared with 4,538 for the IV-Probit. The magnitude of the instrumented coefficient and the loss of precision of the controls therefore call for caution. The exclusion restriction remains demanding: as Manski (1993) emphasizes, a local aggregate may also capture characteristics common to firms

within the same area. Subject to this qualification, the estimated sign remains consistent with H1. The IV-Probit is therefore interpreted as a sensitivity analysis for endogeneity rather than as definitive causal identification.

Table 3 then distinguishes the four statuses Domestic, Import only, Export only, and Two-way trader. The multinomial logit model is estimated on 4,541 observations. The Hausman–McFadden (1984) test does not reject the independence of irrelevant alternatives assumption. This diagnostic is favorable to the use of the multinomial logit model, although failure to reject cannot be interpreted as definitive validation of the IIA assumption.

Table 3. Average marginal effects from the multinomial logit model

Variables	Domestic	Import only	Export only	Two-way trader
Digitalization Index	-0.1887***	0.0369	0.0186*	0.1333***
	(-8.49)	(1.45)	(1.74)	(6.42)
Log of Labor Productivity	-0.0175***	0.0071	-0.0033	0.0137***
	(-3.64)	(1.32)	(-1.32)	(2.89)
Manager's Sector Experience	-0.0013**	0.0009	0.0003	0.0001
	(-2.24)	(1.40)	(1.10)	(0.24)
Female Top Manager	-0.0205	0.0133	-0.0270*	0.0341
	(-0.88)	(0.52)	(-1.68)	(1.59)
Log of Firm Size Category	-0.1030***	-0.0633***	0.0125*	0.1538***
	(-7.61)	(-4.24)	(1.87)	(12.93)
Log of Firm Age	-0.0145*	0.0134	-0.0035	0.0046
	(-1.75)	(1.45)	(-0.80)	(0.61)
Local Financial Constraint	0.2672***	-0.0630	-0.0130	-0.1912***
	(4.42)	(-0.85)	(-0.40)	(-3.02)
Observations	4,541	4,541	4,541	4,541
Country fixed effects	Yes	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	Yes

Source: Authors' calculations based on WBES. *Note:* Robust z-statistics are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Higher digitalization is associated with an 18.87 percentage-point lower probability of belonging to the Domestic category. The corresponding differences are +3.69 percentage points for Import only, +1.86 points for Export only, and +13.33 points for Two-way trader. The associations are significant at the 1% level for Domestic and Two-way trader, at the 10% level for Export only, while they are not statistically significant for Import only.

The lack of statistical significance for Import only suggests that the association between digitalization and the importing margin is comparatively weaker in this sample. This finding does not invalidate the mechanisms examined by Antràs et al. (2017) and Shen et al. (2025), but indicates that the relationship between digitalization and international trade may be more pronounced for configurations involving foreign market access.

The stronger association with Two-way trader is, in turn, consistent with the complementarities between both margins of international activity identified by Bernard et al. (2018), as well as with the relationship between foreign sourcing and export opportunities discussed by Bas and Strauss-

Kahn (2014). Firms in this category combine foreign sourcing with access to foreign markets, a configuration in which digital tools may contribute to reducing these costs.

H3 is tested using the coefficients from the multinomial logit model rather than the marginal effects alone. Relative to the Domestic category, the coefficients associated with digitalization are 1.150 for Import only, 1.597 for Export only, and 2.239 for Two-way trader. The Wald test rejects equality between Import only and Two-way trader, with $\chi^2(1) = 21.27$ and $p < 0.001$, but does not reject equality between Export only and Two-way trader, with $\chi^2(1) = 2.69$ and $p = 0.1008$. The complementary test likewise does not reject equality between Import only and Export only [$\chi^2(1) = 1.42$; $p = 0.2332$]. H3 is therefore only partially supported: the relationship with digitalization is statistically stronger for Two-way trader than for Import only, whereas the difference relative to Export only is not established. Although the point estimates follow an increasing ordering from Import only to Export only and Two-way trader, the equality tests do not establish a complete statistical hierarchy across the three forms of international trade participation.

The distinction between coefficients and marginal effects further confirms the importance of evaluating differences across statuses using tests directly applied to the coefficients. Export only has a larger point coefficient than Import only, whereas its marginal effect is smaller, at 1.86 compared with 3.69 percentage points. This reversal arises because the magnitude of a marginal effect also depends on the baseline probability of each category. However, the Wald test does not reject equality between the coefficients associated with Export only and Import only [$\chi^2(1) = 1.42$; $p = 0.2332$]. Differences in point coefficients or marginal effects therefore do not, by themselves, establish a statistical hierarchy between these two statuses.

The controls reveal a clear contrast between Domestic and Two-way trader: for productivity, the marginal effects are -1.75 and +1.37 percentage points, respectively, while firm size exhibits the same contrast (Table 3). This pattern is consistent with the regularities documented by Bernard et al. (2007, 2018).

The manager's gender is not significantly associated with the Domestic, Import only, or Two-way trader statuses, but is associated with -2.70 percentage points for Export only at the 10% significance level. The local financial constraint is associated with +26.72 percentage points for Domestic and -19.12 points for Two-way trader, both significant at the 1% level, compared with -6.30 points for Import only and -1.30 points for Export only, neither of which is statistically significant. For the more extensive forms of participation, this pattern is consistent with the financial relationship discussed by Manova (2013). The marginal effects across the four categories sum to zero by construction.

4.3. Regional heterogeneity

Table 4 extends the analysis beyond the MENA region to provide an external comparison. The six estimations include a total of 59,428 observations: 4,538 for MENA, 15,290 for Sub-Saharan Africa, 7,844 for East Asia & Pacific, 10,161 for Europe & Central Asia, 9,629 for Latin America & Caribbean, and 11,966 for South Asia. The main analysis remains centered on the MENA region. The countries included in each regional group, subject to data availability, are listed in Table A5 in the Appendix.

Table 4. Regressions by region: average marginal effects on international trade participation

Variables	MENA	Sub-Saharan Africa	East Asia & Pacific	Europe & Central Asia	Latin America & Caribbean	South Asia
Digitalization Index	0.1989***	0.2747***	0.2219***	0.3069***	0.3323***	0.2078***
	(8.87)	(17.94)	(11.04)	(14.37)	(15.46)	(15.46)
Log of Labor Productivity	0.0185***	0.0390***	0.0328***	0.0266***	0.0371***	0.0051*
	(3.80)	(16.07)	(8.56)	(7.93)	(9.20)	(1.79)
Manager's Sector Experience	0.0014**	0.0011**	0.0017***	-0.0002	-0.0007	0.0017***
	(2.36)	(2.34)	(3.20)	(-0.35)	(-1.62)	(4.72)
Female Top Manager	0.0238	-0.0098	-0.0074	0.0083	-0.0321***	0.0612***
	(1.04)	(-0.95)	(-0.69)	(0.75)	(-2.85)	(7.67)
Log of Firm Size Category	0.1091***	0.1627***	0.1898***	0.1157***	0.1299***	0.1090***
	(7.87)	(16.48)	(16.07)	(11.64)	(11.66)	(14.69)
Log of Firm Age	0.1016***	0.0165***	0.0048	-0.0030	0.0363***	-0.0013
	(3.07)	(2.79)	(0.63)	(-0.45)	(5.26)	(-0.32)
(Log of Firm Age)²	-0.0167**	—	—	—	—	—
	(-2.56)					
Local Financial Constraint	-0.2619***	0.0138	-0.2172**	0.1520***	0.2852***	-0.0423*
	(-4.37)	(0.45)	(-2.43)	(2.94)	(3.69)	(-1.83)
Observations	4,538	15,290	7,844	10,161	9,629	11,966
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Source: Authors' calculations based on WBES. *Note:* Robust z-statistics are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

The digitalization index is positively associated with participation in all six regional groups, with marginal effects ranging from 19.89 percentage points in the MENA region to 33.23 points in Latin America & Caribbean; all six associations are significant at the 1% level. The relationship observed in the MENA region therefore does not appear to be region-specific. However, comparisons of magnitudes should remain descriptive because the quadratic age term is included in the MENA specification but omitted from the other five estimations; differences in magnitude therefore cannot be interpreted as structural differences across regions.

This magnitude can be compared with the findings of Imbruno et al. (2025), who identify differentiated relationships between digital connectivity and entry into exporting according to absorptive capacity. The objects of analysis nevertheless differ: their study focuses on bilateral digital connectivity and exporting, whereas our indicator captures digital practices observed at the firm level and participation encompassing both margins. In the context of the "digital paradox"

described by Gévaudan et al. (2022), uneven aggregate diffusion of digital capabilities can therefore coexist with a positive microeconomic association between digital practices and international trade.

Firm size is positively and significantly associated with participation in all six regional groups. Productivity is also positive and significant throughout, although only at the 10% level in South Asia, which remains consistent with the regularities documented by Melitz (2003) and Bernard et al. (2007). The other controls are more heterogeneous: the manager's sector experience is significant only in some regional groups. For the manager's gender, the association is negative in Latin America & Caribbean and positive in South Asia, both at the 1% level; these opposite signs do not support a common pattern.

The local financial constraint exhibits a reversal in sign across regions: it is associated with -26.19 percentage points in the MENA region, compared with +28.52 points in Latin America & Caribbean. This reversal suggests that the subnational aggregate does not capture a strictly comparable financial environment across regions.

This heterogeneity also sheds light on the instrumental strategy. Both the local financial constraint and the average digitalization measure used as an instrument are leave-one-out measures calculated at the subnational level. If the former captures broader location characteristics, the latter may likewise reflect differences in infrastructure, skills, or agglomeration that are directly related to trade participation. This observation extends the qualification based on Manski (1993): it is not sufficient to invalidate the instrument, but it reinforces the demanding nature of the exclusion restriction.

5. Conclusion

This article examines the relationship between digitalization and participation in international trade at the firm level in the MENA region. It brings digitalization and trade configurations together within a unified empirical framework by jointly estimating four statuses—Domestic, Import only, Export only, and Two-way trader—and by constructing, from the World Bank Enterprise Surveys, an index combining three observable practices: application for a fixed broadband connection, website ownership, and receipt of electronic payments.

The estimates reveal a positive and robust association between the digitalization index and participation in international trade. In the full specification, a one-unit increase in the index is associated with a 19.89 percentage-point higher probability of participation. The three components likewise exhibit positive and significant relationships, indicating that the result is not driven by a single digital practice. H1, H2b, and H2c are therefore supported, while H2a, for which no sign was imposed a priori, is resolved in the positive direction, subject to potential simultaneity.

Distinguishing trade statuses provides the article's most specific result. The relationship with digitalization is particularly pronounced for Two-way trader, whereas it is not statistically established for Import only and is significant only at the 10% level for Export only. Tests directly applied to the multinomial logit coefficients further characterize this heterogeneity: the coefficient associated with Two-way trader is significantly higher than that for Import only [$\chi^2(1) = 21.27$; $p < 0.001$], whereas the test does not identify a statistically significant difference relative to Export only [$\chi^2(1) = 2.69$; $p = 0.1008$]. H3 is therefore only partially supported.

Two interpretations remain consistent with this configuration. The first emphasizes the combination of both margins: Two-way traders engage simultaneously in foreign sourcing and foreign market access, in line with the complementarities described by Bernard et al. (2018) and Bas and Strauss-Kahn (2014). The second gives greater weight to downstream presence, since Export only and Two-way trader display the highest coefficients, while Import only lags behind. This interpretation is consistent with studies linking digital technologies to access to foreign markets (Freund and Weinhold, 2004; Clarke, 2008; Carballo et al., 2022). However, the available results do not allow these two interpretations to be formally distinguished: the direct test of equality between the Export only and Import only coefficients does not reject equality [$\chi^2(1) = 1.42$; $p = 0.2332$].

The comparison with five other regional groups shows that the positive association between digitalization and participation in international trade is not specific to the MENA region. In each of the six groups, it is statistically significant at the 1% level. Its magnitude is nevertheless the smallest in the MENA region, at 19.89 percentage points, compared with a maximum of 33.23 points in Latin America & Caribbean. This ranking should remain descriptive because the specifications are not fully homogeneous: the quadratic age term is included in the MENA estimation but omitted from the other five; differences in magnitude therefore cannot be interpreted as structural differences across regions.

The marginal effects of the three components range from 7.29 percentage points for website ownership to 6.90 points for electronic payments and 5.09 points for application for a fixed broadband connection. This ordering echoes the "digital paradox" described by Gévaudan et al. (2022), in which the diffusion of technologies coexists with more limited use of tools that can be directly mobilized for economic purposes. The results therefore suggest that the development of digital infrastructure could usefully be complemented by measures facilitating its commercial and transactional use by firms, subject to the observational nature of the estimates.

Several limitations qualify the interpretation. First, the WBES pool surveys conducted between 2023 and 2026 into a cross-sectional dataset; the same firms are not followed over time, and transitions between trade statuses cannot be observed. Second, the index measures extensive adoption across three components rather than their intensity of use. In particular, the broadband

variable records an application for a connection during the two years preceding the survey rather than actual ownership of a connection. Third, the trade information covers direct imports of material inputs and exports but does not identify the firm's position within a global value chain or the domestic and foreign value-added content of its activities. Fourth, as with any self-reported survey, the WBES may be subject to measurement error or differences in reporting.

The IV-Probit raises an additional qualification: despite an F-statistic of 16.09 and rejection of exogeneity at the 5% level [$\chi^2(1) = 4.10$; $p = 0.0429$], the average digitalization of other firms in the same subnational unit may capture common local characteristics, including infrastructure, available skills, or agglomeration effects. This estimation therefore remains a sensitivity analysis. The multinomial logit model, in turn, relies on the independence of irrelevant alternatives assumption, which the non-rejection of the Hausman–McFadden (1984) test supports without definitively validating.

Longitudinal data would extend the analysis by directly observing transitions between trade configurations and determining whether digitalization is primarily associated with entry into exporting, entry into importing, or transition toward Two-way trader status. More detailed measures of the intensity of digital technology use and of transactions with foreign suppliers and customers would also improve the identification of the search, information, and coordination costs with which the different digital practices are associated.

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Appendix

Table A1. Distribution of firms across MENA economies

Economy	Frequency	Percent	Cumulative (%)
Bahrain	150	2.8	2.8
Djibouti	153	2.8	5.6
Egypt, Arab Rep.	1,024	18.8	24.3
Jordan	592	10.9	35.2
Kuwait	150	2.8	37.9
Morocco	598	11.0	48.9
Oman	299	5.5	54.4
Qatar	480	8.8	63.2
Saudi Arabia	1,002	18.4	81.6
Tunisia	645	11.8	93.4
West Bank and Gaza	360	6.6	100.0
Total	**5,453**	**100.0**	—

Source: Authors' calculations based on WBES.

Table A2. Distribution of firms across ISIC sectors in MENA

ISIC Code	Frequency	Percent	Cumulative (%)
10	623	11.4	11.4
11	32	0.6	12.0
12	5	0.1	12.1
13	74	1.4	13.5
14	375	6.9	20.3
15	21	0.4	20.7
16	40	0.7	21.5
17	34	0.6	22.1
18	44	0.8	22.9
19	4	0.1	23.0
20	87	1.6	24.6
21	18	0.3	24.9
22	195	3.6	28.5
23	165	3.0	31.5
24	64	1.2	32.7
25	212	3.9	36.6
26	12	0.2	36.8
27	49	0.9	37.7
28	35	0.6	38.3
29	13	0.2	38.6
30	7	0.1	38.7
31	65	1.2	39.9
32	31	0.6	40.4
33	24	0.4	40.9
41	365	6.7	47.6
42	59	1.1	48.7
43	146	2.7	51.3
45	140	2.6	53.9
46	490	9.0	62.9
47	956	17.5	80.4
49	99	1.8	82.2
50	14	0.3	82.5
51	5	0.1	82.6
52	47	0.9	83.4
53	11	0.2	83.6
55	273	5.0	88.7
56	272	5.0	93.6
58	8	0.1	93.8
61	19	0.3	94.1
62	61	1.1	95.3
69	17	0.3	95.6
70	31	0.6	96.1
71	68	1.2	97.4
72	3	0.1	97.4
73	26	0.5	97.9
74	28	0.5	98.4
79	67	1.2	99.7
95	19	0.3	100.0
Total	**5,453**	**100.0**	—

Source: Authors' calculations based on World Bank Enterprise Surveys WBES.

Table A3. Descriptive statistics of main variables

Variable	Obs	Mean	Std. Dev.	Min	Max	Description
International Trade Participation	5,372	0.677	0.468	0	1	=1 if the firm imports foreign material inputs and/or exports directly or indirectly.
International Trade Status	5,332	1.042	1.009	0	3	Firm trade status: 0 = *Domestic*, 1 = *Import only*, 2 = *Export only*, 3 = *Two-way trader*.
Digitalization Index	4,832	0.512	0.239	0	1	Composite index based on fixed broadband connection application, website ownership, and receipt of electronic payments.
Website Ownership	5,449	0.603	0.489	0	1	=1 if the firm owns its own website.
Electronic Payments	4,835	0.813	0.390	0	1	=1 if the firm receives at least part of its payments electronically.
Fixed Broadband Application	5,448	0.117	0.322	0	1	=1 if the firm applied for a fixed broadband Internet connection during the previous two years.
Log of Labor Productivity	5,171	9.992	1.350	3.440	15.650	Log of real annual sales per permanent full-time worker.
Manager's Sector Experience	5,355	20.983	10.819	1	67	Number of years of sector-specific experience of the top manager.
Female Top Manager	5,439	0.052	0.222	0	1	=1 if the firm's top manager is female.
Log of Firm Size Category	5,453	0.473	0.443	0	1.099	Natural logarithm of the WBES firm-size category: 1 = Small (<20 employees), 2 = Medium (20–99 employees), and 3 = Large (100 employees and over).
Log of Firm Age	5,396	2.725	0.774	0	5.011	Log of firm age, measured from the year of establishment.
Local Financial Constraint	5,453	0.240	0.172	0	0.738	*Leave-one-out* share of other firms in the same subnational unit reporting access to finance as a major or very severe obstacle.

Source: Authors' calculations based on WBES.

Table A4. Correlation matrix

Variables	1	2	3	4	5	6	7	8
1. International Trade Participation	1.000							
2. Digitalization Index	0.107	1.000						
3. Log of Labor Productivity	0.345	0.062	1.000					
4. Manager's Sector Experience	0.021	0.076	0.053	1.000				
5. Female Top Manager	-0.059	0.027	-0.110	-0.079	1.000			
6. Log of Firm Size Category	0.181	0.193	0.104	0.195	-0.072	1.000		
7. Log of Firm Age	0.043	0.029	0.021	0.524	-0.005	0.244	1.000	
8. Local Financial Constraint	-0.186	-0.028	-0.097	0.167	0.011	-0.037	0.005	1.000

Source: Authors' calculations based on WBES.

Table A5. Countries included in the regional regressions

MENA	Sub-Saharan Africa	East Asia & Pacific	Europe & Central Asia	Latin America & Caribbean	South Asia
Bahrain, Djibouti, Egypt, Arab Rep., Jordan, Kuwait, Morocco, Oman, Qatar, Saudi Arabia, Tunisia, West Bank and Gaza	Angola, Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Congo, Dem. Rep., Congo, Rep., Côte d'Ivoire, Equatorial Guinea, Eswatini, Ethiopia, Gabon, Gambia, The, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Seychelles, Sierra Leone, Somalia, South Sudan, São Tomé and Principe, Tanzania, Togo, Uganda, Zambia, Zimbabwe	Brunei Darussalam, Cambodia, China, Fiji, Indonesia, Kiribati, Lao PDR, Malaysia, Mongolia, Papua New Guinea, Philippines, Samoa, Solomon Islands, Thailand, Tonga, Vanuatu, Vietnam	Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Bulgaria, Georgia, Hungary, Kazakhstan, Kosovo, Kyrgyz Republic, Moldova, Montenegro, North Macedonia, Poland, Romania, Serbia, Tajikistan, Turkey, Turkmenistan, Uzbekistan	Antigua and Barbuda, Argentina, Barbados, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Jamaica, Mexico, Panama, Paraguay, Peru, St. Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago, Uruguay	Bhutan, India, Maldives, Nepal, Sri Lanka