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The Impact of Digital Product Imports on the Export Resilience of Chinese Firms

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Abstract: Imports of digital products have become an important channel for Chinese firms to enhance export resilience and cope with external shocks. Using matched data from the Annual Survey of Industrial Firms and China Customs, this paper empirically examines the impact of digital product imports on firms' export resilience and its underlying mechanisms, with the 2008 global financial crisis serving as the external shock scenario. The results show that imports of digital products significantly improve the export resilience of Chinese firms, and this finding remains robust after a series of robustness tests. The findings of this study provide implications for China to leverage digital trade to strengthen firms' export resilience and promote the development of a trading nation.

Keywords: Imports of digital products; Export resilience; Export diversity

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1. Introduction

Global trade growth is broadly sluggish, yet China's foreign trade maintains stable expansion supported by digital trade and enterprise digital transformation. As a core part of digital trade, digital product imports boost firm resilience via technology spillovers and efficiency gains. China's digital product import volume keeps rising, strongly backing enterprises' digital upgrading. Customs data shows China's cross-border e-commerce imports and exports hit 2.63 trillion yuan in 2024, up 10.8% year-on-year, with massive smart hardware and digital components imported. China's digital imports mainly consist of industrial software, smart equipment and other production-focused goods, enabling firms to optimize production, enrich product lines and explore global markets. Using digital imports to stabilize overseas demand and strengthen export resilience has become an increasingly critical real demand.

2. Theoretical analysis and research hypotheses

Digital product imports serve as a vital way for enterprises to access global advanced digital technologies and

high-end production inputs, and their boosting effect on export resilience is backed by firm heterogeneity theory and Schumpeterian innovation theory.

Per firm heterogeneity theory, imported digital goods generate technology spillovers to lift production efficiency and expand firms' productivity edges. With imported industrial software, smart devices and digital core parts, companies absorb top-tier technologies and managerial experience, streamline production and cut marginal costs to lift global competitiveness. Higher efficiency helps firms withstand external risks and enables export diversification: they broaden product lines and overseas markets to hedge risks and stabilize exports.

Under Schumpeter's innovation theory, digital imports represent typical creative destruction. The inflow of external digital factors overturns traditional production and tech modes, pushing firms to upgrade processes, products, and management for unique competitive strengths. This improves export quality, realizes dual diversification of products and overseas markets, speeds up post-shock structural adjustments and market recovery, and steadily lifts firms' export resilience via sustained innovative momentum.

Based on the above analysis, this paper proposes the following hypotheses:

H1: Imports of digital products can enhance firms' export resilience.

3. Empirical design and variable specifications

3.1. Construction of the econometric model

To examine the impact of digital product imports on firms' export resilience, this study specifies the following two-way fixed-effects baseline regression model:

$$Resi\_export_{it} = \alpha_0 + \beta_1 Dige_{it} + \lambda X_{it} + \mu_i + \theta_t + \varepsilon_{it}$$

where i denotes the firm and t denotes the year; the dependent variable $Resi\_export_{it}$ represents the export resilience of firm i in year t, measured as the deviation of the firm's export value from the baseline year, reflecting the stability and risk-resilience of the firm's exports; the core independent variable $Dige_{it}$ represents the share of digital product imports for firm i in year t, measured as the proportion of the firm's digital product import value relative to total import value, characterizing the firm's intensity of digital product imports; X_{it} is a set of firm-level control variables, primarily including firm profits, leverage ratio, capital intensity, firm size, and firm age, to control for the effects of firm operational characteristics, capital structure, and life cycle; μ_i is the firm-specific fixed effect, θ_t is the year-specific fixed effect, and ε_{it} is the random error term.

3.2. Variable selection

3.2.1. Dependent variable: Firm export resilience (Resi_export)

Firm export resilience captures a firm's ability to maintain export stability and withstand risk shocks in the face of external shocks. Drawing on the research approach of Yao and Sun, this study uses the 2008 financial crisis as the exogenous shock event and measures export resilience by the deviation of firm export volumes from the baseline year. Specifically, this study measures export resilience as the deviation of firm export volumes relative to the 2008 baseline export volume [1]. The calculation formula is:

$$Resi\_export_{it} = \frac{export_{it} - export_{it,base}}{export_{it,base}}$$

Here, "$export_{it}$,base" represents a firm's export value in 2008; if data for 2008 are missing, the export value

for 2007 is used as the baseline. To ensure the availability of baseline data, this study excludes firm samples that had no exports in either 2007 or 2008. A higher value for this indicator indicates that a firm has a stronger ability to grow its exports relative to the baseline period and exhibits greater export resilience.

3.2.2. Key explanatory variable: Digital product imports (Dige)

The core explanatory variable in this study is the firm-level intensity of digital product imports [2]. Drawing on the research approach of Yu *et al.* and incorporating the definitions of digital products from the OECD's *Manual on the Measurement of Digital Trade (2020 Edition)* and the China Academy of Information and Communications Technology's *White Paper on Digital Economic Development*, we construct a firm-level composite digital product import indicator to measure firms' reliance on and level of application of digital technologies, equipment, and digital intermediate goods [3].

The specific approach is as follows: First, identify digital products. Initially, based on the classification standards for tangible digital products outlined in the OECD (2020) and the *White Paper on the Development of the Digital Economy* [4], we extract keywords related to digital products and match them against the Chinese product names in the customs database to preliminarily identify digital products; Second, based on the subheading notes in the *Explanatory Notes to the Commodity and Item Descriptions of the Import and Export Tariff (2020 Edition)*, samples containing keywords but not falling within the scope of digital products are excluded; finally, by combining the list with the ICT product catalog published by the OECD, a final list of digital products is compiled [5]. Trade agent samples are then removed, retaining only import data from manufacturing firms to ensure the sample focuses on actual production activities. Step 2: Constructing a composite measure of digital product import intensity at the firm level. Unlike existing studies that directly use digital product import values or import shares, this approach builds upon the identification of digital products described above and further in firms the level of digital economic development in the countries of origin to construct a composite digital product import intensity indicator at the firm level. The calculation formula is as follows:

$$Dige_{it} = \sum_{d \in \Omega^d} \left(\frac{M_{idt}^{dige}}{M_{it}^{total}} \times NRI_{dt} \right)$$

Here, i represents a firm, t represents the year, and d represents the country of origin; M_{idt}^{dige} is the value of digital product imports by firm i from country d in year t; M_{it}^{total} is the total import value of firm i in year t; Ω^d is the set of countries of origin; and NRI_{dt} is the Networked Readiness Index (NRI) of country d in year t, which measures the level of digital economic development in the country of origin. The data is sourced from the World Economic Forum's *Global Information Technology Report*. This indicator comprehensively considers a firm's reliance on digital product imports and the technological sophistication of the imported products; a higher value indicates greater intensity and higher technological content in the firm's digital product imports. To avoid the influence of outliers, this study winsorizes this indicator at the 1% level on both tails to ensure the robustness of the regression results.

3.2.3. Control variables

To control for the impact of firm-level heterogeneity on export resilience, this study selects five variables—firm size, firm age, firm profit, capital intensity, and leverage ratio—as control variables. The specific measurement methods are as follows: Firm size (lnsize) is measured using the natural logarithm of the total number of

employees at year-end; Firm age (lnage) is measured as the natural logarithm of the difference between the current year and the year the firm was established, plus one; Firm profit (lnprofit) is measured as the natural logarithm of the ratio of total firm profit to industrial sales output, plus one; Capital intensity (lnkdes) is measured as the natural logarithm of the ratio of total fixed assets to the number of employees at year-end; Leverage ratio (leverage) is measured as the ratio of total liabilities to total assets.

3.3. Sample selection and data sources

This paper adopts matched 2008–2014 panel data combining China Industrial Enterprise Database and China Customs Database. The industrial database supplies yearly production, operation, and financial indicators, while the customs database provides microtransaction records including import/export volumes, product types, trade modes, and trade partners.

To ensure sample quality, standardized cleaning and annual matching were performed: both databases were preprocessed separately by standardizing the formats of company names, postal codes, and phone numbers, removing redundant text, and normalizing symbols. Annual observations were matched using three identifiers: exact name matching was performed first, followed by supplementary matching using postal codes and telephone numbers for unmatched records [6]. The annually matched datasets were stacked longitudinally to construct an unbalanced firm-year panel dataset. Delete observations with missing core variables, outliers, and trade intermediaries, keeping only manufacturing enterprises. Apply 1% two-tailed winsorization to major continuous variables to weaken outlier interference. The final benchmark manufacturing firm sample lays a solid data foundation for estimating how digital product imports affect export resilience and relevant mechanisms.

4. Results of the empirical analysis

4.1. Benchmark regression

Table 1 reports baseline regression outcomes of digital product imports' effect on firm export resilience. Columns (1)–(6) add controls stepwise: profit, leverage, capital intensity, firm size, and firm age. The coefficient of Dige slightly fluctuates but stays significantly positive at the 1% level. This verifies that digital product imports significantly boost export resilience, consistent with Hypothesis 1.

For controls: Profit shows a significantly positive coefficient—more profits supply funds to withstand shocks and lift resilience. Higher moderate leverage optimizes resource allocation to stabilize exports. Capital intensity is positive; capital-rich firms enjoy stronger technology and risk resistance. Larger firms rely on scale and resource edges to buffer risks, with higher resilience. Older firms accumulate market experience and networks to cope with external shocks, also raising export resilience.

Table 1. Benchmark regression results

	(1)	(2)	(3)	(4)	(5)	(6)
Variable	*Resi_export*	*Resi_export*	*Resi_export*	*Resi_export*	*Resi_export*	*Resi_export*
Dige	0.473**	0.474**	0.464**	0.467**	0.420**	0.421**
	(0.200)	(0.198)	(0.198)	(0.197)	(0.190)	(0.189)
ln*profit*		0.639***	0.671***	0.673***	0.629***	0.628***
		(0.072)	(0.074)	(0.074)	(0.075)	(0.074)

leverage			0.279***	0.287***	0.290***	0.292***
			(0.041)	(0.041)	(0.041)	(0.041)
ln*kdes*				0.041***	0.208***	0.203***
				(0.006)	(0.011)	(0.011)
ln*size*					0.239***	0.232***
					(0.012)	(0.012)
ln*age*						0.158***
						(0.038)
_cons	0.453***	0.431***	0.286***	0.102***	-1.995***	-2.283***
	(0.012)	(0.013)	(0.026)	(0.036)	(0.120)	(0.140)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	77813	77813	77813	77813	77813	77813
R^2	0.062	0.068	0.070	0.072	0.088	0.088
Adj. R^2	0.062	0.068	0.070	0.072	0.087	0.088

4.2. Endogeneity test

To further mitigate issues of reverse causality and omitted variables between digital product imports and firm export resilience, this study follows the approach of Yu *et al.* by using the firm-level weighted average import tariff as an instrumental variable for digital product import intensity, and conducts a two-stage least squares estimation [7]. The formula for the instrumental variable is:

$$IV_{it} = \sum_{p \in \Omega_i} \left(\frac{\overline{import_{it}}}{\sum_{p \in \Omega_i} \overline{import_{it}}} \right) \times \tau_{pt}$$

In this context, `$import_{it}$` represents the average import value of digital product `p` by firm `i` during the sample period, and `$\tau_{pt}$` denotes the import tariff rate for product `p` in year `t`. The data are sourced from the WTO's Tariff Download Facility database. Since tariff policies are uniformly established by the government and are exogenous to individual firms, and since changes in tariffs directly affect firms' import costs for digital products, these variables satisfy the requirements for correlation and exogeneity as instrumental variables.

Table 2. Results of the endogeneity test

	(1)Phase 1	(2)Phase 2
Variable	***Dige***	***Resi_export***
IV	0.001*	
	(0.000)	
ln*profit*	-0.000	0.627***
	(0.001)	(0.066)
leverage	0.001	0.294***
	(0.001)	(0.035)
ln*kdes*	0.000	0.202***
	(0.000)	(0.010)
ln*size*	0.001**	0.231***
	(0.000)	(0.011)

ln*age*	-0.000	0.157***
	(0.001)	(0.035)
Dige		0.405**
		(0.166)
_cons	0.002	
	(0.003)	
Control variable	Yes	Yes
Firm FE	Yes	Yes
Year FE	Yes	Yes
N	74254	74254
Adj. R^2	0.000	0.290
Kleibergen-Paap rk LM	4.050	
	(p=0.0442)	
Kleibergen-Paap rk Wald F	28.053	
	(threshold = 16.38)	

The test results show that the p-value for the Kleibergen-Paap rk LM statistic is 0.0442, which meets the 5% significance level, thereby rejecting the hypothesis of unidentifiable instrumental variables; meanwhile, the Kleibergen-Paap rk Wald F statistic is 28.053, far exceeding the critical value of 16.38 at the 10% significance level, indicating that there is no issue of weak instrumental variables. In the first-stage regression, the coefficient of the instrumental variable on the intensity of digital product imports was significantly positive, indicating that tariff reductions significantly increased firms' levels of digital product imports; in the second-stage regression, the coefficient of the intensity of digital product imports on firms' export resilience was 0.405, which was significantly positive at the 5% level, confirming the promotional effect of digital product imports on firms' export resilience. The above results indicate that the core conclusions of this paper remain robust after effectively addressing the endogeneity issue.

4.3. Robustness tests

Two sets of robustness tests are carried out to validate baseline results, as displayed in the table.

Switch regression model: The benchmark adopts fixed effects to control firm heterogeneity. We re-estimate with random effects while retaining firm controls (profit, leverage, capital intensity, size, age) and year fixed effects. The core variable dige equals 0.614, significantly positive at the 1% level. Coefficient sign and significance match baseline outcomes, proving the positive effect is stable regardless of fixed/random effect choices, free from model specification bias.

Lag dependent variable by one period: To alleviate reverse causality (high export resilience may enable more digital imports), lagged export resilience is used as the explained variable. Dige's coefficient is 0.406 and still significant at 1%. Digital imports lift both current and subsequent export resilience, eliminating contemporaneous reverse causality and confirming time-consistent conclusions.

Table 3. Results of robustness tests

	(1)	(2)
Variable	***Resi_export***	***Resi_export***
Dige	0.614***	0.406***
	(0.132)	(0.059)
ln*profit*	0.664***	0.374***
	(0.071)	(0.067)
leverage	0.302***	0.291***
	(0.029)	(0.048)
ln*kdes*	0.079***	0.150***
	(0.006)	(0.013)
ln*size*	0.134***	0.197***
	(0.006)	(0.015)
ln*age*	0.183***	0.312***
	(0.016)	(0.058)
_cons	-1.260***	-2.497***
	(0.067)	(0.195)
Control variable	Yes	Yes
Firm FE	Yes	Yes
Year FE	Yes	Yes
N	77813	42912
R^2	0.047	0.099
Adj. R^2	0.047	0.099

Overall, in the two robustness tests described above, the sign of the coefficient for the core explanatory variable Dige remained positive throughout, and it passed the significance test at the 5% level in both cases; simultaneously, the signs and significance levels of the control variables were consistent with the results of the baseline regression. This indicates that the core conclusion of this paper—that "imports of digital products can significantly enhance firms' export resilience"—remains robust across different tests involving variations in model specification, variable construction, and sample selection, with no apparent bias or randomness.

5. Conclusion

This study finds that imports of digital products significantly improve the export resilience of Chinese firms. Policy implications: Optimize digital import structure and cut enterprise import costs. Authorities should ease barriers for core digital intermediates (industrial software, smart components), simplify customs procedures, and lower institutional costs to fill high-end input shortages [8]. Firms shall purchase digital goods rationally, matching transformation demands to maximize technological spillovers and operational efficiency. Perfect supporting facilities and build a full-cycle technology absorption & re-innovation system. Banks offer special low-interest credit for digital imports to ease firm financing stress. Firms should shift from simple import reliance to localized adaptation and secondary innovation, forming an "import–application–absorption–re-innovation" loop to turn external digital inputs into internal innovation drivers for lasting export risk resistance.

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References

[1] Yao S, Sun Z, 2023, Import Diversity of Tangible Digital Products and Firm Export Resilience. World Economic Research, (9): 16–28 + 134.

[2] Zhu S, Zhang W, Zhong T, 2023, Digital Product Imports and the Service-Oriented Transformation of Manufacturing. World Economy, (4): 89–108.

[3] Yu H, Yao L, He H, 2022, How Do Digital Product Imports Affect the Technological Complexity of Chinese Firm Exports. International Trade Issues, (3): 35–50.

[4] Liu J, Sun P, 2021, How Do Digital Product Imports Effectively Promote Firm Innovation? An Empirical Analysis Based on Chinese Micro-firms. Issues in International Trade, (8): 38–53.

[5] Huo Q, Fang H, 2024, Innovation Spillover Effects of Digital Product Imports. Southern Economy, (3): 121–140.

[6] Tian W, Yu M, 2013, Corporate Export Intensity and the Liberalization of Trade in Imported Intermediate Goods: An Empirical Study of Chinese Enterprises. Management World, (9): 28–44.

[7] Yu H, He H, Yao L, 2022, Digital Product Imports and the Export Quality of Chinese firms. Journal of Zhongnan University of Economics and Law, (5): 108–118.

[8] Wei Y, Gong X, Liu C, 2022, Can Digital Transformation Enhance Firm Export Resilience? International Trade Issues, (10): 56–72.