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Impact of third-party online payment systems on trade, export, import, and internet retailing

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ABSTRACT

This study estimates the impact of third-party online payment systems on trade, export, import, and Internet retailing in China. Also, the study examines the financial development mechanism via which third-party payment affects trade, export, import, and Internet retailing in China. By employing a sample of 31 provinces in China covering 2011 to 2018, the findings indicate that, third-party payment drives China's trade (0.43%), export (0.42%), import (0.47%), and Internet retailing (0.24%). The study also finds that third-party payment complements financial development to positively affect trade, export, import, and Internet retailing in China. The study recommends policymakers promote third-party payment development in China to boost trade, export, import, and Internet retailing.

KEYWORDS

Payment technology innovation; Third-party payment; Fintech; Trade; Internet retailing; China

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1. Introduction

International trade has been documented extensively to contribute to economic growth, investment, employment, and poverty reduction (Le & Jan, 2014; Musila & Yiheyis, 2015; Were, 2015; Zahonogo, 2017); however global trade has slowed in recent times (Gächter & Gkrintzalis, 2017; Sun & Muganyi, 2019). This has been attributed mainly to the extensive protectionism and trade tensions, especially between the U.S and China (Bekkers, 2019; Lin & Wang, 2018), financial frictions (Chan, 2019; Gächter & Gkrintzalis, 2017; Sun & Muganyi, 2019), and the recent coronavirus (COVID-19) pandemic (Coquidé et al., 2022b; Hayakawa & Mukunoki, 2021b; Kiyota, 2022b). For instance, the volume of trade in China witnessed a marginal decline from $4,622,415 million in 2018 to $4,577,891.07 million in 2019. Despite these trade frictions, technological progress and digital transformations have been hailed to reduce trade barriers and increase productivity (Barbero & Rodriguez-Crespo, 2018; Choi, 2010a; Fernandes et al., 2019; Freund & Weinhold, 2004; Gnangnon & Iyer, 2018; Rodríguez-Crespo & Martínez-Zarzoso, 2019; Y. Wang & Li, 2017). Digitalization has indeed improved trade by reducing barriers and entry costs, the recent period has also witnessed rapid growth in third-party party payment platforms, especially in China (Duoqi et al., 2019; Jingu, 2014). Third-party payment which constitutes traditional payment and the rapid growth of Fintech services is made up of Internet payment, mobile payment, mobile Point of Sale (POS) payment, cross-border payment service, and POS service and it is dominated by Internet payment and mobile payment.[1]

According to the 2020 China Internet Network Information Center (CNNIC) report[2], China had 854 million third-party payment users in December 2020. This represented 86.4% of the total population from 64.90% in 2016 (see Figure 1). Also, the volume of transactions of third-party payments has surged since March 2013. In March 2013, the volume of transactions stood at RMB 42 billion; however, in December 2018, China recorded RMB 52 trillion in transactions of third-party payments (see Figure 2). Alipay and Tenpay are the dominant third-party payment platform players in China (see Figure 3). As of March 2020, Alipay's market share stood at approximately 56%. Tencent Tenpay consisting of WeChat pay and QQ wallet had a share of approximately 39%. The two combined control approximately 95% share of the third-party payment transactions in China.

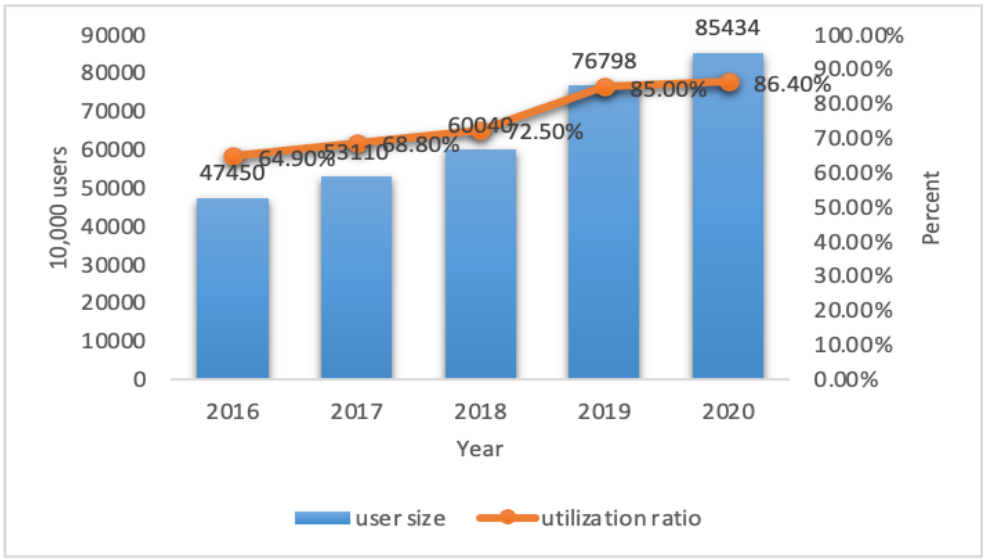

Figure 1. Third-party payment users.

[1] https://www.giiresearch.com/report/rinc291108-china-third-party-payment-industry-report.html retrieved 1/2/2022.
[2] https://www.cnnic.com.cn/IDR/ReportDownloads/202012/P020201201530023411644.pdf retrieved 1/12/2021.

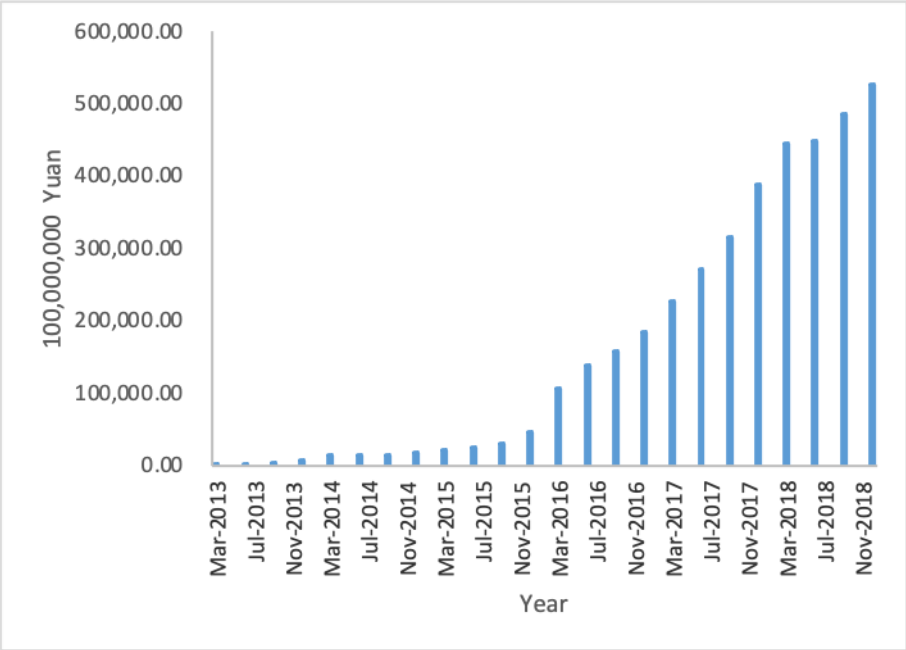

Figure 2. Third-party payment volume of transactions.

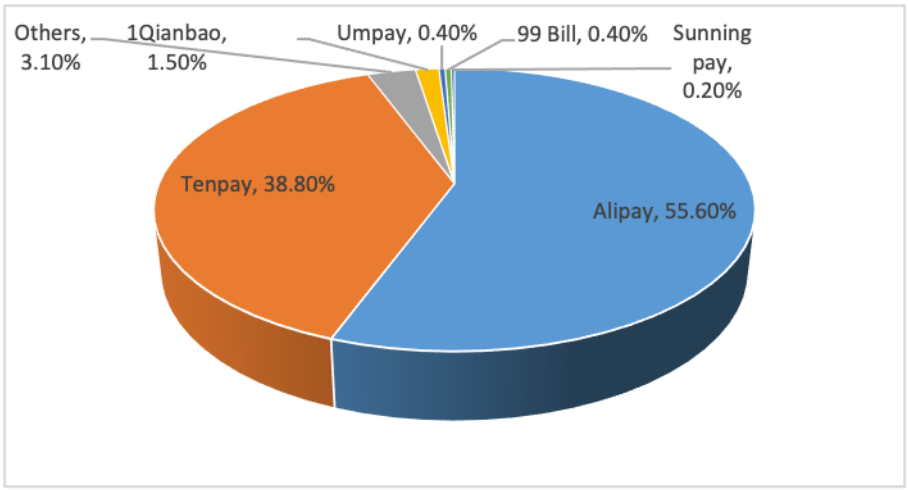

Figure 3. Third-party payment platform's market share.

Alipay, a third-party payment platform founded in 2004, provides payment solutions to Alibaba's Taobao C2C site, Aliexpress, and others (Jingu, 2014). It is used to settle electricity and credit card bills as well as send money to banks that participate (Jingu, 2014). It also enables lending to Micro-Small and Medium-Sized Corporations (MSMSE), which frequently face difficulties obtaining credit from commercial banks, mainly caused by a lack of collateral and banks' inclination to lend to well-capitalized government enterprises (Appiah-Otoo & Song, 2021). Moreover, it promotes easier, cheaper, and more efficient access to financial services and products (Leong et al., 2017). This promotes macroeconomic efficiency (Cheng & Qu, 2020). Despite the tremendous growth of third-party payment platforms and their advantages, these platforms carry risks such as default and credit risks (Gao et al., 2021; Suryono et al., 2021; Wei, 2015; Zhang et al., 2020; Zhongkai & Hassan, 2019; Zhou et al., 2018); however, there exists limited scholarship on the impact of third-party payment on trade. Accordingly, this study aims to examine: (i) the impact of third-party payment on trade, export, import and Internet retailing in China. (ii) the financial development mechanism via which third-party payment affects trade, export, import, and Internet

retailing in China. Unveiling the contributions of third-party payments to trade, export, import, and Internet retailing will guide in making effective policies toward third-party payment development and trade in China.

This research makes three significant contributions to the literature: First, this study adds to the substantial literature on the drivers of trade, export, import, and Internet retailing by examining the impact of third-party payment for the first time on trade, export, import, and Internet retailing and found that third-party payment drives China's trade, export, import, and Internet retailing. Most of the empirical studies on trade have focused on Information and Communication Technologies (ICTs) (Barbero & Rodriguez-Crespo, 2018; Choi, 2010a; Fernandes et al., 2019; Freund & Weinhold, 2004; Gnangnon & Iyer, 2018; Rodríguez-Crespo & Martínez-Zarzoso, 2019; Y. Wang & Li, 2017), financial development (Ahmad et al., 2018; Gächter & Gkrintzalis, 2017; Liang et al., 2019; Osabuohien et al., 2017; Sun & Muganyi, 2019), policy uncertainties (Jiang et al., 2019), and more recently the COVID-19 pandemic (Coquidé et al., 2022a; Hayakawa & Mukunoki, 2021a; Kiyota, 2022a). This study sheds more light on the literature by also showing that third-party payment contributes to trade, export, import, and Internet retailing. Also, this study developed the hypotheses linking third-party payment and trade. Furthermore, we contribute to the limited literature on third-party payment by looking at trade, export, import, and Internet retailing. Most of the empirical studies on third-party payment have focused on financial development (Meifang et al., 2018; Wei, 2015), economic growth (Deng et al., 2019; Y. Li et al., 2019), poverty reduction (Appiah-Otoo & Song, 2021; X. Wang & He, 2020), and the determinants (Fu et al., 2020; Shim & Shin, 2015). This study expands the literature by looking at trade, export, import, and Internet retailing. Finally, we assessed the complementary role of financial development in the third-party and trade, export, import, and Internet retailing relationship and found that third-party payment complements financial development to positively affect trade, export, import, and Internet retailing in China

In the accompanying segments, we present the literature review and hypothesis development, methodology, findings and discussions, and conclusions and policy suggestions.

2. Literature review and hypothesis development

ICTs are found to be a major enabler of trade. For instance, (Freund & Weinhold, 2004) documented an increase in Internet use to increase export by approximately 0.2%. (Choi, 2010b) documented an increase in Internet use to increase service trade within the ranges of 0.23% to 0.42%. Also, (Nath & Liu, 2017) documented an increase in Internet use to increase trade for seven service items. Focusing on the European Union, (Barbero & Rodriguez-Crespo, 2018) documented Internet use to increase trade. Finally, focusing on China, (Fernandes et al., 2019) documented that the Internet increases China's export and improve firm performance as a whole even before the emergence of third-party payment platforms.

Third-party payment platforms are the technologies behind e-commerce development in China. They employ the use of blockchain technology, big-data analytics, machine learning, Internet-of-Things technology, cybersecurity, biometrics, distributed ledger, and quantum computing among others to address the problems of asymmetric information and high transaction costs mostly associated with the traditional banking system (Xie et al., 2015) and the trade barriers. They also facilitate tighter collaboration between customers, businesses, suppliers, and joint associates. Thanks to third-party payment platforms, one can stay in the U.S and buy goods from China and vice versa. Also, one can easily access credit for exporting and importing goods and services. As a result, this study hypothesizes:

Hypothesis 1: The impact of third-party payment on trade, export, import, and Internet retailing in China is positive.

Third-party payment platforms are acknowledged to stimulate financial development by promoting security, profitability, and innovation while financial development also promotes third-party payment (Dong et al., 2020). For instance, (Y. Wang et al., 2021a) argued that fast third-party payments have driven global financial services

reform and encouraged financial disintermediation realization. Third-party payments have promoted traditional financial services innovation and reform through the application of e-finance and this has promoted the efficiency of traditional banks (Y. Wang et al., 2021b). (Y. Wang et al., 2021b) also stressed that third-party payment raises bank deposit business by influencing the risk assessment methods of commercial banks, which changes the market rules to some extent. Moreover, it is favourable to the broad enhancement of the performance of commercial banks (Y. Wang et al., 2021b). In the same vein, (Meifang et al., 2018) argued that third-party payment improves financial development by improving the customer base of banks. For instance, one has to create a bank account before using third-party payment platforms such as Alipay. This broadens banks' income through fees obtained from bank cards and late credit card fees (Meifang et al., 2018). Also, banks benefit from gateway fees from the use of third-party payment platforms for transactions (Meifang et al., 2018). (S. Li et al., 2020) also argued that commercial banks rely on third-party payment platforms to develop shopping centers to extend the sales channels of off-balance sheet business and financial products while finance is empirically demonstrated to influence trade. Third-party payment platforms have to deposit their funds into bank's account which raises bank's income (Meifang et al., 2018). Third-party payment platforms further facilitate the easier flow of funds to banks which enhances bank liquidity while financial development also stimulate third-party payment (Meifang et al., 2018). For instance, (Sun & Muganyi, 2019) explored the linkages between financial depth and China's trade and documented financial depth to influence China's trade; however, the nature of impact depends on the proxy of financial depth employed. (Osabuohien et al., 2017) examined the contributions of financial development on trade focusing on the ECOWAS region and documented financial development to improve trade flow in ECOWAS. (Jaud et al., 2015) showed finance to be an important contributor to export performance, especially with goods with higher financial needs benefiting the most. According to (Gächter & Gkrintzalis, 2017), (Ahmad et al., 2018), financial depth improves access to finance to the private sector which helps suppliers to provide more trade credit to manufacturing firms. Also according to (Wu et al., 2012), (Tang & Moro, 2020), (X. Wang et al., 2019) in a country with a well-developed financial sector, firms rely mostly on trade and short period finance instruments. Finally, according to (Héricourt & Poncet, 2015), financial development saves Chinese exporters who target countries with higher exchange rate volatilities. Thus, we hypothesize:

Hypothesis 2: Third-party payment and financial development are complementary drivers of trade, export, import, and Internet retailing in China.

3. Data and methodology

3.1 Data

We employed panel data on trade, export, import, Internet retailing, population, Internet use, domestic credit, and third-party payment for 31 provinces in China- Beijing, Tianjin, Hebei, Shanxi, Neimenggu, Liaoning, Jilin, Heilongjiang, Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, Shandong, Henan, Hubei, Hunan, Guangdong, Guangxi, Hainan, Chongqing, Sichuan, Guizhou, Yunan, Xizang, Shaanxi, Gansu, Qinghai, Ningxia, and Xinjiang. The data covers the period from 2011 to 2018. This period was influenced by the availability of third-party payment datasets. Third-party payment denotes payment services offered on an unbiased payment platform other than banks that are connected to the bank payment and settlement systems of e-commerce firms and commercial banks (Meifang et al., 2018). Trade is the summation of export and import. Export represents the total amount of goods or services sold from China to abroad whilst import represents the total amount of goods or services sold in China from abroad. Internet use refers to the number of individuals using the Internet. Internet retailing denotes the use of the Internet to sell goods and services. Population size signifies the total provincial population. Domestic credit was used to represent financial development. The data on third-party payment was obtained from (Feng et al.,

2019)[3] while the data on trade, export, import, population, and Internet use were derived from the China Statistical Yearbook, 2022[4]. The data on domestic credit was derived from the wind database (Wind, 2021.).

Table 1 shows the summary statistics for the variables. Trade has an average of 19.46% and a maximum of 22.74%. At the disaggregated level, the averages of export and import are not significantly different; however, export (18.84%) has a higher average as compared to import (18.55%). Internet retailing has an average of 9.67% with a maximum of 11.49%. The averages of third-party payment, population, Internet use, and domestic credit are 4.86%, 8.12%, 5.49%, and 8.94%, respectively. The study does not have issues with outliers since the standard deviation of the variables lies below the averages.

Table 1. Descriptive statistics.

Variable	Definition	Obs.	Mean	Std. Dev.	Min	Max
lntrade	Summation of export and import	248	19.463	1.656	15.019	22.742
lnexport	Export	248	18.836	1.627	14.889	22.219
lnimport	Import	248	18.545	1.831	12.758	21.868
lnretail	Internet retailing	248	9.674	0.977	6.407	11.485
lntpp	Third-party payment	248	4.859	0.817	2.381	5.939
lnpop	Population	248	8.123	0.841	5.714	9.337
lnint	Internet use	248	5.488	3.263	5.333	8.990
lndcps	Domestic credit	248	8.938	3.167	7.710	11.886

3.2 Model

3.2.1 Empirical model

Following (Choi, 2010b), this study employs the modified gravity model; however, we ignored the distance variable since we focused only on China.

The empirical model is as follows: Eq. (1)

$$\ln trade_{it} = b_0 + b_1 \ln tpp_{it} + b_2 \ln pop_{it} + b_3 \ln int_{it} + b_4 \ln dcps_{it} + \varepsilon_{it} \quad (1)$$

where $\ln trade$ signifies trade which is further disaggregated into export ($\ln export$) and import ($\ln import$), and Internet retailing ($\ln retail$), $\ln tpp$ denotes third-party payment, $\ln pop$ denotes population, $\ln int$ signifies Internet use, $\ln dcps$ signifies domestic credit while ε represents the error term. The subscript i and t show provinces and time respectively.

To explore the financial development channel via which third-party payment affects trade, we specify the following model: Eq. (2)

$$\ln trade_{it} = b_0 + b_1 \ln tpp_{it} + b_2 \ln pop_{it} + b_3 \ln int_{it} + b_4 \ln dcps_{it} + b_5 \ln tpp_{it} \times \ln dcps_{it} + \varepsilon_{it} \quad (2)$$

The purpose of this study is to estimate b_1 of Eq. (1) and b_5 of Eq. (2). According to (Brambor et al., 2006), it is incorrect to interpret the coefficients b_1, b_2, b_3, and b_4 of Eq. (2) when the model contains an interaction term. Thus, b_1, b_2, b_3, and b_4 are not highlighted in Eq. (2). We anticipate $b_1 - b_4$ having a statistically significant positive relationship with trade in Eq. (1). We also expect $b_5$to have a statistically significant positive relationship with trade in Eq. (2).

[3] See (Feng et al., 2019) for the construction of the index on third-party payment.
[4] http://data.stats.gov.cn/ retrieved 1/10/2021.

3.2.2 Econometric model

The Panel-Corrected Standard Errors (PCSE) and the Feasible Generalized Least Squares (FGLS) estimators were employed for the econometric investigation in this work. These approaches yield reliable standard errors and address the issues of cross-sectional dependence (Appiah-Otoo et al., 2023; Fomby et al., 1984; Ntiamoah et al., 2023; Reed & Webb, 2010).

The PCSE model is stated as Eq. (3):

$$y_{it} = \alpha_i + \delta x_{it} + \mu_{it} \tag{3}$$

Where: y_{it} denotes the dependent variables; α_i denotes the constant; δ is the vector of coefficients to be estimated, x_{it} is the matrix of independent variables; μ_{it} denotes the error term.

The FGLS is also estimated using Eq. (4)

$$y_{it} = \varpi x_{it} + \varepsilon_{it} \tag{4}$$

Where: y_{it} signifies the dependent variables; ϖ is the vector of coefficients to be estimated, x_{it} is the matrix of independent variables; ε_{it} represents the error term.

This study further employed the two-step system GMM (sys-GMM) model for our robust analysis. This model produces efficient results since it addresses endogeneity by removing fixed effects, and transforms all the regressors via differencing. This model is appropriate when the period (T) is small and the number of cross-sections (N) is large. That is, N>T as in the case of this study N (31) > T (8).

4. Results and discussion

Because the study focuses on different provinces in China and a short period, there could be the existence of cross-sectional dependence among the provinces. To this end, this study initially scrutinized the cross-sectional dependence of the variables and reports the findings in Table 2. The findings in Table 2 reveal that all the variables are cross-sectionally dependent (correlated across the provinces understudy). This implies that any shock in one variable will influence the other.

Table 2. Cross-sectional dependence results.

Variable	CD-test	p-value
lntrade	22.170***	0.000
lnexport	22.260***	0.000
lnimport	17.880***	0.000
lnretail	54.920***	0.000
lntpp	60.090***	0.000
lnpop	29.990***	0.000
lnint	60.980***	0.000
lndcps	44.000***	0.000

Table 3 depicts the correlation connection between the variables. Third-party payment, population, and domestic credit are found to have a considerable positive correlation with trade, although Internet use has a modest positive correlation with trade. As a result, growth in third-party payment, population, Internet use, and domestic credit will fuel China's trade. Population size and domestic credit have a significant positive correlation with third-party payment, but Internet use has a strong negative correlation with third-party payment. The maximum correlation coefficient value of 0.65 is less than 0.7, indicating that the study does not suffer from multicollinearity.

Table 3. Correlation analysis.

Variables	lntrade	lntpp	lnpop	lnint	lndcps
lntrade	1				
lntpp	0.334***	1			
lnpop	0.649***	0.220***	1		
lnint	0.143*	-0.371***	0.178**	1	
lndcps	0.439***	0.250***	0.288***	-0.0387	1

*Notes: * p < 0.05, ** p < 0.01, *** p < 0.001.*

Table 4 summarizes the PCSE results about the direct impact of third-party payment on trade, export, and import. At the 5% significance level, the baseline findings in Modes 1, 3, and 5 reveal that third-party payment significantly improves trade (0.68%), export (0.67%), and import (0.75%). When population, Internet use, and domestic credit were factored in, the findings revealed that third-party payment significantly improves trade (0.43%), export (0.42%), and import (0.44%) at the 5% significance level. The considerable positive association between third-party and trade, export, and import verifies our presumptions and hypothesis 1. Third-party payment platforms, therefore, assist e-commerce development in China, with e-commerce development recognized to cut trade costs by decreasing moral hazard costs between consumers and sellers (Fernandes et al., 2019). These platforms have also created a new route to funding, reducing the bottlenecks that SMEs, importers, and exporters encounter in trade. We also discovered that population size has a significantly positive impact on trade, export, and import. This finding is in collaboration with (Choi, 2010b). Internet use also has a significantly positive impact on trade and export in China. This discovery also backs up (Freund & Weinhold, 2004), (Choi, 2010b), (Nath & Liu, 2017), and (Fernandes et al., 2019). Domestic credit is also a driving force in China's trade, export, and import. This supports the findings of (Sun & Muganyi, 2019), (Osabuohien et al., 2017), and (Jaud et al., 2015)

Table 4. Panel corrected standard errors output for third-party payment and trade, export, and import.

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Trade		Export		Import	
lntpp	0.676**	0.433**	0.665**	0.419**	0.751**	0.440**
	(0.325)	(0.198)	(0.305)	(0.172)	(0.354)	(0.215)
lnpop		0.996***		1.077***		1.075***
		(0.098)		(0.094)		(0.086)
lnint		0.072**		0.068**		0.060
		(0.036)		(0.031)		(0.040)
lndcps		0.128***		0.106***		0.160***
		(0.020)		(0.019)		(0.016)
Constant	16.176***	7.729***	15.604***	6.732***	14.898***	5.911***
	(1.603)	(1.026)	(1.505)	(0.964)	(1.744)	(0.917)
Observations	248	248	248	248	248	248
R^2	0.111	0.528	0.112	0.559	0.112	0.521

*Notes: Standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01.*

The FGLS findings in Table 5 are not significantly different from the PCSE in Table 4; however, Internet use was found to significantly affect import. Thus, we can conclude that our findings are robust.

4.1. Mechanism result

Tables 6 highlight the financial development route via which third-party payment influences trade, export, and import. The interaction impact of third-party payment on trade, export, and import is considerably positive in both the PCSE and FGLS models, according to the results of Table 6. This lends credibility to our hypothesis 2. As a result,

Table 5. Feasible generalized least squares output for third-party payment and trade.

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Trade		Export		Import	
lntpp	0.676***	0.433***	0.665***	0.419***	0.751***	0.440***
	(0.121)	(0.102)	(0.119)	(0.097)	(0.134)	(0.114)
lnpop		0.996***		1.077***		1.075***
		(0.095)		(0.090)		(0.105)
lnint		0.072***		0.068***		0.060**
		(0.025)		(0.024)		(0.028)
lndcps		0.128***		0.106***		0.160***
		(0.024)		(0.023)		(0.027)
Constant	16.176***	7.729***	15.604***	6.732***	14.898***	5.911***
	(0.598)	(0.769)	(0.587)	(0.730)	(0.661)	(0.857)
Observations	248	248	248	248	248	248

*Notes: Standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01.*

an expansion in third-party payment systems broadens China's financial industry and vice versa, thereby promoting trade, export, and import.

Table 6. Third-party payment and trade, export, and import (financial development channel).

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	PCSE			GLS		
	Trade	Export	Import	Trade	Export	Import
lntpp	-0.158	-0.243*	0.100	-0.158	-0.243	0.100
	(0.124)	(0.137)	(0.141)	(0.183)	(0.172)	(0.208)
lnpop	1.013***	1.096***	1.085***	1.013***	1.096***	1.085***
	(0.091)	(0.085)	(0.081)	(0.092)	(0.086)	(0.105)
lnint	0.092**	0.091**	0.072	0.092***	0.091***	0.072**
	(0.044)	(0.039)	(0.046)	(0.025)	(0.023)	(0.028)
lndcps	-0.281**	-0.352**	-0.075	-0.281***	-0.352***	-0.075
	(0.129)	(0.137)	(0.128)	(0.109)	(0.102)	(0.124)
lntpp×lndcps	0.085***	0.096***	0.049*	0.085***	0.096***	0.049*
	(0.027)	(0.029)	(0.026)	(0.022)	(0.021)	(0.025)
Constant	10.246***	9.551***	7.361***	10.246***	9.551***	7.361***
	(0.793)	(0.852)	(0.686)	(0.994)	(0.933)	(1.131)
Observations	248	248	248	248	248	248
R^2	0.554	0.594	0.528			

*Notes: Standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01.*

4.2. Robustness analysis

4.2.1 Alternative measure of trade

According to (Chan, 2019), financial frictions in trade force manufacturers to sell their goods through alternate channels such as wholesalers, trading businesses, and retailing. Based on this logic, we investigate the influence of third-party payment on trade via Internet retailing in China. Table 7 shows that the findings are not substantially different from our earlier findings. At the 1% level, third-party payment promotes Internet retailing considerably (0.242%). Third-party payment and domestic credit have a positive and substantial interaction impact on Internet retailing to also collaborate with our aforementioned discoveries.

Table 7. Third-party payment and Internet retailing.

Variables	Model 1	Model 2	Model 3	Model 4
	PCSE		GLS	
lntpp	0.242***	0.096***	0.242***	0.096*
	(0.039)	(0.028)	(0.031)	(0.055)
lnpop	0.942***	0.946***	0.942***	0.946***
	(0.021)	(0.018)	(0.028)	(0.028)
lnint	0.000	0.005	0.000	0.005
	(0.006)	(0.007)	(0.007)	(0.008)
lndcps	0.046***	-0.055**	0.046***	-0.055*
	(0.005)	(0.026)	(0.007)	(0.033)
lntpp×lndcps		0.021***		0.021***
		(0.005)		(0.007)
Constant	0.441*	1.061***	0.441*	1.061***
	(0.244)	(0.160)	(0.231)	(0.301)
Observations	248	248	248	248
R^2	0.878	0.883		

*Notes: Standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01.*

4.2.2 Two-step system GMM results

Table 8 shows the two-step system GMM[5] results. The findings show that previous trade, export, import, and Internet retail serve as an impetus to the current trade, export, import, and Internet retail volumes. Third-party payment significantly enhances trade, import, and Internet retail to concur with our previous findings. Population size and domestic credit also significantly enhance trade, export, import, and Internet retail, except domestic credit which impedes export. Internet use was found to significantly impede trade, import, and Internet retailing while it enhances export. The results of the interaction effect of third-party payment and domestic credit on trade, export, and Internet retailing were positive and statistically significant. This also aligns with our previous outcomes.

Also, the AR (2) probability values show that the study does not suffer from second-order autocorrelation. The Hansen test probability values also show that the instruments used are not over-identified.

Table 8. Sys-GMM output (third-party payment).

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
	Trade		Export		Import		Internet retailing	
l.lntrade	0.852***	0.815***						
	(0.008)	(0.013)						
l.lnexport			0.966***	0.926***				
			(0.023)	(0.010)				
l.lnimport					0.885***	0.886***		
					(0.011)	(0.030)		
l.lnretail							0.956***	0.941***
							(0.007)	(0.009)
lntpp	0.133***	-0.063	0.079	-0.365***	0.437***	0.417***	0.053***	0.041**
	(0.025)	(0.054)	(0.163)	(0.030)	(0.037)	(0.052)	(0.008)	(0.020)
lnpop	0.198***	0.174***	0.091***	0.127***	0.137***	0.135***	0.038***	0.048***
	(0.020)	(0.035)	(0.026)	(0.016)	(0.019)	(0.042)	(0.008)	(0.009)
lndcps	0.013***	-0.304***	0.002	-0.255***	0.011***	0.017	0.003***	-0.039***
	(0.003)	(0.027)	(0.002)	(0.028)	(0.003)	(0.045)	(0.001)	(0.013)
lnint	-0.034***	0.033*	0.068***	-0.002	-0.034***	-0.027**	-0.009***	0.004*

[5] In the two-step system GMM model, we treated the time dummies and the lag form of the independent variables as instruments.

	(0.012)	(0.018)	(0.011)	(0.009)	(0.011)	(0.012)	(0.002)	(0.002)
lntpp×lndcps		0.063***		0.053***		-0.001		0.008***
		(0.005)		(0.005)		(0.009)		(0.003)
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.455***	2.662***	0.000	2.084***	0.000	-0.587***	0.000	0.000
	(0.140)	(0.251)	(.)	(0.151)	(.)	(0.218)	(.)	(.)
Observations	217	217	124	217	217	217	217	217
AR (1) test p-value	0.238	0.234	0.020	0.009	0.095	0.096	0.127	0.170
AR (2) test p-value	0.159	0.189	0.379	0.117	0.865	0.857	0.271	0.703
Hansen test p-value	0.337	0.355	0.126	0.383	0.363	0.326	0.410	0.786

*Notes: Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.*

4.3. An alternative measure of third-party payment

Third-party payment is a sub-section of digital finance, digital financial inclusion, Internet finance, or fintech (financial technology) development in China (Appiah-Otoo & Song, 2021; Song & Appiah-Otoo, 2022). To this end, this study further uses fintech ($\ln if$) as a comprehensive measure to compute the impact on trade, export, import, and Internet retailing and the findings are displayed in Table 9. It was observed that the findings are close to those derived in Table 8. Thus, fintech development accelerates trade, import, and Internet retailing in China.

5. Conclusion

This research evaluated the contributions of third-party payment to Chinese trade, export, import, and Internet retailing. The study also explored the financial development mechanism via which third-party payment affects trade, export, import, and Internet retailing. By engaging a sample of 31 provinces in China covering 2011 to 2018 and utilizing the Panel-Corrected Standard Errors and the Feasible Generalized Least Squares techniques, the study documented that third-party payment drives China's trade (0.43%), export (0.42%), import (0.47%), and Internet retailing (0.24%). Finally, third-party payment complements financial development to positively affect trade, export, import, and Internet retailing in China.

The following theoretical contributions have been made by this work. First, this study has created the mechanisms via which third-party payment affects trade. These theoretical frameworks will serve as the foundation for future research on the influence of payment technologies on trade. Second, this study looked at the financial development route via which third-party payment affects trade. Finally, by demonstrating that third-party payment contributes to trade, this study adds to the considerable literature on the influence of financial development and ICT on trade.

The findings of this study offer important practical implications for policymakers in China. The conclusions show that third-party payment drive trade in China. The results also showed that third-party payment complements financial development to stimulate trade in China. Accordingly, this study recommends that policymakers should promote third-party payment development in China. Specifically, this study recommends that there should be strong institutional reforms to guide the safe development of third-party payment in China. Among some of the reforms are: there should be restrictions on the amount of money one can send and receive on third-party payment platforms; there should be a threshold on the amount of loan one can borrow from third-party payment platforms; there should be regular customer identification; there should be a minimum capital requirement before one can set-up a third-party payment platform; there should be qualified shareholders; there should be a well-structured

Table 9. Sys-GMM output (fintech).

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
	Trade		Export		Import		Internet retailing	
l.lntrade	0.806***	0.709***						
	(0.013)	(0.023)						
l.lnexport			0.975***	0.858***				
			(0.014)	(0.025)				
l.lnimport					0.862***	0.846***		
					(0.009)	(0.011)		
l.lnretail							0.930***	0.914***
							(0.013)	(0.016)
lnif	1.330***	0.612***	-0.145	-0.335***	1.248***	1.137***	0.133***	0.062
	(0.085)	(0.164)	(0.098)	(0.104)	(0.124)	(0.140)	(0.033)	(0.049)
lnpop	0.287***	0.332***	0.099***	0.202***	0.193***	0.200***	0.067***	0.081***
	(0.019)	(0.034)	(0.024)	(0.027)	(0.018)	(0.020)	(0.013)	(0.016)
lndcps	0.010***	-0.932***	0.010***	-0.589***	0.011***	-0.115**	0.004***	-0.066***
	(0.003)	(0.118)	(0.002)	(0.081)	(0.003)	(0.057)	(0.001)	(0.018)
lnint	-0.126***	-0.014	-0.051***	0.005	-0.078***	-0.054***	-0.011***	-0.005***
	(0.014)	(0.020)	(0.011)	(0.013)	(0.017)	(0.018)	(0.002)	(0.002)
lnif×lndcps		0.179***		0.114***		0.024**		0.013***
		(0.022)		(0.016)		(0.011)		(0.004)
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-4.984***	-1.128	0.435	2.497***	-4.747***	-4.098***	-0.482***	-0.164
	(0.335)	(0.896)	(0.471)	(0.507)	(0.541)	(0.621)	(0.146)	(0.244)
Observations	217	217	217	217	217	217	217	217
AR (1) test p-value	0.251	0.277	0.012	0.014	0.106	0.124	0.137	0.170
AR (2) test p-value	0.202	0.401	0.085	0.100	0.759	0.729	0.243	0.779
Hansen test p-value	0.502	0.568	0.427	0.671	0.626	0.533	0.535	0.324

*Notes: * p < 0.1, ** p < 0.05, *** p < 0.01.*

organization with a well-known premise; there should be deposit insurance for consumers to protect them against any platform failure, and there should be the protection of consumer's privacy. Also, it was established that trade, export, import, Internet retailing, and Internet use explain third-party payment in China, thus this study recommends policymakers promote the development of Internet and mobile Internet infrastructure investment to promote third-party payment development. This study also suggests that policymakers should encourage partnerships between civil societies, and the private and public sectors to stimulate Internet investment in China. Finally, further collaboration between third-party payment companies, banks, shipping, and logistic services, customs, and regulators will ensure all actors benefit from trade.

Due to multicollinearity, this study controlled for population, domestic credit, and the Internet while ignoring other variables that might equally impact trade. Although the sys-GMM technique addresses this challenge, future studies can expand the control variables to test the validity of our findings when further data becomes accessible. Also, due to inadequate data, this study focused on macro data thus future studies should focus on enterprise data. Moreover, future studies should examine the impact of third-party payment on service trade. Furthermore, future studies should explore the impact of third-party payment on trade by focusing on the various industries. Finally, future studies should extend this study to different countries.

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Conflict of interest

All the authors claim that the manuscript is completely original. The authors also declare no conflict of interest.

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