Chapter 5

Retail Fintech Payments: Facts, Benefits, Challenges, and Policies

Yueling Huang

5.1. Introduction

Digital technology is reshaping many aspects of personal lives and business practices, and payment systems are no exception.[1] In fact, payment is the most important business area in financial technology (fintech), comprising 77% of transaction value worldwide in 2019. This number is even higher in Asia (85%), compared with 9% in alternative lending and 5% in personal finance. Up to 92% of fintech users worldwide are in digital payments (Statista 2020). Fintech presents a unique opportunity for emerging economies to leapfrog, in that renovation of traditional financial systems in these countries is not costly. Given such importance and relevance of fintech payments for Asia and emerging economies, this chapter comprehensively and empirically assesses the growing penetration of fintech payment systems, evaluates their impacts and challenges, and reflects on ways to improve.

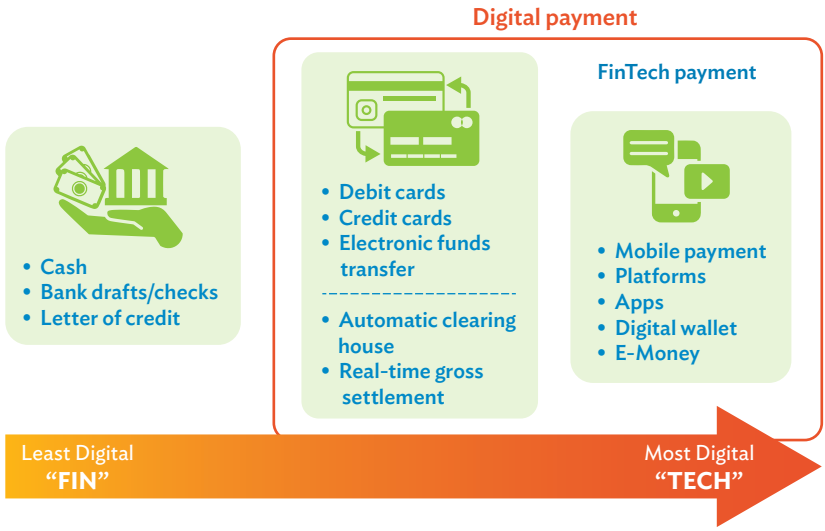
What is a fintech payment system? Figure 5.1 lists different types of payment systems and classifies them based on the level of digitization. Most payment systems (except for physical cash) require both financial intermediary efforts to connect the senders and recipients of transactions as well as technological infrastructure to securely and accurately clear and settle these transactions. Traditional payment methods (leftmost in Figure 5.1) such as bank drafts, checks, and letters of credit involve more formal financial institutions, typically banks, but a limited role for digital technologies. Digital payment systems gradually took over with the emergence of debit cards, credit cards, and electronic fund transfers. Cash can also be more easily withdrawn

[1] This chapter was prepared as a background paper for ADB (2021).

anytime from ATMs, reducing the need to visit banks physically. In addition to the adoption of cards and cashless payments, digitally enabled clearing and settlement facilities such as an automated clearing houses and real-time gross settlement have also greatly ensured cheaper, faster, and safer transactions. Since smaller payments can now be better implemented electronically, reliance on cash has been reduced, which also facilitates record-keeping and increases transparency.

This chapter defines fintech payments (rightmost in Figure 5.1), as those that leverage the latest advances in digital technology. Fintech payments reinforce the benefits of earlier digital payment solutions (middle, Figure 1) in efficiency, convenience, and transparency. Fintech payments also foster financial inclusion, as a substantial part of fintech firms' customers were previously unbanked or underbanked. In the economies of the Association of Southeast Asian Nations (ASEAN), 41% of users of fintech payments were unbanked or underbanked in 2018 (CCAF, ADB Institute, and FinTechSpace 2019). Previous digital payment solutions, such as debit or credit cards, did not impart this benefit, as these payment methods typically require access to

Figure 5.1: Classification of Payment Systems



Source: Author.

a financial account. This chapter will deal with three other aspects to which fintech payments have brought convenience: e-commerce, spillover effect on the development of other fintech products, and remittance transfers.

This chapter focuses on retail payment systems, i.e., payment systems that transfer large volumes of funds of relatively small value.[2] Two main segments of retail payment systems are consumer-to-consumer (C2C) and consumer-to-business (C2B) (see Table A5.1 for examples). The focus is on retail payments because individuals and small and medium-sized enterprises are the two largest customer segments of fintech payments—52% and 26% of fintech payment users on average in ASEAN in 2018, respectively (CCAF, ADB Institute, and FinTechSpace 2019).

The chapter mainly examines the current fintech payments landscape and its impacts, both within the context of the People's Republic of China (PRC) and across countries. It uses aggregate and cross-country data to highlight five stylized facts on payment systems, some unique to Asia. Exploiting province-level variation of Alipay from the PKU Digital Financial Inclusion Index of China (PKU-DFIIC), the chapter uses the PRC as a country case study to empirically evaluate the benefits of fintech payment systems on e-commerce and fintech development, in general. The analysis also extends to the cross-country level in terms of e-commerce and remittances transfers using primarily data from the World Bank's Global Findex Database. Finally, the chapter outlines several challenges faced by fintech payments and offers policy recommendations.

CCAF, ADB Institute, and FinTechSpace (2019) provide a comprehensive overview of the fintech ecosystem in the ASEAN region. A recent report by the Bank of International Settlements (2020) discusses the relationships between fintech payments and efficiency, inclusion, competition as well as central banking. Aron and Muellbauer (2019) focus on the economics of mobile money and revisit the empirical evidence from the micro literature, especially in terms of financial inclusion. Agarwal et al. (2020) exploit the introduction of QR-code payment technology in 2017 by DBS, the largest bank in Singapore. They show that due to reduction in frictions and transaction/cash-handling costs, mobile payments stimulate small business creation, especially in poorer communities. Fintech payments also enable more efficient distribution of government transfers, which is particularly relevant during crisis times such as the current

[2] This is as opposed to wholesale payments, which involve transactions of large value. Therefore, certain commercial transactions, if of low value (e.g., purchase of grocery items from a supermarket), are also considered retail payments.

pandemic. Bangura (2016) estimates that the costs saved by Sierra Leone's shift to mobile wallets to distribute payments to frontline workers during the Ebola crisis was more than $10 million. During the COVID-19 pandemic, many national governments are also encouraging the distribution of cash assistance digitally. Prominent examples include the distribution of consumption coupons via Alipay and WeChat Pay in PRC (Agur Peria, and Rochon 2020), the PromptPay system in Thailand (Rutkowski et al., 2020), and "Bono COVID-19" in Chile (Prady, 2020). Compared to the more traditional payment methods, digital G2P (government-to-person)/G2B (government-to-business) payments have the advantages of being more transparent, timelier, less costly, better at identifying intended beneficiaries through digital ID, and targeting the most deserving recipients more accurately (Agur Peria, and Rochon 2020; Auer, Cornelli, and Frost, 2020; Una et al., 2020). This chapter differs from the literature in terms of its data-driven approach and comprehensiveness of the empirical assessment of the benefits of fintech payments.

The rest of the chapter is organized as follows: Section 2 reviews the related literature on fintech and its implications. Section 3 documents five stylized facts on the current payment systems landscape. Section 4 empirically evaluates the role of fintech payments within the context of the PRC. Section 5 extends the empirical analysis to a cross-country framework. Section 6 discusses the potential challenges of fintech payments systems and offers policy recommendations. Section 7 concludes.

5.2. Literature Review

Klein (2020) describes the current digital payments landscape in the PRC. Shen, Hueng and Hu (2020) show that promoting financial literacy and digital financial products are essential for advancing financial inclusion. Using data on the province-level variation in Alipay penetration in the PRC, this chapter highlights the positive relationship between fintech payments and e-commerce and the spillover effect on development in other fintech products.

Furthermore, using data from Alibaba, Fan et al. (2018) show that e-commerce increases aggregate domestic trade and results in 1.6% welfare gains on average and even higher in smaller and more remote cities. E-commerce thus enhances financial inclusion. In a recent paper, Kang, Wang, and Ramizo (2021) assess the role of technology in business-to-consumer (B2C) e-commerce in Asia, but they mainly focus on ICT.

5.3. The Fintech Payments Landscape

This section presents five stylized facts about the current fintech payments landscape.

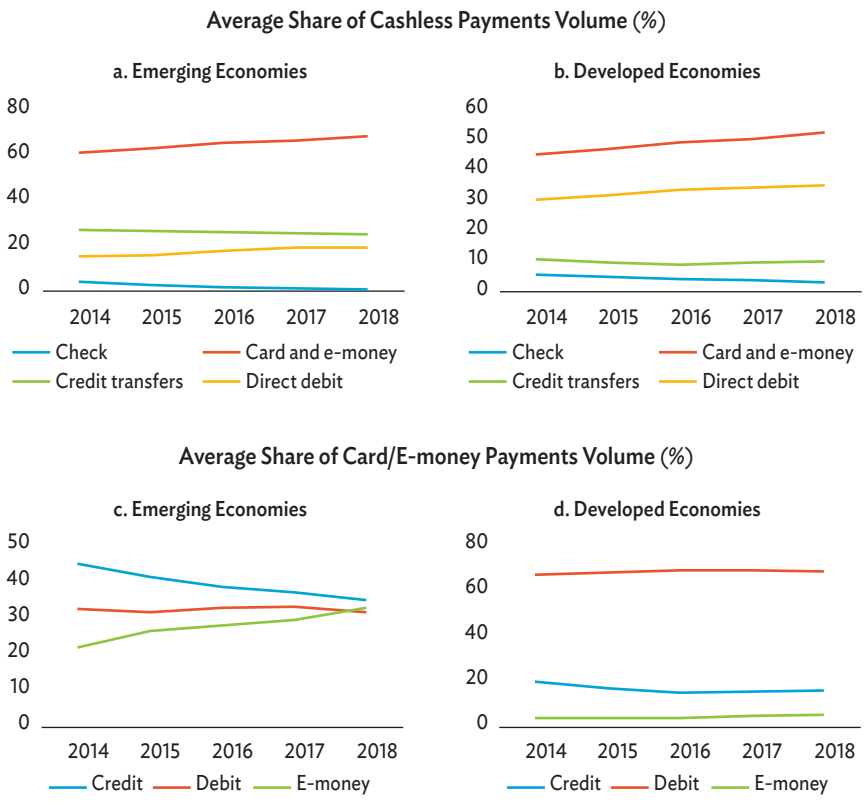
1. *The relative importance (as measured by the average volume share) of card and e-money payments among cashless payment instruments is significant and rising in emerging economies. Among card and e-money payment instruments, the relative importance of e-money is rising, whereas that of credit cards is declining in emerging economies. Such trend is also present in developed economies, albeit at a much smaller magnitude (Figure 5.2).*

   Panel (a) of Figure 5.2 plots the average volume share by cashless payments instruments in emerging economies versus developed economies from 2014 to 2018. Card and e-money is the dominant cashless payment instrument in both emerging and developed economies, taking up around 70% and 60%, respectively, of the total cashless payment volume. Use of cards and e-money is also on a clear upward trend, while checks are moving in the opposite direction in emerging and developed economies. The average share of direct debit is also declining, more so in developed economies.

   Panel (b) deals only with card/e-money payment instruments. The average volume share of e-money increases from approximately 20% in 2014 to nearly 30% in 2018 in emerging economies. This increase is mainly at the expense credit cards, which declined from 40% to 30%. The trends are much more stable in developed economies. Similar to emerging economies, credit cards are in decline and e-money is on the rise, but only slightly. Debit cards are the most prevalent instrument in emerging and developed economies, although they capture around 70% of the share in developed economies, compared to only 40% in emerging economies.

   These trends suggest that e-money, which corresponds to our definition of fintech payments, is relevant for emerging economies. Their relatively underdeveloped traditional payment systems may in fact provide natural comparative advantage for emerging economies in the adoption of fintech payments.

Figure 5.2: Relative Importance of Payment Instruments by Volume



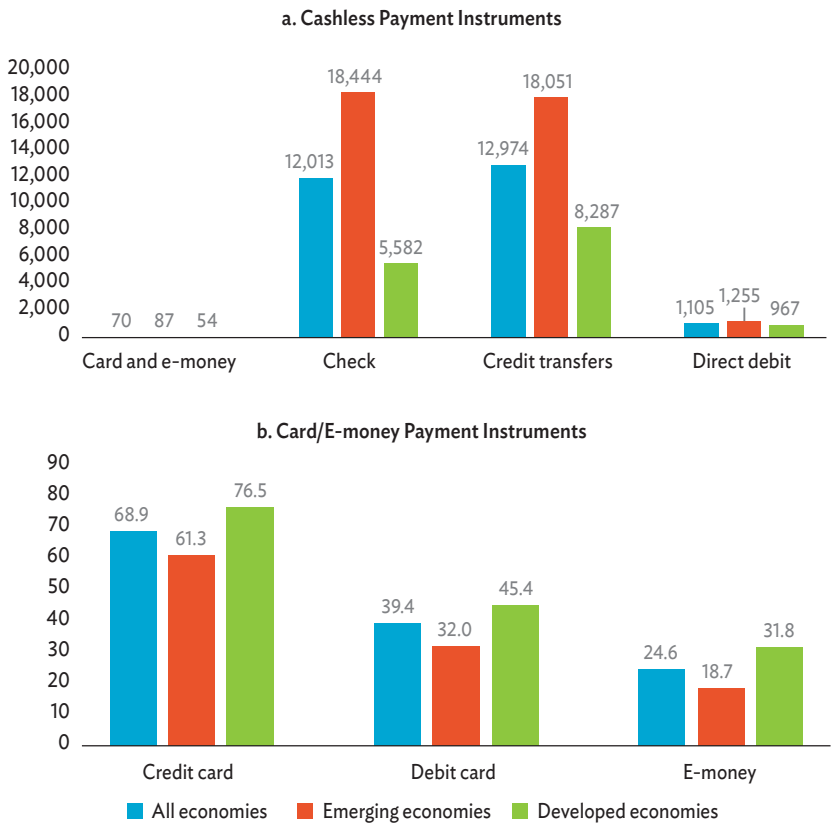
Note: Emerging economies include Indonesia, the Republic of Korea, Singapore, and others. Developed economies include Belgium, France, Germany, Italy, and the United States.
Source: Author, based on BIS (2020).

2. *Average value per transaction through cards and e-money is substantially smaller than other cashless payment instruments. Average value per transaction through e-money is the smallest among all card and e-money payment instruments in emerging and developed economies, and smaller in emerging markets than in developed economies (Figure 5.3).*

The left panel of Figure 5.3 clearly shows that the average value per transaction of card and e-money is substantially smaller than other cashless payments instruments. Cards represent the wave of digital

payment innovations preceding fintech payments, whereas e-money is the closest to our definition of fintech payments. The right panel of Figure 5.3 indicates that fintech payments (in this case e-money) can accommodate even smaller payment values than credit and debit cards. As a result, fintech payments reinforce the existing benefits that debit and credit cards provide for retail payments. Table A5.2 in Appendix 1 compares cash, debit card, credit card, and fintech payments in terms of cost, speed, security, transparency, and inclusion.

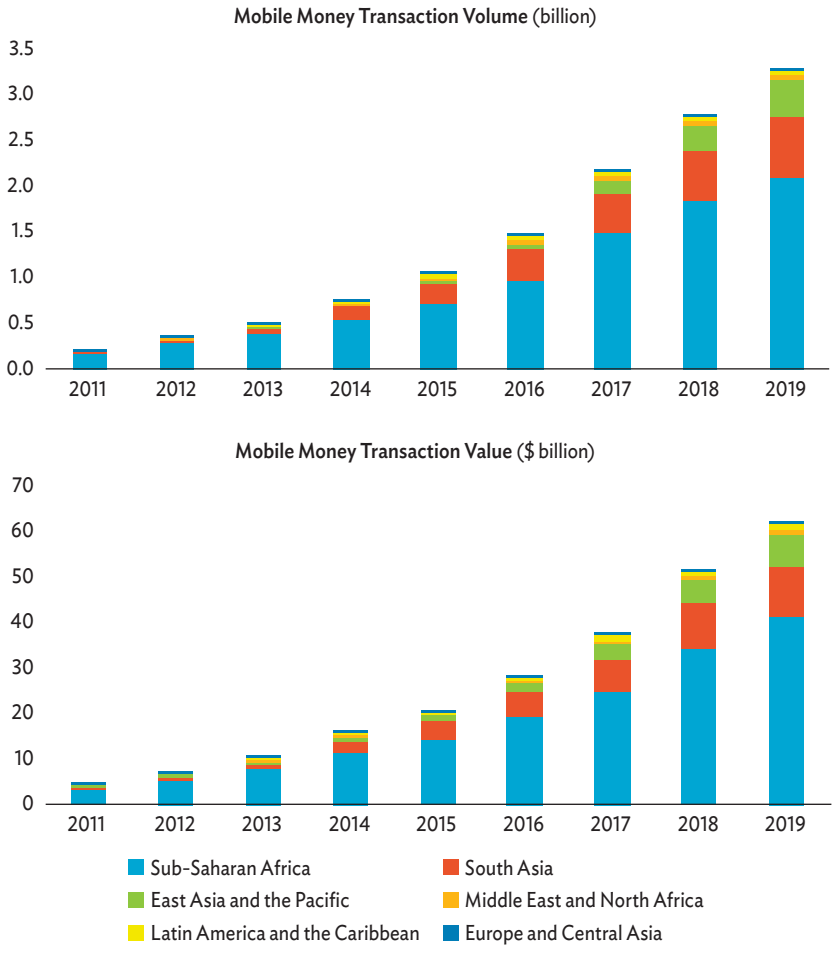
Figure 5.3: Average Value per Transaction by Payment Instrument
($)



Note: Emerging economies include Indonesia, the Republic of Korea, Singapore, and others. Developed economies include Belgium, France, Germany, Italy, and the United States.
Source: Author, based on BIS (2018).

3. *Total mobile money transaction volume and value increased substantially during 2011–2019. Mobile money is most widely used in sub-Saharan Africa, followed by East Asia and the Pacific and South Asia (Figure 5.4).*

Figure 5.4: Trends in Mobile Money Transaction Volume and Value



Note: The Global System for Mobile Communications Association (GSMA) database only considers mobile money services that are "available to the unbanked, e.g., people who do not have access to a formal account at a financial institution." Therefore, fintech payment systems that need to be linked to a financial account or credit card (e.g., Alipay, WeChat Pay, Apple Pay, Google Pay) do not qualify as mobile money. Regional groupings follow the definitions of the source.
Source: GSMA (2020).

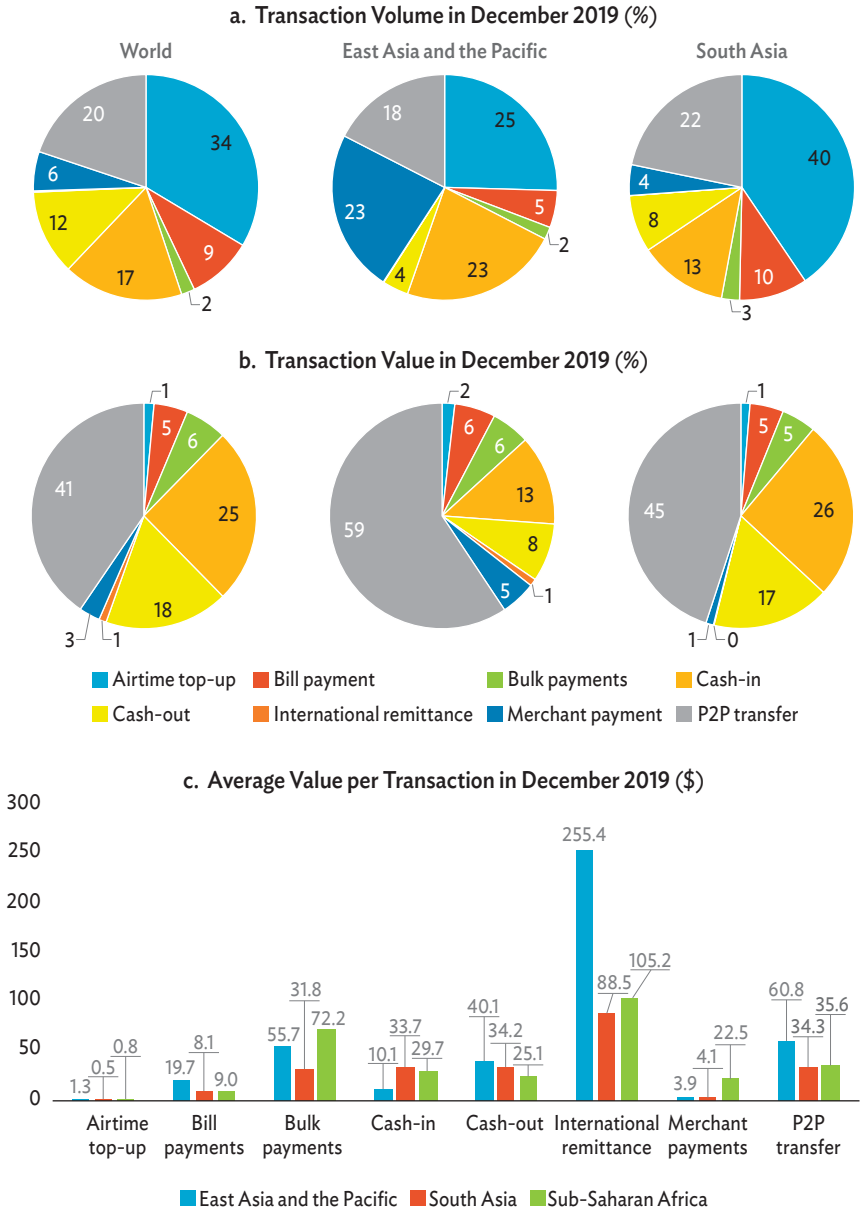
According to the definition by the Global System for Mobile Communications Association, a mobile money service "must be available to the unbanked, e.g., people who do not have access to a formal account at a financial institution [...and...] must offer a network of physical transactional points ... that make the service widely accessible to everyone". Therefore, many fintech payment systems that need to be linked to a financial account or credit card (e.g., Alipay, WeChat Pay, Apple Pay, Google Pay) do not qualify as mobile money according to their definition. The fact that mobile money has to be available to the unbanked implies it contributes to financial inclusion.

4. *Mobile money transaction volume is the highest for airtime top-up*[3] *globally and relatively high for merchant payment in East Asia and the Pacific, followed by peer to peer (P2P) and cash-in/cash-out. Mobile money transaction value is the highest for P2P, followed by cash-in/cash-out (Figure 5.5).*

   Notably, mobile money is used frequently in merchant payments in East Asia and the Pacific and South Asia. The high transaction volume but low average value per transaction suggests that mobile money is widely adopted when transacting with smaller merchants. Compared to debit and credit cards, the lack of fees associated with fintech payments is particularly attractive to small merchants. The engagement of smaller merchants in adopting more digital payment methods (rather than cash) increases transparency and facilitates the inclusion of the potentially large informal economy in these countries, as electronic transactions can be more accurately recorded.

[3] Airtime top-up refers to adding credit to a mobile phone to connect to the telecom's network.

Figure 5.5: Mobile Money by Usage

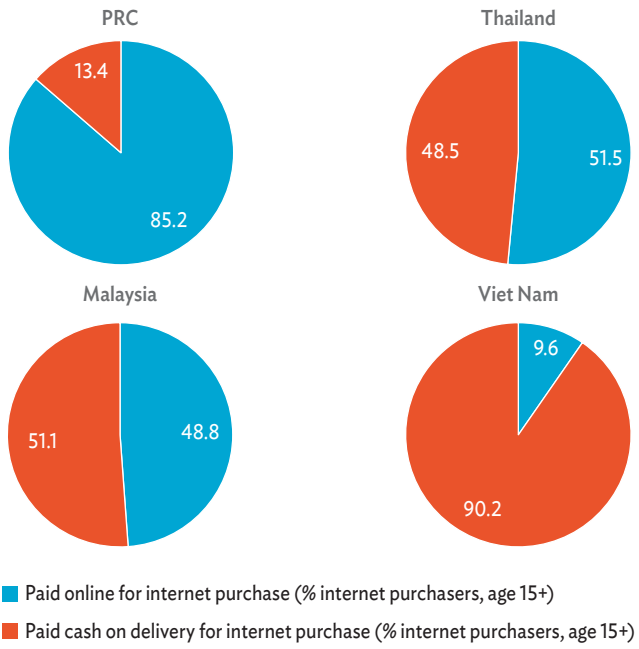


P2P = peer to peer.
Note: The country groupings are based on the definitions of the source.
Source: Author, based on GSMA (2020).

5. *The retail value of e-commerce is expanding exponentially, especially in Asia and the Pacific. E-commerce payment methods vary substantially across countries in Asia, with the PRC paying predominantly online while countries such as Malaysia and Viet Nam pay predominantly in cash in person (Figure 5.6).*

To sum up, fact 1 reveals the growing importance of digital payments (card and e-money). A finer breakdown suggests that the driving force behind this trend is fintech payments, as measured by the average share of e-money transaction volume, especially in emerging economies. Fact 2 shows how fintech payments are revolutionizing retail payments by accommodating even smaller payment values, which reinforces the benefits of previous types of digital payments (e.g., credit or debit cards). Facts 3 and 4 are related to mobile money,

Figure 5.6: E-Commerce Payment Methods by Selected Asian Economies in 2017



PRC = People's Republic of China.
Source: Author, based on Global Findex Database (2017).

a prominent type of fintech payment. P2P and cash-in/cash-out seem to play the most significant roles in mobile money usage. Mobile money is also used frequently for merchant payment in East Asia and the Pacific and South Asia, particularly small merchants. Fact 5 is related to e-commerce and e-commerce payments.

These facts imply several key benefits of fintech payments in convenience (facts 1, 2, and 4); access and transparency of small value transactions (facts 2 and 4); financial inclusion of the unbanked (fact 3); and small merchants (fact 4). They also imply a potential relationship with e-commerce (fact 5) and remittances transfers (fact 4). In sections 5.4 and 5.5, this chapter details the impacts of fintech payments on e-commerce, general fintech development, and remittances transfers.

5.4. Country Case Study: People's Republic of China

This chapter chooses the PRC as a case study as it is leading the global fintech payments market. The dominant player is Ant Financial (the provider of Alipay), an affiliate company of the tech giant Alibaba Group, specializing in fintech. As of the first quarter of 2020, Alipay captured 55.4% of market share in the PRC, followed by Tencent's WeChat Pay and QQ Wallet (38.8%) (iResearch 2020). The number of active Alipay users reached 1.2 billion in 2019 (Klein 2020).

Specifically, we exploit province-level variation of Alipay from the PKU Digital Financial Inclusion Index of China (PKU-DFIIC) to study the role of fintech payments on e-commerce and the spillover effect on other fintech products, two important areas for economic development and inclusion. Fan et al. (2018) show that e-commerce increases aggregate domestic trade and results in 1.6% welfare gains on average. The welfare gain is even higher in smaller and more remote cities. Fintech services have expanded the set of financial services available to the public, particularly those who had lacked engagement with the traditional financial system. Therefore, in addition to the direct impact on the unbanked and smaller merchants suggested in Section 3, fintech payments can also lead to inclusive development indirectly, through e-commerce and development in other fintech products.

Fintech payments, e-commerce, and the development of other fintech products (e.g., e-saving, P2P lending, online wealth management) are strongly intertwined and difficult to disentangle. The underdeveloped traditional electronic payment systems in the PRC (i.e., debit or credit cards) and its e-commerce platform Taobao incentivized Alibaba to develop Alipay back in 2004, which in turn expanded its e-commerce business due to the convenience of transactions (Chorzempa 2018). Similarly, following the success of Alipay, a variety of fintech services have been integrated with the e-wallet function (e.g., Yu'e Bao for savings and investment, Huabei/Ant Check for credit payment, Ant Fortune for wealth management, Zhima Credit for credit scoring). All these services complement each other, thereby broadening the consumer base, and generate a rich amount of data. Ant Financial, as an aggregator of big data, can leverage the data created and further target their service requirements. Given this complicated relationship, the methodology controls for multiple factors and exploits the panel structure to alleviate as much endogeneity as possible.

The main variable of interest is fintech payment penetration, which is measured using the digital payment index for 31 provinces in the PRC from the PKU-DFIIC data from 2011–2018. PKU-DFIIC is an index on fintech inclusion compiled based on Ant Financial's massive dataset. The raw data provide 31 "specific indicators" on digital financial inclusion. Using both the coefficient of variation weighing method (objective weighing) and analytical hierarchy process (subjective weighing), these "specific indicators" are then combined into a comprehensive set of "level 2 dimension indicators." These include account coverage rate, payment, money funds, credit, insurance, investment, credit investigation, etc., which are used as the main measures of fintech penetration and fintech development. These "level 2 dimension indicators" are then consolidated into three "level 1 dimension indicators": breadth of coverage, depth of usage, and level of digitalization, which are then consolidated into the PKU-DFIIC. Figure A5.1 in the Appendix provides an illustration of the index system. A more detailed description of the specific indicators used can also be found in Table 5.2 of Institute of Digital Finance, Peking University (2019).

The payment index is a composite of three elements: number of payments per capita, amount of payments per capita, and proportion of the number of high-frequency active users (50 times or more each year) to number of users with at least one frequency each year (Institute of Digital Finance, PKU 2019). The Eastern Coastal Area, where Shanghai and Alibaba's

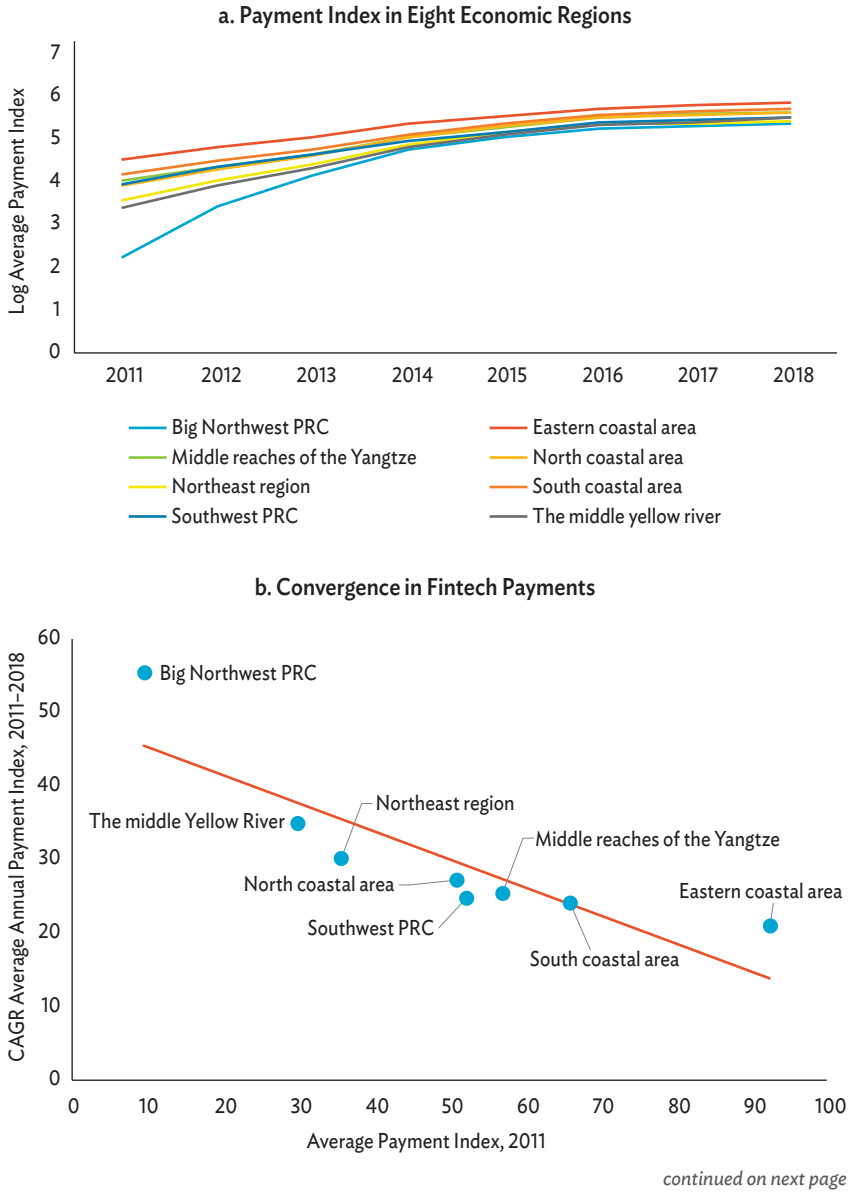
headquarters Zhejiang are located, is the leader in fintech payments. The Big Northwest PRC, which includes the more remote and less developed provinces such as Xinjiang, Gansu, Qinghai, and Ningxia (Figure 5.7, panel a), is also the region with the lowest average payment index. However, regions lagging behind are rapidly converging (Figure 5.7, panels a and b). Panels c and d of Figure 5.7 further confirm the positive relationship between fintech payment and GDP per capita and negative relationship between fintech payment growth and GDP per capita in the cross-section. Figure A5.2 in the Appendix shows that the GDP-weighted averages also yield similar patterns.

E-commerce

The PRC is among the leading countries in e-commerce, with particularly robust growth in recent years, driven by a confluence of factors. The subsequent exercise empirically examines the effect of fintech payments on e-commerce. The results are shown in Table 5.1, whereby the dependent variable, the log of e-commerce sales value, is regressed on the log of payment index and a set of controls: log GDP per capita, share of rural population, share of population aged 65 and above, log of broadband subscribers, and log of average persons served by every postal office. The effect of payment is positive and statistically significant across different specifications, which include various fixed effects such as time fixed effects, region fixed effects and time-region fixed effects. Column (1) is the baseline pooled ordinary least squares (OLS) results without fixed effects. A 1% increase in the payment index is associated with 0.586% increase in e-commerce sales value.[4] After taking out time fixed effects, the coefficient increases to 2.012% (Column [2]). Column (3) removes regional fixed effects and the coefficient is 0.449, hence it is robust at around 0.5%. Log GDP per capita, log of broadband subscribers, and log of average persons served by postal office (which measures the level of postal services) are, as expected, positively related to e-commerce and are all statistically significant. Meanwhile, the share of rural population is negatively associated with e-commerce and is also statistically significant.

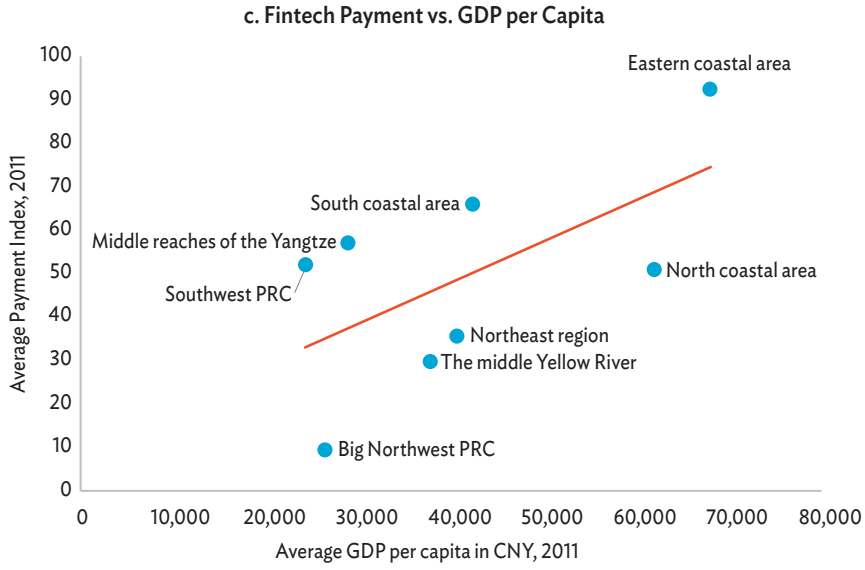
[4] To make sense of the magnitude of a 1% increase in payment index, note that the cross-sectional average of payment index increases from 46.54 in 2011 to 260.86 in 2018, or almost 460%.

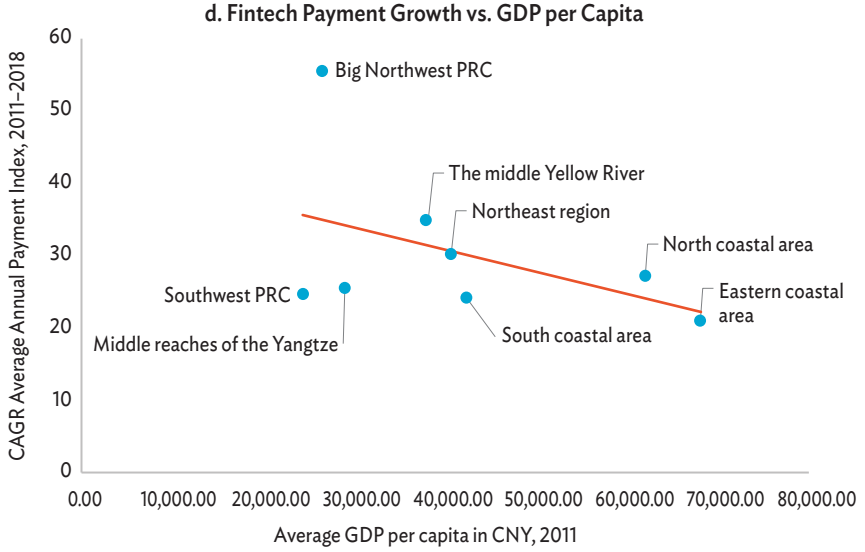
Figure 5.7: The PKU-DFIIC Payment Index by Economic Region



continued on next page

Figure 5.7 *continued*





CAGR = compounded annual growth rate, PRC = People's Republic of China.
Sources: Author, based on Institute of Digital Finance, Peking University (2019) and the National Bureau of Statistics (2019).

Table 5.1: Fintech Payment and E-Commerce in the People's Republic of China
(pooled OLS)

	(1)	(2)	(3)	(4)
Log of payment index	0.586***	2.012***	0.449**	0.990*
	(0.193)	(0.344)	(0.182)	(0.579)
Log of GDP per capita	0.571*	0.430*	0.410	0.587**
	(0.290)	(0.259)	(0.253)	(0.285)
Share of rural population	−3.126***	−2.340***	−3.434***	−2.893***
	(0.859)	(0.751)	(0.716)	(0.808)
Share of population 65 and over	−0.867	0.431	−2.498	−2.530
	(2.558)	(2.490)	(2.933)	(3.354)
Log of broadband subscribers	0.835***	0.762***	0.722***	0.771***
	(0.0581)	(0.0600)	(0.0669)	(0.0782)
Log of average persons served by postal office	0.325**	0.290**	0.191	0.0950
	(0.134)	(0.139)	(0.135)	(0.192)
Constant	9.639**	4.073	14.32***	9.894**
	(3.795)	(3.787)	(3.446)	(5.001)
Time fixed effects (FE)	No	Yes	No	No
Region FE	No	No	Yes	No
Region-time FE	No	No	No	Yes
Observations	186	186	186	186
R-squared	0.822	0.852	0.879	0.893

GDP = gross domestic product, OLS = ordinary least squares, PKU-DFIIC = Peking University-Digital Financial Inclusion Index of China.
Notes: Robust standard errors in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Regions are defined as the eight economic regions by the National Bureau of Statistics.
Sources: Author's estimates, based on PKU-DFIIC (2019) and the National Bureau of Statistics (2019) data.

Determining the effect of fintech payment is challenging because of endogeneity. Fintech payments and e-commerce are jointly determined, and causality may run in both directions. Therefore, the baseline results are verified in two ways. The first method implements the pooled OLS regression but with the log of payment index in previous period as the main regressor (Table 5.2). The second method uses the fixed effects estimator with the log of payment index and log of lagged payment index as the main regressor, respectively (Table 5.3). The results confirm that the positive association between e-commerce and fintech payment, although the lagged payment index typically yields a smaller coefficient estimate than the payment index in current period.

Table 5.2: Fintech Payment and E-Commerce in the People's Republic of China
(pooled OLS, lagged payment index)

	(1)	(2)	(3)	(4)
Log of lagged payment index	0.350**	1.173***	0.274*	0.570
	(0.148)	(0.281)	(0.140)	(0.509)
Log of GDP per capita	0.644**	0.658**	0.451*	0.648**
	(0.289)	(0.279)	(0.254)	(0.295)
Share of rural population	−3.003***	−2.045***	−3.331***	−2.769***
	(0.871)	(0.783)	(0.731)	(0.811)
Share of population 65 and over	−0.713	0.603	−2.274	−2.456
	(2.591)	(2.552)	(2.950)	(3.305)
Log of broadband subscribers	0.842***	0.785***	0.724***	0.772***
	(0.0584)	(0.0587)	(0.0688)	(0.0738)
Log of average persons served by postal office	0.275**	0.159	0.153	0.0396
	(0.138)	(0.138)	(0.142)	(0.179)
Constant	10.49***	7.114**	15.10***	11.98***
	(3.798)	(3.546)	(3.454)	(4.447)
Time fixed effects (FE)	No	Yes	No	No
Region FE	No	No	Yes	No
Region-time FE	No	No	No	Yes
Observations	186	186	186	186
R-squared	0.819	0.846	0.877	0.893

GDP = gross domestic product, OLS = ordinary least squares, PKU-DFIIC = Peking University-Digital Financial Inclusion Index of China.
Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.
Source: Author's estimates, based on PKU-DFIIC (2019) and the National Bureau of Statistics (2019) data.

Table 5.3: Fintech Payment and E-Commerce in the People's Republic of China
(fixed effects estimator)

	(1)	(2)	(3)	(4)
Log of payment index	0.888***	0.926***		
	(0.213)	(0.223)		
Log of lagged payment index			0.712***	0.734***
			(0.183)	(0.176)
Log of GDP per capita	0.189	0.193	0.354	0.362
	(0.296)	(0.295)	(0.282)	(0.282)
Share of rural population	4.963	4.396	3.523	2.932
	(3.727)	(3.588)	(3.225)	(3.183)
Share of population 65 and over	-0.225	0.566	0.0363	0.797

continued on next page

Table 5.3 *continued*

	(1)	(2)	(3)	(4)
	(3.721)	(3.471)	(3.591)	(3.593)
Log of broadband subscribers	0.434**	0.486**	0.131	0.17
	(0.210)	(0.227)	(0.230)	(0.236)
Log of average persons served by postal office		0.164		0.145
		(0.149)		(0.131)
Constant	14.15***	12.28**	15.99***	14.42***
	(4.175)	(4.752)	−3.825	−4.074
Observations	186	186	186	186
R-squared	0.606	0.612	0.611	0.615
Number of provinces	31	31	31	31

GDP = gross domestic product, PKU-DFIIC = Peking University-Digital Financial Inclusion Index of China.
Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.
Sources: Author's estimates, based on PKU-DFIIC (2019) and the National Bureau of Statistics (2019) data.

As a robustness check, the same specification in Table 5.1 is estimated without the log of average persons served by postal office as control. Results are robust and reported in Table A5.5 in the Appendix. The log of e-commerce purchase value is also used as the alternative measure of e-commerce. In principle, the sales value and purchase value should be fairly similar, and may differ slightly due to factors such as transportation costs and local taxes. The elasticity of e-commerce to payment index is generally higher for sales than purchases but remains robust (Appendix Tables A5.6 to A5.8).

Fintech Development

The multiple functions of technology, availability of big data, and broad customer base of digital platforms are factors that generate complementarity among fintech products. Five types of fintech products[5] other than payments are regressed to gauge the spillover effect of fintech payments on fintech development in general using pooled OLS with region-year fixed effects and the fixed effects estimator (Table 5.4 and Table 5.5, respectively). To reduce endogeneity, the log of lagged payment index is used as the main regressor. Similar to the regressions on e-commerce, control variables are the log of GDP per capita, share of rural population, and population aged 65 and above, as well as the log of broadband subscribers. The outcome variables are the log of the index of five main fintech products: insurance, money funds, credit, investment

5 The five are insurance, monetary fund, credit, investment, and credit investigation.

and credit investigation from PKU-DFIIC. Tables 5.4 and 5.5[6] present a consistently strong relationship between fintech payment and the development of other fintech products. Credit investigations, investment, and money funds show the largest response to fintech payments. A 1% increase in payment index increases credit investigation index by more than 5%, investment index by almost 3%, and money funds index by more than 2%. This is consistent with Ant Financial's success in its saving/investment/money funds service Yu'e bao, and credit investigation service Zhima Credit. The coefficient of log GDP per capita is negative and statistically significant for these three fintech products. One possible explanation could be that these fintech services are replacing traditional financial institutions in more impoverished areas, where the provision of such services by formal financial institutions is rather limited.

Table 5.4: Fintech Payment and Fintech Development in the People's Republic of China
(region-year fixed effects)

	Insurance	Monetary Fund	Credit	Investment	Credit Investigation
Log of lagged payment index	0.483***	1.343***	0.402***	1.934***	3.994***
	(0.034)	(0.089)	(0.034)	(0.089)	(0.250)
Log of GDP per capita	0.265***	−0.0115	−0.0104	−0.168	−0.948***
	(0.059)	(0.157)	(0.096)	(0.137)	(0.221)
Share of rural population	0.628***	0.225	−0.705**	−0.187	−0.725
	(0.141)	(0.452)	(0.280)	(0.348)	(0.610)
Share of population 65 and over	1.105	−2.092*	−0.936	−0.153	0.226
	(0.703)	(1.084)	(0.766)	(1.620)	(1.888)
Log of broadband subscribers	−0.0691***	−0.0164	0.147***	−0.0633*	−0.109**
	(0.013)	(0.035)	(0.017)	(0.034)	(0.054)
Constant	0.956	−1.417	2.426**	−2.670*	−4.745*
	(0.661)	(1.699)	(1.124)	(1.520)	(2.441)
Observations	215	185	215	155	123
Number of provinces	31	31	31	31	31

GDP = gross domestic product, PKU-DFIIC = Peking University-Digital Financial Inclusion Index of China. PRC = People's Republic of China, FE = fixed effects.
Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.
Sources: Author's estimates, based on PKU-DFIIC (2019) and the National Bureau of Statistics (2019) data.

[6] The number of observations varies across fintech products because some products were introduced later than 2011, the starting year of the PKU-DFIIC.

Table 5.5: Fintech Payment and Fintech Development in the People's Republic of China
(fixed effects estimator)

	Insurance	Monetary Fund	Credit	Investment	Credit Investigation
Log of lagged payment index	0.483***	1.343***	0.402***	1.934***	3.994***
	(0.034)	(0.089)	(0.034)	(0.089)	(0.250)
Log of GDP per capita	0.265***	−0.0115	−0.0104	−0.168	−0.948***
	(0.059)	(0.157)	(0.096)	(0.137)	(0.221)
Share of rural population	0.628***	0.225	−0.705**	−0.187	−0.725
	(0.141)	(0.452)	(0.280)	(0.348)	(0.610)
Share of population 65 and over	1.105	−2.092*	−0.936	−0.153	0.226
	(0.703)	(1.084)	(0.766)	(1.620)	(1.888)
Log of broadband subscribers	−0.0691***	−0.0164	0.147***	−0.0633*	−0.109**
	(0.013)	(0.035)	(0.017)	(0.034)	(0.054)
Constant	0.956	−1.417	2.426**	−2.670*	−4.745*
	(0.661)	(1.699)	(1.124)	(1.520)	(2.441)
Observations	215	185	215	155	123
Number of provinces	31	31	31	31	31

GDP = gross domestic product, PKU-DFIIC = Peking University-Digital Financial Inclusion Index of China.
Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.
Sources: Author's estimates, based on PKU-DFIIC (2019) and the National Bureau of Statistics (2019) data.

To summarize, through the lens of the PRC's Alipay, this analysis shows that fintech payment penetration is higher for regions with higher GDP per capita, but the less-penetrated regions are catching up. Using regression analyses, it highlights how fintech payments act as an enabler for e-commerce and general fintech development, with far-reaching implications for financial development and inclusion.

5.5. Cross-Country Study

This section examines the implications of fintech payment systems at the cross-country level. The share of population over the age of 15 that has made or received a digital payment in the past year from World Bank's Global Findex Database is used to capture digital payment penetration. This share increased from 41% in 2014 to 52% in 2017 worldwide. Note that the definition of digital payments does not exclude more traditional digital payment methods such as debit and credit cards. Of interest is the relationship of digital payments with e-commerce and remittances transfer.

E-commerce

Table 5.6 presents estimation results for the effect of digital payment penetration on e-commerce. The analysis obtains the retail value of e-commerce ($ million) from the Euromonitor International Retailing industry edition 2019. It converts all the values to US dollars since they are reported in domestic currency. The coefficient of digital payment penetration is positive and statistically significant at the 1% level. Moreover, broadband access seems to contribute positively to e-commerce. The pooled OLS estimate suggests that a 10-percentage-point increase in digital payment penetration is related to a 0.39% increase in the retail value of e-commerce. The estimate is slightly higher once time effects and/or region fixed effects are extracted. Appendix Table A5.9 resents similar regressions using log retail value of mobile e-commerce ($ million) as the dependent variable.

Table 5.6: Digital Payments and E-commerce
(cross-country)

	(1)	(2)	(3)	(4)
Digital	0.0394***	0.0402***	0.0540***	0.0573***
	(0.013)	(0.014)	(0.015)	(0.019)
Log of GDP per capita	0.599	0.575	0.698	0.622
	(0.401)	(0.421)	(0.427)	(0.526)
Share of rural population	−0.00176	−0.00205	0.0291	0.029
	(0.017)	(0.017)	(0.019)	(0.023)
Share of population 65 and over	2.189	2.086	4.725	4.651
	(7.318)	(7.373)	(10.300)	(7.140)
Log of broadband subscribers per 100 people	0.615*	0.622*	0.496	0.503*
	(0.323)	(0.327)	(0.353)	(0.303)
Constant	−20.58***	−20.40***	−23.31***	−22.80***
	(3.411)	(3.505)	(3.892)	(4.613)
Time fixed effects	No	Yes	No	Yes
Region fixed effects	No	No	Yes	Yes
Observations	153	153	153	153
R-squared	0.516	0.516	0.547	0.548

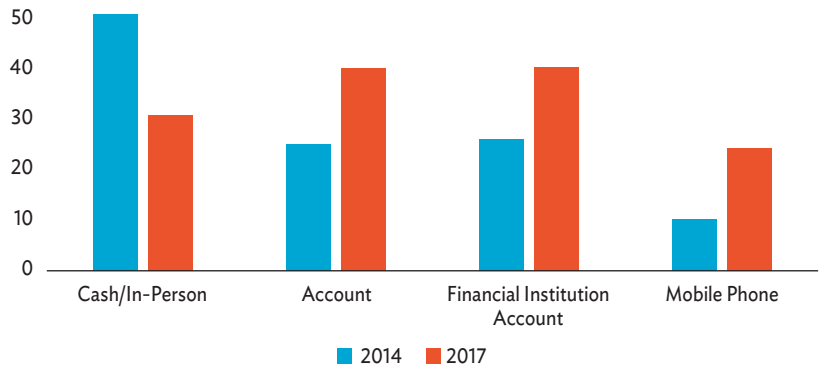
GDP = gross domestic product.
Notes: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Regions follow the World Bank definition, which are High Income, East Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia, and sub-Saharan Africa.
Sources: Author's estimates, based on Global Findex Databases 2014 and 2017, Euromonitor International Retailing industry edition 2019, and the World Development Indicators database (accessed 19 August 2020).

Remittances Transfer

The three broad categories with the greatest level of mobile phone penetration are account access, followed by domestic remittances transfer and utility bills payment. In 2017, nearly 40% of those with an account[7] accessed it through a mobile phone, and about a third with a *financial* account accessed it through a mobile phone. Meanwhile, in 2014, only an average of 10% of senders or recipients of domestic remittances do so through a mobile phone. This number increased to one-quarter in 2017. This analysis explores the relationship between payment methods and domestic remittances transfer as an example of how digital payments add convenience to personal lives. Since remittances are particularly relevant for developing countries due to regional and urban–rural disparities, the convenience brought by fintech payments may encourage labor mobility and increase the welfare of migrant workers and their families, making development more inclusive.

Among senders and recipients of domestic remittances, cash/in-person transfer dropped from a cross-country average of 50% in 2014 to 30% in 2017. Roughly half of the decrease is met by the increase in payments through financial accounts, and the remaining by the increase in mobile payments (Figure 5.8).

Figure 5.8: Payment Methods for Domestic Remittance Transfers



Note: Total countries is 120, with 110 in 2014 and 109 in 2017.
Source: Author, based on Global Findex Databases (2014, 2017).

[7] An account is either an account at a bank or other financial institution ("financial account") or account for mobile money service ("mobile money account").

Due to data limitations, most of the evidence related to remittances is descriptive and suggestive. More reliable cross-country data on fintech payments penetration will enable us to better assess the effects of fintech payments on various economic outcomes.

5.6. Challenges and Policy Recommendations

As payment systems embrace cutting-edge digital technologies, boosting efficiency and achieving socially beneficial solutions, reflecting on the challenges ahead and coping policies can help sustain progress.[8]

The discussion here looked at how fintech payments make retail payments more efficient, transparent, and inclusive. The chapter has presented empirical evidence of fintech payments in areas such as e-commerce, fintech development, and domestic remittances transfers, and has argued that fintech payments leverage the platform nature of their providers in terms of big data, broad customer base, and multi-purpose technology; and enable e-commerce and fintech development.

The analysis considered four additional benefits and their corresponding risks for efficiency/convenience, transparency, security, and network effects.

1) ***Efficiency/convenience***

With fintech payments, carrying and transaction costs fall and real-time settlement increases efficiency, particularly for liquidity-constrained firms and households. The benefits of lower costs and greater efficiency and convenience extend to unbanked individuals, due to the availability of mobile accounts for this group.

However, a digital divide exists among the less tech-savvy (e.g., the elderly or less educated who lack knowledge of digital products) and those without access to smartphones, internet, or computers (such as lower-income or rural households), and thus unable to take advantage of the efficiency and convenience of fintech payments. Lack of financial literacy may also put some consumers and businesses at more risk due to the complexity and newness of fintech payment

8 ADB (2021) also discuss these points.

systems relative to more traditional payment methods. Since most of these groups are also more socially deprived, the digital divide in payments can exacerbate existing social disparities.

Another caveat is the tendency of overreliance on fintech payments. Leveraging the benefits of fintech payments should not preclude other means of payments, especially acceptance of cash. Rather, cash and fintech payments should be treated as complements, and the transition to a more digitalized system should be gradual. In Section 3, fact 4 indicates that a large percentage of mobile money transactions are for cash-in/cash-out purposes. Auer, Cornelli, and Frost (2020) call for the defense of cash and promotion of contactless payments and digital currencies at the same time during the pandemic. Fintech payments are still at a relatively early stage in the diffusion process. Alvarez and Argente (2020) show that a complete ban of cash for payment for Uber rides can induce an average loss of about 50% of expenditures on trips for riders who used to paid in cash before the ban. This outcome disproportionately burdens low-income households.

2) ***Transparency***

Fintech payments expand the set of transactions made digitally, enhancing electronic recordkeeping. With the advent of blockchain technologies, the irrevocability of electronic records is strengthened. This enhanced transparency can contribute to collection of taxes; reduction of the informal economy; and detection of illegal activities such as fraud, money laundering, and corruption.

Fintech payments generate a huge amount of data, ranging from personal information, transaction history, credit history, financial situation, social networks, and consumption behavior. To this end, digital technologies create too much transparency. Fintech payment providers can exploit this data advantage with machine-learning algorithms to study and predict behavior, so that businesses can better match customers with product offerings and reap higher profits. Governments can leverage these data and better identify the most vulnerable individuals subject to cash assistance in crises, including people in the informal economy. Unbanked individuals can have access to credit as their transaction and credit histories are

now verifiable. This increase in transparency arising from big data can also assist in crime detection. However, the downside is obvious: unrestricted use of personal data may lead to consumer privacy violation and discriminatory business practices.

3) ***Security***

Electronic recordkeeping protects consumers and fosters trust. The complexity of fintech payment systems provides additional layers of safety in the prevention of cyberattacks, but such complexity also renders the system harder to recover if cyberattacks actually take place.

Since traditional payment options have subjected consumers to possible infection during the COVID-19 pandemic, fintech payment systems have been advantageous. However, they may be more vulnerable in other scenarios, such as network disruptions or cyberattacks. The availability of a diversified set of payment methods can increase resilience, as payment methods can back up each other in case of temporary disruption.

New forms of illegal activities may arise as the digital economy expands. There may be less risk of physical wallet theft, but criminals can steal smartphones, identity, information, and assets in e-wallets. Although greater transparency improves the detection of fraud, money laundering, and corruption, increased cost-effectiveness and convenience of cross-border transactions may facilitate cross-border crimes and money laundering.

4) ***Network effects***

Fintech payment platforms embody the main characteristics of traditional networks in terms of network externalities, economies of scale, high fixed costs, and low marginal costs. They also incorporate features such as big data usage, broad user base, and multi-purposefulness (BIS 2020). Hence, fintech payment systems can leverage customer data and networks to encourage the adoption of other fintech services such as e-saving, credit payment, credit scoring, P2P lending, and wealth management. Nevertheless, these unique characteristics will be more prone to create excessive market power. Competition policies should therefore be re-considered to address potential problems.

Policy makers and fintech payment providers can work together to tackle these challenges. Policies can be broadly categorized as fulfilling the following goals: (i) fill existing loopholes of the regulatory system to reflect key changes resulting from digitalization such as privacy breach and excessive market power; (ii) expand access, particularly to the more socially disadvantaged groups; and (iii) promote regional cooperation. Governments and central banks are also encouraged to utilize digital technology in their own business practices.

More specifically:

1) *Bridging existing regulatory gaps to reflect emerging legal issues arising from fintech payments.*

   Fintech payments, and the rise of the digital economy in general, introduce unprecedented risks, including but not limited to data privacy breaches, violation of consumer rights, cybersecurity, identity theft, and anti-competitive practices. Regulatory systems should keep up with recent developments in the fintech industry and bridge existing gaps.

2) *Encouraging interoperability between platforms.*

   Since technology can be widely applicable, many fintech payment providers (e.g., GrabPay, Alipay, WeChat Pay) mix a variety of services, ranging from e-saving, wealth management, P2P lending to online shopping, ride hailing, social networks, and food delivery. These "super apps" greatly increase convenience, but without regulation, may create excessive market power and eventually harm consumer welfare and innovation. Encouraging interoperability between platforms is a way to reduce switching costs and maintain sufficient competition between platforms. This is essential to maintain fair opportunities for small fintech providers, incentivize long-run innovation, improve convenience of services to customers, and build a healthy digital ecosystem.

3) *Providing relevant devices, connectivity, digital ID/know-your-customer and digital/financial literacy, especially to more socially disadvantaged groups.*

To mitigate the digital divide in payments, governments should address potential obstacles among people with difficulty adopting new technology. These may include individuals who lack mobile phones, internet, or computers; valid documentation for identity verification; or technical knowledge for operation.

4) *Maintaining the provision of alternative payment options, especially the availability of cash.*

As fintech payments are still at a relatively early stage in the diffusion process, availability to more socially disadvantaged groups remains limited. While promoting fintech payments, the government should not abolish more traditional payment options, especially cash, but rather treat them as complementary. Mobile money providers should continue to provide and improve cash-in/cash-out services.

5) *Promoting regional cooperation in the standardization of industry practices, addressing cross-border crimes, and payment systems integration.*

Fintech payment systems greatly facilitate cross-border transactions through lower transaction costs, faster settlement, and increased convenience. As the world becomes more interconnected, governments should collaborate regionally and promote payment system integration, for which standardization of industry practices is a crucial first step.

A more integrated system can help deal with cross-border crimes, reduce transaction costs, improve accessibility and reach, and encourage resource and skill/capabilities sharing. During the pandemic, many countries have recognized the importance of cross-border payments, particularly for remittances for less developed countries. In February 2020, the G20 recognized the importance of enhancing cross-border payments and planned a three-stage process to address this pressing need.

However, payment integration is challenging, as multiple stakeholders are involved and countries can differ in their existing systems. For instance, countries may differ in sophistication of digital financial infrastructure and regulation intensity. Moreover, some countries may be generally more decentralized than others, which raises the question of the extent of government intervention. Lastly, countries may simply differ in preferences of payment instruments, with some preferring QR payments (e.g., the PRC, Thailand) and others preferring credit card (e.g., the United States, Japan).

The focus of policy efforts thus depends on the level of digital financial infrastructure development. Table 5.7 suggests key policy focus areas for countries at the initial, developing, and advanced stages of digital financial infrastructure development.

Table 5.7: Policy Focus Areas by Digital Financial Infrastructure Development

Stage	Policy Focus Areas
Initial	■ Establish basic telecommunication infrastructure (e.g., broadband, mobile) ■ Digitalize administrative network such as national ID and know your customer ■ Improve digital and financial literacy
Developing	■ Enhance interoperability between financial infrastructure ■ Consumer incentive policies such as tax exemption for diffusion
Advanced	■ Policies and regulations for effective management and financial market stability (e.g., competition policies, data privacy protection) ■ Cross-border cooperation and standardization

Source: Author.

5.7. Conclusion

As the financial industry is transformed, traditional financial services are giving way to frontier digital technologies. This fintech revolution is affecting payments most among business areas. This chapter has evaluated the state and impact of fintech payments using a data-driven approach, focusing on retail payments.

It documents five stylized facts regarding fintech payment systems. Using province-level data on Alipay's penetration in the PRC, it shows the positive impact of fintech payments on e-commerce and the spillover effect on the development of other fintech products. The cross-country analyses highlight the importance of fintech in e-commerce and remittances transfers. Fintech payments benefit from the unique characteristics of the platform economy, including in big data, broad customer bases, and multi-purpose technology. These make retail payments more efficient, transparent, and inclusive and enable e-commerce, general fintech/financial development, and financial inclusion. With more data available, future research can exploit the impact of fintech more thoroughly.

Fintech payments are still at early stage of adoption in most emerging economies and a digital divide can exacerbate income inequality. Governments should therefore address the potential obstacles among people at a technical

or knowledge disadvatage. To advance Asia's payment systems through fintech, policies should also aim to bridge existing regulatory gaps to reflect key changes spawned by digitalization such as data privacy, identity theft, cybersecurity, and anti-competitive practices. Enhancing interoperability, standardization, and cross-border payments should also get attention.

Appendix

Table A5.1: Examples of Consumer-to-Consumer and Consumer-to-Business Fintech Payment Systems

Segment	Example
C2C	■ Venmo, Xoom ■ Remittances: Ria, Transferwise
C2B	■ US: Apple Pay, Google Pay ■ China: Alipay, WeChat Pay ■ Southeast Asia: GrabPay, GCash ■ Digital wallet: Starbucks, Uber

C2B = consumer-to-business, C2C = consumer-to-consumer.
Note: Examples of payment systems for each segment may not be the only segment the system serves to.
Source: Author.

Table A5.2: Characteristics by Payment Methods

	Cash	Debit Card	Credit Card	Fintech Payments
Carrying cost	High	Medium	Medium	Low
Processing cost	Medium	High	High	Low
Speed	Low	Medium/high	Medium/high	High
Security	Theft, robbery	Theft, robbery	Theft, robbery	Identity theft
Transparency	Low	High	High	High
Inclusion	High	Medium	Low	High

Source: Author.

Table A5.3: Key Variables and Data Sources

Data Source	Definition/Variable
Bank for International Settlements, Red Book Statistics for CPMI Countries, 2014–2018	■ Relative importance of cashless payment instrument = transaction volume of payment instrument/total transaction volume of cashless payments ■ Value per transaction = transaction value/ transaction volume
GSMA, Global Mobile Money Dataset, 2020	■ Mobile money service must meet the following criteria: (i) include transferring money and making and receiving payments using the mobile phone; (ii) be available to the unbanked; (iii) offer a network of physical transaction points which can include agents, outside of bank branches and ATMs, that make the service widely accessible to everyone; (iv) mobile banking or payment services (e.g., Apple Pay and Google Wallet) that offer the mobile phone as just another channel to access a traditional banking product are not included; and (v) payment services linked to a traditional banking product or credit card (e.g., Apple Pay and Google Wallet) are not included (GSMA, 2020). ■ See Appendix B of GSMA (2020) for more definitions of airtime top-up; bill payment; bulk disbursement; cash-in, cash-out; and international remittance enabled by mobile money. ■ Transaction value or volume of mobile money by region ■ Transaction value/volume/average value per transaction by usage
PKU Digital Financial Inclusion Index of China (PKU-DFIIC), 2011–2018	■ Log of payment index ■ Log of insurance index ■ Log of money fund index ■ Log of credit index ■ Log of investment index ■ Log of credit investigation index
National Bureau of Statistics of China, 2011–2018	■ Log of e-commerce sales (purchase) value (million CNY) ■ Log of primary insurance payment value (100 million CNY) ■ Log of gross domestic product per capita ■ Share of rural population = rural population (10,000 persons)/total population (10,000 persons) ■ Share of population aged 65 and above = population aged 65 and above in sample survey/total population in sample survey ■ Log of broadband subscribers

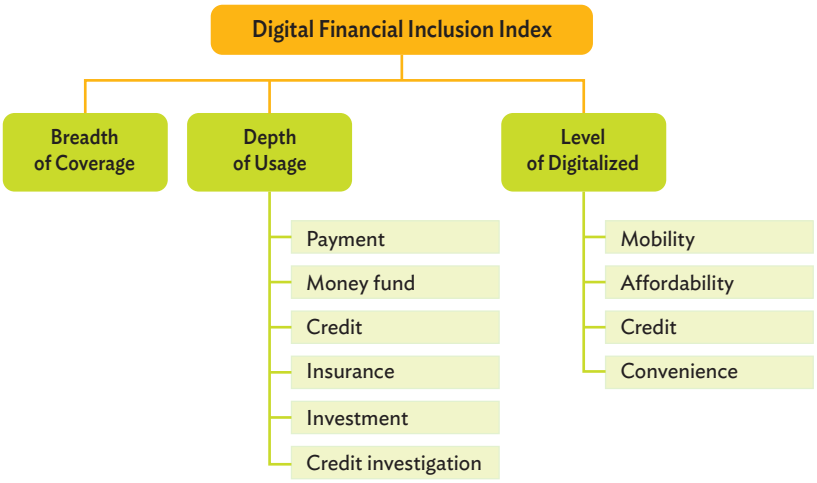
continued on next page

Table A5.3 *continued*

Data Source	Definition/Variable
World Bank, Global Findex Survey, 2011, 2014, 2017	■ Share of people aged 15+ who made or received a digital payment in the past year ■ Share of internet purchases aged 15+ who pay by cash/online ■ Share of senders/recipients of domestic remittances aged 15+ through a mobile phone ■ Share of payers of utility bills aged 15+ through a mobile phone ■ Share of those with (financial) accounts aged 15+ who access through a mobile phone ■ Share of recipients of agricultural products payments aged 15+ through a mobile phone ■ Share of recipients of self-employment payments aged 15+ through a mobile phone ■ Share of recipients of agricultural products payments aged 15+ through a mobile phone ■ Share of wage recipients aged 15+ through a mobile phone ■ Share of recipients of government payments aged 15+ through a mobile phone ■ Share of senders/recipients of domestic remittances aged 15+ in cash/person ■ Share of senders/recipients of domestic remittances aged 15+ through (financial) accounts
World Bank, World Development Index, 2011, 2014, 2017	■ Log GDP per capita ■ Rural population (% of total population) ■ Share of population aged 65 and above = Total population aged 65 and above/Total population ■ Log of broadband per 100 people ■ Official exchange rate (LCU per $, period average) ■ Real effective exchange rate index (2010 = 100)
Euromonitor International Retailing industry edition 2019	■ Log of e-commerce retail value (excluding sales tax, in LCU) ■ Log of mobile e-commerce retail value (excluding sales tax, in LCU)

CPMI = Committee on Payments and Market Infrastructures, GDP = gross domestic product
GSMA = Global System for Mobile Communications Association, LCU = local currency unit,
PKU = Peking University.
Source: Author.

Figure A5.1: Index System of PKU-DFIIC



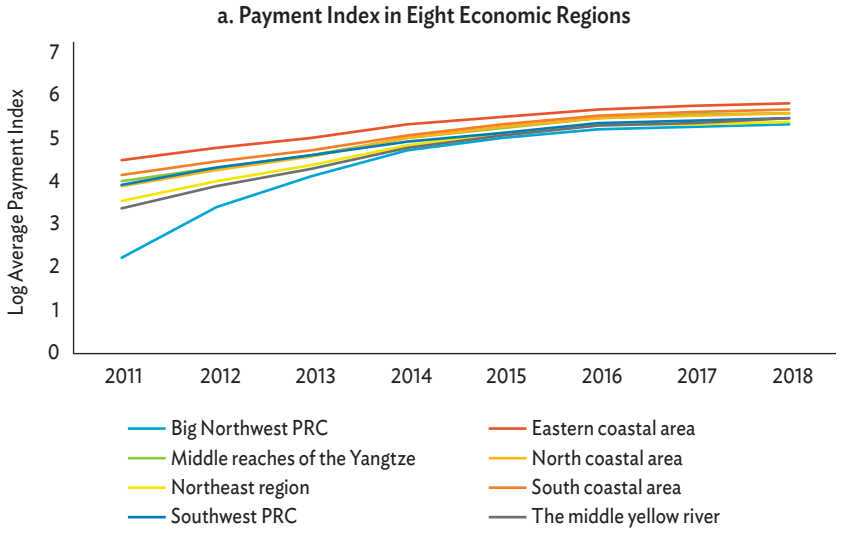
PKU-DFIIC = Peking University – Digital Digital Financial Inclusion Index of China.
Source: Institute of Digital Finance, Peking University (2019).

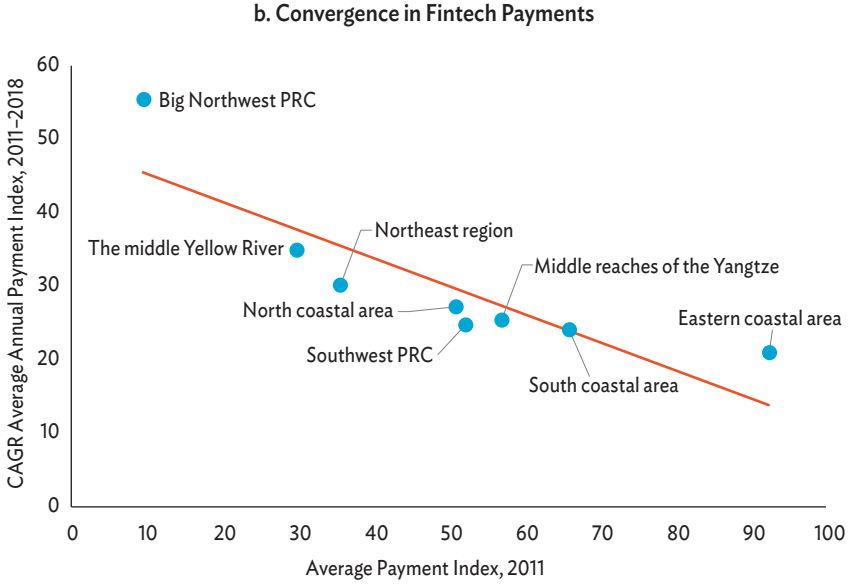
Table A5.4: Emerging versus Developed Economies in BIS CPMI Countries Data

Emerging Economies	Developed Economies
Argentina, Brazil, China (People's Republic of), Indonesia, Korea (Republic of), Mexico, the Russian Federation, Saudi Arabia, Singapore, South Africa, Turkey, and other economies	Australia, Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Spain, Sweden, Switzerland, the United Kingdom, the United States

BIS = Bank for International Settlements, CPMI = Committee on Payments and Market Infrastructures.
Source: BIS, 2018.

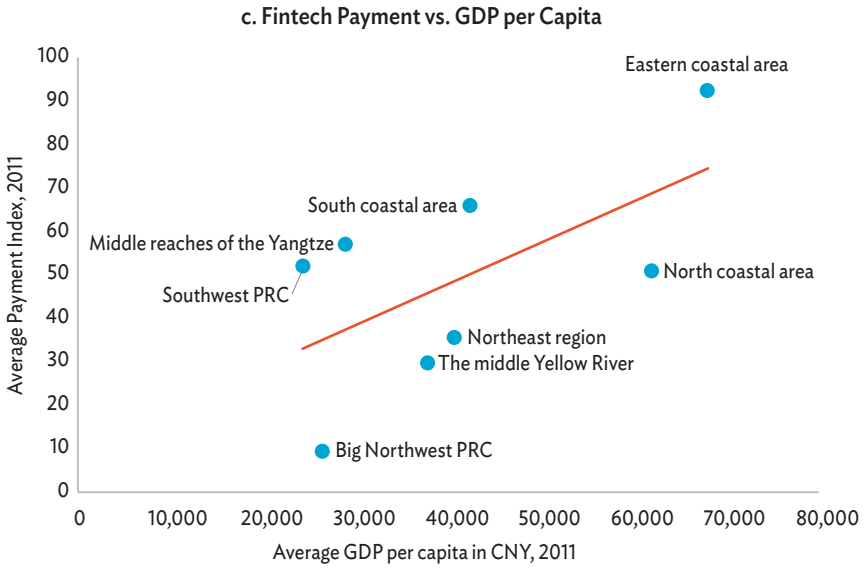
Figure A5.2: PKU-DFIIC Payment Index (GDP-weighted average)

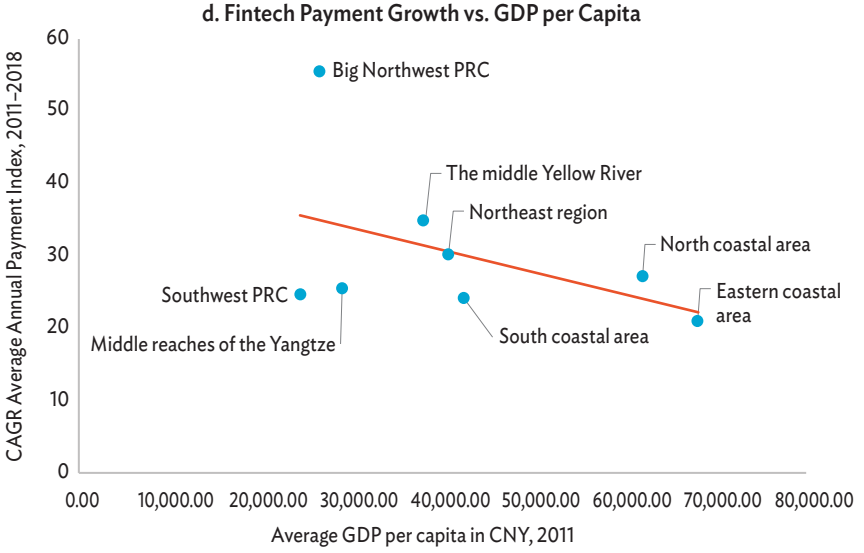




continued on next page

Figure A5.2 *continued*





CAGR = compounded annual growth rate, GDP = gross domestic product, PKU-DFIIC = Peking University-Digital Financial Inclusion Index of China, PRC = People's Republic of China.
Sources: Author, based on PKU-DFIIC (2019) and National Bureau of Statistics (2019).

Table A5.5: Fintech Payment and E-Commerce
(pooled OLS, no postal service control)

	(1)	(2)	(3)
Log of payment index	1.756**	0.316**	0.900*
	(0.300)	(0.141)	(0.522)
Log of GDP per capita	0.350	0.336	0.560
	(0.265)	(0.251)	(0.279)
Share of rural population	−2.489***	−3.464***	−2.901***
	(0.746)	(0.695)	(0.798)
Share of population 65 and above	0.883	−2.511	−2.404
	(2.396)	(2.885)	(3.297)
Log of broadband subscribers	0.799***	0.738***	0.781***
	(0.0558)	(0.0647)	(0.0749)
Constant	5.189	3.598	−2.393
	(3.055)	(2.658)	(3.580)
Time fixed effects (FE)	Yes	No	No
Region FE	No	Yes	No
Region-time FE	No	No	Yes
Observations	186	186	186
R-squared	0.848	0.878	0.893

GDP = gross domestic product, OLS = ordinary least squares, PKU-DFIIC = Peking University-Digital Financial Inclusion Index of China.
Note: Robust standard errors in parentheses,*** p<0.01, ** p<0.05, * p<0.1.
Sources: Author's estimates, based on PKU-DFIIC (2019) and the National Bureau of Statistics (2019) data.

Table A5.6: Fintech Payment versus E-Commerce Purchase
(pooled OLS)

	(1)	(2)	(3)	(4)
Log of payment index	0.396**	0.868**	0.233	0.344
	(0.198)	(0.372)	(0.190)	(0.637)
Log of GDP per capita	0.180	0.118	−0.206	−0.195
	(0.344)	(0.334)	(0.318)	(0.360)
Share of rural population	−4.871***	−4.591***	−5.873***	−5.762***
	(1.102)	(1.100)	(1.085)	(1.174)
Share of population 65 and above	−2.975	−2.293	−1.680	−0.799
	(2.736)	(2.763)	(3.140)	(3.487)
Log of broadband subscribers	0.892***	0.876***	0.920***	0.953***
	(0.0671)	(0.0747)	(0.0778)	(0.0882)

continued on next page

Table A5.6 *continued*

	(1)	(2)	(3)	(4)
Log of average persons served by postal office	0.410***	0.337**	0.274*	0.161
	(0.149)	(0.163)	(0.165)	(0.227)
Constant	14.13***	12.91***	20.48***	20.44***
	(4.448)	(4.823)	(4.104)	(6.045)
Time fixed effects (FE)	No	Yes	No	No
Region FE	No	No	Yes	No
Region–time FE	No	No	No	Yes
Observations	186	186	186	186
R–squared	0.820	0.826	0.863	0.877

GDP = gross domestic product, OLS = ordinary least squares, PKU-DFIIC = Peking University-Digital Financial Inclusion Index of China.
Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.
Sources: Author's estimates, based on PKU-DFIIC (2019) and the National Bureau of Statistics (2019) data.

Table A5.7: Fintech Payment versus E-Commerce Purchase
(lagged payment index)

	(1)	(2)	(3)	(4)
Log of lagged payment index	0.189	0.405	0.0831	0.144
	(0.154)	(0.292)	(0.152)	(0.499)
Log of GDP per capita	0.233	0.218	–0.176	–0.168
	(0.344)	(0.345)	(0.319)	(0.372)
Share of rural population	–4.792***	–4.538***	–5.825***	–5.740***
	(1.110)	(1.124)	(1.094)	(1.172)
Share of population 65 and above	–2.698	–2.170	–1.321	–0.794
	(2.741)	(2.755)	(3.160)	(3.462)
Log of broadband subscribers	0.905***	0.897***	0.932***	0.955***
	(0.0685)	(0.0726)	(0.0788)	(0.0845)
Log of average persons served by postal office	0.341**	0.261	0.209	0.136
	(0.155)	(0.160)	(0.172)	(0.220)
Constant	15.13***	14.82***	21.39***	21.41***
	(4.499)	(4.610)	(4.149)	(5.269)
Time fixed effects (FE)	No	Yes	No	No
Region FE	No	No	Yes	No
Region-time FE	No	No	No	Yes
Observations	186	186	186	186
R-squared	0.817	0.823	0.862	0.877

GDP = gross domestic product, OLS = ordinary least squares, PKU-DFIIC = Peking University-Digital Financial Inclusion Index of China.
Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.
Sources: Author's estimates, based on PKU-DFIIC (2019) and the National Bureau of Statistics (2019) data.

Table A5.8: Fintech Payment versus E-Commerce Purchase
(fixed effects estimator)

	(1)	(2)	(3)	(4)
Log of payment index	0.730***	0.618**		
	(0.229)	(0.303)		
Log of lagged payment index			0.447*	0.478**
			(0.233)	(0.222)
Log of GDP per capita	0.0868	0.0516	0.189	0.200
	(0.411)	(0.408)	(0.403)	(0.397)
Share of rural population	−0.389	0.938	−1.390	−2.218
	(4.249)	(4.090)	(4.163)	(4.384)
Share of population 65 and above	−2.027	−4.792	−1.910	−0.844
	(4.866)	(5.499)	(6.139)	(5.833)
Log of broadband subscribers	0.429	0.302	0.203	0.257
	(0.261)	(0.336)	(0.171)	(0.180)
Log of average persons served by postal office	0.234			0.203
	(0.203)			(0.186)
Constant	15.92**	18.66***	20.34***	18.15***
	(5.811)	(5.342)	(5.562)	(5.819)
Observations	186	186	186	186
R-squared	0.456	0.447	0.430	0.437
Number of provinces	31	31	31	31

GDP = gross domestic product, OLS = ordinary least squares, PKU-DFIIC = Peking University-Digital Financial Inclusion Index of China.
Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.
Sources: Autho's estimates, based on PKU-DFIIC (2019) and the National Bureau of Statistics (2019) data.

Table A5.9: Digital Payments and Mobile E-Commerce
(cross-country)

	(1)	(2)	(3)	(4)
Digital	0.0408***	0.0304*	0.0663***	0.0599**
	(0.0152)	(0.0156)	(0.0187)	(0.0234)
Log of GDP per capita	1.565***	1.866***	0.821	0.999
	(0.509)	(0.529)	(0.602)	(0.649)
Share of rural population	0.00340	0.00965	0.0261	0.0278
	(0.0252)	(0.0253)	(0.0249)	(0.0293)

continued on next page

Table A5.9 *continued*

	(1)	(2)	(3)	(4)
Share of population aged 65 and above	6.504	6.797	−3.354	−3.065
	(5.542)	(5.537)	(10.91)	(7.696)
Log of mobile per 100 people	0.270	0.208	0.939***	0.907**
	(1.274)	(1.272)	(0.317)	(0.450)
Constant	−32.28***	−34.41***	−27.40***	−28.69***
	(8.504)	(8.640)	(5.738)	(5.797)
Time fixed effects	No	Yes	No	Yes
Region fixed effects	No	No	Yes	Yes
Observations	120	120	119	119
R-squared	0.545	0.554	0.605	0.607

GDP = gross domestic product, OLS = ordinary least squares, PKU-DFIIC = Peking University-Digital Financial Inclusion Index of China.
Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.
Sources: Author's estimates, based on Global Findex Databases 2014 and 2017, Euromonitor International Retailing industry edition 2019, and the World Development Indicators database.

References

Agarwal, S., W. Qian, Y. Ren, H. Tsai and B. Yeung. 2020. The Real Impact of FinTech: Evidence from Mobile Payment Technology. *NUS Business School Working Paper*.

Agur, I., S. M. Peria, and C. Rochon. 2020. Digital Financial Services and the Pandemic: Opportunities and Risks for Emerging and Developing Economies. *IMF Fiscal Affairs: Special Series on COVID-19.* Washington DC: International Monetary Fund.

Alvarez, F. and D. Argente. 2020. Consumer Surplus of Alternative Payment Methods: Paying Uber with Cash. *Working Paper*.

Aron, J. and J. Muellbauer. 2019. The Economics of Mobile Money: Harnessing the Transformative Power of Technology to Benefit the Global Poor. *Oxford Martin School Working Paper*. Oxford.

Asian Development Bank (ADB). 2021. Asian Economic Integration Report 2021: Making Digital Platforms Work for Asia and the Pacific. Manila. http://dx.doi.org/10.22617/TCS210048-2.

Auer, R., G. Cornelli, and J. Frost. 2020. Covid-19, Cash, and the Future of Payments. *BIS Bulletin 2020 No. 3*. Basel: Bank of International Settlements.

Bangura, J. A. 2016. Saving Money, Saving Lives: A Case Study on the Benefits of Digitizing Payments to Ebola Response to Workers in Sierra Leone.

Bank for International Settlements (BIS). 2020. *BIS Annual Economic Report 2020*. Basel, Switzerland.

CCAF, ADBI, and FinTechSpace. 2019. *ASEAN FinTech Ecosystem Benchmarking Study*. Cambridge, United Kingdom.

Chorzempa, M. 2018. How China Leapfrogged Ahead of the United States in the FinTech Race. Washington DC: Peterson Institute for International Economics. https://www.piie.com/blogs/china-economic-watch/how-china-leapfrogged-ahead-united-states-fintech-race.

Euromonitor International. Retailing industry edition 2019.

Fan, J., L. Tang, W. Zhu, and B. Zou. 2018. The Alibaba Effect: Spatial Consumption Inequality and the Welfare Gains from E-Commerce. *Journal of International Economics*. 114. pp. 203–220.

GSMA. 2020. *2019 State of the Industry Report on Mobile Money*. London, United Kingdom.

iResearch. 2020. *2020 Q1 Chinese Third-Party Mobile Payments Market Report*. https://www.iresearch.com.cn/Detail/report?id=3601&isfree=0.

Institute of Digital Finance, Peking University (PKU). 2019. *The Peking University Digital Financial Inclusion Index of China (2011-2018)*. Beijing.

Klein, A. 2020. China's Digital Payments Revolution. *Brookings Institution Report*. https://www.brookings.edu/wp-content/uploads/2020/04/FP_20200427_china_digital_payments_klein.pdf.

Prady, D. 2020. Reaching Households in Emerging and Developing Economies: Citizen ID, Socioeconomic Data, and Digital Delivery. *IMF Fiscal Affairs: Special Series on COVID-19*. Washington DC: International Monetary Fund.

Rutkowski, M., A. Garcia Mora, G. L. Bull, B. Guermazi, and C. Grown. 2020. Responding to Crisis with Digital Payments for Social Protection: Short-Term Measures with Long-Term Benefits. *World Bank Blogs*. 31 March. https://blogs.worldbank.org/voices/responding-crisis-digital-payments-social-protection-short-term-measures-long-term-benefits.

Sender, H. 2020. China's New Digital Currency Takes Aim at Alibaba and Tencent. *Financial Times*. https://www.ft.com/content/fec06de9-ac43-4ab8-81f3-577638bd3c16?accessToken=zwAAAXO5zrrAkdP-wG3prENKuNOB81d2OL08Fg.MEUCIClZUceuOZplO5tjtius9kuo9zmXDvql_741rEaSqGPlAiEA59iUtL53pH4l1qrG_iixJdC4n4O-vQ9kQ5wYLeq7XZc&sharetype=gift?token=325a4af8-c1db-43d5-946b-95de026308db (accessed August 2020).

Shen, Y., C. J. Hueng, and W. Hu. 2020. Using Digital Technology to Improve Financial Inclusion in China. *Applied Economics Letters*. 27 (1). pp. 30–34.

Statista. 2020. *Statista Digital Market Outlook*. Hamburg.

Una, G., R. Allen, S. Pattanayak, and G. Suc. 2020. Digital Solutions for Direct Cash Transfers in Emergencies. *IMF Fiscal Affairs: Special Series on COVID-19*. Washington DC: International Monetary Fund.