THIRD-PARTY PAYMENTS IMPACT ON COMMERCIAL BANKS' NON-INTEREST INCOME: EVIDENCE FROM CHINA

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Fulfillment of the Requirements for the Degree of
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ABSTRACT

Title of Thesis	THIRD-PARTY PAYMENTS IMPACT ON COMMERCIAL BANKS' NON-INTEREST INCOME: EVIDENCE FROM CHINA
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This study aims to explore the effects of Chinese third-party payment on commercial banks' non-interest income over the period 2008-2017. In China, third-party payment is a digital payment provided by private non-bank firms that consist of desktop payment and mobile payment. More Chinese people prefer to use third-party payment, especially mobile payment, instead of cash and bank card as the payment can be transacted easily and safely on the mobile phone by scanning QR code. To find whether this new digital payment trend impacts on non-interest income or not, this paper first employs random effects panel data technique. The regression results show that for overall banks, higher desktop payment yields higher non-interest income, while the mobile payment deters the non-interest income. Then in order to check whether third-party payment exerts the effects differently across bank types, we include interaction terms and dummy variables in the regression. Findings show that from the perspective of bank types, small-medium commercial banks reap the positive spillover effects. But for large state-owned commercial banks, the non-interest income suffers a loss when desktop payment and mobile payment are growing. Based on the findings, the insightful policy implications are put forth for commercial banks' non-interest income expansion and profitability enhancement.

Keywords: digital payment, mobile payment, non-interest income, interaction terms, random effects model

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CHAPTER 1

INTRODUCTION

1.1 Background

Initiating from the digital age, the Chinese payment market has undergone the remarkable reforms in recent years. These reforms gradually promoted the payment patterns to be more efficient, convenient, and secure, particularly on the Internet finance and e-commerce market. Third-party payment, with the typical features of fast speed, low cost, and the high security, is increasingly accepted and spread in China. In comparison with the traditional bank payment, third-party payment is accomplished in non-bank firms via a digital process, mainly in the term of desktop payment and mobile payment. With the aim of boost the development of digital payment and e-commerce fields, the Chinese government has issued a series of policies to support Internet finance. As the "Internet +" policy plan in 2015, it was proposed to promote the integration of the Internet of Things and big data with modern manufacturing. In addition to actively encouraging the evolution of digital payment, the policy further proposed the concept of the Belt and Road, namely, promoting the collaboration between the Silk Road Economic Belt and the 21st Century Maritime Silk Road, accelerating the construction of interconnected customs clearance and international logistics. Taking this opportunity, the digital payment industry has more room to boom. Besides the domestic development, the related payment companies have expanded the mobile payment mode cross-border. The scope of the mobile payment business includes catering, supermarkets, VAT refunds, department stores, duty-free shops, theme parks, etc.

From the market perspective, the penetration of the Internet promotes the customer to change the payment habit. Payment behaviors shift from bank counters to diversified digital payment modes, like third-party desktop payment and mobile

payment. Besides, the growing acceptance and dependence from young people and small businesses provide a strong impetus for the third-party payment's progress.

1.2 Statement of the Problem

So far, a large number of descriptive research analyze the effects of third-party payment on bank performance (Shuo & Ting, 2012; Junping, 2012; Song Hua & Liao Juanjuan, 2017; Diwanji and Kannan, 2017), a few studies related to the empirical evidence (Su Man, 2015). In the perspective of third-party desktop payment and mobile payment, empirical study relates to commercial bank's non-interest income is rather rare.

The interest in this topic is motivated by two factors. The first derives from the experiencing of real life as well as the discovering in payment literature. The innovative digital payment patterns like third-party desktop payment, mobile payment have increasingly attracted attention and application all over the world. Globally well-known third-party payment companies are the United States PayPal (1998), British Skrill (2001), China Alipay (2004), Germany Giropay (2006), Japan Line pay (2014). Among them, PayPal was established in 1998, is one of the first companies engaged in person to person online payment (D. Williams, 2007). The founder of PayPal, Thiel, has stated that PayPal is an Internet payment company but not a bank because PayPal does not carry out fractional-reserve banking (Thiel & Levchin, 2004). This is consistent with the concept of third-party payment in China. A study from Manning (2015) shows that as the third-party payment companies like PayPal, Apple and Google are constructing a direct relationship with customers over convenient, bank's business may get challenged especially for non-interest income. Because the direct interactions between third-party payment platforms and commercial banks are among settlement, retail, and payment.

Considering the Chinese market, third-party payment is piloting by Alipay and WeChat pay. Alipay has introduced desktop payment in 2004 and it has been developing stably since then. Based on the Alibaba e-commerce platform, Alipay grows rapidly in both desktop payment and mobile payment. Right after the Alipay third-party payment, WeChat payment became the second largest platform, relying on

its huge social communication system, it also quickly opens online payment in the mobile market in 2013 (Yixian, 2017). Developed till present, desktop payment has relatively long time periods and a stable growth rate, while mobile payment rises rather sharply. The research from Goldman Sachs (Mancy, Piyush, Tian, & Stanley, 2017) found that the number of electronic payment transactions via third-party payment is greater than transactions via banks. But the average amount per transaction of third-party payment is much lower than banks. It indicates that the dominant payment still lies on banks, but in terms of transaction frequency, third-party payment has higher potential velocity as more and more people shift to use it. Directly and indirectly, third-party payment is reshaping bank' non-interest income. Therefore, our first motivation is to explore: what is the effect of third-party total payment on commercial bank's non-interest income? Specifically, what are the effects of third-party desktop payment and mobile payment on commercial bank's non-interest income?

The second motivation arises from the research on the importance of non-interest income and the difference in bank types. Research in European countries found that the profitability of commercial banking business such as commercial loans and deposits has declined in recent years. Hence, banks have turned to expand product breadth and to improve non-interest income (Smith, Staikouras, & Wood, 2003). In India, the empirical evidence results (Mostak Ahamed, 2017) reveal that as commercial banks shift from interest income activities to non-interest income banking businesses, they gain greater returns and profits after risk adjustment. To testify whether non-interest income affects commercial banks financial performance in the United States, DeYoung & Rice (2004) findings suggest that noninterest income and interest income are coexisting rather than replacing. From 1980 to 2002, the U.S. banking rate of non-interest income on aggregate operating income increased more than doubled, from 20% to 42%. It becomes more obvious that nowadays intermediation business remains the core financial services role of commercial banks. In China, commercial banks gradually adjust income structure to increase the proportion of non-interest income after implementation of the modern corporate governance pattern in this transitional period. External pressure and internal motivate are dual prime powers that drive China commercial banks to make more efforts to

promote non-interest income growth (Li, 2014). The stringent supervision is the major external pressure, especially for capital adequacy requirements. Compare to interest business, non-traditional business generating non-interest income expends less economic capital. Hence, commercial banks inevitably turn to pay more attention to non-interest income business under capital constraints. Meanwhile, the accelerated liberalization of interest rate and the intensification of homogeneity competition lead to narrow interest spread. Since the potential benefit spaces of non-interest business still can be developed, there are strong internal incentives for commercial banks to extend non-interest businesses.

Most of the studies state that government ownership of large bank does not tend to have better efficiency or profitability (e.g. Pennathur et al., 2012; Altunbas et al., 2001; Beck, Demirgüç-kunt and Maksimovic, 2003). As the transformation of China's economy and society has profoundly promoted the evolution of the banking system towards marketization since 1979, the banking layout in China has undergone tremendous changes. In essence, it has shifted from a planned dominant economy structure to a pluralistic system containing diverse of market-oriented banks (Xu, Rixtel, & Leuvensteijn, 2013). The research from Elliott and Yan (2013) summarized that the banking industry in China is highly centralized, top five largest state-owned commercial banks control about half of the entire banking assets. Followed by joint-equity commercial banks and city commercial banks, which can be regarded as small and medium size group. Thus, from different bank types perspective, the second motivation of this paper is to explore: what the different impacts of third-party payment on non-interest income between large state-owned banks and small-medium banks in China?

Commercial bank’s non-interest income is primarily derived from fees including transaction fees, account service fees, etc. Before the third-party payment is introduced to the market, all these payment transactions and fee charges are dominated by commercial banks. With the fast growth of third-party payment in China, like Alipay and WeChat pay, what’s the impact of these new trend payment patterns on the non-interest income is the main line of this paper.

1.3 Objective of the Study

Overall, the objective of this study is twofold. First, to explore the impacts of third-party total payment, desktop payment and mobile payment on commercial bank's non-interest income. Second, to examine whether this impact differs across small-medium commercial banks and large state-owned commercial banks.

1.4 Significance of the Study

(1) Theoretical significance

This paper presents a new factor which is about the third-party payment that affects the bank's non-interest income. Previous studies on non-interest income mainly focused on banks internal factors, or on macroeconomic factors. The reason may be that the third-party payment is just being developed in recent years, thus the relevant empirical researches are rare. However, this new trend payment is very valuable and vital to the whole financial environment. In this paper, the research and analysis can provide a theoretical basis for the follow-up studies.

(2) Practical significance

For banks, this paper offers them the magnitude effects from third-party payment, which facilitates banks to detect the potential opportunities besides and beyond challenges. In China, third-party payment has been able to develop rapidly. Mainly because banking institutions, especially the large state-owned banks, have neglected the user experience, and have ignored the financial needs of ordinary users for a long time. The estimation of the effect of third-party payments on non-interest income will help banks enhance the innovation model and service awareness.

For regulators, this study is to provide policymakers with information on the correlation within the third-party payment platform and China's commercial banks. On the one hand, the reforms of banking sectors need more innovative and incentive efforts. So, it is necessary to build an integrated and coordinated regulatory framework that is consistent with the characteristics of modern banks governance. On the other hand, the rise of third-party payment in China has greatly contributed to the

digital process of money, at the same time it also accompanies with the risk. The information provided in this paper will help the government to determine the intensity and breadth of payment policy, such as the corresponding payment license threshold, personal real-name system account requirement, reserves entrust, Internet safeguard, so that form a security and viable financial market.

1.5 Conceptual Framework

The conceptual model of non-interest income is mainly related to income diversification theory, such as the research from the U.S. (Stiroh, 2004), Turkey (Turkmen & Yigit, 2012), and India (Pennathur et al., 2012). Particularly, Modern portfolio theory and arbitrage pricing theory provide the guidelines for income diversification. Modern portfolio theory is an optimization method put forth by Markowitz (1959). This theory has two implications: one is that we can maximize the expected return for a given level of risk by constructing a portfolio; another one is that an asset's risk and return depending on the overall risk and return of a portfolio other than itself. Under this model, the rate of return and the level of risk are measured by weighted asset expected return and variance respectively. Besides, Arbitrage price theory was essentially established by Ross (1976). It is explained that the yield of securities is linearly related to a group of factors, which are some fundamental factors of the rate of return on securities. There are basically three assumptions: risky assets' returns can be described by multi-factors structure model; there are enough securities to spread the risk; No continuous arbitrage opportunity in an effective financial market.

Based on these two theoretical models, we can explore the variables that primarily influence diversification in portfolios of non-interest income. Abdelaziz, Helmi and Mouldi (2012) reveal the determinants of non-interest income are deregulation policy, information and communication technologies adoption, banking characteristics, and macro factors. For third-party payment, the influence mechanism on non-interest income may reflect in two directions since third-party payment platforms and commercial banks are both competitors and collaborators. Therefore, in our model, besides the key variable third-party payment, the portfolios of the banking

characteristics and macro factors are incorporated as the control variables to indicate the supplementary impacts on the non-interest income.

The rest of the paper is set up as follows: Section 2 discusses the existing literature. The data description and empirical models are presented in section 3. Section 4 reports the regression results and discussions, while section 5 summarizes the paper and provides some policy implications.

CHAPTER 2

LITERATURE REVIEW

2.1 Digital Payment and Bank's Non-Interest Income

2.1.1 The Development of Digital Payment

Both the research from Germany (Thomas Dapp, 2014) and the U.S. (Tandulwadikar, 2015) reckon that we still remain at a relatively early stage of digital payment society that urgently requires further potential academic research. The transition to digital payment is the outcome of the development of Internet technologies, the penetration of the smartphones, and the change of consumer's expectations. As Tandulwadikar (2015) defined, digital payment is an innovative pattern which transfers through the electronic process, including desktop payment, mobile payment, and digital wallets. And the providers are mainly non-bank players, namely third-party payment firms. These third-party payment firms like Google and Apple have been quick to seize the opportunity of the mobile market and extensively engage in the mobile payment gateway. In this way, they attract a lot of young customers in a short time.

Some research (Robleh et al., 2014; Light, 2013) regard payment as an infrastructure. Once the third-party payment companies control this gateway, they can form their own digital ecosystem. Digital payment has the inherent advantages on deep customers relationship and tracks the credit record which makes the Internet finance happen. The third-party payment companies can use the historical data of online transactions to establish a credit rating model. By using this model, the customers who have no collateral also can be served. Customers can get loans from P2P (Peer-to-Peer) networks lending. As Thomas Dapp (2014) investigates that

digital payment inspires self-employed persons and start-up companies by financing from crowdfunding platforms.

Regarding with China, the proliferation of e-commerce in China drives third-party payment experiencing the spectacular acceleration in growth. Because the third-party payment platform effectually meets the needs of online shopping assurance (Wenqing, 2015). When the buyer pays, the third-party payment firm does not transfer funds to the seller's account, and only if the buyer confirms receipt of the goods, the funds are allocated to the seller's account. At the same time, for the sake of the seller, if the buyer did not promptly confirm the receipt, the funds would be automatically allocated to the seller account after the specified period. The transaction money is maintained by a third-party payment platform about 15 days or so, forming a huge amount of precipitation funds. From *Goldman Sachs research* (Mancy et al., 2017), in 2016, the number of digital payment transactions via third-party payment is greater than transactions via banks. But the average amount per transaction of third-party payment is much lower than banks. This is due to the characteristics of individual's frequent and small amount. Third-party payment is usually done via desktop and mobile devices. Compared with desktop payment, mobile payment has its priority of real-time delivery of funds whenever and wherever. So, smartphone usage has set an excellent stage for mobile payment to prosper. As Mancy, Piyush, Tian, and Stanley (2017) find that the 4-year compound annual growth rate of the third-party value of mobile payment could go as high as 344%, whereas the rate in the USA is 27%.

Besides the fast growth of payment transactions, the amounts of third-party companies are also increasing. Jiage (2018) documents that there are 246 companies which obtained payment licenses from China Central Bank. Although there are diversified third-party payment companies, the most market share is dominant by Alipay and Tenpay (including WeChat pay and QQ wallet) no matter in desktop payment or mobile payment. From Analysys (2018) report, in the fourth quarter of 2017, the total market share of Alipay and Tenpay third-party in desktop payment account for 74.51%, whereas, the total market share of Alipay and Tenpay in third-party mobile payment is as high as 94.3%.

With the maturity of the mobile payment industry in China, third-party payment companies have expanded the payment mode abroad. As Lanqing (2018) cites that both Alipay and WeChat pay get into the market of Southeast Asia, and other countries. The scope of the business includes catering, shopping, sightseeing, VAT refunds, etc. There are mainly two factors that drive third-party mobile payment quickly applied the cross-border transactions. First, the Chinese government supports the cross-border trade. The related companies are encouraged to provide the payment platforms for the International trade. Government issued the cross-border payment licenses and gave the policy guidances to the third-party companies. Second, the consumers' demand is increasing. Driven by consumption upgrades, domestic consumers are increasingly demanding cross-border goods. Especially when the amounts of tourists, the scale of shopping, and the number of students studying abroad are on the rise. It shows the high potential for the third-party mobile payment development in the cross-border transactions.

2.1.2 The Relationship Between Third-Party Payment and Bank's Non-Interest Income

The fast growth of digital payment via non-bank providers (third-party payment companies) is an issue of great concern in many countries. The prior research regarding digital payment is mainly from the developed countries, such as Germany, the U.S., the UK, and the emerging economies like India and China. Most theoretical studies document that digital payment brings the challenges for banks. For example, Denecker, Gulati, and Niederkorn (2014) deem that payment represents the gateway for the entire banking activities, and through analyzing the digital payment situations in the United States, they further found that digital payment in non-bank competitors has higher operational productivity. This brings bank's non-interest income under attack. Similarly, a report from Tandulwadikar (2015) suggests that the U.S. retail banks need to provide strong payment patterns and embrace mobile payment approach in order to compete with non-bank digital payment companies. In the UK, Robleh et al. (2014) describe that the innovative third-party digital payment distributes the bank' s non-interest income flow. Same findings as Robleh et al.

(2014), by detecting the development of digital payment in Germany, Thomas Dapp (2014) discovers that the third-party digital payment is squeezing the scale on banking sectors. As traditional banks have individual digital shortcomings, Fintech companies are increasingly gaining the payment market share, replacing some non-interest income activities of banks. For emerging economies like India, the research from Wahi (2017), Diwanji and Kannan (2017) shows that the digital payment has grown quite quick no matter in terms of transactions or values, and mobile wallet is expected to grow in popularity due to the convenience. As a result, the new trend of the digital payment intensifies the competition from the bank's credit and debit card businesses.

In China, although commercial banks play an important role in domestic financial markets, in the initial stages of online shopping development, commercial banks do not adapt to changes in transaction patterns and payment methods. Fuchun (2010) and Kun (2010) summarize that the advent of the third-party payment platform successfully solved the trust problems between sellers and buyers for the time-space separation between the delivery of the online transaction and the payment of funds. Since then, third-party payment platform for desktop payment and mobile payment have been booming. Referring to the literature, most of the third-party payment research has been carried out by the qualitative method. Empirical studies mainly emphasized the impact of Internet finance on bank performance. Internet finance consists of third-party payment service, Peer to Peer lending & borrowing, crowdfunding & investment and other Internet forms (Su Man, 2015). From the Internet finance perspective, most studies show that Internet finance positively influences on commercial bank performance, such as the research of Guo & Shen (2016), studying the effects by using the dynamic panel model and SYS-GMM test for thirty-six China commercial banks during period 2003-2013. And the research from Peijun (2014) for 16 Chinese banks from 2002 to 2013.

However, the majority of studies claim that third-party payment presents the negatively impact on bank performance. Using the 16 Chinese banks as a sample, Su Man (2015) employs panel data model to run the regression, with the results showing that, to a certain extent, the third-party payment reduces the operating efficiency of commercial banks through decreasing the intermediary business income and profitability. Song Hua & Liao Juanjuan (2017), by analysis the competition and

cooperation correlation between third-party payment institutions and commercial banks, summarize that third-party payment seems to bring down the bank profits.

2.2 The Determinants of Non-Interest Income

Besides third-party payment factor, we need to find other determinants of non-interest income as the control variables. Many factors associated with the economies may affect the commercial banks' non-interest income. It may depend on the supervision of the government on the banking industry, and the degree of financial market development, as well as the commercial bank's own development strategy and management level. Some theoretical and empirical studies showed that determinants of non-interest income mainly stand on banking characteristics and macro factors.

(1) Banking Characteristics

Size: The size of the bank is often considered as one of the crucial factors which can influence the non-interest income. Most studies consider large banks to have greater ability to diversify risks which can affect non-interest income. The interpretation is that large banks have advantages on relatively low unit cost due to their economies of scale, in the sense that it is comparatively easier for large banks to carry out various businesses toward non-interest income. But small-medium commercial banks are more sensitive to the daily operation cost (Atellu, 2016). Thus, we expect a positive relationship between bank size and non-interest income (Almazari; 2011; Pelton; 1960; DeYoung and Hunter; 2002). In America, Pelton (1960) selected 1508 American banks as a sample to study the determinants of the non-interest income during 1988-2008. He found that bank size in the form of total assets is positively linked with the ratio of non-interest income to total assets. But total assets growth was considered ambiguous on how it would contribute to non-interest income to total asset ratio. Similarly, DeYoung and Hunter (2002) also prove that the size of the bank possesses a positive relationship with non-interest income.

Net interest margin: It reflects banks profitability based on interest income business. It is used to reflect banks liquidity. Net interest margin equals the spread between the interest earned by banks and the interest paid out to the depositor. If the net interest margin of each commercial bank is larger, it implies that the bank can earn

more from interest income, which results in a reduction of motivation to develop non-interest income. Accordingly, the non-interest income will be reduced. Joon-Ho Hahm (2008) studied 29 OECD countries (the Organization for Economic Co-operation and Development) with the sample of 662 commercial banks. The results showed that banks with low net interest margins would cause higher non-interest income. Same conclusions are drawn as Joon-Ho, by observing 10 Tunisian deposit banks from 1998 to 2009, Abdelaziz et al. (2012) find that the net interest margin is negatively and significantly correlated with non-interest income. In the case of European, Smith et al. (2003) analyzed European countries banking industry during 1994-1998. Both the time series analysis and cross-section analysis were used to examine the diversification and variability of non-interest income. Their findings suggested that, in several European countries, a negative correlation appears to exist between non-interest income and interest income, and also suggest that the reduction in the net interest margin may not be amply offset for the augment of non-interest income.

Loan-deposit rate: It is a ratio that equals the bank's total loans divides total deposits. If the ratio is too high which means that the bank issued too much loan relative to deposit, the banks might not have enough liquidity to meet any unforeseen funding requirements. On the other hand, banks may not be able to an optimal return if the ratio is too low, as less loan generate less net interest income. To pursue more profits, large size banks tend to set a considerable high loan-deposit ratio which drives large banks to develop non-interest income to diversify the potential risks. So, it's a positive relationship (Shujin & Yinfei, 2016). On the contrary, DeYoung and Rice (2004) found that non-interest income would increase when banks' strategy is to diversify its incomes, suggesting a negative correlation between the loans ratio and the amount of non-interest income raised by commercial banks. In addition, an empirical study from China (Junshan & Guoqiang, 2011) presents that non-interest income is not significantly linked to the loan-deposit ratio of commercial banks.

Overhead ratio: It is the bank's expense to organize or manage the operating activities such as for rent or maintenance. This ratio implies the running cost for the office facilities, labor cost for the total employment, as well as the attrition cost for the materials. Both negative (Davis & Tuori, 1998; Karakaya & Er, 2012) and

positive (Davis & Tuori 1998); (DeYoung & Hunter 2002) relationship between overhead ratio and commercial banks' non-interest income are found by previous researches. Based on Davis & Tuori (1998) study in the 28 OECD countries banking sector for 1979-1995, it was concluded that less cost-effective banks like small banks tend to have a higher overhead ratio. For such small banks, there may be incentives to diversify the revenue sources by expanding non-interest income, so that they can preserve profitability. With similar results to DeYoung & Hunter (2002), the positive correlation was discovered between non-interest income and overhead ratio in the U.S. commercial banking industry. However, the study from Karakaya & Er (2012) on the Turkish banking industry yields different outcomes. The conclusion conducts that bank's financial performance is negatively affected by overhead ratio. As efficient banks with good performance are expected to have relatively lower operating costs.

Non-performing loan: It refers to a loan that is in default or cannot be recovered due to the debtor bankruptcy, dissolution, and other causes. The ratio equals the nonperforming loan to total credit sales. Nonperforming loan is also one of the credit risk indicators for evaluating banks performance. The low level of NPL suggested that a bank functions properly and comfortably because of less nonperforming loans. (Shujin & Yinfei, 2016) reports that the higher the NPL ratio will motivate banks to carry out non-interest business and try to offset the reduction of net interest income, so that maintains the overall profit level of the bank.

(2) Macro Factors

The macroeconomic factors that affect non-interest income from previous studies mainly include two broad types, GDP growth rate, and inflation rate.

GDP growth rate: Both Joon-Ho Hahm (2008) and Atellu (2016) conclude that the country with the rapid GDP growth rate seems to have a lower non-interest income rate. This negative correlation suggests that as economic boosts, people will increase the investment due to their optimistic perceptions of the economy. The increasing demand for lending promotes banks lending and borrowing business income. Thus banks focus more on interest income and have less incentive to diversify to non-interest income. For Abdelaziz et al. (2012), there is no significant

effect of economic growth on the degree of non-interest income in their empirical results.

Inflation rate: By using the data of 10 Tunisian banks from 1998 to 2009, Abdelaziz et al. (2012) found that inflation rate poses a negative effect on non-interest income. And this effect is very significant. The significantly negative coefficient of inflation rate also observed by Joon-Ho Hahm (2008) in OECD countries banking.

Payment policy: Most research study the determinants and non-interest income includes the policy factor, but usually in terms of deregulation. To some extent, deregulation policy on bank industry has changed the market structure, which in turn affects banks performance. But for non-interest income, it has an insignificantly positive relationship associated with deregulation in Kenya Atellu (2016). Same findings as Atellu, Craigwell & Maxwell (2006) showed that deregulation does not act as a determining role of non-interest income in Barbados. As deregulation directly affects market competition through banks deposits and loans, the effects on the growth of non-interest income have not been reflected.

In China, there some deregulation policies relate to third-party payment, such as the Barcode Payment Business Norms in 2016 issued by Payment and Clearing Association of China. The policy strengthened the payment security and boosted the mobile payment in 2016. Hence, our paper would incorporate this payment policy to investigate the impact on bank' non-interest income. Set payment policy as a dummy variable, it equals 1 when the payment policy is implemented in that year. Otherwise, it equals 0.

2.3 Theoretical Model

In accordance with the theory of income diversification and portfolio (Markowitz, 1959; Calomiris, 1998; Stiroh, 2004), diversification of non-interest business may allow for increasing the expected return at the same risk level. Commercial banks' non-interest income diversification can be carried out with a variety of strategies. Atellu (2016) explores the variables that primarily influence diversification in portfolios of non-interest income. The variables include deregulation, bank-specific characteristics, technological development and

macroeconomic factors. Combining the set of multi-factors, it is, in turn, related linearly to the non-interest income based on the Arbitrage Pricing Theory from Ross (1976).

(1) Modern Portfolio Theory

Modern portfolio theory is an optimization method put forth by Markowitz (1959). The key point of this theory is how to maximize the expected return rate of a portfolio under a given risk level, or how to minimize the risk under a given expected the rate of return. The approach is that investors can maintain a portfolio's expected rate of return while reducing non-systemic risk through a portfolio of assets with a small or even negative correlation coefficient; or in a portfolio, when the standard deviation of each security and the correlation coefficient of each asset are fixed, the only way to reduce portfolio risk is to include another asset and expand the size of the portfolio. Moreover, this theory has two implications: one is that we can maximize the expected return for a given level of risk by constructing a portfolio; another one is that an asset's risk and return depending on the overall risk and return of a portfolio other than itself. Under this model, the rate of return and the level of risk are measured by weighted asset expected return and variance respectively.

Stiroh (2004) elaborates that information on how banks maximize their returns from a diversified income portfolio is a key part of successful risk management decisions. Interest income is influenced greatly by the change of interest rate and economic cycle, with unstable cyclical characteristics and a high risk of bad debts. Therefore, banks would like to expand the relatively stable non-interest income activities through diversification. By diversifying towards non-interest income, banks are able to gain the revenues or reduce the operational risk from holding the portfolio combinations.

(2) Arbitrage Pricing Theory

Arbitrage pricing theory was essentially established by Ross (1976). It is regarded that the securities' rate of return is linearly related to a vector of factors, which constitute some fundamental factors of the return rate on securities. There are basically three assumptions: risky assets returns can be described by multi-factors structure model; there are enough securities to spread the risk; No continuous

arbitrage opportunity in an effective financial market. By using the factor models to delineate the determinants of property prices and the emergence of equilibrium prices, the theoretical model can be constructed as (Ross, 1976; Satya Sekhar, 2013):

$r_j = a_j + b_{j1}F_1 + b_{j2}F_2 + \cdots + b_{jn}F_3 + \epsilon_j$

Where:

r_j is the returns of risky asset j

bj is the coefficient of the factor k for the asset j, factor loading.

F_k is an influencing factor

(3) Financial Innovation Theory

Apart from banking characteristics and macro factors, third-party payment could play a key role in non-interest income activities. According to financial innovation theory (Frame & White, 2004), the third-party payment platform is one of the innovative financial intermediation which serves as digital money. Thus, Junping (2012) and Wenqing (2015) conclude that the impact of third-party payment innovation on commercial bank's non-interest income may be through these three channels: First, technical process innovation makes payment ease and instant. Especially for third-party mobile payment, which promotes face to face payment only through scanning QR code from a smartphone. Second, business model innovation solves the problem of trust in online shopping. When the buyer pays, the third-party payment platform does not transfer funds to the seller's account, and only if the buyer confirms receipt of the goods, the funds are allocated to the seller's account. At the same time, for the sake of the seller, if the buyer did not promptly confirm the receipt, the funds would be automatically allocated to the seller account after the specified period. Besides, the third-party payment institutions can use the historical data of online transactions to establish a credit rating model. By using this model, the customers who have no collateral also can be served. Customers can get the loans from P2P (Peer-to-Peer) networks lending. Although each customer has the small amount of money, many a little makes a mickle, the profit is also very impressive (Wenyue Zhang, Shuning Wu, 2010). Third, user experience innovation induces mobile payment efficiency and personalization. Third-party payment is a unified integration of the various banking network system to support a variety of bank card

payment. And it is also safe and stable. If users adopt to pay by the online banking system, in order to support a number of bank cards to pay online banking, they need to handle a number of banks card and be equipped with various banks of the network interface (Junping, 2012). In terms of mobile payment, the multifunctional apps in the smartphones provide the attractive and personalized promotion and information for each customer.

The physical connection between commercial bank and third-party payment platform is that each third-party payment user needs access to the bank card for the first-time flow money into the platform. Therefore, we shall develop our hypothesis that third-party total payment will exert a positive effect on commercial bank' non-interest income, while there is a negative correlation between third-party mobile payment and non-interest income.

CHAPTER 3

METHODOLOGY

3.1 Data and Sample Selection

The data collection mainly comes from three categories. One category is third-party payment data in which third-party desktop payment covers the period 2008-2017. Third-party mobile payment covers the period 2013-2017, encompassing the experience of Chinese third-party payment development. This categorical data is obtained from China iResearch third-party payment reports. The macro factor is the second category. Both GDP and Inflation rate can be gathered from China Statistical Yearbook. The third category is banking industry data which is mainly collected from the Bankscope database and bank's annual reports. Most information can be directly gathered, such as non-interest income, total assets, total loans, total deposits, net interest margin, return on assets, overhead ratio, and non-performing loan. For the sake of the usefulness, we calculate two ratios, i.e. non-interest income to total assets ratios and deposit-loan ratios. The sample contains 16 listed commercial banks operating in China banking industry throughout 2008-2017, of which 5 are large state-owned commercial banks, 8 are joint-equity commercial banks, and 3 are city commercial banks. These 16 listed banks' total assets account for the entire of China commercial banks more than 80% of total assets (Elliott & Yan, 2013).

Table 1 displays the definitions of variables as well as some general statistics of the data for all sample banks. The non-interest income rate (NIIT) varies between 0.026 and 1.33 with an average of 0.39. This value is relatively small because the amount of non-interest income is tiny and trivial compared to the commercial banks' tremendous total assets. The natural logarithm of third-party total payment (LNTPP) ranges from 24.6 to 31.4, with a mean of 27.9 and a standard deviation of 2.0. Table 2 shows the descriptive statistics by bank types for the period 2008-2017. In general, the five state-owned banks have the largest scales of total assets, followed by joint-

equity commercial banks and city commercial banks. And the non-interest income also indicates the same tendency. For state-owned banks, non-interest income comprises 0.46% of the total assets, while the ratio for city commercial banks is nearly half of state-owned banks. Moreover, the risk of state-owned commercial banks ranks higher than joint-equity commercial banks and city commercial banks with respect to the non-performing loan.

Table 3.1 Descriptive Statistics of all Banks

All banks						
Variable	Definitions	Obs	Mean	Std.Dev.	Min	Max
NIIT	Non-interest income/Total assets	620	0.394307	0.24078	0.02644	1.33071
LNTA	The natural logarithm of total assets	620	28.68547	1.27917	25.1371	30.8925
LDR	Loan/Deposit	598	71.80996	8.98356	42.681	102.17
NIM	Net interest income/Average interest-bearing assets	624	2.529776	0.39394	1.4	3.66
ROA	Earnings before interest and tax/Average gross assets	626	0.732099	0.33388	0.0943	1.7154
OVHR	Cost/Income	626	29.90056	5.94377	15.6	46.9607
NPL	Bad loans/Loans	607	1.170692	0.54058	0.34	5.15
GDP	The growth rate of GDP	640	8.345	1.65749	6.4	12.2
INFL	Represented by the Consumer Price Index	640	2.577	2.00964	-1.7	8.3
POL	Payment policy, Yes=1; Otherwise=0	640	0.189063	0.39186	0	1
LNTPDP	The natural logarithm of third-party desktop payment	640	27.49295	1.50785	24.6089	29.6812
LNTPMP	The natural logarithm of third-party mobile payment	320	28.77743	1.88427	24.4747	31.2614
LNTPP	The natural logarithm of third-party total payment	640	27.93268	2.01544	24.6089	31.4487

Table 3.2 Descriptive Statistics by Bank Types

Types	State-owned banks (Obs.=193)				Joint-equity banks (Obs.=313)				City banks (Obs.=120)			
Variable	Mean	Std.Dev.	Min	Max	Mean	Std.Dev.	Min	Max	Mean	Std.Dev.	Min	Max
NIIT	0.46	0.21	0.071	0.978	0.403	0.267	0.045	1.331	0.265	0.15	0.0264	0.865
LNTA	30.07	0.544	28.447	30.892	28.485	0.633	26.738	29.488	26.939	0.869	25.137	28.453
LDR	70.15	8.476	50.844	90.685	75.745	6.655	62.179	102.17	63.480	9.092	42.681	84.898
NIM	2.461	0.359	1.57	3.56	2.555	0.4	1.4	3.66	2.575	0.419	1.83	3.544
ROA	0.788	0.338	0.227	1.475	0.685	0.325	0.094	1.46	0.764	0.335	0.227	1.715
OVHR	28.39	4.351	19.32	44.71	31.598	6.18	18.03	46.961	27.899	6.288	15.6	46.87
NPL	1.445	0.502	0.81	4.32	1.107	0.565	0.34	5.15	0.865	0.231	0.35	1.74
GDP	8.345	1.66	6.4	12.2	8.345	1.659	6.4	12.2	8.345	1.663	6.4	12.2
INFL	2.577	2.013	-1.7	8.3	2.577	2.011	-1.7	8.3	2.577	2.016	-1.7	8.3
POL	0.2	0.401	0	1	0.178	0.383	0	1	0.2	0.402	0	1
LNTPDP	27.49	1.51	24.609	29.681	27.493	1.509	24.609	29.681	27.493	1.513	24.609	29.681
LNTPMP	28.78	1.891	24.475	31.261	28.777	1.887	24.475	31.261	28.777	1.897	24.475	31.261
LNTPP	27.93	2.019	24.609	31.449	27.933	2.017	24.609	31.449	27.933	2.022	24.609	31.449

3.2 Analytical Method

3.2.1 Model Specification

Panel data is used in this study as our data contains time series observations (T) and a number of individuals (N), 16 commercial banks covering 40 quarters. With two dimensions of cross section and time, panel data has its own advantages. Firstly, the estimated parameters tend to have more accurate inference because of the increased observations. Compared with time series data or cross-sectional data, panel data normally comprises more degree of freedom and more sample variability, thus enhancing the efficiency of econometric estimation (Hsiao, 2007). Secondly, control the effects of omitted variables. These unobservable time-invariant variables are often associated with the explanatory variables resulting in endogeneity. Panel data incorporates the information on both temporal change and individual capture may allow one to control the impact of unobserved variables. The basic panel data model has the following form:

$$y_{it} = \alpha + \beta' X_{it} + \mu_{it} \qquad (1)$$

Where X indicates a vector of independent variables, i is the individual dimension and t is the time dimension. There are usually three models for panel data estimation, namely pooled model, fixed effects model, and the random effects model. The characteristics of the pooled model are that the regression coefficients α and β are the same for any individual and cross-section. To analyze the individual special effects, we usually set the stochastic error term as:

$$\mu_{it} = \delta_i + \varepsilon_{it} \qquad (2)$$

α_i reflects the differences between individuals. Some researchers argue that fixed effects model assumes that δ_i is a fixed constant, while the random effects model is under the assumption that δ_i is not a fixed term. However, M.Wooldrige (2011) elaborates that to see whether δ_i is correlated with X_{it} is the critical criterion for adoption fixed effects model or random effects model. Fixed effects model can allow the specific effects to be correlated with X_{it}. Random effects model assumes that E (δ_i ׀ X_{it}) = 0, which means the individual error term δ_i is not related with the independent variables X_{it}. Hence random effects model has an advantage on including invariant variables. But for the fixed effects model, these variables are absorbed by the intercept (Oscar, 2010).

To determine which model is more appropriate between fixed effects and random effects, we can run the Hausman (1978) test in Stata. It essentially tests whether the specific errors (δ_i) are correlated with regressors. The null hypothesis is that the preferred model is random effects. And the alternative hypothesis prefers a fixed effects model. In this study, the test results reveal that the null hypothesis cannot be rejected (see Appendix A). Therefore, we choose random effects model as our regression specification.

3.2.2 Empirical Model

Since commercial banks' non-interest income is diversified, this study first focuses on finding the determinants. Following DeYoung & Rice (2004), Njogu (2014) and Abdelaziz, Helmi, & Mouldi (2012), we employ the multiple linear panel data random effects model as follows:

NIIT= f {banking characteristics, macro factors, third-party payment}

$$NIIT_{it} = \beta_0 + \sum_k \beta_k X_{it}^k + \sum_n \beta_n Z_{it}^n + \beta_1 P_{it} + \varepsilon_{it} \quad (3)$$

Where $NIIT_{it}$ is the ratio of non-interest income to total assets for bank i and in year t. X_{it} represents a vector of bank characteristics variables, and Z_{it} refers to a vector of macro factors, with parameters n to be estimated. The P_{it} is either third-party total payment or third-party desktop payment or third-party mobile payment.

By including all the independent variables in the Eq.(3), we can construct our empirical model, using a translog functional form (Diewert & Wales, 1987).

$$NIIT_{it} = \beta_0 + \beta_1 LNTA_{it} + \beta_2 LDR_{it} + \beta_3 NIM_{it} + \beta_4 ROA_{it} + \beta_5 OVHR_{it} + \beta_6 NPL_{it} + \beta_7 POL + \beta_8 GDP_t + \beta_9 IFL_t + \beta_{10} LNTPP_t + \varepsilon_{it} \quad (4)$$

Among banking characteristics, total assets ($LNTA_{it}$) measures the size of banks. The proxies of the loan to deposit ratio (LDR_{it}) and the overhead ratio ($OVHR_{it}$) represent the operational efficiency. Net interest margin (NIM_{it}) and returns to assets (ROA_{it}) are bank's performance variables to characterize the profitability of interest income business and the profitability of overall business (Pennathur et al., 2012). Non-performing loan ratio (NPL_{it}) reveals the risks and assets quality. Regarding the fluctuation of the macro environment, the factors of GDP, inflation rate, and payment policy, all are taken into consideration. The key variable, third-party total payment scale ($LNTPP_t$), is also contained in the above equation. The effects of third-party payment and third-party mobile payment can be estimated by replacing $LNTPP_t$ with $LNTPDP_t$ and $LNTPMP_t$ in the regression.

Secondly, in order to investigate whether third-party payment exerts the effects differently across bank types, we include interaction terms and dummy variables in the regression. Follow the research of M.Wooldrige (2011) and Williams & Dame (2015), if only involve the dummy variable, we can capture the overall differences between the two groups in one model. In this approach, it assumes that each the independent variable has the same effect or slope for both groups, and the difference lies in the intercept. However, the major limitation of this approach is that

it does not show which coefficient differ across groups. Another related problem is that running separate models for each group, as Williams and Dame (2015) cite that the coefficients estimated from the separate model may be more difficult to compare the actual differences between two groups. Therefore, we employ a more effective and flexible alternative approach that is interaction terms to explore the different effects across groups in one model. By incorporating the interaction terms, it allows all coefficients freely differ across the groups, so more specific differences can be detected (Zhao, Casu, & Ferrari, 2010).

For a simple Ordinary Least Squares (OLS) estimation, suppose Y denotes a dependent variable, X_1, and X_2 are independent variables that may impact on the Y. To investigate the interaction effects between two independent variables X_1 and X_2, Rajan and Zingales (1998) specified a simple multiple regression model form:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_1 X_2 + \epsilon \qquad (5)$$

Where the independent terms X_1 and X_2 represent the explanatory effects, which are called the main terms. The new variable X_1X_2 is calculated by the product of two observations and it is called the interaction term.

Specifically, we can use one independent variable as the dummy variable to denote the group membership. The interactions terms for group type with other explanatory variables designate whether there are significant differences on each independent variable across the groups. Now suppose Y is regressed on X_1, $Dummy_1$ and the interaction term $Dummy_1 * X_1$. The coefficient for this interaction term will imply how the effect of X_1 differs across groups. For example, in the eq. (5), if the coefficient of the interaction term is significant positive β_3, this indicates that X_1 has a larger effect on group 1 than it does on the other group.

With respect to our sample, the 16 Chinese commercial banks can be divided into two groups. One group is the five largest banks, another group is eight joint-equity commercial banks plus three city commercial banks. Since the main differences between the two groups are the ownership and bank size, we can create the size dummy variable to form the interaction terms as:

$$I_{it} = \delta_0 + \delta_1 D_s + \delta_2 \mathrm{LNTA_{it}} \times D_s + \delta_3 \mathrm{LDR_{it}} \times D_s + \delta_4 \mathrm{NIM_{it}} \times D_s + \delta_5 ROA_{\mathrm{it}} \times D_s + \delta_6 OVHR_{it} \times D_s + \delta_7 \mathrm{NPL_{it}} \times D_s + \delta_9 POL \times D_s + \delta_{10} GDP_t \times D_s + \delta_{11} IFL_t \times D_s + \delta_8 LNTTP_t \times D_s + v_{it} \quad (6)$$

Eq. (6) incorporates 10 independent variables to reflect the interactive effect of bank size. D_s denotes the size dummy variable. Set D_s =1 if it is the five largest state-owned banks group, otherwise D_s =0. Each interactive term facilitates estimator difference between two group banks. Therefore, coming to the empirical model of Eq. (4), the model involving the interaction terms is fully specified as:

$$\mathrm{NIIT_{it}} = \beta_0 + \beta_1 \mathrm{LNTA_{it}} + \beta_2 \mathrm{LDR_{it}} + \beta_3 \mathrm{NIM_{it}} + \beta_4 ROA_{\mathrm{it}} + \beta_5 OVHR_{it} + \beta_6 \mathrm{NPL_{it}} + \beta_7 POL + \beta_8 GDP_t + \beta_9 IFL_t + \beta_{10} LNTTP_t + \varepsilon_{\mathrm{it}} + I_{it} \quad (7)$$

For each explanatory variable, β explicates the effects for small-medium banks, and the corresponding β+δ characterized the effects for large state-owned banks. Again, the effects of third-party payment and third-party mobile payment can be estimated by replacing $\mathrm{LNTPP_t}$ with $\mathrm{LNTPDP_t}$ and $\mathrm{LNTPMP_t}$ in the regression.

CHAPTER 4

RESULT

This section firstly introduces the information on Chinese commercial banks, mainly focus on our sample small-medium banks and large state-owned banks. Secondly, it presents the empirical results that cater to our objectives. We find the determinants of commercial banks' non-interest income is particularly to explore the effect of third-party payment on commercial banks' non-interest income. Then from two groups of banks perspective, this section explores whether this relationship between third-party payment and commercial banks' non-interest income differs across the small-medium banks and the five largest state-owned banks.

4.1 Banking Characteristics in China

(1) Five large state-owned commercial banks

China's commercial banks have developed rapidly since the economic reform and openness. In the 1980s, five state-owned banks were established, the Bank of China (BOC), the Industrial and Commercial Bank of China (ICBC), the China Construction Bank (CCB), the Agricultural Bank of China (ABC), and the Bank of Communications (BOCOM). These five large state-owned banks become the primary financing providers for China's economic construction. As the systemically important financial institutions, they shoulder the important functions of maintaining financial stability and activating financial efficiency. Almost 65% residents' savings, and 80% payment and settlement services of the whole society are supplied by them (wwwfchina, 2007).

After China's accession to the WTO in 2001, the Chinese government implemented stock reform for state-owned commercial banks in order to keep pace with China's economic evolution. The efforts of reform relieve several banking problems. (i) Incomplete and inefficient governance structure; (ii) High proportion of

non-performing assets and low profitability; (3) Redundant institution with overstaffing. Gradually, these five banks have been listed through share reform with mixed ownership rudiments. But the state-owned nature is still relatively strong. With a high degree of equity concentration, state-owned shares are in an absolute holding position.

(2) Small and medium commercial banks

In comparison with large state-owned commercial banks, the small and medium commercial banks have more diversified ownership structures such as the joint-equity banks and city commercial banks. Their corporate governance structures are more effective. Most city commercial banks and joint-equity commercial banks are not completely privately owned, but the shares of government in them are significantly less than in the five large state-owned commercial banks (Elliott & Yan, 2013).

Small and medium sized banks have injected more vitality into the financial market. The main feature is that the scale is small, and the corresponding department setting is flexible. In this way, small and medium banks can flexibly adjust their business scope according to market demand. Besides, the simple personnel composition and small amount employees make the working assessment easy and controllable. In turn, it promotes the small and medium banks to offer the better service for the customers. However, small and medium banks also have their own disadvantages, inefficient funds, weak self-foundation, weak ability to resist risks, and the limited capacity for cross-regional operation.

With a brief overview of China's commercial banks, we might have a better understanding of the following regression results.

4.2 Regression Results

The regression results for Eq. (4) are reported in Table 3. While column 1 reports the determinants of commercial banks' non-interest income, the effects of third-party desktop payment and third-party mobile payment on commercial banks' non-interest income are reported in column 2. In terms of econometric issues, the data

used in this study covers 40 quarterly periods, so it is necessary to check whether all the variables are stationary or not before starting panel data analysis. By using Augmented (ADF) Dickey-Fuller unit root test, the results display that all the variables are stationary at first differencing. Then random effects panel data technique is employed after checking the Hausman test.

For the first column in table 3, the results show that most variables significantly determined non-interest income. Especially for banking characteristics, total assets, return on assets, loan to deposit ratio, and non-performing loan ratio all exert the significant positive effects upon non-interest income. This results present that larger assets banks are more likely to realize economies of scale and achieve more non-interest income, in line with the studies in American from Pelton (1960), DeYoung & Hunter (2002). The banks perform well with higher ROA tend to generate more non-interest- income. Same as Yuhua & Xiaodong (2014) noted, better performance banks would like to diversify the income sources. Both loan to deposit ratio and non-performing loan ratio are the risk measurements of traditional interest-based businesses. With higher liquidity risk or bad debt risk, banks are forced to expand the non-interest income activities to offset the risks (Shujin & Yinfei, 2016). While only net interest margin shows the significantly negative correlations with non-interest income. If banks focus on the interest income activities would have higher profitability, there is less incentive to diversify the non-interest income activities. For the macro factors, GDP, and inflation rate do not show the significant effects, which is a contrast to the findings from Joon-Ho Hahm (2008) and Abdelaziz et al. (2012). But the payment policy presents the significantly negative influence on non-interest income. It makes sense that when the Chinese government encourages electronic payment and digital payment, the overall payment competition is increasing. At present, China's economic structure is shifting from the old economy (steel, coal, building materials, etc.) to the new economy (Fintech consumption, etc.), from the heavy asset industry, the debt-driven model to the light asset industry, and the endogenous growth model. In terms of policy, it has strengthened the supply-side structural reform of the economic industry. Third-party payment as one of the new economic infrastructure, its influence and industry penetration is further highlighted. Government has relaxed regulatory requirements of cross-border payment services for

third-party payment institutions. And cross-border foreign exchange payment pilot services are expanded nationwide. It has created convenient conditions for third-party payment institutions to conduct cross-border payment services. Currently, cross-border payment services have become a new growth point for third-party payment institutions. More importantly, our regression results show that the significant coefficient of third-party total payment portrays that one percent of third-party total payment will promote the banks' non-interest income with 0.0387%. This implies that although third-party payment platforms distribute banks payment flow, the total electronic payment transactions increase the money velocity. Thus, it leads to a positive spillover influence on banks' non-interest income.

The third-party desktop payment and third-party mobile payment are elaborated in the second column of table 3. The results show that significantly, both third-party desktop payment and third-party mobile payment are the determinants of non-interest income of Chinese commercial banks. Differently, non-interest income positively correlated with third-party desktop payment while negatively associated with the third-party mobile payment. This opposite effect embodies the cooperation and competition between the third-party payment providers and the commercial banks in China. Each amount of money for the first time flows into third-party platform must have access to the bank's account. Once there is a transaction, the banks will gain fee income. With the increasing of transactions, banks' non-interest income gets positively promoted. However, the widespread use of smartphone makes mobile payment more attractive. In third-party mobile payment app, it presents many premium functions which serve Chinese people's daily life. When most of the payments process within the mobile payment, a third-party payment platform will form its own ecosystem (Mancy et al., 2017). As a result, more transactions in the third-party mobile payment circle tend to reduce banks' non-interest income.

Table 4 shows whether the relationship between third-party total payment and commercial banks' non-interest income diverges across the five largest state-owned commercial banks and small-medium commercial banks. By involving the interaction terms approach, we employ random effects panel data techniques to run the regression of Eq. (7). The results in the case of third-party total payment are shown in column 3, while column 4 constitutes the effects from third-party desktop payment and third-

party mobile payment. We discover that the determinants of non-interest income for both large state-owned banks and small-medium size banks are almost the same but the degree of the effects differ. Large state-owned banks, which can earn more non-interest income, attributes to the economic scale and client resources. Therefore, different ownership or size seems to have an evident effect on non-interest income (Pennathur et al., 2012). Furthermore, there are no such significant differences in the return on assets, overhead ratio and non-performing loan ratio. We also find that macro factors like payment policy and inflation rate facilitate more influences on small-medium banks due to the less stable of financial fundaments. In the perspective of the regulator, as the results note that the payment policy of Barcode Payment Business Norms in 2016 declined bank's non-interest income. It means that bank's non-interest income gets hindered when government encourages the third-party development. Concerning third-party total payment, it is remarkable that the impacts on non-interest income for large state-owned and small-medium banks are divergent. For large state-owned banks, the growth in third-party total payment appears to decline its non-interest income. It indicates large state-owned banks have the disadvantages of meeting individual payment requirements. In the era of mobile Internet, users pay more attention to experience and service. When young and middle-aged groups have gradually become the main force in transaction and consumption, O2O (Online to Offline) and e-commerce are the important sources for people to obtain goods and services. Consumption upgrades will continue to be the biggest driver of the growth of the third-party payment progress. It's urgent for traditional large state-owned commercial banks to strengthen financial technology and service. Compared the large state-owned banks with more complicated organizational structures, the less management hierarchy small-medium banks exert certain advantages in serving small businesses and clients. This is consistent with the empirical evidence on the comparative advantages of large and small banks in the US (Berger & Black, 2011). Since the small-medium banks have better user experiences, they still can gain the positive marginal non-interest income when third-party total payment has an upswing.

Turning to the third-party desktop payment and third-party mobile payment in column 4 of table 4, the overall effects on small-medium banks' non-interest income

are found similar to the above all banks in column 2. By contrast, large state-owned banks appear to reflect the negative impacts on non-interest income for both third-party desktop payment and third-party mobile payment. As the large state-owned banks act the prudential roles in the Chinese financial market, for a long-term, their businesses more focus on large scale and well-performed enterprises. The individual customers and the small-medium enterprises, who are unfulfilled from the bank, start to shift to the third-party payment platforms. Consequently, the booming of third-party desktop payment and third-party mobile payment jointly has been draining the non-interest income of large state-owned banks. To some extent, third-party mobile payment exerts more negative effects on small and medium banks than the effects on large state-owned banks. This is because large state-owned commercial banks have the advantages on numerous business lines, wide channel coverage, and strong negotiation power.

Table 4.1 Non-Interest Income and Third-Party Payment

	(1)	(2)
VARIABLES	NIIT	NIIT
Constant	-2.404***	-4.147***
	(0.464)	(1.600)
LNTA	0.0464***	0.0544*
	(0.0167)	(0.0291)
LDR	0.00241***	0.00161
	(0.000890)	(0.00152)
NIM	-0.0687***	-0.0533*
	(0.0185)	(0.0283)
ROA	0.483***	0.611***
	(0.0158)	(0.0246)
OVHR	8.46e-05	-0.00220
	(0.00166)	(0.00266)
NPL	0.0881***	-0.00366
	(0.0103)	(0.0391)
GDP	-0.00845	-0.222***

	(1)	(2)
VARIABLES	NIIT	NIIT
	(0.00650)	(0.0401)
INFL	0.00125	0.0434***
	(0.00386)	(0.0166)
POL	-0.0514***	-0.0561**
	(0.0193)	(0.0284)
LNTPP	0.0387***	
	(0.00766)	
LNTPDP		0.206***
		(0.0618)
LNTPMP		-0.0595***
		(0.0163)
Observations	587	310
Number of id	16	16

Table 4.2 Non-Interest Income and Third-Party Payment: Differences in Bank Groups

	(3)	(4)
VARIABLES	NIIT	NIIT
Constant	-3.815***	-6.727***
	(0.334)	(1.825)
SIZE	-1.467	7.415
	(1.546)	(4.524)
LNTA	0.0599***	0.114***
	(0.00978)	(0.0334)
SIZE#C. LNTA	0.129***	0.00843
	(0.0477)	(0.116)
LDR	0.00218**	-0.00283
	(0.000956)	(0.00172)
SIZE#C.LDR	0.00986***	0.0103*
	(0.00332)	(0.00614)

VARIABLES	(3) NIIT	(4) NIIT
NIM	0.0222	-0.0407
	(0.0197)	(0.0280)
SIZE#C.NIM	-0.151**	-0.160
	(0.0613)	(0.120)
ROA	0.456***	0.622***
	(0.0193)	(0.0268)
SIZE#C.ROA	0.0511	-0.0644
	(0.0407)	(0.0623)
OVHR	0.00798***	0.00254
	(0.00121)	(0.00263)
SIZE#C. OVHR	-0.00363	0.00245
	(0.00410)	(0.00711)
NPL	0.105***	0.119**
	(0.0137)	(0.0472)
SIZE#C.NPL	-0.0359	-0.190**
	(0.0302)	(0.0857)
GDP	-0.00572	-0.205***
	(0.00876)	(0.0478)
SIZE#C.GDP	-0.0147	0.0294
	(0.0159)	(0.0910)
INFL	-0.00799	0.0374**
	(0.00514)	(0.0185)
SIZE#C. INFL	0.0274***	-0.0154
	(0.00962)	(0.0363)
POL	-0.0499**	-0.0593*
	(0.0248)	(0.0307)
SIZE#POL	0.0423	0.0807
	(0.0563)	(0.0707)
LNTPP	0.0603***	

VARIABLES	(3) NIIT	(4) NIIT
	(0.00755)	
SIZE#C. LNTPP	-0.0947***	
	(0.0180)	
LNTPDP		0.246***
		(0.0687)
SIZE#C. LNTPDP		-0.356**
		(0.144)
LNTPMP		-0.0708***
		(0.0183)
SIZE#C. LNTPMP		0.0684*
		(0.0360)
Observations	587	310
Number of id	16	16

CHAPTER 5

CONCLUSION

5.1 Summary

The empirical evidence on the nexus between third-party payment and banks' non-interest income is limited to date whether in developed countries or emerging market economies. Taking China commercial banks as the sample, this paper tries to examine the impacts of third-party payment on non-interest income for the period 2008-2017. We first disentangle the determinants of non-interest income in order to find the control variables. Then the impacts on non-interest income are respectively estimated in terms of third-party total payment, third-party desktop payment, and third-party mobile payment by using random effects panel data techniques. Furthermore, we have explored whether the impacts differ across the large state-owned commercial banks and small-medium commercial banks in China.

Results bespeak that besides banking characteristics, the macro factor like payment policy and third-party payment scales exert strongly impact on non-interest income, likely findings (but in terms of ATM, card payment, and deregulation) are identified by Abdelaziz et al. (2012) for Tunisian banks. So far Chinese third-party total payment has presented a positive spillover effect on overall commercial banks' non-interest income as third-party payment platform links with online banking interface. It stimulates the whole electronic payment to get promoted (Shujin & Yinfei, 2016). Similar to the third-party total payment, third-party desktop payment also can push up the non-interest income for banks. On the other hand, it is interesting that third-party mobile payment demonstrates a depression effect on non-interest income. Once the money flows in the third-party mobile payment circle, the functional applications in the mobile phone would attract the payment processed within the third-party payment platforms.

In addition, the results indicate the impacts on non-interest income differences between the two bank groups (e.g. Pennathur et al., 2012; Sanya & Wolfe, 2011) For the five largest state-owned commercial banks, the correlation with non-interest income turns out to be extremely negative for entire third-party total payment, desktop payment, and mobile payment. Because of the less concern on the majority of small enterprises and customers' requirements for a long-term, large state-owned commercial banks' non-interest income is subducted, bit by bit, by the third-party payment. However, regarding small-medium commercial banks, only third-party mobile payment exerts the depression effects. In terms of third-party total payment or desktop payment, it enhances non-interest income for small-medium commercial banks.

5.2 Policy Implication

Following the results, we found that the rise of third-party payment has expressed the complicated and complex effects on commercial bank's non-interest income at the present stage. In consideration of the negative effects, third-party payment platforms of Fintech provide the better payment services for small and medium-sized companies and retail customers. This leads to the loss of existing and potential customers in commercial banks, thus it reduces the non-interest income. In effect, China's commercial banks have a powerful foundation and strong support. The main reasons for the reduction in non-interest income of commercial banks are due to the administration and innovation, especially for the large state-owned commercial banks. They have experienced the transition towards the standard modern enterprise system with the aim of breaking the administrative monopoly. To promote the optimization of corporate governance structure, and to establish the market-based incentive mechanism may help commercial banks encourage innovation and improve payment efficiency.

Our findings suggest two important policy implications. First, the reforms of banking sectors need more innovative and incentive efforts, like the concerns from emerging economies in India (Bhaumik, Kutan, & Majumdar, 2017), Russia and Ukraine (Love & Rachinsky, 2015), suggesting commercial banks establish modern

corporate governance. The reforms with more competition and autonomy contribute the development of banks. Thus, particularly for large state-owned commercial banks in China, set up a standard corporate governance structure and an effective incentive mechanism can help solve the problems of insider control and moral hazard. In this way, with the improvement of user experiences and the service attitudes toward small and medium clients, large state-owned banks can regain more customer base.

Second, supervision of non-interest income activities should be strengthened with respect to the quality and efficiency, as Sun, Wu, Zhu, and Stephenson (2017) mentioned, to provide more resources on non-interest income. In most developed countries, commercial banks' non-interest income accounts for 50%-60% of the total income. While commercial banks' non-interest income in China is about 20%-40%. There is still a high potential for the development of Chinese commercial banks' non-interest income. In practice, it is necessary for banks to develop the functional mobile banking payment and simplify the payment process for the small amount. With the widespread of the mobile phones, striving for the own mobile payment share is vital to the non-interest income. Moreover, close collaboration with third-party payment platforms is also crucial. The third-party payment firms grasp more information on the small and medium clients, the collaboration may form the clients sharing system to remove the information cost. Small and medium-sized commercial banks can promote the digitization, automation, and intelligence of financial services. Rely on the closed-loop layout of Internet finance in the whole industry chain, and the financial technology service platform of the professional team, banks can obtain information on platform sharing, asset acquisition, online exhibition industry and cooperative operation. Among them, platform sharing is not only an Internet banking platform, but also an asset management platform, a big data risk control platform, and a big data precision marketing platform. Asset acquisition mainly refers to providing high-yield, low-risk quality assets. Online exhibitions include acquiring new customers, increasing customer activity, and precision marketing for high-net-worth clients. By embracing the Fintech and digital innovation, commercial banks can keep competitive and efficiency.

5.3 Limitation and Recommendation

As with all research, however, this empirical paper has its own limitations, for instance, lack of previous studies, which restrains the scope of our discussions. Even though the researches regarding bank's non-interest income are many, there is little prior empirical evidence related to third-party desktop payment, mobile payment, or even digital payment, as these are burgeoning payment patterns that beyond bank's electronic payment. In addition, lack of other smaller commercial banks' data and specific third-party payment amount for each bank. Hence the impacts on non-interest income are only compared in two bank groups.

For future studies, first, it would be interesting to extensively explore the relationship between the third-party payment and non-interest income based on various bank ownership for different countries. Furthermore, an extension of this paper can estimate the effect of third-party payment on bank's overall profitability. Understanding how this new trend payment alters bank attains would contribute to yielding countermeasures. Finally, referring to the factoring technique, third-party desktop payment, and mobile payment could be used as the determinants for the development of other financial sectors.

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APPENDIX A Econometric Test

Table A.1 depicts the Pairwise correlations of the main variables in this study. It can be roughly observed that commercial banks' non-interest income has positive correlations with total asset, loan-deposit ratio, ROA, non-performing loan, payment policy and third-party payment scales. Any increasing at these variables may promote the non-interest income. In particular, the total assets and return on assets express more strongly positive effects.

Table A.1: Correlation Matrix

	NIIT	LNTA	LDR	NIM	ROA	OVHR	NPL	GDP	INFL	POL	LNTPP
NIIT	1										
LNTA	0.4183	1									
LDR	0.2377	0.1615	1								
NIM	-0.1835	-0.2898	-0.27	1							
ROA	0.6121	0.0657	-0.098	0.1871	1						
OVHR	-0.0819	-0.3325	-0.012	0.1459	0.0575	1					
NPL	0.2326	0.3493	0.1085	-0.059	-0.062	-0.074	1				
GDP	-0.3419	-0.3134	-0.162	0.4056	0.0636	0.3711	-0.1155	1			
INFL	-0.1697	-0.1308	-0.136	0.4025	0.05	0.0935	-0.0736	0.6705	1		
POL	0.2166	0.2451	0.2974	-0.49	-0.173	-0.28	0.338	-0.451	-0.198	1	
LNTPP	0.4437	0.4076	0.2597	-0.5	-0.037	-0.438	0.1578	-0.751	-0.318	0.7128	1

In this study Augmented (ADF) Dickey-Fuller unit root test has been used to check data stationarity. The H0 hypothesis is that all panels contain unit root. If the unit root test results reject H0, it indicates that the variable is stationary at level. If not, the non-stationary variable should be taken the first differencing or higher order level to test again until the level which does not contain the unit root, implying the stationary is attained. In table A.2, most variables are stationary at original level. Only loan to deposit ratio, non-performing loan and the natural logarithm of third-party total payment are stationary at first differencing.

Table A.2: ADF Unit Root Test of Variables

Variable	t statistics	Decision	First differencing	t statistics	Decision
LNTA	-2.9140***	Stationary	DLNTA	-19.8818***	Stationary
NIIT	-14.4692***	Stationary	DNIIT	-27.9879***	Stationary
LNTA	-2.9140***	Stationary	DLNTA	-19.8818***	Stationary
LDR	3.1729	Non-stationary	DLDR	-24.1931***	Stationary
NIM	-4.6149***	Stationary	DNIM	-22.6248***	Stationary
ROA	-22.1903***	Stationary	DROA	-27.2655***	Stationary
OVHR	-6.3361***	Stationary	DOVHR	-26.4881***	Stationary
NPL	-0.8165	Non-stationary	DNPL	-12.2469***	Stationary
GDP	-2.6415***	Stationary	DGDP	-16.8210***	Stationary
INFL	-7.9757 ***	Stationary	DINFL	-8.0139***	Stationary
LNTPDP	-5.3501***	Stationary	DLNTPDP	-16.4595***	Stationary
LNTPMP	-10.2761***	Stationary	DLNTPMP	-3.0590***	Stationary
LNTPP	7.9628	Non-stationary	DLNTPP	-14.9080***	Stationary

Note: *** show the statistical significance level at 0.01

F test is performed to determine either mixed model or fixed effects model is preferred. Firstly, the paper regressed the data on pooled OLS model and fixed effects model respectively. The sum of squared residuals of two models are obtained, which presented by RSS_1 and RSS_2. Secondly, the F test can be constructed as:

$$F = \frac{(RSS_1 - RSS_2)/[(N-1)(K+1)]}{RSS_2/[NT - N(K+1)]}$$

N represents the number of cross-sections in this panel data, K represents the number of independent variables, and T is the time periods. If the F statistic value is greater than critical level, it indicates that the mixed model is not appropriate. After calculating, the F statistic value equals 22.03 that is greater than the critical value 4.099 at 5% significance level. So, the mixed effects model does not apply to this panel data.

Then the Hausman test is used to differentiate between fixed effects model and random effects model. The outcome of the test shows Prob>chi2 = 0.1335 which is

higher than 5% significance level. It means that the null hypothesis: difference in coefficients not systematic can't be rejected, and the random effects model should be adopted in this study.

Table A.3: Hausman Fixed Random Specification Test

Variable	Fixed(b)	Random(B)	Difference(b-B)
LNTA	0.1316377	0.0524346	0.0792031
LDR	0.0035631	0.0021834	0.0013797
NIM	-0.05974	-0.0597466	-1.64E-06
ROA	0.498192	0.4914388	0.0067531
OVHR	-0.000997	-0.0003391	-0.0006584
NPL	0.0826442	0.0778876	0.0047566
GDP	-0.010206	-0.0111872	0.0009811
INFL	0.0012286	0.0012884	-0.0000598
LNTPP	0.0075196	0.0291934	-0.0216738

APPENDIX B Commercial Banks and Non-Interest Income

Table B.1: Presentation of 16 Listed Commercial Banks

Bank Type	Abbreviation	Full Name
Five Largest State-Owned Commercial Bank	ICBC	Industrial and Commercial Bank of China
	ABC	Agricultural Bank of China
	BOC	Bank of China
	CCB	China Construction Bank
	BOCOM	Bank of Communications
Joint-Stock Commercial Bank	PAB	Ping An Bank
	SPDB	Shanghai Pudong Development Bank
	HXB	Huaxia Bank
	CMSB	Minsheng Bank
	CMBC	China Merchants Bank
	CIB	China Industrial Bank
	CEB	China Everbright Bank
	CITIC	China CITIC Bank
City Commercial Bank	BOB	Bank of Beijing
	BON	Bank of Nanjing
	NBCB	Bank of Ningbo

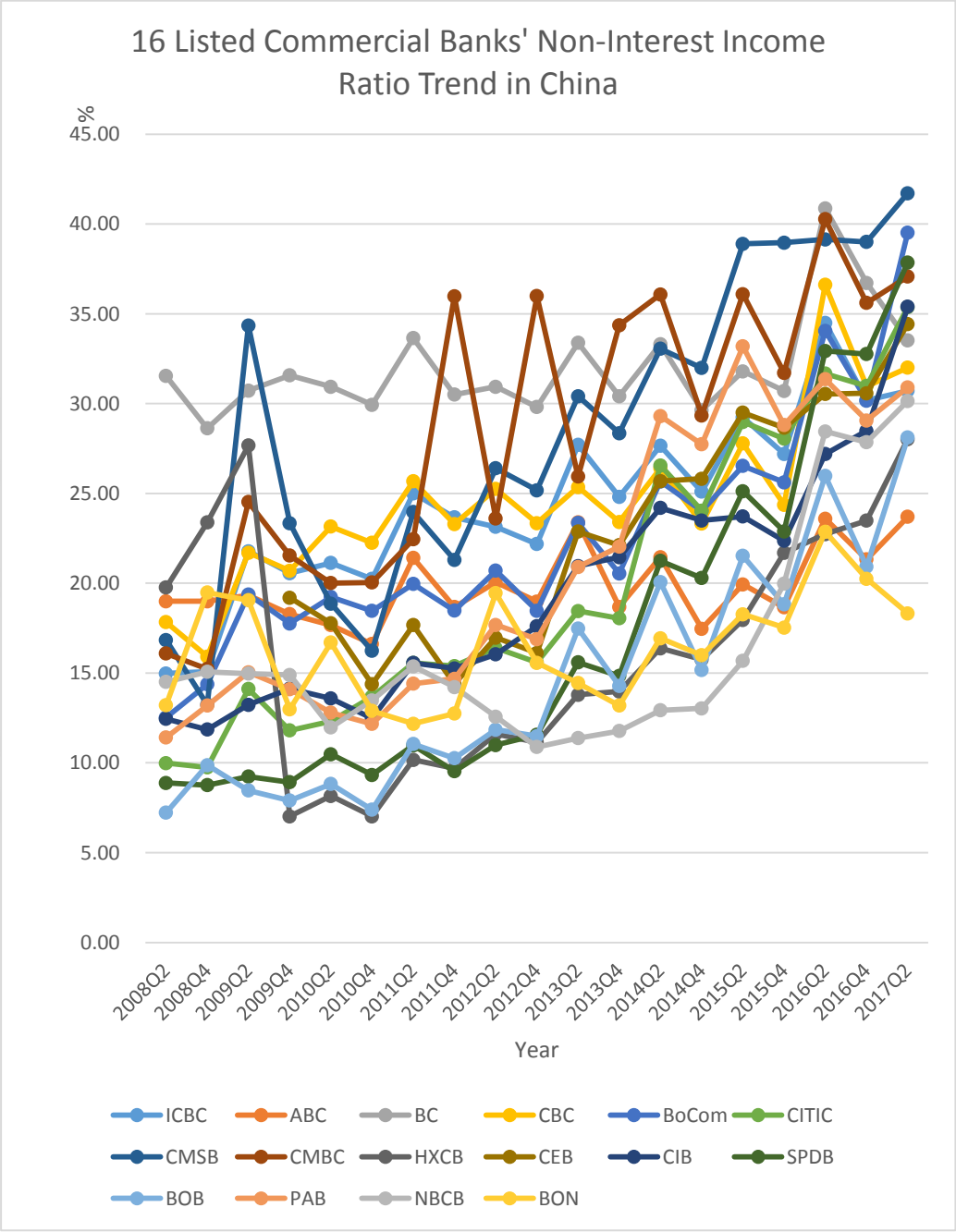
Source: The People's Bank of China

Table B.2: Related Payment Polices in China

Year	Payment Policy	Content	Authority
2010	Non-Financial Institution Payment Service Regulation	Standardize third-party payment license application threshold	The People's Bank of China
2014	Payment Agency Customers Reserve Deposit Regulation	Set up costumer reverse management requirement to protect consumers legitimate rights and interests.	The People's Bank of China
2015	Administration of Internet Payment Business in Non-Bank Payment Institutions	Real-name registration system for third-party payment	The People's Bank of China
2015	Internet +, the Belt and Road	Promote mobile Internet, big data and e-commerce	Central government
2016	Barcode Payment Business Norms	Set up the security standards for barcode business payment institutions	Payment & Clearing Association of China
2017	Payment Agency Customers Reserve Deposit Centralized Management	Centralized customers reserve management to prevent appropriation	The People's Bank of China

Source: The People's Bank of China and websites.

Diagram B.1 16 Listed Commercial Banks' Non-Interest Income Ratio Trend in China

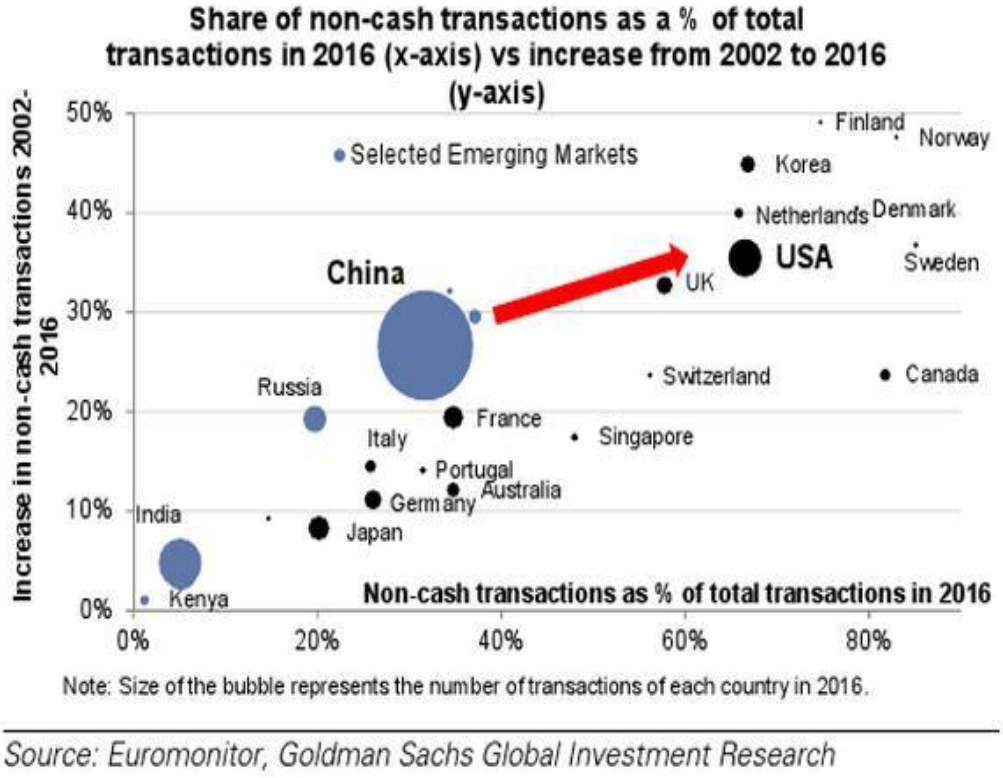


Source: Author's Calculation. Data from each bank's financial statement. Shanghai Stock Exchange Website; Shenzhen Stock Exchange Website.

APPENDIX C Third-Party Desktop Payment and Mobile Payment in China

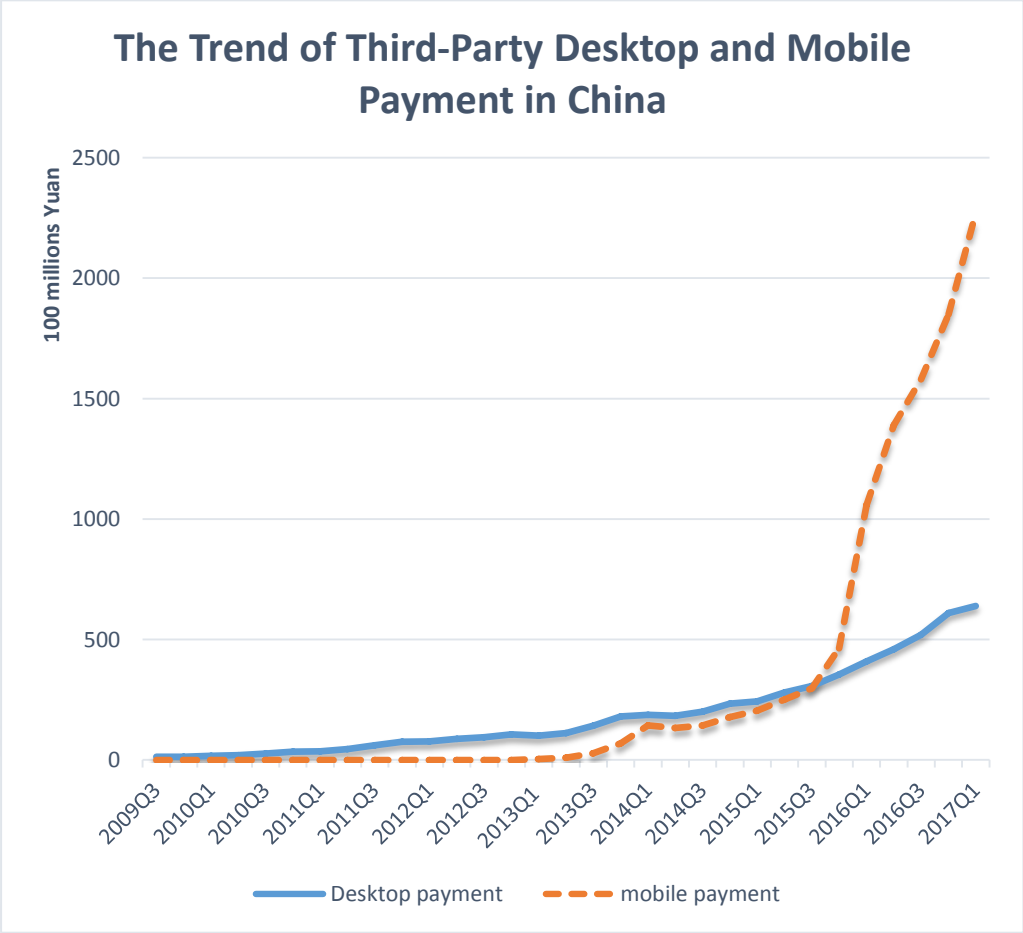
Diagram C.1 Share of Non-Cash Transactions in Worldwide

Source



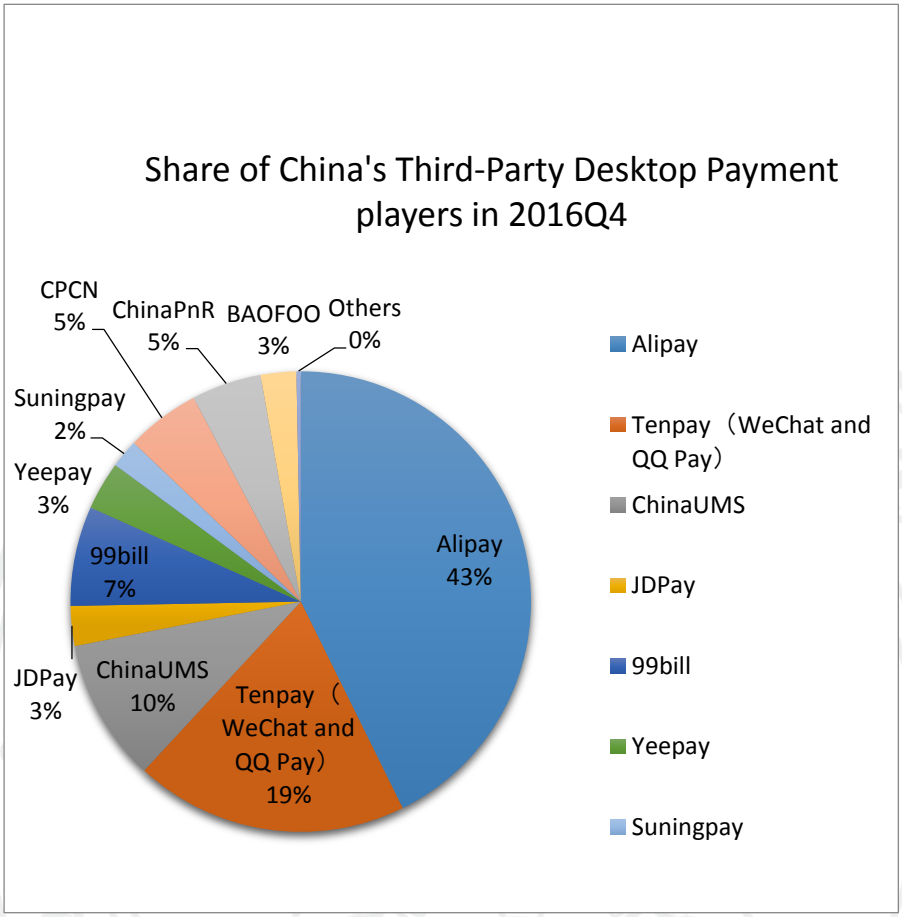
Source: Goldman Sachs, Future of Finance: The Rise of China FinTech (2017), Page 11

Diagram C.1 The Trend of Third-Party Payment and Mobile Payment in China



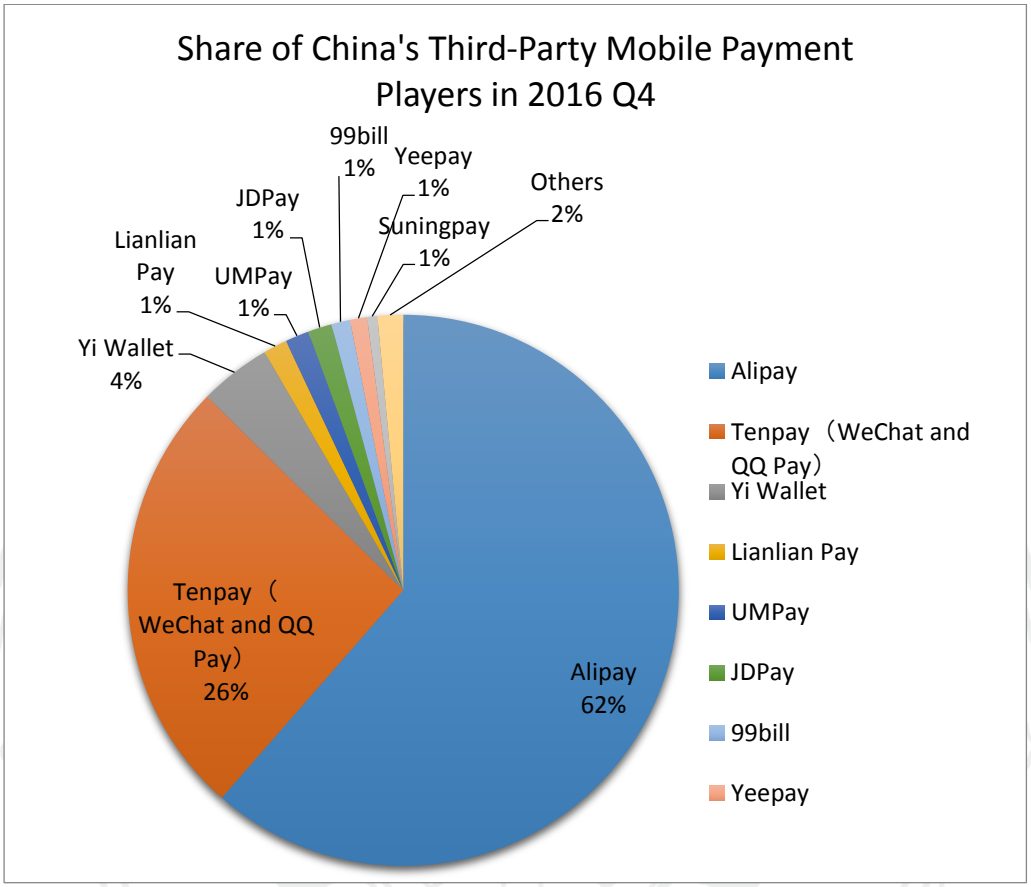
Source: Author's Calculation. Data from iResearch Reports in China.

Diagram C.2 Share of China's Third-Party Desktop Payment players in 2016Q4



Source: iResearch; China’s Third-party Online/Mobile Payment Transaction Scale in Q4 2016, Page 2.

Diagram C.2 Share of China's Third-Party Mobile Payment players in 2016Q4



Source: iResearch; China’s Third-party Online/Mobile Payment Transaction Scale in Q4 2016, Page 2.

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