Mobile-Payments in the U.S. and China

by

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Abstract

Mobile payment is a non-cash payment method that uses mobile terminals as a medium. The United States, the world's most financially advanced country, has lagged far behind China in mobile payment innovation. The reasons for this phenomenon have not been well explained in past studies. This thesis examines and deeply analyzes the development history and lineage of the payment industry infrastructure - banking industry, payment clearing system, bank card industry, and the whole payment industry in the U.S. and China with a historical and comparative research approach, and comes up with four main factors that lead to the differences between the mobile payment industry in the U.S. and China. First, the high concentration of China's banking industry and the singularity of the payment clearing system lowered the threshold for mobile payment startups to expand their business in the early stage. Second, the relative backwardness of China's Internet and bank card industries has led the Chinese to move directly from cash payments to electronic payments, and the lack of supporting hardware has spawned innovation in QR code payments. Third, mobile payment is a natural multi-side platform model, and the endowment of Chinese innovators in e-commerce and social user "sides" plays a decisive role in the direction of innovation and the probability of success. Fourth, fees in the Chinese payments chain are much lower than in the U.S., reducing the incentive for stakeholders to impede industry change and objectively facilitating mobile payment innovation and development.

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Chapter 1

Introduction

1.1 Mobile-Payments Definition

Mobile payment is a form of payment. It uses a mobile device (such as a smartphone) as the payment medium and credential, rather than cash, checks, or credit cards. Consumers can use their mobile devices alone to complete a payment or transfer without providing any other signature or physical credentials.

Four mobile payment methods are covered in this paper, namely:

1. Phone bill payment (e.g., China Mobile, 1999)
2. SMS payment (e.g., China UnionPay, 2002)
3. QR code payment (e.g., Alipay, 2012)
4. Near field communication (NFC) payment (e.g., Apple Pay, 2015)

Mobile payments have profoundly changed the way people interact with cash-based property and credit assets, while creating new transaction scenarios and possibilities. In China today, it is almost impossible to see anyone transacting in cash (the author herself has not used cash for over a decade). Mobile payment providers have

evolved into giants covering every aspect of consumers' lives, keeping tabs on everyone's spending and credit history. Mobile payments have also made innovations such as bike-sharing possible.

1.2 Significance of the Study

The U.S. and China have taken very different paths in the development of the mobile payment industry.

The U.S. has a highly developed financial and banking industry, and leads the world in Internet technology, but is not only far behind China in the development of the mobile payment industry, but also inferior to many Southeast Asian countries. China's financial industry started late, with modern banks appearing just over 40 years ago, but the electronic payment and mobile payment industry has become the world's number one in less than 20 years.

Most existing articles or reports attribute the imbalance in the development of the mobile payment industry in China and the United States to the advanced credit card industry and high switching costs in the United States. However, the research methodology is generally superficial, investigating and studying only aspects such as the consumer technology acceptance model (TAM). Moreover, these researches did not explain why mobile payments did not originate and flourish in the United States, the world's most advanced country in terms of finance and information technology, but rather in China, a developing country that has made innovations and led the trend.

This paper hopes to find the deep-seated reasons for the differences in the mobile payment industry between the U.S. and China through historical and comparative research by examining the journey and lineage of the development of the infrastructure of the payment industry in both countries - the banking industry, the payment clearing system, the bank card industry, and the payment industry as a whole.

1.3 Structure

This paper is divided into five chapters. Chapter 1 defines the scope and significance of the study. Chapters 2 and 3 introduce the banking industry, the bank card industry, the payment clearing system, the history of mobile payment development and the current industry landscape in the United States and China, respectively. Chapter 4 provides a comparative analysis of the various segments of the mobile payment industry. Chapter 5 summarizes the conclusions drawn in the previous section.

In addition, considering that most readers of this paper may be more familiar with the U.S. mobile payment industry and more difficult to obtain information in Chinese, this paper deliberately focuses on the history and current status of the Chinese banking system and payment and clearing system, as well as the origins, changes and various periods of the Chinese mobile payment industry from its birth to its prosperity, in the hope that it can be a useful addition to the English literature in this research area.

Chapter 2

The History and Status of Mobile-Payments and Relevant Industries in the United States

2.1 U.S. Banking System

The foundation of the development of the modern payment industry is the banking sector. By understanding the history of a country's banking industry, we can clearly grasp the origins and changes of the country's payment and settlement system, and eventually analyze the roots and potential of the mobile payment industry in the country.

The U.S. banking industry started in 1780 and has been in the making for more than 200 years, roughly through the free banking era (1836-1863), the national banking system era (1863-1913) and the federal reserve system era (1913-present). As Jeffersonian thinking prevailed in the early years, the United States developed a tradition of not establishing a central bank. This resulted in a proliferation of private banks and indiscriminate issuance of money, which eventually led to several inflationary and

financial crises. 1863 saw the passage of the National Bank Act, which attempted to rectify the situation by limiting the issuance of money by state banks and giving the Treasury Department the authority to manage monetary policy. The Act had some success, but it did not solve the problem of the absence of a central bank in a fundamental way and created many new conflicts, which eventually led to the emergence of a "dual system" of financial banking in the United States - federal and state legislation and regulation at two separate levels. The Great Panic of 1907 prompted the U.S. Congress to pass the Federal Reserve Act in 1913, formally establishing the Federal Reserve System with the Federal Reserve as the central bank, which has largely continued to this day. The establishment of this system was the beginning of the modernization of the U.S. financial banking industry and the foundation of U.S. global dominance through the financial sector.

However, this system also left behind many problems that did not adapt to the changing times and directly affected the birth and development of the payment clearing system. First, allowing private individuals to obtain a banking charter led to the number of banks in the United States exceeding 14,000 in the 1980s, with bank failures and mergers occurring regularly. Second, the National Banking Act prohibited banks from establishing branches across state lines, which greatly limited bank expansion and later led to the emergence of two major credit card organizations, Visa and MasterCard. Third, the clearing services provided by the Federal Reserve in the early 20th century were later gradually transferred to the networks of the private sector CHIPS and the nonprofit organization ACH for processing, making the U.S. payment clearing system take on more layers.

2.1.1 From Independence to the "Free Banking Era" (1780-1863)

The history of American banking, founded in 1776, can be traced back as far as 1780. At that time, a number of merchants established the Bank of Pennsylvania to

finance the War of Independence (1775-1783.) In 1781, the Bank of North America was established in Philadelphia by permission of the Federal Congress, replacing the Bank of Pennsylvania, which had been in existence for only one year. This bank was granted the exclusive right to issue national currency (letters of credit).

After the war, in 1774, the Bank of New York and the Bank of Massachusetts were established in the eastern United States as two state banks.

In 1791, the First Bank of the United States was established under a congressional charter. The bank had both federal and private shareholders and was a national commercial bank. However, due to conflicts with state banks, it was not able to obtain the passage of the renewal legislation, and the First Bank of the United States collapsed in 1811.

As the United States experienced severe inflation during the War of 1812, it was difficult to adequately fund military operations. 1817 saw the chartering of the Second Bank of the United States.

When the war ended in 1815, private banking in the America exploded rapidly. The banks' reckless issuance of paper money eventually led to the first widespread and protracted financial crisis in the United States in 1819.

During Jackson's time in power, his vigilance and antipathy toward central banking led to the stagnation of banking in the U.S. Prior to 1837, the issuance of bank charter licenses was very limited. But in 1837, the Michigan Act was introduced to grant automatic charters to banks that met Michigan's requirements and removing the need for the approval and consent of the state legislature. in 1838, New York passed a similar provision through the Free Banking Act. A number of other states followed suit.

These automatically-chartered banks were permitted to issue several different currencies. The state governments set some requirements such as reserve ratios, capital adequacy ratios and interest rates.

"Free banking" soon expanded in many states. From 1840 to 1863, all banking in the U.S. was performed by these chartered banks.

In this environment of free banking, in principle, anyone could operate a bank. This led to the United States suffering from financial turmoil during the free banking era, with numerous banking crises and a disorderly system of monetary bills characterized by thousands of different currencies. This instability and chaos renewed the call for greater central regulation in the 1860s.

2.1.2 National Bank Act (1863 & 1864)

In view of the chaotic and disorderly state of the financial market during the free banking period, there was a renewed demand for a unified currency and the restoration of federal regulation of banks. Meanwhile, the Civil War made the public more open to government.

Against this favorable social background, the National Currency Act was passed by Congress in March 1863. In 1864, attempts were made to establish a national banking system.

The National Bank Act was the first law to unify the nation's banking and financial industry. Its most important missions are to give the government the power to supervise the banking industry and to establish a uniformly regulated system to replace the decentralized state banks, thereby coordinating the flow of money and ensuring financial stability.

To achieve this purpose, the National Bank Act provides for national and state banks in a number of ways. First, it establishes a three-tier standard for bank reserve ratios. Second, it required that bank notes issued by national banks be secured by bonds issued by the federal and levied a 10 percent tax on state banknotes to discourage state banks from issuing currency and to attempt to issue a new, stable, nationally circulating currency of uniform value through the national banking system. Third,

the national banks were not allowed to operate trust business. Fourth, the National Bank was required to have a single banking system and could not establish branches.

The National Bank Act also set up the Office of the Comptroller of the Currency under the United States Treasury Department, which was in charge of the regulation, supervision and examination of national banks.

The National Banking Act was enacted as a revision of laissez-faire in the monetary and banking fields, reflecting to some extent Hamilton's ideological tradition of strengthening federal oversight and regulation of the nation's monetary systems.

However, the Act still has serious drawbacks. One of the biggest drawbacks was the failure to create a central bank to achieve uniform surveillance.

The National Bank Act created the dualistic (federal-state) structure that is now a defining feature of the U.S. banking system. The OCC continues to play an important role in the U.S. economy, regulating and supervising national banks and certain activities of bank subsidiaries.

The imperfections of the Act, and the shortcomings of the national banking system established on its basis, led to a soaring industrial economy while the United States was plagued by financial crises, such as the severe financial crises of 1873, 1884, 1893, and 1907. The frequent financial crises had a devastating impact on the U.S. society, often even plunging the country into a years-long economic depression. The financial crisis of 1907 exposed the flaws in the U.S. banks and made the American community recognize the need for comprehensive reform to achieve uniform regulation and maintain financial stability. Deficiencies in the national banking system were the primary cause of the formation of the Federal Reserve System.

2.1.3 Federal Reserve Act (1913)

In 1907, there was a financial crisis in the US. Very similar to the 2008, the run on the trusts radiated from New York to the entire United States. This crisis was the first global financial crisis of the 20th century, and it was second only to the Great Depression in terms of severity.

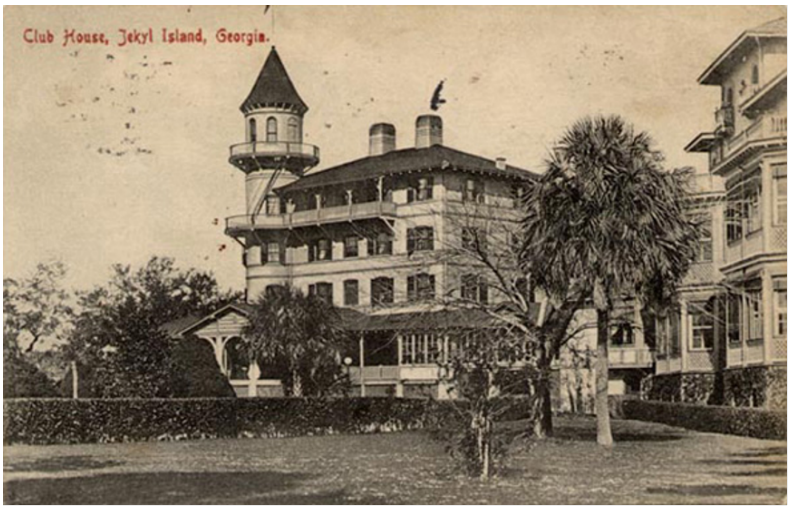


Figure 2-1: The old clubhouse, Jekyll Island, Georgia

In November 1910, Nelson Aldrich, a Republican senator and chairman of the National Monetary Commission, called a secret meeting of 5-7 financial industry leaders on a secluded island off the coast of Georgia.

This meeting gave birth to many legends and the motives of the participants were questionable. In any case, historical research now recognizes that this meeting gave birth to the prototype of the Federal Reserve Act.

In 1913, the 63rd U.S. Congress adopted the Federal Reserve Act, which overhauled the National Banking Act. This was the first true central banking system (although at the time the United States did not refer to it as a central bank).

2.1.4 Summary

The U.S. states have relative legislative independence from each other. This has led to a unique structure of U.S. commercial banks, which resulted in relatively small bank size, low concentration, fewer branches on average and a larger number of banks overall.

As the economy grows, the number of banks in the U.S. continues to decline (due to mergers and bankruptcies). According to the FDIC, by the end of 2021, the number of commercial banks declined from 14,407 in 1980 to 4,839.[1]

FDIC Statistics At A Glance

Historical Trends

As of December 31, 2021

Dollar Amounts in Billions		2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
Number of FDIC-Insured		4,839	5,002	5,177	5,406	5,670	5,913	6,182	6,509	6,812	7,083	7,357
Number of FDIC-Supervised		3,122	3,221	3,338	3,483	3,637	3,787	3,947	4,138	4,312	4,460	4,598
Total Assets	$	23,719	21,869	18,646	17,943	17,415	16,780	15,968	15,554	14,731	14,450	13,891
Total Loans	$	11,247	10,864	10,518	10,152	9,721	9,305	8,839	8,309	7,893	7,695	7,474
Domestic Deposits	$	18,189	16,290	13,221	12,613	12,081	11,649	10,908	10,371	9,791	9,447	8,758
Bank Net Income	$	279.13	147.12	232.78	236.76	164.09	170.51	163.44	152.25	154.31	141.04	118.41
Percent Profitable	%	97.0	95.3	96.3	96.6	94.4	95.5	95.2	93.7	91.8	89.0	83.8
Average Return on Assets	%	1.23	0.72	1.29	1.35	0.97	1.04	1.04	1.01	1.07	1.00	0.88
Average Return on Equity	%	12.21	6.85	11.38	11.98	8.60	9.27	9.29	9.01	9.54	8.90	7.79
Net Interest Margin	%	2.54	2.82	3.36	3.40	3.25	3.13	3.08	3.14	3.26	3.42	3.60
Equity to Assets	%	9.94	10.17	11.32	11.25	11.22	11.10	11.24	11.15	11.15	11.17	11.16
Noncurrent Loan Rate - Total Loans[1]	%	0.89	1.19	0.91	0.99	1.20	1.42	1.56	1.96	2.63	3.60	4.20
Real Estate Loans	%	1.29	1.65	1.12	1.32	1.66	1.95	2.48	3.35	4.45	6.00	6.61
C&I Loans	%	0.68	0.99	0.79	0.68	0.90	1.28	0.78	0.50	0.63	0.88	1.29
Loans to Individuals	%	0.64	0.86	1.02	1.03	0.97	0.92	0.85	0.89	1.05	1.17	1.43
Coverage Ratio[2]	%	178.82	183.71	129.89	124.30	106.30	92.18	85.97	75.39	65.59	58.55	60.08
Net Charge-Off Rate - All Loans	%	0.25	0.50	0.52	0.48	0.50	0.47	0.44	0.49	0.69	1.10	1.55
Real Estate Loans	%	0.01	0.04	0.01	0.01	0.03	0.06	0.13	0.20	0.48	1.02	1.34
C&I Loans	%	0.19	0.53	0.36	0.28	0.38	0.45	0.27	0.24	0.32	0.51	0.80
Loans to Individuals	%	1.19	2.07	2.42	2.35	2.26	1.96	1.80	1.95	2.16	2.50	3.50
Commercial Banks		4,231	4,375	4,518	4,715	4,918	5,112	5,338	5,607	5,847	6,072	6,275
New Reporters		9	6	13	7	5	0	1	0	1	0	3
Mergers		151	147	204	226	196	221	264	238	203	172	165
Savings Institutions		608	627	659	691	752	801	844	902	965	1,011	1,062
New Reporters		0	0	0	1	0	0	0	0	1	0	0
Mergers		13	21	22	33	34	30	40	35	29	36	31
Problem Institutions												
Number		44	56	51	60	95	123	183	291	467	651	813
Assets[3]	$	170	56	46	48	14	28	47	87	153	233	319
Deposit Insurance Fund[4]												
Fund Balance	$	123.1	117.9	110.3	102.6	92.7	83.2	72.6	62.8	47.2	33.0	11.8
Insured Deposits	$	9,729	9,123	7,825	7,523	7,157	6,916	6,519	6,196	5,998	7,402	6,973
Reserve Ratio	%	1.27	1.29	1.41	1.36	1.30	1.20	1.11	1.01	0.79	0.45	0.17
Number Failed Institutions		0	4	4	0	8	5	8	18	24	51	92
Failed Assets[5]	$	0.000	0.455	0.209	0	5.082	0.277	6.706	2.914	6.044	11.617	34.923
Number Assisted Institutions		0	0	0	0	0	0	0	0	0	0	0
Assisted Assets[5]	$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Estimated Losses(DIF)[6]	$	0.000	0.099	0.031	0.000	1.162	0.046	0.859	0.393	1.248	2.462	6.504
Resolution Receivables[7]	$	0.885	1.367	2.669	3.058	5.973	7.730	11.578	18.181	16.345	23.120	28.549
Number of FDIC Employees[8] (Includes RTC before 1996)		5,670	5,591	5,593	5,693	5,881	6,087	6,385	6,631	7,254	7,476	7,973

Dollar Amounts in Billions		2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
Number of FDIC-Insured		7,658	8,012	8,304	8,534	8,680	8,833	8,976	9,181	9,354	9,613
Number of FDIC-Supervised		4,715	4,941	5,097	5,198	5,220	5,245	5,264	5,319	5,353	5,486
Total Assets	$	13,319	13,087	13,818	13,034	11,862	10,879	10,107	9,076	8,436	7,867
Total Loans	$	7,375	7,282	7,858	7,906	7,234	6,718	6,121	5,435	5,053	4,761
Domestic Deposits	$	7,873	7,697	7,490	6,913	6,631	6,221	5,719	5,219	4,910	4,560
Bank Net Income	$	85.40	(9.96)	9.09	99.94	145.22	133.82	122.22	120.62	104.68	86.99
Percent Profitable	%	77.9	69.2	75.1	87.9	92.1	93.8	94.0	94.0	93.3	91.8
Average Return on Assets	%	0.65	-0.08	0.03	0.81	1.28	1.28	1.28	1.38	1.30	1.14
Average Return on Equity	%	5.85	-0.73	0.35	7.75	12.30	12.43	13.20	15.05	14.08	12.95
Net Interest Margin	%	3.76	3.49	3.16	3.29	3.33	3.47	3.53	3.73	3.96	3.78
Equity to Assets	%	11.15	10.88	9.38	10.34	10.52	10.28	10.28	9.15	9.20	8.99
Noncurrent Loan Rate - Total Loans[1]	%	4.87	5.44	2.94	1.42	0.80	0.74	0.80	1.12	1.36	1.30
Real Estate Loans	%	7.03	7.22	3.82	1.75	0.82	0.71	0.61	0.83	0.89	0.92
C&I Loans	%	2.44	3.43	1.69	0.67	0.64	0.77	1.16	2.06	2.89	2.40
Loans to Individuals	%	1.76	2.18	1.77	1.43	1.20	1.13	1.39	1.46	1.43	1.36
Coverage Ratio[2]	%	64.47	57.72	74.90	91.66	134.80	154.70	168.03	140.30	123.71	128.80
Net Charge-Off Rate - All Loans	%	2.55	2.52	1.28	0.59	0.39	0.49	0.56	0.78	0.97	0.83
Real Estate Loans	%	1.97	2.04	0.98	0.24	0.08	0.05	0.07	0.13	0.13	0.15
C&I Loans	%	1.77	2.37	1.01	0.54	0.32	0.32	0.54	1.25	1.76	1.43
Loans to Individuals	%	6.08	5.45	3.41	2.52	2.02	2.72	2.75	3.02	3.21	2.67
Commercial Banks		6,519	6,829	7,076	7,279	7,397	7,523	7,628	7,767	7,887	8,080
New Reporters		9	25	89	164	178	166	122	110	91	126
Mergers		184	152	259	282	305	269	261	224	276	354
Savings Institutions		1,139	1,183	1,228	1,255	1,283	1,310	1,348	1,414	1,467	1,533
New Reporters		2	6	8	17	16	13	6	8	4	20
Mergers		13	26	32	39	37	41	58	49	56	62
Problem Institutions											
Number		884	702	252	76	50	52	80	116	136	114
Assets[3]	$	390	403	159	22	8	7	28	30	39	40
Deposit Insurance Fund[4]											
Fund Balance	$	-7.4	-20.9	17.3	52.4	50.2	48.6	47.5	46.0	43.8	41.4
Insured Deposits	$	6,302	5,408	4,751	4,292	4,154	3,891	3,622	3,452	3,384	3,216
Reserve Ratio	%	-0.12	-0.39	0.36	1.22	1.21	1.25	1.31	1.33	1.29	1.29
Number Failed Institutions		157	140	25	3	0	0	4	3	11	4
Failed Assets[5]	$	92.085	169.709	371.945	2.615	0.000	0.000	0.170	0.947	2.873	1.822
Number Assisted Institutions		0	8	5	0	0	0	0	0	0	0
Assisted Assets[5]	$	0.000	1,917.48	1,306.04	0.000	0.000	0.000	0.000 0.000	0.000	0.000	0.000
Estimated Losses(DIF)[6]	$	15.978	25.797	18.148	0.162	0.000	0.000	0.004	0.063	0.426	0.306
Resolution Receivables[7]	$	29.533	38.409	15.766	0.808	0.482	0.533	0.722	0.784	0.793	1.429
Number of FDIC Employees[8] (Includes RTC before 1996)		8,150	6,557	4,988	4,532	4,476	4,514	5,078	5,311	5,430	6,167

[1] Nonaccruing loans and loans past due 90+ days
[2] Loss reserve as a percentage of noncurrent loans
[3] Assets shown are what were on record as of the last day of the quarter.
[4] Prior to 2006, amounts represent sum of separate BIF and SAIF amounts.
[5] Prior years have been revised to reflect failed/assisted assets as reported on the Call Report for the quarter prior to failure/assistance.
[6] Includes RTC resolutions from 1990-1995, excludes Transaction Account Guarantee program (TAG) losses from inception in 2008 until the program ended in 2011.
[7] Includes remaining receivership assets from prior years.
[8] Beginning in 2008, FDIC began reporting the number of FDIC employees based on a new, full-time equivalent methodology. Prior years have been revised to reflect the number of employees as reported in the FDIC Annual Report.

Figure 2-2: FDIC Historical Trends, 2022

Therefore, it also forms a phenomenon that a few large banks have huge combined assets and the proportion of each bank is seriously unbalanced.

[1] Source: "FDIC Statistics At A Glance | Historical Trends 2022," FDIC

2.2 U.S. Payment/Credit Card

Some stores began by issuing a "loyalty card" in 1915 for high-end and long-term customers. The model was that members of wealthy families would go to the department store, sign for the membership card, and then at the end of each month or quarter, the department store would send a collector to the family's housekeeper to ask for money.

But this card, which is hard-copy in nature, can only be used and acknowledged within the issuer's own restaurants and department stores, and does not allow for cross-border use.

The history of U.S. credit card development could be represented by five organizations.

2.2.1 First payment card Diners Club: 1950

Figure 2-3: Frank X. McNamara

In 1949, Frank X. McNamara, an American businessman, was entertaining guests in a New York restaurant. After the meal, he sent his friends away and called the waiter to settle the bill, but he went through all the pockets of his clothes, but could not find his wallet, and then remembered that he had forgotten his wallet in the pocket of the clothes he wore yesterday.

Faced with the waiter's questioning eyes, he was embarrassed and had no choice but to call his wife and ask her to hurry up and send the money over.

This embarrassing experience made McNamara very memorable, and also began to think: it would be much more convenient if there was a similar thing that could be carried around with him and paid for without having to take cash when paying.

In 1950, he invested $10,000 with two friends, Ralph Schneider and Matty Simmons, to create the Diners Club in New York, issuing the first cards that could be signed at various different restaurants:

2.2.2 First payment card Diners Club: 1950

Figure 2-4: Diners Club cards

The earliest Diners Club cards were made of cardboard with a magnetic strip.

The card was first used only in New York restaurants, but as the number of cardholders grew, it was accepted by department stores, high-end hotels, cruise lines, and

so on.

The convenience for both merchant and customer made the card so popular. Over a 12-month period, it got 42,000 consumer members and 330 merchants willing to accept payments.[2]

The business also expanded to most of the major cities in the United States.

By 1953, Diners Club had expanded to the United Kingdom, Canada, Cuba, Mexico as cardholders roamed the globe.

In 1955, the card was extended to Asia, Europe, and the Middle East.

In 1959, Diners Club had surpassed one million cardholders.

In 1969, Diners Club cards could be used in 130 countries and territories worldwide.

The Diners Club card became the standard for the American upper class.

Diners Club's main business model is to charge an annual fee. It is also the creator of the "annual fee" model. At the time, it required an $18/year initiation fee to join Diners Club, and with 1 million cardholders, the annual fee alone was $18 million a year.

2.2.3 First credit card - BankAmericard and Visa: 1958

In 1958, California-based Bank of America decided to take a page from the diners Club's book and launch its own BankAmericard.

The biggest innovation of BankAmericard is that it gives consumers the ability to defer payments to a later date, provided that they pay a high interest rate. In contrast, Diners Club required members to settle all outstanding balances that month. This design turned the credit card into a lucrative small, high-interest loan business.

[2] "Credit Card | An Article About The History And Rights Of Diners Club," Freewechat

Figure 2-5: BankAmericard

Within a year, the card expanded to major California cities. The lack of experience and risk control resulted in a large number of consumer defaults, peaking at 22% of consumers not paying their outstanding balances. Bank of America's losses in the first year, amounted to $20 million (about $170 million today).[3]

Three years later, the card finally became profitable and grew into a lucrative business in the mid-1960s. Consumers increasingly accepted the card and made a new demand: they wanted to use the card nationwide, not just in California.

This caused a major headache for U.S. banks because Congress passed a law in 1930s stating that banks could only operate in one state and could not operate across state lines. This was because banks in the U.S. were privately owned and there had been many small banks that solicited off-site deposits at high interest rates, causing panic and runs across the country if they failed, hence the rule that banks could not operate across state lines and were regulated by state governments.

In 1966, Bank of America finally came up with a response to expand to the entire country. It decided to form an alliance where banks that joined could issue BankAmericard and develop merchants that would settle with Bank of America each month, thus enabling cross-bank purchases. Wherever consumers saw a store with the BankAmericard logo on it, they could go in and swipe their cards.

The problem with this is that Bank A's cardholders swipe their cards at Bank B's merchants, and Bank B, which does not know the actual status of the cardholder, is

[3]Yifeng, Ruan, "The Historical Origins Of Credit Cards". Ruanyifeng

required to advance him money, which is risky. In addition, the mutual settlement between different banks is getting more and more complicated and the efficiency is decreasing drastically.

In October 1968, Bank of America called a meeting with all member banks to discuss how to solve the problems above. It was finally decided to create an independent company that would specialize in interbank credit card business. All member banks issued cards of this company and settled only with it, but each bank could develop cardholders and merchants under its own name. This company has all the cardholder information and is responsible for settling with each bank.

This credit card company was originally called National BankAmericard Inc. and changed its name to VISA in 1976, which is how the VISA card came to be.

In 1975, the first debit card of the VISA network was issued.

In 1995, the Visa Check Card is created. That same year, Visa participated in the development and formulation of the industry-wide chip card harmonization technology standard EMV to ensure interoperability between all chip cards and terminals. Debit cards become mainstream.

In 1997, Visa reaches $1 trillion in annual transaction volume, a major milestone for the payments industry.

In 2001, Visa reaches one billion cards in circulation.[4]

2.2.4 Another Banking Union MasterCard: 1969

Bank of America invented the credit card and dominated the early national credit card business, with banks that joined the alliance paying into it. Those banks that did not want to pay, then began to develop their own credit cards independently.

[4] "Visa Credit Card History - Our Business," Visa.cn

On August 16, 1966, four California banks established the Interbank Card Association (ICA) to compete with the BankAmericard (the predecessor of Visa) issued by Bank of America.

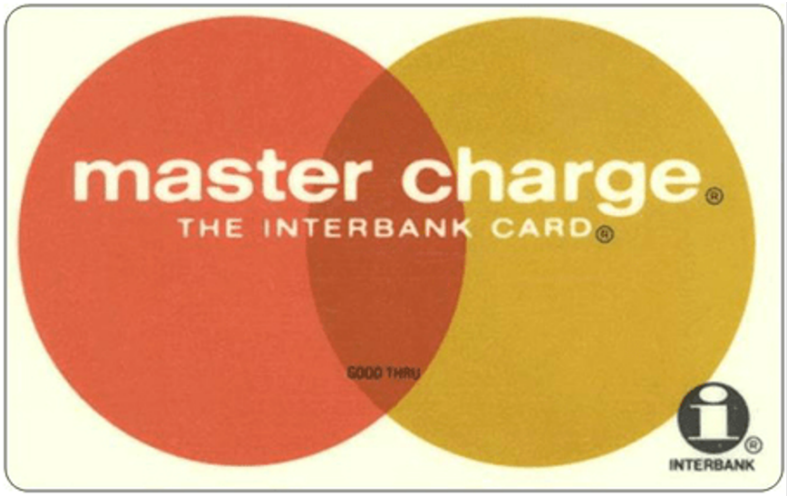


Figure 2-6: Master Charge Card

In 1968, the ICA became an international organization with the addition of Banco Nacional, EuroCard and the Bank of Japan.

In 1970, ICA officially adopted the name and logo "MasterCharge".

In 1980, ICA changed its name to "MasterCard".

In 1983, MasterCard first introduced the use of laser holograms on cards to prevent counterfeiting, thereby minimizing fraud losses to member banks, and in the same year, introduced the Emergency Card Replacement (ECR) program.

The year 1984 marked a milestone in MasterCard's technological development. Banknet, a global transaction processing network, was launched, and the INET system was made operational on this network, which was used by INAS for member bank-to-member bank equal authorization (PTP).

In 1984, MasterCard's automated point-of-sale (POS) program reached full operational status in the U.S., which further supported MasterCard POS operations

In 1987, the Banknet system began installing international outlets, laying the foundation for the next step in international business development. In the same year, the electronic image system was opened in the United States, which transmits images of sales slips between member banks through Banknet.

In 1995, the MasterCard OnLine system made its debut.

At the end of 1996, MasterCard issued more than 400 million cards, including more than 300 million credit cards and more than 100 million transfer cards. The bottom number of card transactions for the year reached nearly $6 billion. The value of transactions exceeded $550 billion, and on Christmas Eve, December 23, 1996, MasterCard set its high transaction volume record with 20 million daily transactions.[5]

In 2002, MasterCard International merged with Europay, a European bank card organization, and became a for-profit company instead of a non-profit organization.

On June 23, 2006, the European Commission filed a lawsuit against MasterCard International for restricting competition among retailers who accept MasterCard credit cards and MasterCard Debit financial cards by requiring them to pay a fee.

On August 7, 2019, MasterCard acquired the Account to Account (A2A) clearing, instant payment services and electronic billing solutions business of Danish payments technology company NetsGroup for 2.85 billion (approximately $3.19 billion).

On February 10, 2021, MasterCard announces its support for cryptocurrencies.

[5] "Global Leader In Payment Technology: Mastercard Inc. (MA)," The home of U.S. stocks

Year	Total Income	Operation Revenue	Stock Price	Employees
2005	2,938	393		
2006	3,326	229		
2007	4,068	1,108	13.65	
2008	4,992	–534	20.33	
2009	5,099	2,260	17.99	
2010	5,539	2,752	22.01	
2011	6,714	2,713	28.73	
2012	7,391	3,937	41.58	
2013	8,312	4,503	59.34	8,200
2014	9,441	5,106	75.33	10,300
2015	9,667	5,078	90.62	11,300
2016	10,776	5,761	94.50	11,900
2017	12,497	6,622	126.54	13,400
2018	14,950	7,282	186.16	14,800
2019	16,883	9,664	300.74	18,600
2020	15,301	8,081	370.00	21,000

Figure 2-7: MasterCard’ s financial data，2005-2020

2.2.5 High-End Route - American Express：1958

Founded in 1850, American Express began its business by providing express services. The company introduced traveler's checks in 1891, which at that time was intended to provide a fast service to the high-end customers who traveled a lot.

Figure 2-8: American Express card

In 1958, American Express introduced the first signature card. With its branding and celebrity endorsement, the American Express card was of great interest to many businessmen and wealthy individuals who traveled frequently. It achieved great market success.

By the end of 1962, the number of merchants accepting the Express card had grown to 82,000 and the number of cardholders had nearly quadrupled to 900,000. For the first time, Express' bill payment cards were profitable.

By 1977, Express had grown in size - 6.3 million cardholders in the U.S. and $20 billion in transaction volume. Nearly 50% of U.S. households with an annual income of $55,000 or more hold a Green Card from Express. Widely accepted by tourism-related businesses, such as upscale restaurants and high-end stores, the Green Card became the dominant and superior bill-paying caIn the early 1980s, merchant discounts on the Express were almost 50% higher than those of Visa and MasterCard. Annual fees for cardholders also rose to $60 and $85.

In 1999, the CenturionCard was issued to a select group of top Platinum cardholders. The Platinum and Centurion cards make Express the face of premium cards.

On November 5, 2008, American Express applicated to the U.S. Federal Reserve to transform into a commercial bank, allowing American Express to also receive customer deposits to better cope with the global financial turmoil caused by the subprime mortgage crisis. After Morgan Stanley and Goldman Sachs, American Express became the third institutional organization to transform into a commercial bank during the subprime mortgage crisis.

2.2.6 Long-Tail Route Discovery Card: 1985

In the 1980s, the two American credit card organization giants - Visa and MasterCard - had a near monopoly on credit card issuance in the U.S.

Figure 2-9: Discover card

American Express went the other way and took the high-end route, occupying a large number of upper-class customers, but it was far inferior to the first two open card organizations in terms of the size of banks, merchants and consumers accessed.

Against this backdrop, in 1985, the largest U.S. retailer at the time, Sears, launched its own Discover Card throughout the United States.

In the late 1980s, Sears did not survive the financial difficulties and sold its credit

card division in 1993; Discover was acquired by Morgan Stanley in 1997.

In a highly competitive market, Discover Card has grown rapidly with two innovations.

First, Discover Card was the first credit card organization to waive annual fees. This strategy quickly attracted a large number of long-tail consumers in the lower and middle classes compared to the increasingly high annual fees of other card organizations at the time.

Second, Discover Card pioneered the Cashback model. It created a huge incentive for cardholders to spend. Also, it did not charge retailers a fee.

Since 2005, Discover has not only acquired a number of financial companies, but has also partnered with financial organizations, large and small, local and global, to share and expand its own customer network. Unlike the monopolistic policies of Visa and Master, this strategy has made Discover a breath of fresh air in the industry, eliminating the competitive, hostile attitudes common among card issuing organizations and enhancing various collaborations.

In 2005, Discover acquired the PULSE network.

In the same year, Discover and UnionPay joined forces and began a strategic alliance partnership to interoperate networks. So now Discover cards can be used on UnionPay-logoed machines and vice versa.

In 2006, Discover signed a reciprocal card acceptance agreement with JCB (Japan Credit Bureau), the largest card issuer in Japan. Cards from both companies work in each other's networks.

On June 30, 2007, Discover Financial Services was separated from Morgan Stanley & Co. as an independent company.

In 2008, Discover acquired Diners Club International, the originator of the sign-up card, for a mutual universal network.

2.3 U.S. Payment and Clearing System

The payment and clearing systems are the channel and hub for the flow of bank funds.

At present, the U.S. has formed a multi-level payment and clearing system, and is at the core of the global bank clearing system. Among them, Fedwire and CHIPS are the two major large-value payment systems supporting the global clearing of U.S. dollars, and ACH (Automatic Clearing House) is the main retail payment system.

Mobile payments rely heavily on the retail payment system.

2.3.1 New York Clearing House The first clearing house: 1853

Because there was so much confusion about the exchange of interbank instruments in the 19th century, 62 banks came together to create the New York Clearing House on October 11, 1853, in the basement of 14 Wall St. This was the first official clearing house in the United States. The New York Clearing House was created to resolve the disorderly settlement of transactions between banks in New York City, and was the primary interbank clearing organization until the Federal Reserve's Federal Reserve Clearing System (Fedwire) was established in 1914. In its wake, banks in other parts of the United States also established clearing organizations similar to the New York Clearing House.

In September 1873, another agreement was signed among the member banks, and in order to facilitate settlement between banks arising from routine transactions, each member bank authorized the clearing committee to obtain additional notes and other securities receivable from members and to make deposits, and to issue an appropriate percentage of certificates in this aggregate amount. These certificates are held in trust by the clearing committee as a means of payment for the daily settlement of clearing house balances.

As a form of promissory note backed by bank assets, clearing house certificates were

used as a means of relieving temporary money supply constraints. The value of clearing house certificates was demonstrated in the panics of 1873, 1884, 1890, and 1893, when the clearing house performed certain functions of a central bank in times of monetary stress.

2.3.2 Fedwire - The first government-run clearing house: 1914

The clearing system is not only a hub for the circulation of funds, but more importantly, a "ballast" for the credit of the currency. Based on this, the Federal Reserve Act of 1913 determined that the newly established Federal Reserve should take on the important task of improving the check clearing process, especially between banks located in different regions. The Federal Reserve required member banks to clear checks drawn on other banks at par.

Based on par value clearing, the Federal Reserve established its own clearing system, the Federal Reserve Communication System (commonly known as Fedwire), which has been in operation since November 1914 and has been operating since 1918 through its own dedicated clearing system. In the 1920s, government bonds also began to be transferred by telegraphic system. Until the early 1970s, domestic transfers of funds and bonds in the United States continued to rely heavily on this telegraphic system.

The Fedwire system was built, managed and operated by the Federal Reserve Bank of New York as a highly centralized system. users of the Fedwire system, regardless of which Fed they opened their accounts with, had to clear their large fund payments through the New York Fed's main processing center, thereby achieving consistency in payment and clearing rules across the United States.

Beginning in the 1970s, a number of U.S. banking groups began to establish their own automated electronic communication systems, and today, while multiple forms of electronic funds payment settlement methods have emerged, the Federal Reserve has always dictated their direction.

Prior to 1980, Fed member banks paid no or little fees for using the Fedwire system. with the introduction of the Monetary Control Act of 1980, fees for Fedwire services were established and non-Fed member banking industries were allowed to use the transfer system. To encourage private sector competition, the law requires that fees for

Fedwire services must reflect the full cost of providing the service, as well as the potential cost of tying up funds and the profitability of the service.

The Fedwire system consists of two parts, the funds transfer system and the book-entry securities system, where funds settlement and securities transactions can be carried out simultaneously, providing extremely efficient processing and operational effectiveness. Because of this, the Federal Reserve can effectively place the major aspects of U.S. securities transactions (including open market operations) under its supervision, and rapidly expand or contract the global market credit of the U.S. dollar by gulping the base currency of the U.S. dollar to the international financial markets through open market operations on the Fedwire system platform.

Funds transferred through Fedwire are immediately valid and available, making Fedwire the only network system that can be used for final settlement of any funds transfer in the United States, including transfers from CHIPS and other payment networks.

Fedwire's funds transfers provide users with a limited overdraft facility (capped intraday credit), which is based on each commercial bank's capital to calculate its maximum overdraft amount. Only when a payment exceeds the overdraft limit will the payment order be placed on hold or rejected. This measure by Fedwire solves the problem of liquidity of commercial banks, improves the efficiency of the payment system, and enables timely transfer of funds.

Fedwire connects the U.S. Federal Reserve headquarters, all Federal Reserve banks, the U.S. Treasury and other federal government agencies, as well as more than 10,000 commercial banks and 20,000 financial institutions through the Federal Reserve's 12

Federal Reserve Districts, 24 branches and 11 dedicated payment processing centers.

2.3.3 CHIPS (Clearing House Interbank Payment System): 1970

Although the New York Clearing House was established before the Fed's clearing system, the Fed's status as a central bank gave it a monopoly in the payment system for a considerable period of time. Despite its inability to break Fedwire's monopoly, the New York Clearing House did not give up, and it continued to improve its clearing capabilities, establishing the Clearing House Interbank Payment System (CHIPS) in 1970, replacing the original paper-based payment clearing with electronic means.

In 1980, the Depository Institutions Deregulation and Monetary Control Act allowed private institutions to provide clearing services to compete with the Federal Reserve, and the private institutions owned and operated the funds payment system to operate simultaneously with the Federal Reserve payment system, and there was interesting competition between the manager and the managed institutions. By 1982, CHIPS membership grew to 100 banks at once, including local New York banks and other regional and foreign banks in the United States.

CHIPS members are divided into two categories, one is the funding participant (funding participant), currently there are 24, are the world's leading commercial banks and investment banks. These funding participants open clearing accounts in CHIPS and clearing accounts at the Federal Reserve Bank, and they can clear on behalf of various non-funding participants; the other category is non-funding participants (non-funding participants), which cannot directly use the CHIPS system for clearing and must act as a correspondent bank through one or more funding participants. However, the non-funding participants are both represented by the funding participants and also represent banks outside of CHIPS for clearing. In this way, the layers of agents constitute a large and complex international clearing network. At present, 95% of the

cross-border U.S. dollar final settlement through the CHIPS system, CHIPS system for 21 countries, 49 participating banks (Participants) to provide U.S. dollar large amount of real-time final settlement services, China has seven banks for CHIPS non-funded participants, they are the Agricultural Bank of China, Bank of China, Bank of Communications, China Construction Bank China Merchants Bank, CITIC Bank and Industrial and Commercial Bank of China.

CHIPS is currently the world's largest private U.S. dollar-denominated funds exchange system, clearing and processing an average of $1.5 trillion in U.S. domestic and cross-border payments per day. CHIPS combines the Liquidity Efficiency of Netting System and the Intraday Finality of Real Time Gross Settlement into a single, highly efficient real-time clearing system.

2.3.4 ACH (Automatic Clearing House): 1968

In the 1970s, check usage in the U.S. grew at such a high rate that the efficiency of manual processing could no longer meet the demands of check clearing and electronic payments needed to be introduced to solve the problem.

In 1972, the first ACH (Automated Clearing House) organization was established in California to process electronic payments. The primary function of Nacha is to manage and promote the ACH network and to establish the rules of the ACH network, without being involved in the actual processing of transactions.

In its early days, like many new things, ACH experienced the paradox of "first comes the chicken or the egg". As it was optional rather than mandatory for banks to join the ACH. It was envisioned that if the payee's account bank did not join the network, payments to the payee would not be delivered via ACH, and payers would be unable or unwilling to use the network because the payee or some of the payees would be outside, leaving few users of ACH, and in turn, banks would not want to bother joining the payment network. This paradox was eventually broken by the U.S.

federal government, which decided to pay Social Security pensions, the nation's most widespread livelihood program, through ACH. The landing of this payment practice benefiting the public in ACH accelerated the process of ACH acceptance, and all banks joined ACH 15 years later.

ACH transactions can be categorized by the increase or decrease of the account amount, mainly in two categories, namely Direct Deposits (ACH Credit) and Direct Payments (ACH Debit). ACH transactions can also be categorized by the bank that initiated the transaction, in two categories, namely ACH pull and ACH push.

ACH allows third-party processors to access the network, either to generate ACH files on behalf of the originator or to act as a sending or receiving point to process ACH files on behalf of the sending or receiving institution; in short, third-party processors charge a fee to provide various services related to ACH. This function has given rise to third-party service providers in various segments of the U.S. mobile payment industry.

ACH is now one of the most dominant payment networks in the U.S. payment system and is heavily used in scenarios such as payroll, social security pension and government benefit payments and tax reimbursements, utility-type usage fees such as utilities, loan and mortgage repayments, and insurance premium payments.

In 2018, the ACH payment network processed $23 billion in transfers, including direct deposit payments for various payroll and government benefits, direct payment payments for various bills, person-to-person (P2P) payments, and business-to-business (B2B) payments. network payment transactions exceeded $51.2 trillion. The ACH network is still growing.

2.3.5 Features of the U.S. payment and clearing system

1. **Coexistence and competition between official and private institutionsy**

   The U.S. bank payment clearing system originated in the private sector, and

after the Federal Reserve was established, a monopoly of sorts developed for a considerable period of time. By the 1980s, along with the comprehensive deregulation of banks and other depository institutions, Congress passed a bill requiring regulators to automatically give up their monopoly on interbank payment clearing, and the Federal Reserve also changed its practice of not charging fees, charging clearing fees according to the cost of services and capital occupation costs, thus forming an environment of equality between official and private bank payment clearing systems. Of course, this competition is not disorderly competition, but differentiated competition. To some extent, the two sides also complement each other.

2. **Multi-tier**

   The U.S. payment and clearing systems are both national, such as Fedwire and CHIPS, and regional. There are both large-value clearing systems and small-value clearing systems. There are both comprehensive clearing systems and industry-specific clearing systems.

3. **Support clearing of multiple payment instruments**

   The U.S. non-cash settlement system is well developed, and credit cards, various instruments. The use of ever-renewing convenient payment tools relies on the support of a large, compatible, and computationally updated bank clearing system.

4. **Legal and regulatory issues**

   The regulatory threat facing Internet hospitals is also very high. China firmly supports the development of Internet medical care, but the laws and regulations and regulatory environment are relatively lax. As the industry gradually matures and regulatory requirements become strict, the threats faced by Internet hospitals will gradually emerge. Such as network security and whether medical data storage is in line with laws and regulations. The complete definition of the services provided by the Internet medical treatment and whether the treatment

boundary aligns with national laws and regulations.

2.4 The Journey of Mobile Payments in the U.S.

The core changes in the development of the U.S. third-party payment industry can be summarized as follows: originating from the development of the bank card industry and growing along with C2B payments; from Internet payments to mobile payments; and from a single payment platform to a comprehensive financial services ecosystem.

In terms of specific development stages, it can be divided into three main phases.

2.4.1 Phase I (1960s 1990s): Bank cards and card organizations

The booming development of offline commercial consumption in retail and service industries has driven the development of the bank card industry, giving birth to card organizations such as Visa, Master and American Express, and laying the foundation for the development of the third-party payment industry.

The development of bank card clearing organizations is an important milestone for the bank card industry, which sets the guidelines related to bank card transactions and determines the entire pricing system of the bank card industry.

See 2.2 for details on the history of the card organization.

2.4.2 Phase II (1990s 2010s): E-commerce and electronic payment

The rise of the e-commerce industry has increased the demand for Internet payments, and the third-party payment industry has emerged and expanded rapidly.

In 1992, Charles M. Stack created the online bookstore Books Stack Unlimited, and consumers had one of the first online shopping experiences. Along with significant advances in the commercial use of the Internet, the e-commerce market emerged in 1995 when Amazon, one of the first e-commerce sites, went online as an online bookstore, and in the same year when eBay, an online auction site, debuted.

On August 11, 1994, an American customer purchased the record "The Legend of Ten Preachers" by the British singer Sting and completed the payment via the Internet. This was the world's first Internet-based electronic transfer of funds.

At that time, cash, check, wire transfer and credit card were the main means of payment, but there was a general problem of low efficiency and high transaction costs, so the traditional means of payment could not meet the payment needs of small and medium-sized merchants.

The world's first third-party payment company was born in 1996, and the third-party payment industry has since grown at a rapid pace, with PayPal being the most prominent. born in 1998, PayPal began developing a payment system that combined email and existing financial infrastructure ACH, and launched its first product in 1999. Subsequently, by enhancing the existing payment infrastructure, PayPal gradually introduced a secure, convenient and efficient online payment system that meets the needs of merchants.

In the same segment, acquirers, gateways, ISOs and other payment segments have also given birth to many representative companies. FirstData started providing acquiring services in 1993 and entered the payment market by partnering with banks to provide e-commerce and technology solution services for merchants and financial institutions; Fidelity Payment Services was founded in 1996 with the initial purpose of providing BlueSnap, established in March 2002, is a global payment service provider that focuses on online retail and has developed payment gateway technology that currently supports more than 180 countries with 60 currency transactions and 110 payment methods.

2.4.3 Phase III (2010s 2020s): Smartphone and mobile payment

With the increase in smartphone penetration and the great development of non-cash payments, third-party payment companies have started to turn their attention to the mobile payment field.

Smartphones and other mobile devices have high popularity and user stickiness as terminals for third-party mobile payments, and the increase in smartphone penetration has promoted the development of mobile payments. In the early days, mobile payment was done by sending SMS. Later, technology developed to allow payments to be completed by taking a picture of a check with a cell phone camera and sending it to the payee, a technology that eventually evolved into the mobile check deposit feature of a bank app.

Since 2014, NFC mobile payment methods such as PayPal, Apple Pay, Android Pay, and Samsung Pay have come online, allowing consumers to complete payments by simply tapping their phone after being near a contactless credit card terminal.

Security, convenience and faster transactions are important factors driving mobile payments for users in the U.S. A 2019 survey showed that 29% of Americans want to pay with their smartphones all the time. Retailers and small and medium-sized businesses have taken notice of this situation, and more and more merchants are offering mobile payment options at checkout.

During this period, the U.S. also saw the birth of third-party payment companies such as Square, which addressed a specific pain point in the payment industry chain and served small and medium-sized enterprises.

2.5 U.S. Mobile Payment Market

2.5.1 Market Size

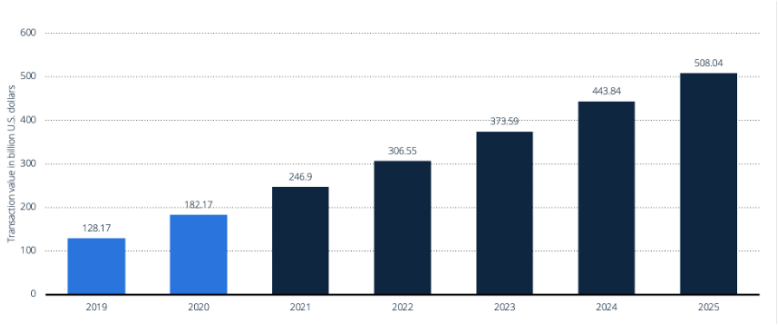


Figure 2-10: Mobile payments market size in the U.S. 2019-2020, with forecasts to 2025 (in billion U.S. dollars)

According to Statista and eMarketer, total U.S. mobile payment transaction value reach $18,217 billion in 2020, up a whopping 42% from $12,817 billion in 2019. The COVID-19 pandemic plays a very important role in the increase.

2.5.2 Users

Data from the same channel shows that in 2020, the number of users who have used mobile payments at least once reaches 92.3 million, which is about 28% of the total U.S. population. This figure represents a 29% increase from 71.5 million in 2019.

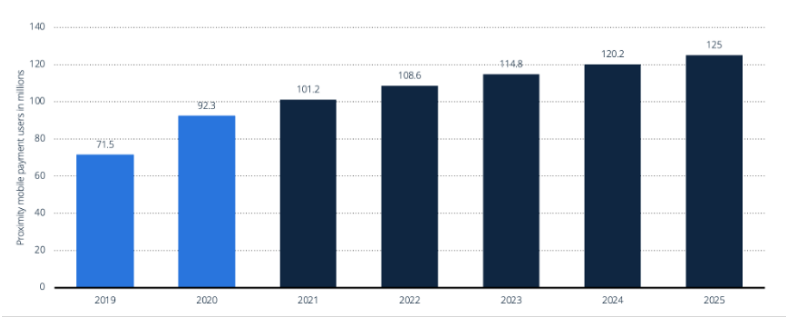


Figure 2-11: Mobile payment user in the U.S. 2019-2020, with forecasts to 2025 (in millions)

Younger and middle-aged consumers far outnumber older people in the use of e-wallet products.

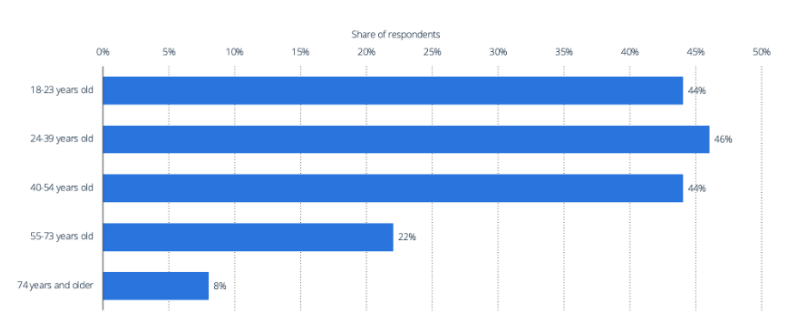


Figure 2-12: Mobile payment user in the U.S. 2019-2020, with forecasts to 2025 (in millions)

2.5.3 Market share of payment methods

As the first country in the world to start electronic and mobile payments, the U.S. has a much lower mobile payment penetration rate than China.

According to Statista, mobile payments will account for just 11 % of offline payments in 2021, the same share as cash. Credit and debit cards have a combined share of two-thirds, although the share of credit cards has been declining. Cash payments have an 11 % share, with the decline largely ceded to mobile payments.

	2017	2019	2020	2021
Credit card	40%	39%	38%	36%
Debit card	35%	34%	29%	30%
Cash	16%	15%	12%	11%
E-wallet, Digital/mobile wallet	3%	6%	10%	11%
Charge card	4%	4%	4%	4%
Prepaid card	2%	2%	4%	4%

Figure 2-13: Market share of payment methods offline in the U.S. 2017-2021

In a survey on payment mediums, only 18% of U.S. consumers will pay offline with their cell phones in 2022, far fewer than with debit cards, cash and credit cards.

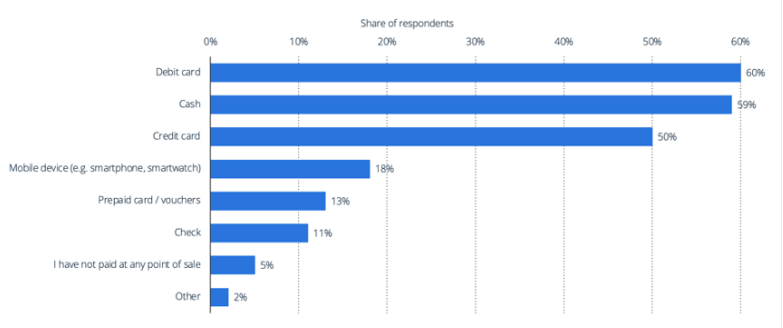


Figure 2-14: Payments at points of sale (POS) by type in the U.S. 2022

In the online shopping scenario, the use of e-wallets reached 30%, tied for first place with credit cards.

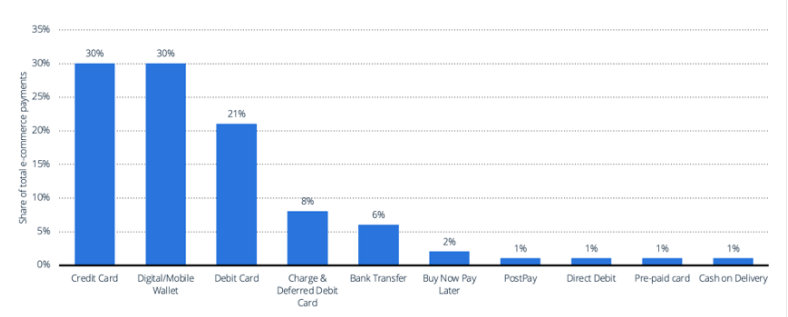


Figure 2-15: Distribution of e-commerce payment methods in the U.S. 2020

In the online payment scenario, the percentage of consumers using online third-party payment services reached 45%, second to debit cards at 52% and credit cards at 47%.

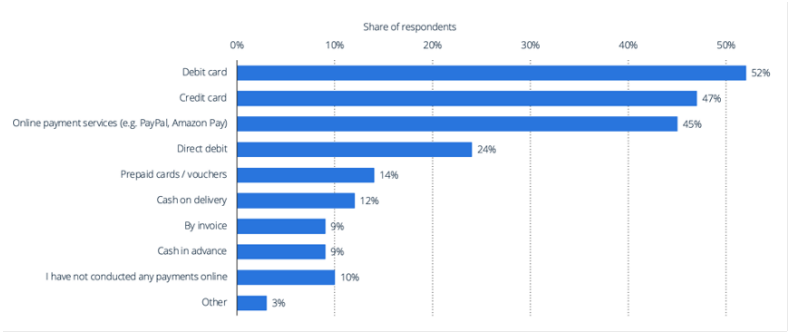


Figure 2-16: Online payments by type in the U.S. 2022

2.5.4 Market share of e-wallet products

Overall, the U.S. e-wallet market shows a relatively fragmented pattern. According to Statista, PayPal is used by the largest number of consumers among all e-wallet products in the U.S., at 57 %, followed by Apple Pay at 56 %. 50% of consumers have used Cash App and 41% have used Google Pay. Other than that, no more than 20 percent of consumers have used any other e-wallet product.

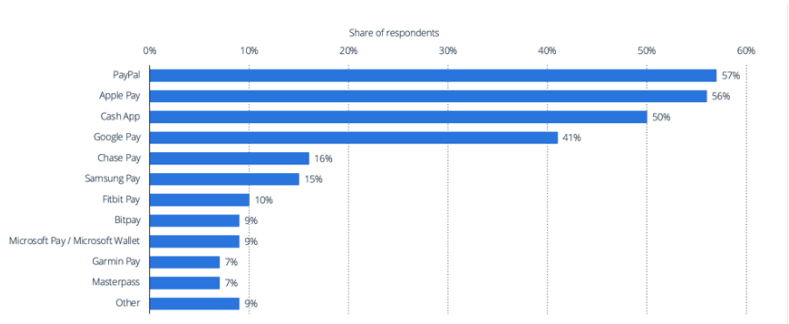


Figure 2-17: Mobile payments by brand in the U.S. 2022

Another survey shows that PayPal is far more popular and well known than all other e-wallets and mobile payment products. It may be due to the fact that its products

are the most versatile.

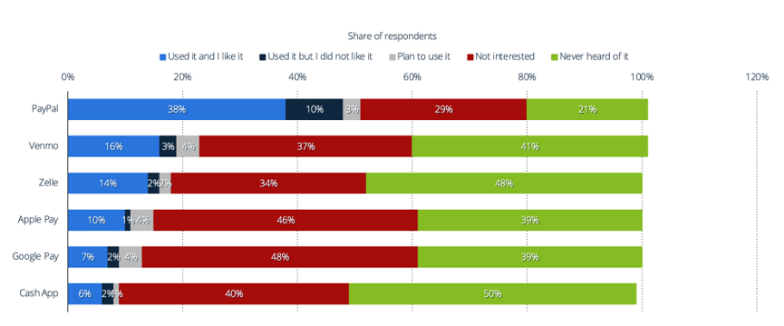


Figure 2-18: User experience with six mobile payment apps in the U.S. in 2021

Chapter 3

The History and Status of Mobile-Payments and Relevant Industries in China

3.1 Chinese Banking System

The Chinese banking industry presents a completely different history and pattern from that of the U.S. The oldest bank is the Bank of China, which was converted from Bank of Qing Dynasty by order of Sun Yat-sen in 1912. During the war from 1911 to 1949, different regions of China were ruled by different governments, and there was no unified banking industry, and the currency proliferation and inflation were very serious. in 1948, after the victory of the war against Japan, the Communist Party established the People's Bank of China, which exercised the role of a central bank and unified the management of currency issuance and other banking operations. Later, specialized banks such as the Agricultural Bank were established in China, but were merged into the People's Bank of China several times. During 1950-1980, there was only one bank in China for many periods. Later, this "referee and athlete" banking system was much criticized, prompting China to carry out financial reforms

in the 1980s and re-establish four state-owned specialized banks, with the People's Bank of China returning to the status of central bank. Later, 12 joint-stock banks were established and the Postal Savings Bureau was reorganized as a bank. These 19 banks own most of the capital in China's banking sector and form the foundation of China's commercial banking industry.

Since 2015, China has allowed private capital to establish banks, and a total of 19 private banks have been approved so far. Two of the most notable are the banks established by China's two payment giants - Alibaba's Net Business Bank and Tencent's WeZhong Bank. This marks a major breakthrough in the liberalization of China's financial sector. In addition, China has many regional commercial banks, including urban commercial banks and rural credit cooperatives, which form the nerve-end network of China's financial sector in the vast rural areas of towns and villages.

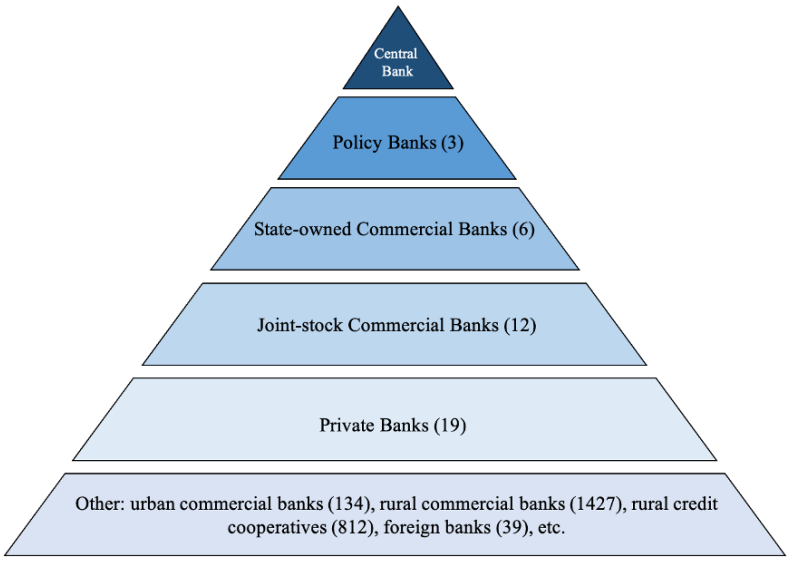


Figure 3-1: Chinese banking system structure

China's banking system is highly centralized. The will of the central bank is thoroughly carried out, and a few state-owned banks control most of the capital, thus unified supervision and regulation is very convenient. Such a sparse number of banks has also allowed China to have only one payment clearing system. In 2001, the Peo-

ple's Bank of China brought together all banks to establish China UnionPay, which has since become the only monopoly credit card organization in China. When electronic and mobile payments flourished in China, the PBOC set up the NetsUnion platform to force all third-party payment institutions to access and control all payment and clearing activities.

Objectively, the exclusivity of the banking system and payment clearing system facilitated the early development of electronic and mobile payments in China. The success of this later strong "state takeover" regulation is also inextricably linked to the highly concentrated structure of China's banking industry.

3.1.1 The First Bank - Bank of China (BOC)

Founded in February 1912, the Bank of China is the oldest bank in China.

On January 1, 1912, when the Republic of China was founded and Sun Yat-sen was inaugurated as the Provisional President, raising funds for the military became an urgent task for the Provisional Government in Nanjing.[1] On January 24, Sun Yat-sen ordered: "Change the Bank of Qing Dynasty into the Bank of China."[2], and on February 5, the Bank of China was opened at the former site of the Bank of Qing Dynasty in Shanghai.[3]

As a benchmark for the development of modern Chinese banks, the Bank of China has undergone a century of vicissitudes and has witnessed the development

[1]Hao, Qian, and Chengping Cai, "The Past Of The Bank Of China And China's Financial Industry In A Hundred Years," Finance.Sina.Com.Cn, 2015.

[2]"The Republic Of China Was Established And The Bank Of China Came Into Being (1912)," Bank of china, September 26, 2008.

[3]Nie, Jing, "The Century-Old History Of The Bank Of China: From The Central Bank Of The Qing Dynasty To The Multinational Bank Of New China,"

3.1.2 Central Bank People's Bank of China (PBC)

On December 1, 1948, the People's Bank of China (PBC) was announced in Shijiazhuang, Hebei Province. In February 1949, the PBC moved from Shijiazhuang to Beiping. In September 1949, the Chinese People's Political Consultative Conference adopted the "Organic Law of the Central People's Government of the People's Republic of China" , giving it the functions of a national bank.[4]

Within three years, PBC established a nationwide vertically led organizational system; unified the issuance of RMB, removed and exchanged all the currencies issued by the Kuomintang government for a limited period of time, and soon made RMB a nationwide unified currency; and implemented unified management of various financial institutions.

Since 1953, China has had a planned economic system. Under which the sources and applications of credit funds nationwide were unified by PBC.

On September 17, 1983, the State Council decided that the PBC ceased commercial banking operations and became a specialized central bank.

3.1.3 State-owned Commercial Banks

There are six large commercial banks in China that are directly controlled by the state. In addition to the aforementioned Bank of China (BOC), there are the following five.

Industrial and Commercial Bank of China (ICBC) was established in 1984. It is the largest commercial banks in China.[5]

Since 2018, ICBC has been consistently at the peak of the list of the top 20 world banks published by The Banker magazine in the UK.

[4] "History of Chinese Bank," The People's Bank Of China, 2003.
[5] "A Brief History of Industrial and Commercial Bank of China (1984-2014)"

TOP 20 WORLD BANKS, 2021

Rank	Previous rank	Bank	Country	Tier 1 capital ($bn)
1	1	ICBC	China	440
2	2	China Construction Bank	China	362
3	3	Agricultural Bank of China	China	336
4	4	Bank of China	China	305
5	5	JPMorgan Chase	US	235
6	6	Bank of America	US	200
7	8	Citigroup	US	167
8	9	HSBC Holdings	UK	160
9	7	Wells Fargo	US	158
10	10	Mitsubishi UFJ Financial Group	Japan	144
11	11	Bank of Communications	China	132
12	12	Crédit Agricole	France	127
13	13	BNP Paribas	France	122
14	17	China Merchants Bank	China	106
15	22	Postal Savings Bank of China	China	103
16	14	Sumitomo Mitsui Financial Group	Japan	101
17	15	Banco Santander	Spain	97
18	20	Shanghai Pudong Development Bank	China	96
19	21	Industrial Bank	China	94
20	16	Goldman Sachs	US	93

Source: www.thebankerdatabase.com

Figure 3-2: Top 20 world banks, 2021

Agricultural Bank of China (ABC) was established in 1951. It was the first state-owned commercial bank. At that time, it was called Agricultural Cooperative Bank. In July 1952, ABC merged with the PBC. In March 1955, it was formally renamed "Agricultural Bank of China". In November 1963, the ABC was established again in accordance with the requirement of unified management of state funds to support agriculture. In November 1965, it was merged with the PBC for the third time. On February 23, 1979, the ABC was re-established for the fourth time.

In 1993, the State Council made a clear decision to transform the ABC into a state-owned commercial bank. In April 1994, the ABC transferred most of its policy business to the newly formed China Agricultural Development Bank.[6] On January

[6] "ABC History," Agricultural Bank of China, 2011.

15, 2009, Agricultural Bank of China Limited was established, and in July 2010, ABC were listed in Shanghai and Hong Kong on the 15th and 16th respectively, achieving the world's largest IPO.[7]

China Construction Bank (CCB) was established in 1954 as the People's Construction Bank of China. Its mission is to manage and distribute government funds allocated to construction projects and infrastructure-related projects in accordance with the national economic plan.

On March 26, 1996, the old bank changed its name to China Construction Bank. On September 17, 2004, CCB was established as a joint-stock commercial bank. On October 27, 2005 and September 25, 2007, CCB was listed in Hong Kong and Shanghai, respectively.[8]

Bank of Communications (BOCOM)' s predecessor is founded in 1908.

Historically, the Bank of Communications issued currency, acted as an agent for the state treasury, invested and supported industry.

In 1958, except for the Hong Kong branch, the domestic operations of the BOCOM were merged into the local PBC and the predecessor of China Construction Bank.

On July 24, 1986, Bank of Communications was re-established. On June 23, 2005 and May 15, 2007, the Bank of Communications was listed in Hong Kong and Shanghai respectively.[9]

Postal Savings Bank of China (PSBC)' s predecessor can date back to 1919, when the Postal Savings and Remittance General Bureau was established. This institution mainly conducted postal deposit business and was limited to deposit book (similar to today's passbook) deposit, and specialized in deposits and remittances for civilians who could not meet the threshold for opening a bank account. By 1942, the Postal Savings and Exchange Bureau was included in the ranks of the "Four Banks and

[7] "Company Overview," Agricultural Bank of China, 2017.
[8] "Corporate History," China Construction Bank, 2008.
[9] "Introduction to the Bank of Communications," Bank of Communications, 2021.

Two Bureaus" of the National Government and was known as one of the six pillars of finance at that time.[10]

In 1949, after the founding of the People's Republic of China, the People's Post Office of China took over the properties of the former General Post Office of the Ministry of Communications of the Republic of China and established the Ministry of Posts and Telecommunications of the Central People's Government. 1953, the postal savings business was discontinued and the related business was integrated into the business departments of the People's Bank of China in various regions, but the post offices still accepted money transfer business. In the period when the number of financial institutions was far from adequate, post offices were the only channel for most people to send money.

On January 27, 1986, the Ministry of Posts and Telecommunications and the PBC jointly issued the "Joint Notice on Starting Postal Savings Business", which officially resumed the postal savings business, which had been stopped for 33 years, by starting to handle personal current and fixed-term savings business in postal branches in 12 cities.[11]

December 2, 1986, the "Postal Law of the People's Republic of China" was promulgated. The law stipulated the postal enterprise could operate postal savings and remittance business, the savings business was handled by the PBC on behalf of postal savings, all deposits absorbed by postal savings were deposited to the People's Bank for unified use, and the People's Bank paid postal commission according to the average balance of deposits deposited. in 1989, the balance of postal savings deposits exceeded 10 billion RMB, and the market share reached 1.96%. Since 1990, the agency relationship between the postal department and the PBC changed into the transfer deposit relationship, and the postal savings funds were transferred to the PBC in full, and the interest rate of the transfer deposit was determined after negotiation between the two parties. Postal savings can enjoy a high interest rate of 4.131%, while at the

[10]Nie, Congxiao, "Postal Savings: A Century of Ups and Downs,"
[11] "Postal Savings Bank of China," Wikimedia Foundation

same time, the transfer deposit interest rate of commercial banks is only 1.89%.[12] By 2003, the postal deposits with the central bank had exceeded 800 billion yuan, and the interest payments on this large amount of deposits became a heavy burden for the central bank.

Meanwhile, despite being such a behemoth, China Postal Savings has a basic genetic flaw - "only deposit but not lend". Because Postal Savings does not have a banking license, it is strictly forbidden to conduct any credit business. Since 60% of its savings outlets are located in counties and below across the country, the "only deposit but not lend" situation has led to Postal Savings being called a "pumping machine" for rural funds, seriously affecting the financial ecology of rural areas.

PSBC was restructured as a joint stock company in January 2012, introduced ten domestic and foreign strategic investors in December 2015, listed on the Hong Kong Stock Exchange in September 2016, and listed on the SSE in December 2019.

3.1.4 Joint-stock Commercial Banks

There are 12 national joint-stock commercial banks in China and each one has their wonderful story.

Over the past 20 years, joint-stock commercial banks have grown rapidly since their inception and become an indispensable and important part of China's banking industry and even national economic development.

3.1.5 Private Banks

China has always been a country with very strict controls in the banking sector, so allowing private capital to enter the banking sector is an important signal and historic progress in China's financial reform.

[12]Nie, Congxiao, "Postal Savings: A Century of Ups and Downs,"

In May 2010, the State Council begin to encouraging private capital to enter six major fields, including infrastructure, social utilities, municipal utilities, financial services, trade circulation, national defense and science and technology, and opening up access signals for private banking institutions. In August 2013, the State Council proposed to promote the establishment of self-risk private banks initiated by private capital. It also provides comprehensive regulations on the establishment threshold, shareholder qualification, shareholding change, corporate governance and institutional withdrawal of private banks.

As of April 2021, 19 private banks have opened for operation nationwide.

No.	Full Name in English	Approved Opening Date
1	WeBank Co.,Ltd	2014.12.12
2	Shanghai HuaRui Bank Co., LTD.	2015.01.27
3	WENZHOU MINSHANG BANK CO.,LTD	2015.3.20
4	Kincheng Bank of Tianjin Co., Ltd.	2015.03.27
5	ZHEJIANG E-COMMERCE BANK CO.,LTD	2015.05.27
6	Chongqing Fumin Bank Co.,Ltd.	2016.08.16
7	BANK OF SANXIANG	2016.12.21
8	SICHUAN XW BANK CORP.,LTD.	2016.12.28
9	Fujian OneBank Company Limited	2017.01.13
10	WUHANZBANK CO.,LTD.	2017.4.24
11	JILIN YILLION BANK CO.，LTD.	2017.05.02
12	WEIHAI BLUE OCEAN BANK CO.,LTD.	2017.05.24
13	Beijing Zhongguancun Bank Corporation Limited	2017.06.06
14	JIANGSU SUNING BANK CO.,LTD.	2017.06.14
15	MEIZHOU HAKKA BANK CO., LTD.	2017.06.22
16	NewUp Bank of Liaoning Co.,Ltd.	2017.09.27
17	Anhui xin'an bank Co.,Ltd.	2017.11.03
18	JIANGXI YUMIN BANK CO., LTD.	2019.09.27
19	WUXI XISHANG BANK CO.，LTD.	2020.04.13

Figure 3-3: China private banks and opening dates

3.2 Chinese Bank Cards

China's bank card industry has developed with the pace of reform and opening up. From the late 1970s, when the Bank of China began to engage in credit card agency business, to the present, China's bank card industry has gone through the following five stages.

1. **Sprouting stage (1978-1993)**

   Bank of China started to act as an agent for credit cards issued by foreign financial institutions since 1978, handling foreign credit cards and foreign traveler's checks for payment.

   In December 1979, Bank of China Guangzhou Branch signed an agreement with Bank of East Asia to act as its agent for credit card business, which was the first time in China's banking industry to start a bank card business.

   From 1981 to 1983, Bank of China signed an agreement with Nanyang Commercial Bank in Hong Kong to handle developed card business, signed an agreement with American Express in Hong Kong to cash personal checks on behalf of American Express Credit Card, signed an agreement with Tokai Bank in Japan and Million Credit Card Service Company to handle Million Credit Card on behalf of Bank of China. We also signed agreements with Bank of East Asia and HSBC for Visa and MasterCard, JCB International and Mitsuwa Bank of Japan for JCB credit cards, and Citibank for Diners Club cards.[13]

[13] "Adapting to the Needs of Reform and Opening Up, Pioneering Credit Card in China (1978)," Bank of China, 2021.

Figure 3-4: The first RMB credit card in China

The first bank card in China was issued in March 1985 by the Zhuhai branch of the Bank of China, called the "BOC Card". However, the number of cards issued was very small and it was not possible to promote its use.

Figure 3-5: The first Great Wall Card issued by Bank of China

In May 1986, the Beijing Branch of Bank of China requested the head office to issue the "Great Wall Card", which was decided by the head office as a unified credit card name for the Bank of China system and was first issued in Beijing on

a trial basis, thus starting the history of issuing the Great Wall Card. This card uses foreign exchange notes as the settlement currency. The card face continues the style of "BOC Card" of Zhuhai Branch, but the cloth coin in the upper left corner is replaced with the pattern of Great Wall emblem, and the pattern of Great Wall is added in the gray part under the card.

Figure 3-6: The nationwide Great Wall Card

In October 1986, the Bank of China issued the Great Wall credit card with RMB as the unified settlement currency, clearly stipulating that the credit cards of the Bank of China are collectively called the "Great Wall Card", and since then the common RMB credit card in China was born.

In 1987, the annual issuance of Great Wall Card reached 12,000 cards and absorbed RMB 200 million.

Figure 3-7: The first ATM card - Great Wall ATM card

In 1987, the Bank of China issued the first ATM withdrawal card. Due to the lack of computer communication equipment at that time, it was not networked throughout the region and was limited to local savings offices in Zhuhai, thus resembling an unguarded depository that could complete withdrawals.

Figure 3-8: RMB Great Wall MasterCard

In view of the importance of computer communication equipment to the development of credit cards, BOC has attached great importance to the construction of computer communication equipment since the start of credit card business

and gradually increased its investment. 1992 saw the completion of regional networking of ATMs in Guangdong Province Branch and Guangzhou, Shenzhen, Shantou and Dongguan Branches, which was the first step towards the nationwide networking of ATMs in Bank of China.[14]

Figure 3-9: 1987 Bank of China Zhuhai Branch of ATM in China

In 1987, BOC joined MasterCard and Visa Credit Card International respectively. In the same year, Bank of China issued the second version of Great Wall Card in cooperation with MasterCard.

[14] "Adapting to the Needs of Reform and Opening Up, Pioneering Credit Card in China (1978)," Bank of China, September 26, 2008.

Figure 3-10: Great Wall International Card with foreign currency settlement

On July 8, 1988, Bank of China launched the first version of Great Wall International Card, which is a MasterCard that can be used overseas to meet the needs of Chinese expatriates, foreign institutions in China and resident expatriates in China for Bank of China foreign exchange credit cards. The card can be used at more than 10 million authorized merchants in more than 200 countries and regions worldwide, thus bringing the Chinese credit card from China to the world.

However, the "threshold" for credit card processing was high at that time, positioning RMB 5,000. Under the income and consumption level at that time, not many people had RMB 5,000, so the debit card became the major of bank cards. By 1994, the number of cards issued in China amounted to 4 million and the transaction value hit RMB 200 billion.[15]

2. **Preliminary Development Stage (1994-1996)**

The period from 1994 to 1996 was the preliminary development stage of China's bank card industry. And the national "golden card" project began to start.

At this stage, in addition to the branches of state-owned commercial banks,

[15]Ma, Chuanlong, "70 years of industry changes | Review the history of the development of China's payment industry,"

the National Postal Savings and Exchange Bureau (October 1994), Guangdong Development Bank (March 1995), Shanghai Pudong Development Bank (April 1995) and China Merchants Bank (June 1995) all joined the card issuance.

In 1993, in order to realize the sharing of POS and ATM network resources and improve the environment of bank card use, General Secretary Jiang Zemin personally advocated the "Golden Card Project". In 1994, the Golden Card Project was formally launched. The preparatory work for the establishment of bank card network service centers and national headquarters in 12 pilot cities, including Shanghai, Beijing, Tianjin, Hainan, Xiamen, Dalian, Qingdao, Hangzhou, Shenyang, Guangdong, Jiangsu and Shandong, began.

3. **Networking Primary Stage (1997-2000)**

   From 1997 to 2001, China's bank cards were gradually networked for common use. a regional interbank information exchange system for bank cards in 12 pilot cities was completed in 1997. Subsequently, six cities, including Shenzhen, Kunming, Fuzhou, Wuhan, Changsha and Zhengzhou, also set up their own interbank information exchange centers. The opening of these centers provided a public network platform for commercial banks to broaden the bank card market, and the number and coverage of bank card issuance, POS and ATM acceptance outlets around the world increased greatly.

4. **Comprehensive Nationwide Networking (2001-2004)**

   In February 2001, the PBC organized a national bank card working conference. The conference adopted the Opinions on the Implementation of the Joint Work of Bank Card Networking in 2001, and reached a consensus among commercial banks on the goal of achieving comprehensive nationwide networking and joint development.

   It was decided that from January 1, 2004, all RMB bank cards used across banks and regions in China should be affixed with the "UnionPay" logo.

   In January 2002, Beijing, Shanghai, Guangzhou, Shenzhen and Hangzhou be-

came the first five pilot cities to start issuing "UnionPay" logo cards.

On March 26, 2002, China UnionPay, China's own bank card organization, was officially established.

From the data obtained from the official website of ICBC, in 2004, the number of cards issued by ICBC was 111 million, accounting for 14.49% of the number of cards issued by financial institutions nationwide and 10.57% of the bank card transaction volume in that year; the balance of bank card RMB deposits at the end of the year was RMB 294.223 billion, accounting for 19.23% of the balance of bank card RMB deposits in financial institutions nationwide.[16]

5. **Maturity and Brand Building Period (2004-present)**

Since 2004, the market-oriented operation mechanism has been established, and China's bank card industry has gradually matured and started to integrate into the international market. Facing the increasing pressure of international competition, it has become a consensus to create China's own bank card brand.

On March 1, 2004, the "China UnionPay Interbank Transaction Revenue Allocation Measures for Networked Institutions" came into effect, which meant that card issuers, acquirers and third-party service providers could set fees and charges according to the actual cost of the relevant business and market demand. At the same time, the mechanism of bank card service charges began to be established gradually.

Over the past 20 years, China UnionPay has developed rapidly with the strong support of the Chinese government. The UnionPay acceptance network has been extended to 180 countries and regions with more than 2,500 member institutions.[17] At present, China has been recognized as the country with the fastest growing bank card business and the greatest development potential in the world.

[16] "A Brief History of Industrial and Commercial Bank of China (1984-2014)," ICBCLtd, 2015.
[17] "Company Profile: China UnionPay," China UnionPay, 2022.

3.2.1 China UnionPay

1. **Overview**

   China UnionPay Corporation is a joint-stock financial service provider headquartered in Shanghai, China. It mainly provides inter-bank payment and settlement services. It used to be the only and monopoly online interbank transaction clearing organization in mainland China. (In 2020, American Express obtain a bank card clearing license) By 2015, China UnionPay became the world's largest bank card clearing organization.

   In March 2002, China UnionPay was established by 85 institutions with a registered capital of RMB 2.93 billion and headquartered in Shanghai, It merged 18 bank card information exchange centers.

   The government's initial goal in promoting the establishment of China UnionPay was to establish and operate a unified bank card clearing network for the common use of China UnionPay cards within mainland China, and to accelerate the bank card industry in mainland China.

2. **Business Model**

   China UnionPay is one of the three largest card organizations in the world. International card organizations have a high degree of industry concentration. There are six major international credit card organizations in the world, Visa, MasterCard and UnionPay belong to open international card organizations, which can realize the rapid expansion of payment network. American Express, Diner Club and JCB are closed card organizations.

   The four-party model is the mainstream model of the bank card payment industry, reflecting the specialized division of labor in the payment industry chain. The four parties include card organizations, card issuers, acquirers and merchants, among which card organizations (card transfer and clearing institutions) are at the core of the industry chain. Card organizations are responsible for formulating and implementing business specifications and technical standards for

interbank transactions of bank cards, building and operating bank card payment networks, and completing information exchange and fund clearing. Card organizations are similar to platform companies in the Internet era.

3.3 Chinese Payment and Clearing System

In the early days, China's inter-bank transfers relied on manual processing, and funds in transit for payment and settlement operations took up to half a month.

In 1989, in order to meet the needs of reform and opening up, the People's Bank of China started to coordinate the construction of electronic payment and clearing system. After the completion of the system, the time of funds in transit was shortened from half a month to 3 days, marking the beginning of China's payment and clearing work into the era of electronic, information and network.

In 1994, the "Golden Card Project" was launched on a pilot basis. Since then, the payment industry has entered the fast track of digital development from cash to bank cards to mobile payment.

3.3.1 National interbank manual clearing period (1984-1989)

With the emergence of modern banking, interbank transactions began to be cleared on the basis of "interbank positions". The banks opened their "Provision accounts" with each other. At this time, each bank was a clearing agency, clearing interbank transactions.

In 1984, after the PBC exclusively exercised central banking functions, China established a legal deposit reserve system.

However, in those days, the central bank was limited in the responsibilities it could undertake. There was no electronic bookkeeping and data processing system, and

the country did not even have bank cards yet, and the first ATM appeared only in 1987. In short, the domestic financial environment had not yet reached the objective conditions that would allow the central bank to implement a unified national clearing system.

In order to meet the demand for inter-bank clearing, the central bank proposed at that time that the head office would be responsible for clearing intrabank transactions; inter-bank transactions had to be supported between different commercial banks; and the resulting fund transactions could be cleared either by the central bank or by the commercial banks themselves.

During this period, the Chinese banking system was very unintelligent, and clearing was almost entirely handled manually, which was called the "national interbank manual clearing" period. During this period, transfer funds are often in transit for up to half a month, causing a lot of inconvenience to the customers.

3.3.2 The Electronic Interbank System (EIS) (1989-2005)

As the banking industry continued to grow and the number of various types of interbank transactions increased, interbank debts became so complex that it becames very difficult for each bank to conduct clearing on its own. This situation required the central bank to assume the role of a national clearing center.

Thus, on December 6, 1989, the central bank issued the "Notice on Reforming the Interbank Clearing System".

Subsequently, in 1990, the People's Bank of China Clearing Center was established to provide payment clearing services to financial institutions. This clearing center includes two levels of processing centers, NPC (National Process Center) and CCPC (City Clearing Processing Center).

On April 1, 1991, the Electronic Interbank System (EIS) launched. EIS is designed

to handle off-site payments clearing (including interbank and intrabank).

Since then, inter-bank transactions between various banks can be done directly through electronic operations, and the time for customers' funds to be in transit has been reduced to one or two days, which is a major milestone for the Chinese financial system.

3.3.3 China National Automatic Payment System (CNAPS) (1991-present)

After the EIS trial run in 1991, two more important changes occurred.

First, the internal electronic system of commercial banks is gradually implemented.

With the development and application of the Internet and information technology, major commercial banks began to build their own electronic business systems one after another. With the commissioning and implementation of internal networking systems, all the major commercial banks' intra-bank off-site transactions can be solved through their own electronic systems and no longer depend on EIS and the central bank's help.

Second, the design of China National Automatic Payment System (CNAPS) started to be designed.

In October 1991, China began work on the China National Financial Network (CNFN) and the China National Automatic Payment System (CNAPS). This project was financed by a loan from the World Bank and the design work was undertaken by PA Consulting of the UK. Since then, EIS has gradually transitioned to CNAPS.

The CNAPS is the core of China's payment and clearing system, which connects the intra-bank systems of commercial banks and constitutes a nationwide and well-connected fund transfer network.

The first generation CNAPS contains the following six main components.

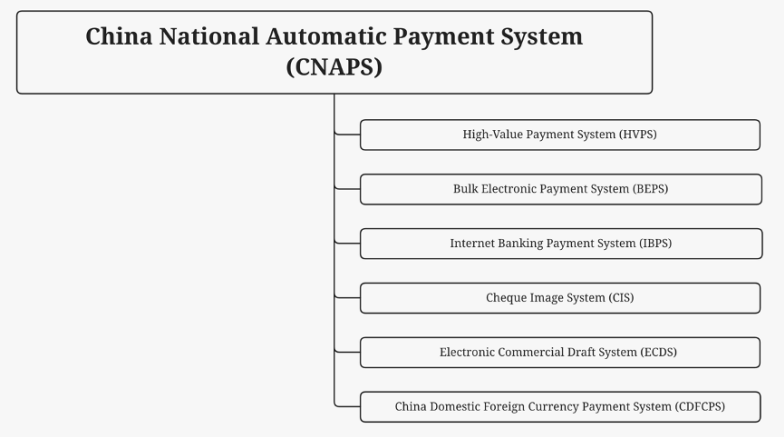


Figure 3-11: CNAPS structure

In CNAPS, there are three systems that are most important.

1. **High-Value Payment System (HVPS) (2002)**

   The High-Value Payment System (HVPS) is an important part of the modern payment system, which operates on national legal working days with daily operating hours from 8:30 to 17:00, mainly handling inter-bank ordinary remittances with single amount above 50,000 yuan or inter-bank emergency remittances below 50,000 yuan. It is also responsible for handling treasury funds, funds clearing for securities trading and foreign exchange transactions, as well as funds clearing for central banking services such as cash access, deposit payment and refinancing, and net clearing for inter-city bills exchange, etc. It is the main channel for large amount of funds remittance and clearing.

   HVPS is a real-time system and it implements the method of initiating and clearing the full amount of payment instructions one by one, thus speeding up the speed of transferring large amounts of funds and the turnover of social funds.

2. **Bulk Electronic Payment System (BEPS) (2005)**

   The Bulk Electronic Payment System (BEPS) is a major component of the CNAPS, which operates in a 7 x 24-hour mode and mainly handles ordinary

credit transactions of less than RMB 50,000 per transaction and regular debit transactions. Compared with the large amount system, the BEPS adopts the processing method of sending transactions in bulk and clearing them at regular intervals, which makes the BEPS less time-bound.

The advantage of the BEPS is that it supports a wide range of transaction types and has low transfer fees.

The operation of the micro-credit system also enables the goal of "one card in hand, no worries about receiving and paying" to be realized. Any individual who opens an account (bank card or bankbook) in one bank and signs an agreement with the bank will be able to realize all collection actions, such as receiving salaries, insurance and pensions, and all payment operations, such as paying utility bills and telephone charges, without having to open accounts in multiple banks.

For each transaction, HVPS is sent and cleared in real time, so the transfer can arrive immediately and the inter-bank funds in transit time is basically zero.

BEPS collects a number of transactions and then packages them up, clearing them at regular intervals. Therefore, transfers with BEPS often take several minutes or even half an hour to arrive, and interbank position delivery is also non-real time.

There is no limit on the amount of money that can be transferred with HVPS, and the maximum single amount supported by BEPS is 50,000 RMB.

In terms of usage, HVPS focuses on the timeliness of fund transfers and is mainly used for capital markets, money market transactions and large trade fund settlements. BEPS is mainly used for small trade payments and personal consumption services.

3. **Internet Banking Payment System (IBPS) (2010)**

   The first generation of CNAPS was designed based on the processing flow of traditional payment. With the development of Internet and e-commerce in

China, new types of electronic payment services such as online banking and telephone banking account for an increasing proportion of payment activities.

At the same time, non-financial payment service providers have gradually become important players in the payment service market (e.g., Alipay in 2003), and these organizations have generated a lot of "online interbank payment" business in the process of development, which urgently needs the support of the central bank payment system.

Online inter-bank payment is an agreement between banks (or between banks and non-bank clearing organizations). When the payee and the payer do not open accounts with the same bank, the interbank clearing of payment instructions is transmitted or converted between multiple systems, and some processing links require manual intervention of commercial bank personnel, which results in longer business processing time, and customers are not informed of the processing results of payment services in a timely manner. In order to improve the efficiency of inter-bank clearing of online payment, enhance the level of commercial banks' online banking services and better perform the payment clearing duties of the central bank, PBoC decided to upgrade CNAPS and build a new system to support the development of online inter-bank payment business.

The Internet Banking Payment System (IBPS), which was launched in 2010, is also known as "Super Internet Banking" in China.

The business operation model of IBPS is similar to that of BEPS. IBPS mainly supports the processing of online interbank retail business, with business instructions sent in sequence, batch settlement and timed clearing. IBPS supports commercial banks and non-financial payment service providers approved by the People's Bank of China to access and provide customers with 7×24 services.

On August 30, 2010, the Internet Banking Payment System (IBPS) was officially launched. By the end of November 2011, a total of 120 banking financial institutions were connected to the IBPS.

IBPS integrates the advantages of HVPS and BEPS and provides 7x24-hour

service for transfers under 50,000 RMB, which greatly improves the efficiency of social fund flow and the success rate of online payment services, and plays an immeasurable role in the development of China's payment system and the explosion of mobile payment.

3.3.4 Payment & Clearing Association of China (PCAC)

On December 25, 2009, the Department of Payment and Settlement of the PBC issued the "Notice on Calling for Sponsors for the Establishment of Payment and Clearing Association of China (PCAC)" and finally selected 61 representative enterprises in the industry as the sponsors of the association.

On May 23, 2011, the Payment and Clearing Association of China (PCAC), which had been in preparation for two years, was officially established in Beijing. The main members include domestic banks, finance companies, third-party payment companies, etc. The function of the association is not only to regulate the electronic payment industry, but also to act as a regulatory entity for the industry.

At present, PCAC has 419 members, including the General Clearing Center of the PBC, China UnionPay and other licensed payment clearing organizations; commercial banks such as ICBC and ABC; finance companies such as China Huadian Group Finance Company Limited and Sinopec Finance Company Limited; non-bank payment institutions such as Alipay and CaiPay; international card organizations such as MasterCard and American Express; and other related institutions.

PCAC is an industry self-regulatory association, but its main task is to accept the commission of the Chinese government authorities to supervise and inspect the payment, clearing and settlement business operations of its members. At the same time, PCAC is able to guide and manage the business conduct of its members by means of association notices, which is a more flexible and faster way of management than legislation.

3.3.5 NetsUnion

Network Payment Clearing Platform for Non-Banking Payment Institutions, abbreviated as NetsUnion. It is a unified clearing platform for third-party payment institutions operated by NetsUnion Clearing Corporation, which is sponsored and established by Payment & Clearing Association of China and mainly handles network payment business involving bank accounts initiated by non-bank financial institutions and is supervised by the PBC.

NetsUnion was established in 2017.In August 2017, the Department of Payment and Settlement of the Central Bank issued "the Notice on the Migration of Network Payment Business of Non-Bank Payment Institutions from the Direct Connection Mode to the NetsUnion Platform for Processing" .

The notice requires that from June 30, 2018, all network payment services involving bank accounts accepted by payment institutions will be processed through the NetsUnion platform. This is also known in the industry as "disconnection".

This notice was issued against the background of the rapid development of mobile payment business in China and the fact that third-party payment institutions used to settle directly with banks without going through China UnionPay, resulting in the central bank not being able to know the information, amount and destination of customer payments, thus creating certain risks, such as money laundering.

Therefore, by setting up the NetsUnion platform and making it mandatory for third-party payment institutions to access it, the People's Bank of China objectively brought third-party payment institutions into the management system of commercial banks, so that third-party payment institutions could no longer clear on their own but had to go through the platform controlled by the central bank.

In other words, the online payment channels of third-party payment institutions do not need to and can no longer be directly connected to banks, but are connected to banks through the NetsUnion platform.

NetsUnion is only a clearing platform and does not directly conduct payment business to maintain neutrality and be regulated by the central bank.

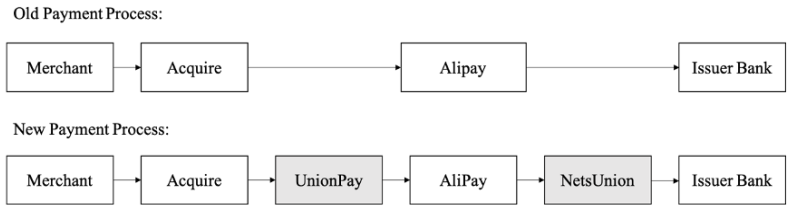


Figure 3-12: Comparison of old and new payment processes

3.4 The Journey of Mobile Payments in China

3.4.1 The Long Emerging Period (1999-2011)

In 1999, the first C2C website Eachnet.com was established, and in the same year, the legendary Chinese entrepreneur Jack Ma led dozens of people to invest 500,000 RMB to set up Alibaba in Hangzhou, and B2C websites such as 8848 were also officially launched, and online shopping began to enter the public's sight.

However, in the early stage of e-commerce, integrity problems were not well solved, the system of e-commerce industry is not perfect, the quality of goods and services are difficult to be guaranteed. Online shopping and consumption is not accepted by the general public by the end of the nineties to 2001, and payment methods are mainly based on the bank's online system and is still in the initial stage.

1. **China Mobile and Phone Bill Payments: 1999**

   In 1999, China Mobile, the largest telecom company in China, started a pilot mobile payment business in some provinces and cities, including Guangdong, in cooperation with ICBC, CMB and other financial sectors.

   In May 2002, China Mobile launched a mobile micro-payment service in Guangzhou to buy Coke and subway tickets with cell phones. Users could automatically

purchase a variety of beverages such as Coke or subway tickets by calling specific numbers on the Coke and subway ticket machines and pressing the button to select the goods according to the prompts; they would then receive a confirmation message that the purchase was successful and the cost of the purchase would be automatically deducted from their phone bill.[18]

This payment method is very different from what we now think of as "mobile payment". The essence is that the user's phone bill stored with China Mobile is considered a broad deposit, which the user can use for the purchase of specific goods, and China Mobile later clears and transfers the funds to the account through the bank with the supplier of the specific goods.

Why was it a telecom company that kicked off China's mobile payment industry? One important reason is the development process of China's bank card industry that we discussed in Section 3.1.2.1. As we learned in the previous discussion, China's bank cards could not be networked in some cities until 2001 and in the whole country until 2004. As a result, Chinese telecom companies could not charge customers' credit cards on a monthly basis, as U.S. telecom companies do, but have been using a "prepayment" model. This resulted in every phone customer having to have a deposit account with the telecom company and always having a positive balance.

China Mobile's choice of this approach to "mobile payments" is unique in the history of payments in the world. This "internal clearing" model may have inspired Alipay and opened a completely different path for the development of China's mobile payment industry.

2. **UnionPay and SMS payment: 2002**

   In 2002, UnionPay launched the cell phone SMS payment service.

   In 2002, Guangdong Mobile launched a new service in cooperation with banks in Guangzhou: Utility Bill Payment. Users can bind their cell phone number to

[18] Ji, Shiwang, and Maolin Wu, "The First Pot of Gold in the 3G Era Will Be Realized by Mobile Payments,"

a certain bankbook or bank card, and pay their bills by sending SMS or calling a specific number, and the money will be transferred from the bank account corresponding to the cell phone after confirmation.[19]

This allows users to easily pay their utility bills through their cell phones, eliminating the need to run around and stand in line to pay their bills.

Cell phone SMS payment service emphasizes mobile bill payment and consumption.

3. **Alipay and Online Payment: 2003**

In May 2003, Taobao, which belongs to Alibaba Group, was launched, and in October 2003, Alipay was launched, kicking off the curtain of online payment.

The saga began with the growth of e-commerce. 2003 was a year when Ebay was in full swing in the U.S. and was the largest e-commerce company in the world at the time. When Ebay began to consider entering the Chinese market, it invested in a comparable Chinese company, Eachnet, which already had a dominant position in the Chinese online auction market. At this point, Alibaba's founder, Jack Ma, realized the potential threat and decided to enter the C2C space to challenge Ebay. So, on May 10, 2003, Taobao.com, developed by 10 engineers, was launched. The name means "search for treasure". Two months after its launch, the site already had 17,000 members, 62,000 products on the Internet, 300,000 average daily page views, 25,000 average daily visitors, and more than 2,000 new products per day.[20]

However, Taobao has encountered a huge problem. While users and products are increasing day by day, very few transactions are completed. The most important problem here is the lack of trust between buyers and sellers.

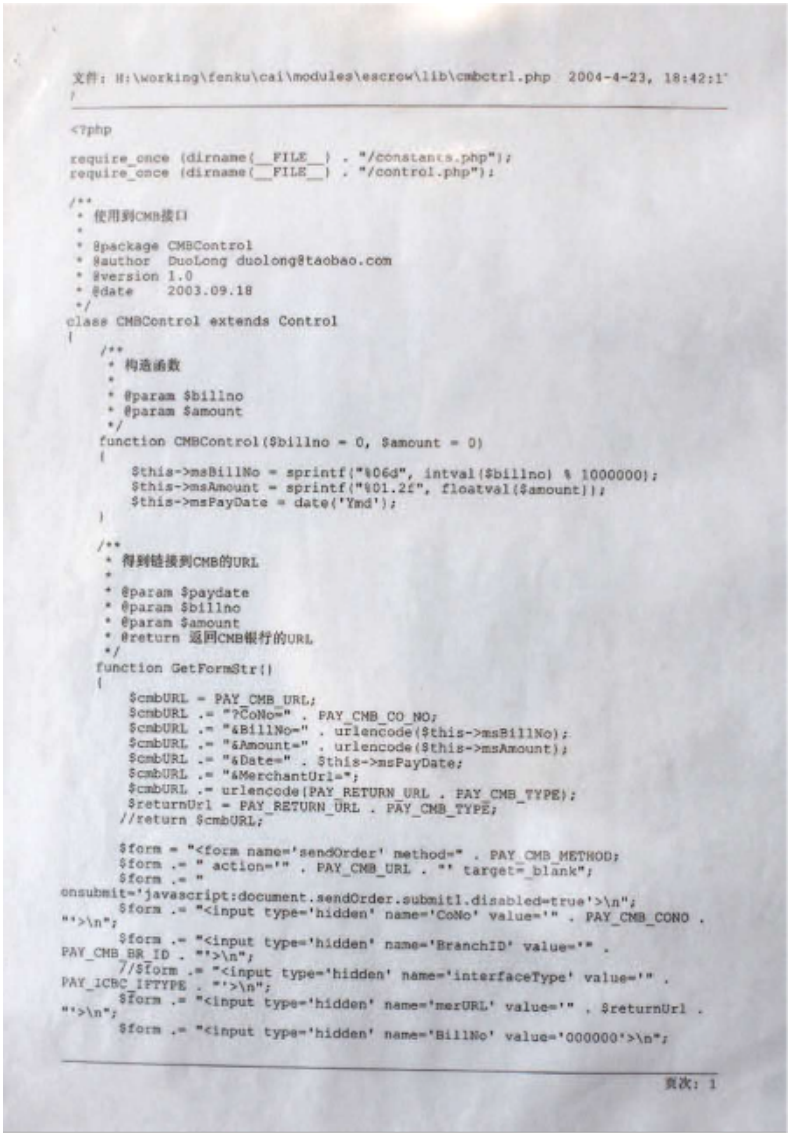
The traditional Chinese business credo is "pay with one hand and deliver with the other". In online transactions, these two actions are not carried out by in

[19]Zeng, Xia, and Jiehang Lin, "Guangdong people will use their mobile phones to pay next month The scope of micropayment business has gradually expanded,"

[20] "When Did China Have Taobao?" Chongqing Legal Network, November 5, 2007.

the same system and cannot be monitored, resulting in buyers and sellers not being able to trust each other. Some fraudulent behavior did occur at that time.

In this context, on October 15, 2003, Taobao launched Alipay, a payment tool based on third-party guaranteed transactions.



```
文件: H:\working\fenku\cai\modules\escrow\lib\cmbctrl.php  2004-4-23, 18:42:1
/
<?php

require_once (dirname(__FILE__) . "/constants.php");
require_once (dirname(__FILE__) . "/control.php");

/**
 * 使用到CMB接口
 *
 * @package CMBControl
 * @author  DuoLong duolong@taobao.com
 * @version 1.0
 * @date    2003.09.18
 */
class CMBControl extends Control
{
    /**
     * 构造函数
     *
     * @param $billno
     * @param $amount
     */
    function CMBControl($billno = 0, $amount = 0)
    {
        $this->msBillNo = sprintf("%06d", intval($billno) % 1000000);
        $this->msAmount = sprintf("%01.2f", floatval($amount));
        $this->msPayDate = date('Ymd');
    }

    /**
     * 得到链接到CMB的URL
     *
     * @param $paydate
     * @param $billno
     * @param $amount
     * @return 返回CMB银行的URL
     */
    function GetFormStr()
    {
        $cmbURL = PAY_CMB_URL;
        $cmbURL .= "?CoNo=" . PAY_CMB_CO_NO;
        $cmbURL .= "&BillNo=" . urlencode($this->msBillNo);
        $cmbURL .= "&Amount=" . urlencode($this->msAmount);
        $cmbURL .= "&Date=" . $this->msPayDate;
        $cmbURL .= "&MerchantUrl=";
        $cmbURL .= urlencode(PAY_RETURN_URL . PAY_CMB_TYPE);
        $returnUrl = PAY_RETURN_URL . PAY_CMB_TYPE;
       //return $cmbURL;

       $form = "<form name='sendOrder' method=" . PAY_CMB_METHOD;
       $form .= " action='" . PAY_CMB_URL . "' target='_blank";
       $form .= "
onsubmit='javascript:document.sendOrder.submit1.disabled=true'>\n";
       $form .= "<input type='hidden' name='CoNo' value='" . PAY_CMB_CONO .
"'>\n";
       $form .= "<input type='hidden' name='BranchID' value='" .
PAY_CMB_BR_ID . "'>\n";
       //$form .= "<input type='hidden' name='interfaceType' value='" .
PAY_ICBC_IFTYPE . "'>\n";
       $form .= "<input type='hidden' name='merURL' value='" . $returnUrl .
"'>\n";
       $form .= "<input type='hidden' name='BillNo' value='000000'>\n";

                                                                  页次: 1
```

Figure 3-13: A piece of code from the early days of Alipay

Guaranteed transaction means that in e-commerce, buyers and sellers conduct trading activities through a third-party guaranteed payment platform, during which the transaction funds are not transferred directly to each other, but are

hosted on the third-party guaranteed payment platform, which can effectively ensure the safety of funds.

It is worth mentioning that the first guaranteed transaction made after Alipay was launched was a cross-border transaction. The seller was a Chinese student studying in Japan and the buyer was another student in Xi'an. The goods they traded was a used Fuji digital camera, and the transaction price was 757.50 yuan.

The success of Alipay cannot be separated from the strong support of the early cooperative banks.

Alipay's partner bank is ICBC Hangzhou West Lake Sub-branch. ICBC is the largest state-owned bank in China, known as the "Bank of the Universe", and is the number one bank in China's banking industry in terms of business scale and technical system capability. However, Alipay, a start-up company, has brought unimaginable business pressure to this ICBC branch.

The reason is that many Taobao sellers' accounts are not opened at ICBC, and after buyers make payments, the funds first enter Alipay's public account at ICBC, and after Alipay receives the payments, it then makes interbank transfers through ICBC, and such interbank transfers have to be routed through the PBC.

In 2004, when China National Advanced Payment System (CANPS) had just been launched and the Bulk Electronic Payment System (BEPS) had not yet been put into operation, each inter-bank transfer had to be manually processed, with vouchers printed and manually entered into PBOC's system. As the volume of Alipay business increased dramatically, reaching 8,000 transactions per day, the work became "horrible" and ICBC had to send more than two hundred people to settle the transactions, leaving a huge backlog of business.

In order to solve this problem, Alipay signed a strategic cooperation agreement with ICBC in March 2005. An application was sent by the West Lake Branch to ICBC's head office, which mobilized its technology centers in Beijing, Zhuhai and Zhejiang to work together to develop an online direct-link transfer pro-

cessing system. In December, the system renovation was completed and the pressure of transferring funds was greatly relieved.

Later, Taobao's business volume continued to grow, driving the rapid increase in the scale of Alipay transactions, objectively making ICBC's e-banking business much higher, and after 2005, Alipay's business was basically taken over by the ICBC head office.

From this experience we can see that a decisive factor in the success of Alipay is the cooperation of ICBC. As we have learned from the previous discussion, the payment business and the banking system and payment clearing system are necessarily bound. Without the support of banks, no innovation in the payment field can be successful. In 2004, when China's Internet industry was still very weak, ICBC, the largest bank in China, did not reject outright a new business with almost zero scale and ambiguous legal definition, but tried to reach out in good faith. After seeing the scale of the business increase, it did its best to cooperate with the system upgrade, which was not the case for any bank at that time.

ICBC was the first bank to sign a strategic cooperation agreement with Alipay, and the cooperation with ICBC served as a model for Alipay's cooperation with other banks. Since then, Alipay has cooperated with China Merchants Bank, Construction Bank and other banks respectively. This partnership with the financial system has continued to this day.

4. **Nokia and Near-Field Communication (NFC) Mobile Payment: 2006**

Figure 3-14: Nokia and Near-Field Communication (NFC) Mobile Payment: 2006

On June 27, 2006, Nokia, together with China Mobile Xiamen Branch, Xiamen EasyCard Company and Philips, announced the launch of China's first Near Field Communication (NFC) cell phone payment field trial in Xiamen. 100 volunteers used the NFC-enabled Nokia 3220 to make mobile payments at any of the business outlets in Xiamen covered by the Xiamen EasyCard, such as buses, ferries, restaurants, cinemas and convenience stores.[21]

In addition to the normal EasyCard functions, the superiority of mobile payment is also reflected in the fact that users can read the EasyCard balance and check

[21] "The First Field Trial of Mobile Payment for near-Range Communication Was Launche,"

the last 9 historical transactions through the cell phone screen.

In 2006, China UnionPay launched an NFC mobile payment method based on the IC card.

In 2008, the NFC payment pilot was expanded to Changsha, Guangzhou, Shanghai and Chongqing.

5. **The competition between the two pioneer camps**

   In the decade of 1999-2009, China's exploration of the mobile payment industry blossomed, resulting in four mainstream payment methods: cell phone bill payment, SMS payment, online payment and NFC payment. At this time, the pioneers were divided into two camps: China Mobile, which was the first to start exploring mobile payment business, and China UnionPay, the only bank card organization in China.

   At that time, there were four major types of mobile payment technology standards in use in China: 13.56MHz contactless technology-based dual interface card scheme; 13.56MHz contactless technology-based NFC scheme; 13.56MHz contactless technology-based SD card scheme and 2.4GHz RF-SIM card scheme.

   Among them, China Mobile insists on using 2.4GHz scheme, while UnionPay insists on 13.56MHz scheme. China's other two major telecom companies, China Unicom and China Telecom, then joined UnionPay's camp.

   In terms of the game between the relevant stakeholders, UnionPay, the bank card organization, is in the role of defender, hoping to maintain its position in the bank card field and become the only payment channel for users. Telecom operators, on the other hand, are the challengers, hoping to become the users' "bank", not only the wallet, but also the only payment channel for users, and to expand payments to all aspects of users lives. Meanwhile, the third-party payment platforms represented by Alipay are hoping to expand their business areas and revenue sources, but their business is limited to remote payments due to their inability to lay out mobile terminals.

In September 2009, China Mobile launched a pilot cell phone mobile payment business within 10 provinces. The number of cards issued exceeds one million.

In 2010, China UnionPay joined hands with 18 commercial banks, including ICBC, ABC, CBC and BOCOM, as well as two telecom operators, China Unicom and China Telecom, and some cell phone manufacturers to establish the "Mobile Payment Industry Alliance".

In 2010, UnionPay launched mobile payment business pilots several provinces and cities.

3.4.2 Explosive growth period (2011-2013)

With the birth of the first generation smartphone iPhone in 2007 and the rise and development of 3G communication technology, cell phones are no longer just ordinary tools that can make phone calls and send text messages, but are getting closer to the functions of computers and becoming the main entrance for people to access the Internet.

The increase in smartphone penetration has brought about the rise of mobile e-commerce. In 2011, the transaction scale of China's mobile e-commerce market was 15.67 billion yuan, an increase of 609% year-on-year. In 2011, China's mobile payment market developed rapidly, with the annual transaction volume reaching 74.2 billion yuan, up 67.8% year-on-year; the number of mobile payment users grew 26.4% year-on-year to 187 million households.[22]

1. **Third-Party Payment License: 2011**

   In June 2011, the PBC issued 27 third-party payment licenses. However, due to the lack of uniform payment standards and other reasons, domestic mobile payment has not been promoted on a large scale.

[22]Li, Dong, and Xia He, eds, "Banks Play Free Cards to Push Mobile Banking Security Issues Are Likely to Become a Constraint,"

During 2011 to 2012, three major telecommunication companies have set up mobile payment companies, respectively. In December 2011, they were granted payment business licenses by the central bank at the same time, and the enthusiasm of telecom companies in developing and promoting mobile payment products was enhanced.

2. **Unification of technical standards: 2012**

   On June 21, 2012, China Mobile and China UnionPay finally agreed to sign a cooperation agreement on mobile payment, setting the communication technology standard for mobile payment at 13.56 MHz. The unification of the standard removed the last stumbling block for China's mobile payment industry.

3. **Alipay and QR Code Payment: 2012**

   In 2012, Alipay first launched QR code payment, creating a completely different way of payment interaction than the previous technology route.

   Today in China, QR code payment has become the most important way for people to pay.

   The specific technology and process of QR code payment is described in Chapter 4.

   QR code payments have two crucial properties and advantages:

   First, because QR code payment does not rely on the physical proximity of the payment device and the receiving device in NFC payment technology, but can save, distribute and deliver QR codes that store a large amount of information in the form of pictures, it is possible to pay both offline in close proximity and online at any distance. The form of QR code payment has completely broken the traditional payment restrictions on time and space.

   Second, the cost of QR code payment is very low, the user side of the identification work can be completed through smart phones, and the merchant side needs much cheaper equipment than NFC devices. Therefore, the difficulty of QR code payment promotion is much lower than NFC payment. In addition,

QR code payment supports individuals (non-registered merchants) to generate payment codes, and user-to-user C2C mobile payment becomes possible, which is not possible with NFC payment. A large number of individual users and small and micro merchants use this method to access the payment platform.

Due to the large network externality of the payment platform, the addition of a large number of users and merchants makes this payment platform more and more efficient and fast growing.

4. **WeChat Pay: 2013**

On August 9, 2013, Tencent's WeChat, China's largest social networking platform founded in 2011, launched WeChat Pay, officially challenging the dominant Alipay.

Before WeChat Pay was born, Tencent's third-party payment business "CaiPay" could only occupy about 10% of the national market. At that time, Tencent's e-commerce business was not developing well and was on the verge of being sold; CaiPay lacked suitable usage scenarios and was not at all in the same weight as Alipay. Although WeChat became the largest mobile social application in the country in 2011, the WeChat team had always adhered to the "minimalist" design philosophy and was very cautious about adding features. As a result, WeChat Pay didn't go live for the first time until August 2013, when Alipay's mobile app was already very mature.

The core development philosophy shared by the two Chinese mobile payment platforms is to "get more people to use mobile payments", rather than focusing on serving people with credit cards or bank cards as the US mobile payment platforms do. As a result, the number of users becomes critical in the competition between platforms.

WeChat, the number one social platform in China, has a strong advantage in terms of user numbers, with 336 million monthly active users in the third quarter

of 2013.[23] The number of Alipay users was less than 100 million at this time.[24]

The entry of WeChat Payment heralded, or brought about, an explosion in the mobile payment industry. the scale of mobile payment (excluding SMS payment) transactions in China's third-party payment market reached 334.3 billion in 3Q 2013, up 173.1% compared to 2Q.[25] 2013 became the fastest growing year in the history of mobile payment in China.

3.4.3 Fierce Competition and Maturity Period (2014-present)

1. **The Ubiquitous War**

   (a) **Round 1: Online Car-Hailing Payment War 2013**

   Mobile payment requires a payment password, fingerprint or facial recognition, which has a high degree of privacy and security, and the payment process requires no cash, no change, and no card signature. Convenient and fast mobile payment will undoubtedly become a fundamental facility and integrate with all walks of life, so seizing the mobile payment market has become an important task for major Internet companies as well as smartphone companies.

   Unlike the previous iteration of payment methods, mobile payment does not require cash bank cards or checks, buyers can pay directly through their smartphones, so the core of this payment war is to seize the mobile payment portal and habits of consumers.

   The scene where the payment business takes place has become a must for mobile payment platforms. Alipay and WeChat have both taken a fancy to the huge business scene of "online car-hailing ".

   In August 2013, Alipay was connected to KuaiDi. In January 2014, Didi

[23] "Tencent's Stock Price Is Inflated? WeChat Pure Social Users Have Stagnated in Growth,"
[24] "Alipay," baike.baidu.com, 2021
[25] "Industry Data: In the Third Quarter of 2013, the Mobile Payment Transaction Scale of China's Third-Party Payment Market Reached 334.3 Billion"

supported WeChat payment. In the first encounter in January, Didi subsidized passengers and drivers who used WeChat Pay to make payments with 10 yuan each. KuaiDi, on the other hand, gave 10 yuan back to passengers who paid with Alipay and 15 yuan to drivers. In February, Didi adjusted its subsidies three times, with the highest subsidy of 15 yuan per single for new passengers and 50 yuan per single for new drivers, while KuaiDi increased its subsidies by a small margin, with the highest subsidy reaching 13 yuan per single. In March, the war cooled down as Didi lowered its subsidies five times, to RMB 5 for first-tier cities and RMB 3 for second- and third-tier cities, while KuaiDi also lowered its subsidies twice, remaining basically the same as Didi and piloting a free taxi service for the elderly in Beijing. This taxi war did not stop there, and continued to burn into 2014. Alipay's subsidy granted to KuaiDi to capture the cab payment scene exceeded RMB 800 million in 2014.[26]

The taxi "burning" war is the first real mobile payment war, which educated the domestic O2O market and conducted a nationwide mobile payment popularization.

This is just the beginning and a microcosm of the two platforms grabbing numerous payment scenarios.

(b) **Round 2: Alipay vs. UnionPay 2014**

Alipay's ambition, boldness and execution of its financial business are uncommon among all Chinese startups.

On June 13, 2013, Alipay launched its "Yu' E Bao" feature. It is an in-app wallet account. In terms of user experience, it's like Alipay is a bank, where users have an account and can deposit money into it and pay with their balance at any time. The key thing is that the balance can earn interest, which is much higher than the bank demand deposit.

Since then, Alipay has become more than just a payment transaction chan-

[26]Bao, Zhongtie, "History Will Remember December 12, 2014: Alipay Officially Declared War on UnionPay," Tsinghua Financial Review

nel for bank cards, but has started to vigorously promote its own wallet and become a financial entity with a large amount of deposits.

On October 16, 2014, Alipay became independent from Alibaba and established Ant Financial Services, and on December 12, 2014, during the second most important shopping festival of the year on Taobao, Alibaba announced that nearly 100 brands and about 20,000 stores offline would participate in the "Double 12" campaign. The event will offer a 50% discount on payments made with Alipay Wallet, covering restaurants, desserts, bakeries, supermarkets, convenience stores and many other everyday places. Meanwhile, in the merchant segment, Alipay is making a high-profile entry into the offline acquiring business (POS acquiring business) through a subsidy of up to 20 yuan per single.

This is a meaningful timing point. Alipay officially declared war on UnionPay, the dominant player in the offline acquiring business, through the Alipay offline marketing event.

In 2014, the annual transaction amount of Alipay was nearly 4 trillion, accounting for one-sixth of the overall social consumption amount in China. Among them, the number of daily transactions of Alipay mobile payment reached 25 million. China UnionPay's annual revenue in 2014 was about more than $6 billion, with a net profit of $1 billion. Domestic POS acquiring revenue accounts for more than half of its business revenue.[27] UnionPay's revenue and profits are at a disadvantage in this war.

(c) **Round 3: WeChat Pay and the Spring Festival Red Packet War 2015**

In the Spring Festival of 2014, WeChat Pay, which has been online for six months, launched the "WeChat Red Packet" function. This feature was inspired by the Chinese custom of giving red packets from elders to their juniors and leaders to their subordinates during the Chinese New

[27] "Double Twelve' Alipay Got the 'Chinese Big Mama"

Year, which fits perfectly with the psychology and behavior of Chinese consumers.

This innovation has brought huge benefits to WeChat Pay. Official WeChat data shows that the number of users using the WeChat Red Packet feature reached 5 million in 2014, bringing an extremely high number of new bank card bindings for WeChat Pay.

"A WeChat Red Packet is more than what Alipay has done in 8 years." This event, which Jack Ma called a "sneak attack on Pearl Harbor," kicked off the "Red Packet War" between WeChat and Alipay.

In the Spring Festival of 2015, WeChat Pay cooperated with the Spring Festival Gala (an enhanced version of the Super Bowl, which every Chinese person watches with their family) to distribute 500 million yuan of cash red packet in the form of "shake and grab red packet". The official data provided by WeChat shows that the total number of WeChat red packets sent and received on New Year's Eve reached 1.01 billion times, and the total number of WeChat shake interactions reached 11 billion times between 20:00 pm and 00:48 am. The peak of interaction occurred at 22:34, reaching 810 million times per minute.[28]

Every year since then, WeChat Pay and Alipay have bid for an exclusive partnership with the Spring Festival Gala. The amount of red packets has also increased year by year. By 2022, the total amount of red envelopes paid by major Internet companies reached 8.4 billion yuan. This has created a very "Chinese" marketing practice.

2. **Regulatory that follows suit**

   As the early QR code payment was still very imperfect in many aspects and there were some security loopholes, Chinese regulators took a cautious wait-and-see attitude towards it, neither killing it completely nor encouraging its

[28]Xiang, Xin, "2015 Different Spring Festival Gala WeChat Red Envelopes Into 'Most Popular Programs' "

liberalization, but studying regulatory approaches and methods while observing it.

In March 2014, the central bank issued a letter on the suspension of Alipay's offline barcode (QR code) payment and other business opinions, requiring a comprehensive assessment of the compliance and security of offline barcode (QR code) payments and virtual credit cards. The industry once felt that the outlook was gray. However, after Alipay's active communication and technical upgrade, in July of the same year, the QR code came back in Shanghai. In August, WeChat Pay also launched the function of "face-to-face payment" to restart QR code payment.

On August 3, 2016, the PCAC issued the "Code of Practice for Bar Code Payment" , which clearly pointed out the security standards that payment institutions need to follow to carry out bar code business, which was the first official recognition of the status of QR code.

Subsequently, on October 13, 2016, Alipay launched the collection QR code.

In February 2022, the China Payment Clearing Association issued the "Announcement on Optimizing Bar Code Payment Services" . Third-party payment institutions are required to set up a new "personal business collection code", which is separate from the "personal collection code", so as to more accurately grasp the flow of social funds and compensate for the possible risk of tax evasion by individual business merchants through QR code collection.

It can be seen that the regulatory authorities have played a positive role in the development of China's mobile payment industry, neither missing nor overstepping the mark. In the nascent stage of the industry, regulation remained silent, allowing the market to explore and solve problems on its own. When more serious problems emerged in the industry, the regulator was able to step in to correct them, establish standards, and coordinate various stakeholders to keep the industry developing smoothly.

3. **Revenge of Banks and UnionPay**

The rise of Alipay and WeChat payments has taken over the majority of the business and revenue of the mobile payment industry. For the original players in this industry, banks, more seriously, the "wallets" - virtual deposit accounts established by third-party payment institutions have seriously threatened the very foundation of the banking industry's survival.

Banks' main income comes from the interest difference between deposits and loans, and because depositors are very fragmented and their bargaining power is very weak, the interest rates they give to depositors on deposits are generally very low. However, because Alipay and WeChat Pay aggregate huge amounts of deposits, they have a very strong bargaining power for any bank, resulting in either loss of deposits or loss of profits for banks.

However, due to institutional and management issues, it is impossible for a single bank to outperform the market-oriented Internet giant companies Alibaba and Tencent in terms of innovation and R&D capabilities. Against this backdrop, banks decided to launch a counterattack with UnionPay in a group.

On February 25, 2016, China's five largest state-owned commercial banks joined forces and held a signing ceremony in Beijing. The five major banks pledged to waive the handling fee for domestic RMB transfers and remittances handled by customers through mobile banking, and to waive the handling fee for domestic RMB online banking transfers and remittances under RMB 5,000 for customers, in order to reduce customers' expenses.

On December 11, 2017, China UnionPay launch the banking industry's unified APP "QuickPass" in Beijing.

Under the guidance of the PBC, QuickPass is a unified mobile payment portal platform jointly developed, constructed and maintained by commercial banks and China UnionPay, bringing together the efforts of all parties in the industry.

QuickPass is the masterpiece of China's mobile payment technology and standard. It supports various payment applications such as QR code payment, NFC payment, money transfer, and ride code. At the same time, as a multi-side plat-

form, UnionPay already has a broad base of merchants and is growing rapidly due to network externalities and its "national team" status. As of November 2021, the number of users of the "QuickPass" app has exceeded 400 million.[29]

QuickPass is operated by UnionPay, but it is not a monopoly. In April 2021, the American Express RMB card supported access to QuickPass. UnionPay's international presence is also an important advantage for QuickPass.

4. **Foreign challenger - Apple Pay**

   In September 2015, Apple held its fall launch event, where in addition to releasing the latest iPhone 6s, it also unveiled Apple Pay, Apple's mobile payment solution, which officially launched in the U.S. on Dec. 20.

   On February 18, 2016, Apple Pay officially entered the Chinese market. Unlike the QR code payment used by WeChat Pay and Alipay, the technology chosen by Apple Pay is NFC payment. With its strong appeal and broad users in China, more than 38 million people bound their bank cards within 12 hours, triggering a lot of public attention and greatly promoting a market education of NFC payment.

   Apple's entry has greatly promoted the development of NFC payment and brought fresh blood to the global mobile payment market.

3.4.4 Summary

In terms of the development history of mobile payment in China, before the emergence of smartphones (1999), mobile payment had already appeared in China, but it was limited to the cooperation between telecommunication companies and financial institutions to complete transactions through phone calls or SMS interactions, and the transaction scenarios realized were limited to services such as phone bill payments and subway ticket purchases.

[29]Wei, Qian, "Create a New Experience of One-Stop Bank Card Management Cloud Flash Payment Transfer Repayment 0 Handling Fees to Benefit People's Livelihood"

With the development of Internet and e-commerce industry (2003), Chinese online shopping platforms represented by Taobao.com led the wave of electronic payment. Alipay, a secured transaction tool derived from the online shopping scenario, quickly developed into a multilateral platform for financial payments. The development of Alipay pushed banks to upgrade and transform their systems, laying the foundation for the later development of mobile payments.

China also had an attempt of NFC payment (2006), and cell phone manufacturers represented by Nokia and Philips had high expectation of NFC payment prospect in China, but they withdrew from the history stage early due to the emergence of Apple. The level of economic development and payment clearing infrastructure in China at the time also prevented a breakthrough in NFC payments.

With the emergence and popularity of smartphones (2011) and the rapid development of mobile Internet, China has taken a world-leading path in the development of mobile payment industry. Compared with the development history of global mobile payment, QR code technology has been vigorously promoted and used in China, reflecting China's innovation in the field of mobile payment in the era of big data. In addition to Alipay and WeChat Pay, China UnionPay's launch of QuickPass is also enriching China's payment technology and channels.

The regulator has played an active role in the development of China's mobile payment industry, neither missing nor overstepping its position. During the industry's infancy, regulators remained silent, allowing the market to explore and solve problems on its own. When more serious problems emerged in the industry, regulators were able to step in to correct them, establish standards, and coordinate with various stakeholders to keep the industry moving smoothly.

At the same time, public information shows that the ratio of capital loss due to payment risks in China's mobile payment industry is much lower than the international average, indicating that China's mobile payment has more obvious technical advantages.

3.5 China Mobile Payment Market

3.5.1 Market Size

In recent years, China's mobile payment business volume and mobile payment amount have been growing continuously. At present, the epidemic accelerates the penetration of the sinking payment market, and the future mobile payment business volume will maintain a rapid growth trend. Data show that in 2016, China's mobile payment business volume was only 25.71 billion strokes, breaking 100 billion strokes in 2019, and the national mobile payment business volume accumulated 123.220 billion strokes in 2020, an increase of 21.48% year-on-year. The latest data show that in 2021, China's mobile payment business accumulated 151.228 billion strokes, an increase of 22.73% year-on-year.

In 2016, the national mobile payment amounted to only 157.55 trillion yuan, and in 2017 it exceeded 200 trillion yuan, and in 2020 the national mobile payment amounted to 432.16 trillion yuan, an increase of 24.50% year-on-year. This figure is more than four times China's 2020 GDP (14.72 trillion dollar)[30] and 11 times the total retail sales of social consumer goods (39.2 trillion yuan).[31]

The latest data shows that in 2021, the amount of mobile payment in China is 526.98 trillion yuan, an increase of 21.94% year-on-year.[32]

[30] "Announcement by the National Bureau of Statistics on the Final Verification of GDP in 2020," National Bureau of Statistics

[31] "Total Retail Sales of Consumer Goods Increased by 4.6% in December 2020," National Bureau of Statistics

[32] "The Overall Operation of the Payment System in 2021," China Payment and Clearing Association

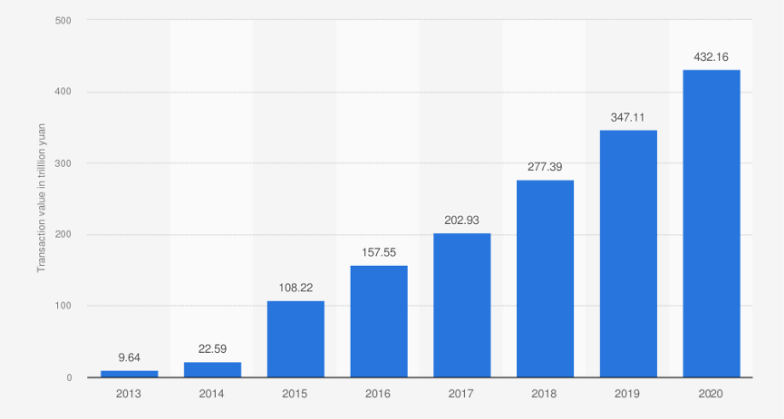


Figure 3-15: Annual transaction value of mobile payments in China from 2013 to 2020 (in trillion yuan)

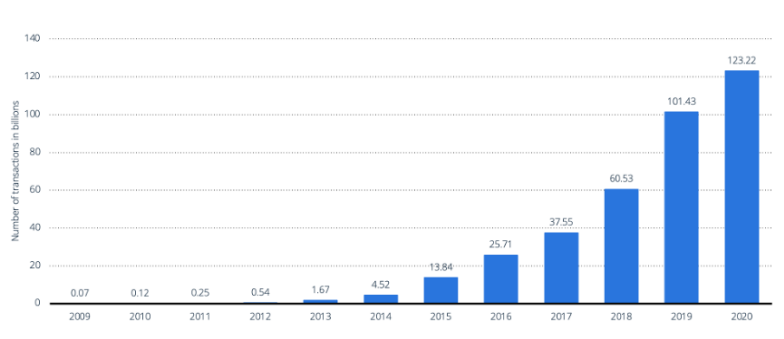


Figure 3-16: Number of mobile payment transactions in China 2009-2020 (in billions)

Due to the active third-party payment APP, people are gradually accustomed to using third-party mobile payment to make payments, and it has become the largest part of mobile payment in terms of market scale. In February 2021, China UnionPay released the "2020 Mobile Payment Security Survey Report".

According to the survey data, 98% of the respondents regarded mobile payment as the most commonly used payment method, and each person used mobile payment three times a day on average, with QR code payment being the most popular.[33]

[33] "China UnionPay Released the 2020 Mobile Payment Security Survey Report," China UnionPay

3.5.2 Users

The comprehensive layout of payment companies in mobile payment has also driven the growth of mobile online payment users. 2011-2020, the scale of mobile payment users in China has increased year by year, and the data of the "47th Statistical Report on the Development Status of China's Internet Network" released by China Internet Network Information Center shows that as of December 2020, the scale of mobile payment users in China reached 854 million, which is 34.9% higher than that of 2019 June, an increase of 34.9%, and the proportion of mobile payment use among Internet users increased to 86.4% from 72.5% at the end of 2018.[34] As of June 2021, the scale of China's online payment users reached 872 million, up 17.87 million from December 2020, accounting for 86.5% of Internet users as a whole.

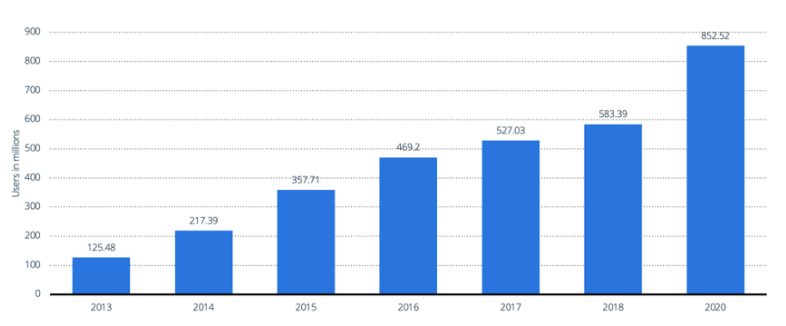


Figure 3-17: Mobile payment users in China 2013-2020 (in millions)

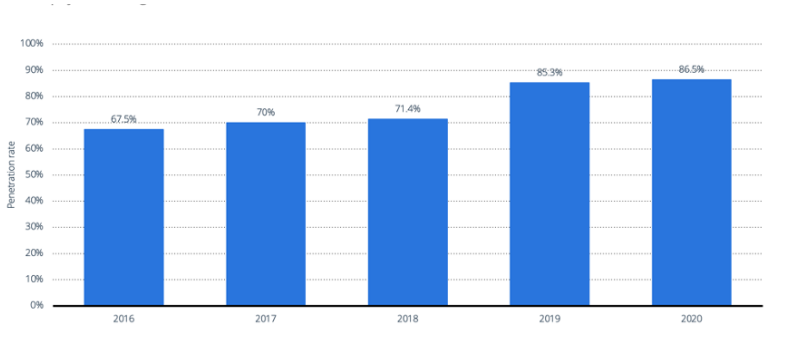


Figure 3-18: Share of mobile internet users using mobile payment in China 2016-2020

[34] "The 47th China Statistical Report on Internet Development," China Internet Network Information Center

The "2020 Mobile Payment User Questionnaire Report" released by China Payment Clearing Association shows that mobile payment is accepted by most users and is becoming the main payment method used by consumers on a daily basis. 74% of users use mobile payment daily in 2020, an increase of 4.4 percentage points from the previous year. QR code payment is the most frequently used payment method by mobile payment users, accounting for 95.2%, an increase of 2.6 percentage points from 2019. [35]

3.5.3 Market share of payment methods

Mobile payment is already the most important payment method in Chinese people's life. According to Statista, mobile payment penetration in China reached 83% in 2018.

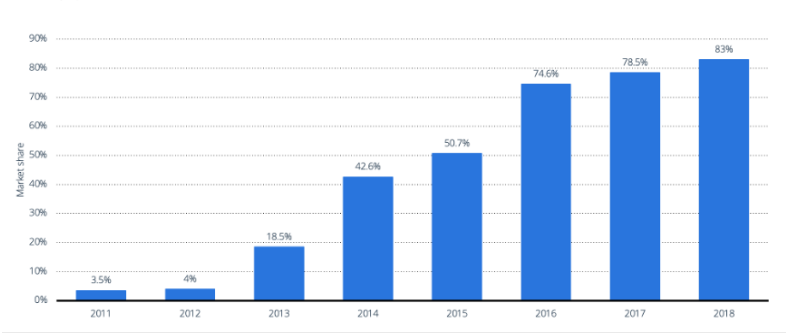


Figure 3-19: Mobile payment market share in China 2011-2018

Mobile payments in China not only have a high penetration rate, but are also used very frequently. 74% of Chinese consumers use mobile payments on a daily basis.

[35] "2020 Mobile Payment User Survey Report," China Payment and Clearing Association

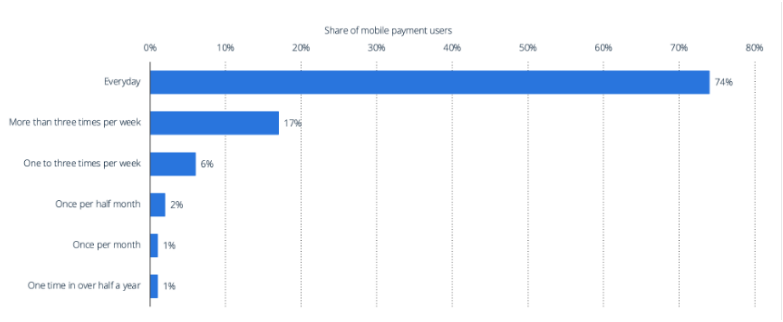


Figure 3-20: Frequency of using mobile payments in China 2020

In terms of payment amount, the main use scenario of mobile payment is small payment below 100 yuan. Only 15% of payment exceeds 1000 yuan.

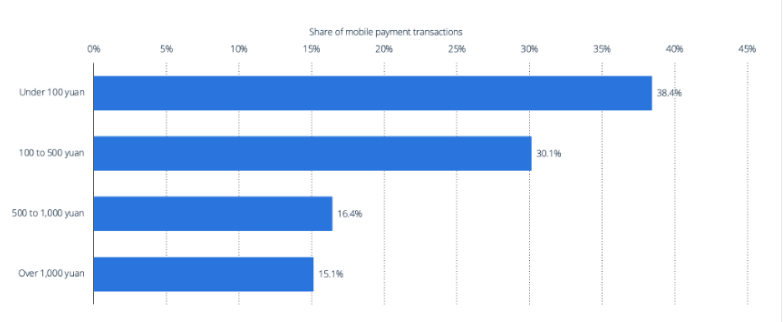


Figure 3-21: Average transaction value of mobile payments in China in 2020

According to the 2020 Mobile Payment User Questionnaire Report released by the China Payment Clearing Association, 95.2% of users will most often use QR code payments in 2020, up 2.6% from 92.6% in 2019. Users who use NFC payments decreased by 4.6% from 49.9% in 2019 to 45.3% in 2020.[36]

At present, QR code payment occupies the absolute dominant position in China's mobile payment field.

[36] "2020 Mobile Payment User Survey Report," China Payment and Clearing Association

3.5.4 Market share of e-wallet products

China's mobile payment market shows a dual oligopoly pattern.

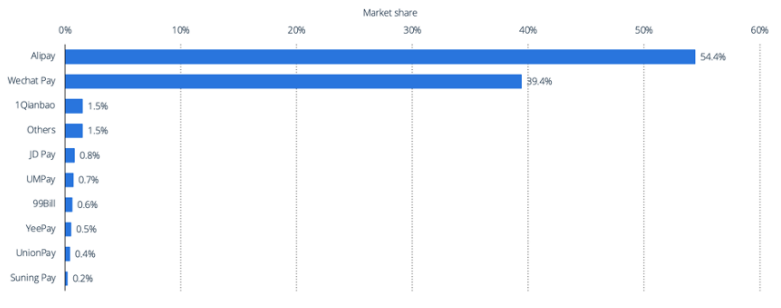


Figure 3-22: Market share of leading third-party mobile payment providers in China 2019

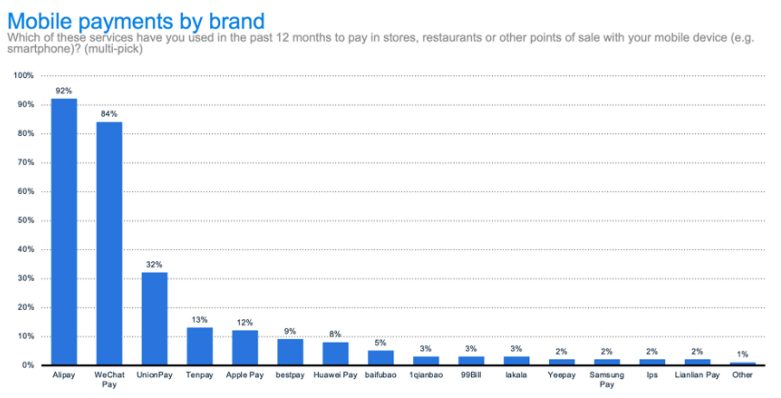


Figure 3-23: Mobile payments by brand 2022

According to another report, as of the fourth quarter of 2019, Alipay's market share is firmly in the leading position of mobile payments, at 55.10%; in second place is Tencent CaiPay (including WeChat Pay), currently at 38.9%.[37]

[37] "2020 China Mobile Payment Industry Market Analysis: Duopoly Market Share of More than 90%"

Chapter 4

Comparative Analysis

4.1 Mobile Payment Market

The development of the mobile payment industry in China and the U.S. is extremely different. As mentioned above, in 2020, after nearly a decade of development, the annual value of mobile payment transactions in China reached 432 trillion yuan. However, in the United States, mobile payment transactions value in 2020 were only 182.17 billion dollars, 0.3% of that of China.

4.2 Mobile Payment Industry Participants

The entire mobile payment process is divided into 6 layers.

The first layer is the consumer's medium of choice, such as credit/debit cards, PayPal, Apple Pay and other e-wallet products.

The second layer is the payment gateway, such as Braintree, whose role is to authenticate and authorize consumer account information.

The third layer is the merchant service provider, such as Square, whose role is to help

merchants with acquiring.

The fourth layer is the acquirer, which may be a bank or a third-party organization, such as PayPal or Alipay.

The fifth layer is the clearing network, such as Visa/MasterCard/UnionPay.

The sixth layer is the card issuing bank.

The interrelationships and business processes of these mobile payment industry participants are illustrated below.

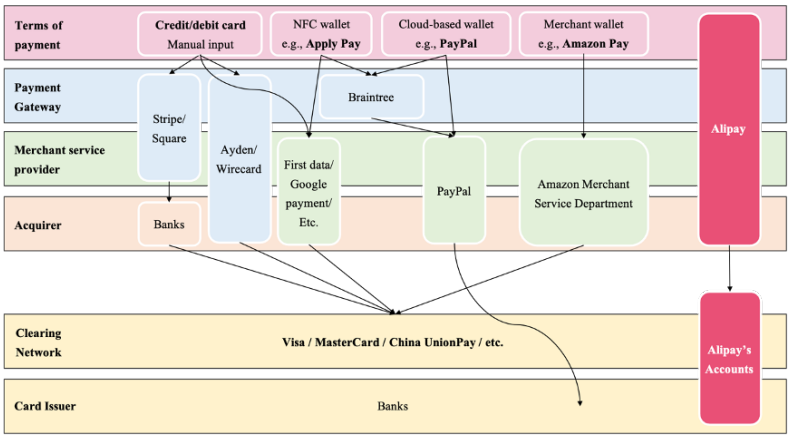


Figure 4-1: Mobile payment industry participants' diagram

The chart above shows that the levels and segments involved in third-party mobile payment companies in the U.S. are more fragmented. Each company cannot do the entire payment process on its own, but must partner with other companies or organizations. More importantly, with the exception of PayPal, all U.S. third-party payment companies must have access to the card organization's clearing network. Because they do not function as deposit accounts, any transfers and payments ultimately rely on credit/debit cards.

In complete contrast, Chinese third-party payment companies, represented by Alipay, are able to complete the entire payment process on their own. Since the mainstream payment method in China is QR code payment, after consumers scan the code, the

payment gateway verification and acquiring process can be done online without the need for additional third party service providers. As Alipay has a virtual deposit account function, clearing can even be done internally without access to the clearing network.

Thus, from the perspective of mobile payment industry participants, Chinese mobile payment companies are far more vertically integrated than in the US. The consequences of such a difference are as follow.

First, Chinese mobile payment companies have a much faster pace of technology iteration and more freedom. Because the mobile Internet is a fast-moving, application-based technology, products need to be iterated quickly. Alipay controls the entire payment process itself, so it has the freedom to upgrade its products without worrying about cooperation with other companies. This has greatly increased the speed of technology development for mobile payments in China.

Second, Chinese mobile payment companies have more data at their disposal and are able to do more business innovation. Since Alipay has access to all information about consumers' payment behavior, including time, place, amount, content, transaction object, account balance, etc. It can precisely understand more information about users, such as credit rating and repayment ability, to develop personalized financial products, thus evolving from a third-party payment service company to a comprehensive financial services platform.

Third, Chinese mobile payment companies have more "sides" to work with, creating greater network externalities. Compared to U.S. mobile payment companies, which only connect with 2-3 parties, Alipay's "sides" include consumers, merchants, banks, financial institutions, utility companies, hospitals, insurance companies, securities firms, and countless other companies and organizations. This creates incalculable network externalities for Alipay, making it a monopolistic payment and financial platform of gigantic proportions.

4.3 Mobile Payment Infrastructure

4.3.1 Banking System

The foundation of the development of the modern payment industry is the banking sector. By understanding the history of a country's banking industry, we can clearly grasp the origins and changes of the country's payment and settlement system, and eventually analyze the roots and potential of the mobile payment industry in the country.

U.S.

The U.S. banking industry started in 1780 and has been in the making for more than 200 years, roughly through the free banking era, the national banking system era and the federal reserve system era. The Fed's actions are determined by the deliberations of the members of the three entities, and the decision-making mechanism is independent of the government.

Another defining feature of the U.S. banking industry is the dualistic system of separate federal and state legislation and regulation. Since there was a long period of time in history when banks were prohibited from operating across state lines in the U.S., this resulted in each state having its own state bank and a very fragmented banking industry. There are significant differences in the scale, model, and technical level of operation of each bank, and little cooperation has been developed.

At the same time, since the birth of the banking industry, the United States has always allowed private individuals to start banks. Under this system, all U.S. banks are privately owned, except for the Federal Reserve. The primary goal of the banking industry is to reap profits. The government has very little control over the banking industry.

China

China's banking sector has developed over a very short period of time. Following the establishment of the Bank of China in 1912 and the People's Bank of China in 1949, the modern banking system was only really established by the financial sector reform in the 1980s, which is only forty years ago.

The modern Chinese banking sector is a pyramidal system with the PBC as the central bank, three policy banks, six state-owned banks and 12 joint-stock banks as the mainstay, supplemented by local commercial banks and rural credit cooperatives. 19 private banks have joined the system as a new force since 2015.

The decisions of the Chinese central bank are highly subordinate to the government's will. The Chinese banking sector can be seen as a mega financial cartel, controlled by administrative orders. All banks must obey unconditionally the orders of the central bank and the government. However, the Chinese banking sector is the government's grip on the country's livelihood, and the first goal is not to gain profit, but to maintain economic prosperity and stability.

As a result of such differences, banks in the U.S. prefer to go their own way, and if they need to cooperate, they mostly form their own alliances by region, making it basically impossible to achieve uniform changes for banks across the country. Banks are very competitive with each other, and mergers and bank failures often occur.

Chinese banks, on the other hand, are completely subservient to the central bank and have the only card organization in the country, UnionPay, as mandated by executive order. This led to a completely different bank card industry landscape in China and the U.S., and led the mobile payment industry to take a completely different path afterwards.

4.3.2 Payment and Clearing System

The payment, clearing and settlement system is the infrastructure for the functioning of the modern banking industry. Without a payment and clearing system, banking

operations can only be conducted within the same branch, and neither off-site nor interbank operations can be handled. The payment and clearing infrastructure in both countries has undergone a shift from manual processing to automated processing, but a very different pattern has developed.

U.S.

The payment clearing system in the United States has undergone a long development. In the beginning, the clearing business was undertaken by a clearing agency jointly founded by private banks and, after the establishment of the Federal Reserve, by Fedwire, a subsidiary of the Federal Reserve. 1970 saw the establishment of the Clearing House Interbank Payment System (CHIPS) by the New York Clearing House for electronic clearing. 1980 saw U.S. legislation allowing private institutions to provide CHIPS officially became the major provider of large-value payment clearing services in the United States.

Also in the 1970s, as the use of checks in the U.S. continued to grow at a rapid pace and manual processing was cumbersome, private banks took it upon themselves to form the Automatic Clearing House (ACH), whose goal was to replace paper check transactions with electronic transactions, dramatically improving the efficiency of payment clearing. Later, ACH became a provider of regular, recurring, small-dollar payment clearing services in the United States. In the era of e-commerce, ACH also became the primary clearing platform for electronic and mobile payments.

In summary, the U.S. payment, clearing, and settlement system has more layers and more complex structures. Multiple payment systems are initiated and operated by different entities or alliances, and all are privately owned and capitalized, over which the Federal Reserve and government have no direct control. Banks can choose for themselves which payment and clearing platforms to join.

China

China's payment clearing system was manual until the 1980s. After the transition of

The Electronic Interbank System (EIS) (1989-2005), the China National Automatic Payment System (CNAPS) became the only payment clearing infrastructure in China and was upgraded to the second generation in 2013.

In CNAPS, there are three systems that are most important. HVPS (2002) processes large payments in real time and BEPS (2005) processes small payments in bulk. IBPS (2010) integrates the advantages of HVPS and BEPS and provides 7x24-hour service for transfers under 50,000 RMB, which greatly improves the efficiency of social fund flow and the success rate of online payment services, and plays an immeasurable role in the development of China's payment system and the explosion of mobile payment.

In 2017, China established a network payment clearing platform for non-bank payment institutions, referred to as NetsUnion. By requiring all third-party payment institutions to access this platform, China has brought all payment practices in society into a unified payment clearing system for supervision and management.

To recap, the U.S. payment clearing system is more hierarchical, more clearly divided, and mostly operated by associations of private banks. In contrast, all banks in China use a single payment clearing system, operated by the central bank and subordinate to government orders.

Such differences result in the U.S. payment clearing system being designed with a greater emphasis on the interests of member banks. If the growth of the third-party payment industry would weaken the banks' interests, it would be difficult for the payment clearing system to make corresponding changes to match the business of the third-party payment companies.

In contrast, China's payment clearing system is subordinate to the government's directives and places more emphasis on the interests and efficiency of society as a whole. When the business volume of Taobao.com and Alipay started to explode in 2005, the whole payment clearing system started to be upgraded, driven by the strongest bank, ICBC. By 2010, the "Super NetsUnion" was built to accommodate e-payments and mobile payments, and all banks were connected to the system. This

has created a solid foundation and a smooth path for the development of China's mobile payment industry.

4.3.3 Credit/Debit Card

There is a significant difference in the maturity of the card industry between China and the U.S. This difference greatly influences the payment methods that people in both countries are accustomed to choose and has had a huge impact on the origin and development of the mobile payment industry.

According to Statista, the credit card penetration rate in the US is much higher than in China. This makes Americans more accustomed to choosing credit cards for payments in their daily lives.

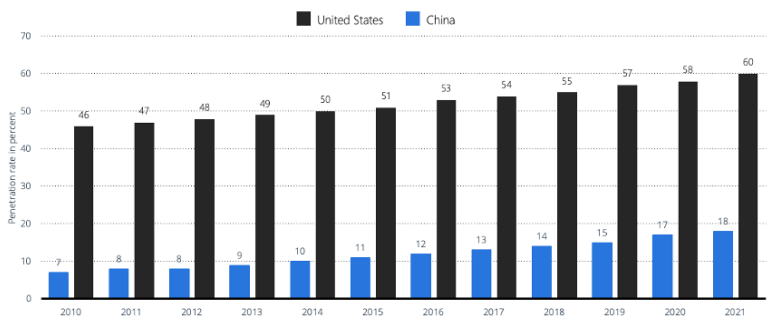


Figure 4-2: Credit card penetration in the United States and China 2010-2021

In addition, the U.S. has a high POS penetration rate due to the developed card payment industry. China, on the other hand, did not establish UnionPay and a unified bank card standard until 2004, and POS penetration remained low in the following years, resulting in Chinese people being accustomed to paying with cash. As a result, when Alipay launched QR code payments in 2012, many Chinese had never used a bank card to make payments, but simply saw it as a deposit and cash withdrawal voucher (like the author herself). This innovation has greatly improved the convenience of payments for Chinese consumers compared to American consumers,

and as a result has been quickly and widely accepted by Chinese consumers.

Another big difference between the credit card industries of the two countries is that due to the fierce competition in the market, credit cards in the US return a percentage of the purchase amount in cash to the consumer (typically 1%-3%), which provides an incentive for consumers to spend as much as possible with their credit cards. China, on the other hand, has never had a card-issuing bank use this marketing technique. As a result, the cost for Chinese consumers to switch to mobile payments is much lower.

4.3.4 Card Organization

There are 6 major card organizations in the world, 4 of which are owned by the US (Visa, MasterCard, America Express and Diners Club) and only 1 in China (UnionPay). The nature and interests of card organizations in China and the US are completely different.

Card organizations in the United States are private institutions. They are founded by private banks or corporations, and their main goal is to make a profit; Visa generally charge 0.21% of the transaction amount as the Interchange Reimbursement Fee[1], while Amex functions as both an issuer and a clearing organization, charging 1.6% -2.4%.[2]

China UnionPay is a card organization formed by the central bank requiring all banks to come together. The government uses executive orders to require all social units to access this network. This has resulted in UnionPay being more of an infrastructure in the payment clearing system. Although UnionPay also generates revenue and profits, it actually charges many public welfare and benefit organizations at reduced or no cost. Since 2016, UnionPay has been charging only 0.0325% of the transaction

[1]Visa Public, "Visa USA Interchange Reimbursement Fees," Visa
[2]American Express. "Network Assessment Fees", 2022

amount as a fee.[3] This amount is one-sixth of what Visa and MasterCard charge, and one-ninetieth of what Amex charges.

As a result, UnionPay has a much weaker incentive to prevent the development of the third-party mobile payment industry for the purpose of safeguarding its own interests, and gives Alipay a more lenient space to grow relative to its U.S. counterparts.

4.4 Business Model and Industry Chain Value Distribution

The difference in value distribution between the U.S. and Chinese mobile payment industries is significant.

Visa, for example, has a merchant discount of 2.11% for the four-party model, with the card issuer taking the biggest risk and getting the biggest return. Visa and acquirers earn hard money, each collecting about 0.2%. The merchant discount is about 2.1%.

In the case of Alipay, China has stipulated by law that the merchant discount cannot exceed 0.6%, of which the card issuer gets 0.45% and the clearing organization and acquirer jointly get the remaining 0.15%.[4]

[3]Lakala. "What Are The Unionpay POS Fee Rates?"
[4]Lakala. "What Are The Unionpay POS Fee Rates?"

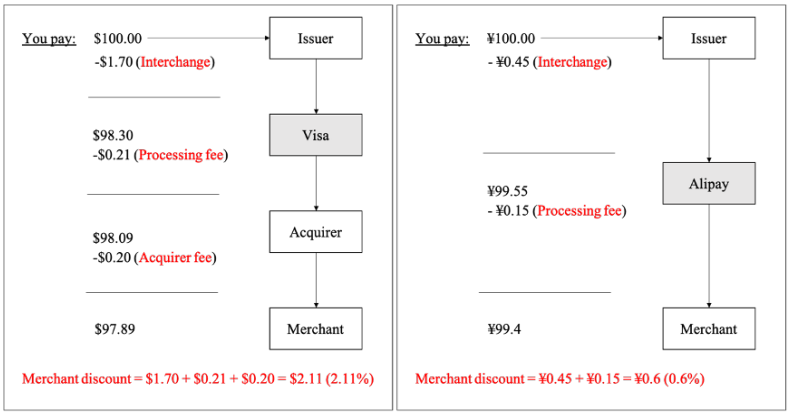


Figure 4-3: Visa vs. Alipay - merchant discounts

Therefore, for Chinese banks and payment clearing institutions, the loss of accepting mobile payments is far less than that of U.S. banks and payment clearing institutions. This has facilitated the development of China's mobile payment industry.

4.5 Innovators' Endowment

Since payments is a naturally platform-based industry, network externalities play a very large role. Innovators' endowments play a critical role in the early stages of the platform. The U.S. and China have unique industry distributions, and the different endowments of their mobile payment innovators have led them down different paths.

The parent companies of China's mobile payment leaders - Alipay and WeChat Pay - are two unique companies. One of them is the largest e-commerce company in China, and the other is the largest social company. In the multilateral platform model, they already have a large pool of customers and are growing rapidly after finding the right scenarios (Alipay - online guaranteed transactions; WeChat Pay - acquaintance transfers).

Smartphone manufacturers such as Apple generally have another endowment, hardware, so Apple has a huge push for NFC payments.

Chapter 5

Conclusion

This paper aims to find the deep-seated reasons for the differences in the development of the mobile payment industry between the U.S. and China through historical and comparative research by examining the journey and lineage of the development of the infrastructure of the payment industry in both countries - the banking industry, the payment clearing system, the bank card industry, and the payment industry as a whole.

After the analysis in Chapters 2 to 4, this paper concludes that the following four factors play a decisive role in the differences between the development of the mobile payment industry in China and the United States:

First, industry infrastructure.

The mobile payment industry is not a new industry developed in isolation, but is deeply dependent on the established banking and payment clearing system, combined with innovations made by the rapidly developing Internet technology and smartphone industry. Therefore, mobile payment cannot be developed in isolation from a country's existing payment and clearing system, but must rely on it. China's highly centralized banking industry and single payment clearing system brought great convenience to the early development of Alipay, while the U.S. does not have such favorable

conditions.

Second, the context of the times.

The timing of the great development of China's bank card industry, the time when China's payment clearing system underwent modernization and reform and the time when China entered the Internet era basically overlapped, resulting in the Chinese evolving from cash payments to electronic payments and then to mobile payments almost in one leap, with almost no period of separate bank card payments. This means that China's bank card penetration rate and POS penetration rate are both much lower than that of the United States, resulting in China not having the objective conditions to shift from bank card payments to NFC payments, giving birth to the innovation of QR code payments and leading China's mobile payment industry to take a unique path.

Third, innovators' endowments.

The parent companies of China's mobile payment leaders - Alipay and WeChat Pay - are two unique companies. One of them is the largest e-commerce company in China, and the other is the largest social company. In the multilateral platform model, they already have a large pool of customers and are growing rapidly after finding the right scenarios (Alipay - online guaranteed transactions; WeChat Pay - acquaintance transfers). Smartphone manufacturers such as Apple generally have another endowment, hardware, so Apple has a huge push for NFC payments.

Fourth, stakeholders.

The distribution of interests in the payment industry chain has a significant impact on the development of mobile payments. Compared to the U.S. merchant discounts of 2%-3%, Chinese law stipulates that merchant discounts may not exceed 0.6% in total, card issuer fees are between 0.35% and 0.45%, clearing agency fees do not exceed 0.065%, and the remainder belongs to the acquirer. Therefore, for Chinese banks and payment clearing institutions, the loss of accepting mobile payments is far

less than that of U.S. banks and payment clearing institutions. This has facilitated the development of China's mobile payment industry.

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