



## INDUSTRY BRIEF ON PAYMENT SYSTEMS

**Payment systems are “a set of common rules and procedures, which support the transfer of funds between people, businesses and financial institutions”<sup>1</sup>. Modern payment systems provide the means of transferring funds without physical interaction. Their relative efficiency generates vast benefits for consumers, producers, and intermediaries. They are vital to the national and global economy.**

### 1. INTRODUCTION

Transactions are not easy. Do consumers get what they paid for? Is a consumer’s claim of a defective product valid? Did sellers get what the payments they were promised on a timely basis? Put simply, most transactions take place without a “complete contract.” (Refer to the Brief on *Incomplete Contracts and Opportunism*.)

Payment systems do not eliminate all *transactions costs*;<sup>2</sup> they do not create a complete contract between parties to a transaction. But a payment system can reduce some types of transactions costs. If the payment system is fast, then the lack of a gap between payment by the customer and receipt of funds increases certainty and reduces risk. Payment systems may also provide safeguards against fraud for buyers. Conversely, they protect for sellers against consumers who lack funds for their purchases. If large numbers of buyers and sellers use a particular payment system, then network effects make payments yet more convenient.

Technology is now changing payment systems around the world. We are in a fascinating time period when paper currency, credit cards, and digital payment systems (both public and private) all compete with each other.

In Section 2, we identify the characteristics of payment systems. In Section 3, we review the history of payment systems through the development of credit card networks. In Section 4, we turn to digital payment systems. We close in Section 5 with intriguing questions about the fate of cash and cryptocurrencies.

Please note that the Appendix provides information about differences in payment systems across China, EU, and US.

### 2. CHARACTERISTICS OF PAYMENT SYSTEMS

Importantly, a dollar is a dollar, a Euro is a Euro, etc. But the costs of transactions in these currencies vary greatly by the method of payment. Cash transactions have no fees. Many digital transactions, especially in China, have fees that are approaching zero. Could they go negative? Meanwhile, PayPal charges have substantial fees. (In 2022 students in 960 predicted that

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<sup>1</sup> [www.bankofengland.co.uk/payment-and-settlement](https://www.bankofengland.co.uk/payment-and-settlement).

<sup>2</sup> The vast literature on transactions costs started with Ronald Coase’s article, “The Nature of the Firm”, *Economica* (1937).



PayPal's business model was vulnerable. They were right! Since then, PayPal had to cut its commissions.) Credit cards that have rewards features, e.g., points for travel, cash back, have the highest fees. So-called interchange fees can exceed 3 percent.

Put differently, the *Law of One Price* does not hold across these means of payment. Why? The answers lie in product differentiation and differences in efficiencies.

Speed of settlement. The term "settlement" is informally synonymous with "delivery". Multiple banks and bank-type organizations operate in almost any country, and they often transfer funds to others. This creates some risk, which is mediated by an intermediary (the settlement agent), often with significant governmental oversight. In general, long settlement times create opportunities for fraud. Cash transfers are immediate; bank checks are slow, which leads to the possibility of "check kiting"; wiring funds is fast but involves some set-up; and digital transactions are nearly instantaneous.

Fraud risk. Banks now confirm credit card and check transactions above various limits. The fraud risk of transactions using one's phone is not yet well understood.

Point of sale. Presenting one's credit to the merchant is less efficiency than inserting it in a chip terminal. Chip terminals are less efficient than scanning your phone.

Fees. Cash has no fees. Credit cards have substantial fees. What will be the terminal fee structure for on-line payment systems? A good case can be made for zero based on actual practice and the underlying economics. Any positive fee risks users on both sides of the market. New systems of course compete with old systems whose fees vary. Of note, interchange fees depend on factors such as whether the transaction was performed online or in store and other factors. The EU and Australia, capped interchange fees at lower levels (currently 0.3% of the transaction for credit cards and to 0.2% for debit cards in the EU). Nevertheless, credit cards and so-called "premium cards" that provide discounts and awards to users are under competitive pressure. (Rf. "Premium Cards Lose the Shine", *WSJ*, page B1, June 29, 2020.)

### 3. FROM COINS TO PLASTIC

A compelling case can be made that payment systems spurred a wide-ranging set of advances over the last 3,000 years. (Yale's William Goetzmann has written a terrific history, Money Changes Everything, Princeton, 2016.<sup>3</sup>) The Greeks used silver and gold coins in the 5th Century B.C. Indian coins date back to the 7th Century B.C. The Chinese introduced coins yet earlier. The shifts from coins to paper currency varied greatly in timing and completeness.<sup>4</sup> Scholars believe that China was early among countries to introduce paper currency, in part as a complement to the coins used in the 8<sup>th</sup> and maybe even in the 9<sup>th</sup> century BC.<sup>5</sup> Paper currencies

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<sup>3</sup> Review of William Goetzmann, Money Changes Everything, *Financial Times* ([www.ft.com/content/015d965c-16ab-11e6-b197-a4af20d5575e](http://www.ft.com/content/015d965c-16ab-11e6-b197-a4af20d5575e)). The FT states: "Money Changes Everything is a global history of this technology, with a focus on the ancient near east, classical Greece and Rome, China through the Song dynasty, and medieval and modern Europe.

<sup>4</sup> See for example, "The Transition to Paper Money," RBS, 2017, [www.rbsremembers.com/remembers/banking-in-wartime/supporting-the-nation/the-transition-to-paper-money.html](http://www.rbsremembers.com/remembers/banking-in-wartime/supporting-the-nation/the-transition-to-paper-money.html).

<sup>5</sup> Rf. Niv Horesh, "From Chengdu to Stockholm: A Comparative Study of the Emergence of Paper Money in East and West," *Provincial China*, Vol. 4, No. 1 (2012).



have been a great advantage to governments if they can secure a monopoly in their production and, when necessary, over-supply the market to reduce the real value of their debts.

Paper currencies were complemented by “bank checks,” which led to the monthly ritual of individuals and families writing out checks for the mortgage, utilities, insurance, and contractors.

Checks still exist in large part because the signatures of the payor and payee document the transactions in a legally enforceable way.

Advances beginning around 1960 focused the use of plastic credit cards. Plastic has a big advantage for customers who do not want to carry large amounts of cash.<sup>6</sup> The same is true for merchants not wanting to accept, hold, and process cash. As explained by David S. Evans and Richard Schmalensee in the great reference, Paying with Plastic: The Digital Revolution in Buying and Borrowing (MIT Press, 2004), both open (Visa, MasterCard) and closed (American Express) developed with complex contracting that include so-called interchange fees that are divided among the intermediaries.

Credit card transactions involve these steps:

- i. Authorization using information about the credit card and the cardholder;
- ii. Approval of the transaction using information about the purchase;
- iii. Completion of the transaction by the merchant; and
- iv. Clearing and settlement, i.e., actual transmissions of funds.<sup>7</sup>

In the case of open systems, the parties include the cardholder’s banks as well as the credit card network. In the case of closed systems, the only important intermediary is the network itself.

What are the major lessons from the development of credit cards? Efficient payment systems attract densities of sellers and customers. While interchange fees – typically in the range of 2 to 3 percent – led to litigation around the world, the “factoring” (payout) of these fees to the various parties left the networks with net fees well below 0.5 percent. The ratio of net revenue to Visa and MasterCard to the gross value of transactions is further reduced by the credit card company bearing the costs of non-payment and, in some cases, seller fraud. (FYI, in open systems, most banks use SWIFT, a secure interbank network headquartered in Belgium, to transfer funds between one another. These transfers occur regularly, e.g., daily, but not instantly. Merchants could not reliably use SWIFT because they need to get approval of transactions within a few seconds. One can view the development of credit card companies as a solution to the problem of facilitating transactions across large numbers of customers and sellers<sup>8</sup>.)

#### 4. DIGITAL PAYMENT SYSTEMS

Payment systems are now undergoing another wave of innovation featuring on-line payments

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<sup>6</sup> For a relatively brief period, so-called traveler’s checks were popular. Better than cash, but ultimately less convenient than an American Express card.

<sup>7</sup> Many institutions are involved in the payment process. Different companies clear wire transfers and payments, manufacture card terminals, operate online payment providing services, exchange currencies, and offer extra services such as dynamic currency conversion (DCC). For example, Ingenico and Verifone are two largest manufacturers of wired and wireless credit card terminals, which merchants use to receive payments from customers. These payments, however, do not go to merchants immediately; the clearing house may wire all funds after a business day ends, or only on certain days of the week.

<sup>8</sup> Stripe, a fintech decacorn startup, was widely successful in the US since it developed cheap devices with similar capabilities to a standard terminal yet cheaper and compatible with most mobile phones. As of January 2020, Stripe offers its magnetic stripe reader for free to its new users, while a chip card reader can be purchased for under \$30.



using personal devices. Annual transactions now exceed \$2T.

China, where the role of banks in payment systems was limited compared to EU and US, is the leader in mobile payments. Tencent's WeChat Pay works because Tencent has a user base of has over a billion active users (rf. [businessofapps.com](http://businessofapps.com)). If those customers get in the habit of using WeChat Pay, Tencent gains substantial traction in developing the other side of the two-sided market, i.e., sellers. Alibaba has also taken realized network economies within China's big market. Now others, like Apple and PayPal, operate payment systems that by-pass banking institutions that in recent decades were viewed as indispensable. Along with these networked approaches, governments are introducing payment their own payment systems.<sup>9</sup>

The shifts to these on-line payment systems vary across countries and demographic groups. Wallets in China and many countries are slim or non-existent. A person pays with his or her phone using various new networks. In the US and Europe where, as indicated, banks have developed stronger relationships with clients. A major US Bank's advertising slogan is, "What is in your wallet?", remains highly relevant. Geographic diversity in payment systems is indeed striking. Many payment systems widely used in one country are non-existent in other countries, even among developed states. QR-code generated payment systems known from China (WeChat Pay, AliPay) or Japan (LinePay) are virtually non-existent in western countries. India's central bank has supported UPI but requires zero transaction fees. While the approaches differ, across the globe we observe a shift toward new payment systems.

## 5. WILL CASH AND CRYPTOCURRENCIES SURVIVE?

As indicated, cash can be transferred quickly. More important to its possible survival, cash transactions can be *anonymous* and *private*. Those features of cash appeal to people who want to give money to relatives, "take care of local officials", avoid paying taxes, and engage in criminal activity. However, those same features do not appeal to governments and high-minded citizens.

Who will win the argument? Given the growth of governments around the world and their appetites for tax revenues, the odds for cash surviving are not good. Some may lament the death of "Cash is King" but it probably is not far off.

What advantages do Cryptocurrencies have? Some libertarians view them favorably because they are not controlled by central banks. Instead, they are based on algorithms that are not public but presumably "locked in"<sup>10</sup> But are cryptocurrencies actually a good means of making transactions? A huge problem is that their valuations change dramatically from month to month. For this reason alone, they are unlikely to be a major competitor to other payment systems with less risk.

## 6. WILL GLOBAL SYSTEMS EMERGE?

The argument in favor is that digital payment systems can easily span borders and that network benefits increase as a payment system moves from one country to a region and then beyond.

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<sup>9</sup> The Mexican government launched its own mobile payment platform, CoDi, in September 2019.

<sup>10</sup> <https://insights.som.yale.edu/insights/is-cryptocurrency-really-new-idea>.



One could imagine that consumers would benefit from global payment systems and that competition among them would lead to zero fees for most transactions.

The arguments against the development of global payment systems is that governments have demonstrated that they want to be involved in the evolution of payment systems and, in some cases, want to provide payment services. This reflects the power that comes with control of payment systems. Payment systems backed by a government or clearly identified as from another country is one more reason to pay attention to the role of tensions among countries.

A recent reference is the Economist's special briefing on *Digital Finance*, May 20, 2023. Among the many insights are these two:

- i. Credit cards and cash have been surprisingly resilient.
- ii. Going forward, competition will continue among (a) credit card networks and banks, (b) government supported payment systems in important countries like Brazil and India, and (c) the China's top two – Alibaba and Tencent.

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## APPENDIX

This appendix covers two topics: Regional Differences and the potential for a pan-Asian payment system.

### Regional Differences

Regions exhibit important differences in what payment systems they rely on. Some differences are due to different initial conditions, e.g., the developed banking system in the US and the lack thereof in China.

**Means of Payment at point of sale (POS) (%) Across Geographic Regions**

Means of Payment	Geography		
	China (2022) <sup>11</sup>	EU-20 (2022) <sup>12</sup>	US (2023) <sup>13</sup>
1. Cash	8%	59%	12%
2. Credit cards and debit cards <sup>1</sup>	33%	34%	69%
3. Online Payment Systems / Digital Wallets <sup>2</sup>	56%	3%	15%
4. Others	<3%	4%	4%
TOTAL	100%	100%	100%

<sup>11</sup> <https://www.statista.com/statistics/1296674/preferred-payment-methods-china/>

<sup>12</sup> [https://www.ecb.europa.eu/stats/ecb\\_surveys/space/html/ecb.spacereport202212~783ffdf46e.en.html](https://www.ecb.europa.eu/stats/ecb_surveys/space/html/ecb.spacereport202212~783ffdf46e.en.html)

<sup>13</sup> <https://www.statista.com/statistics/568523/preferred-payment-methods-usa/>



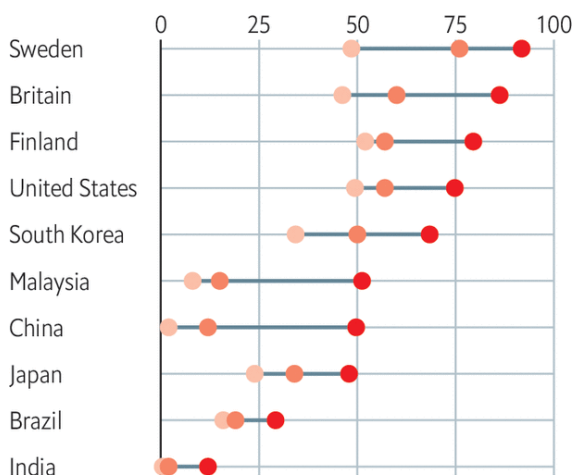


### The digital march

Non-cash payments as % of all transactions

By volume

● 2011 ● 2016 ● 2021



Source: McKinsey Global Payments Map

The Economist

Note: The percentage calculations differ across regions, e.g., using GDP as the denominator versus total transactions. Hence, some differences across cells in the table are due to differences in methodologies used by the sources cited below.

### Potential for a pan-Asian payment system

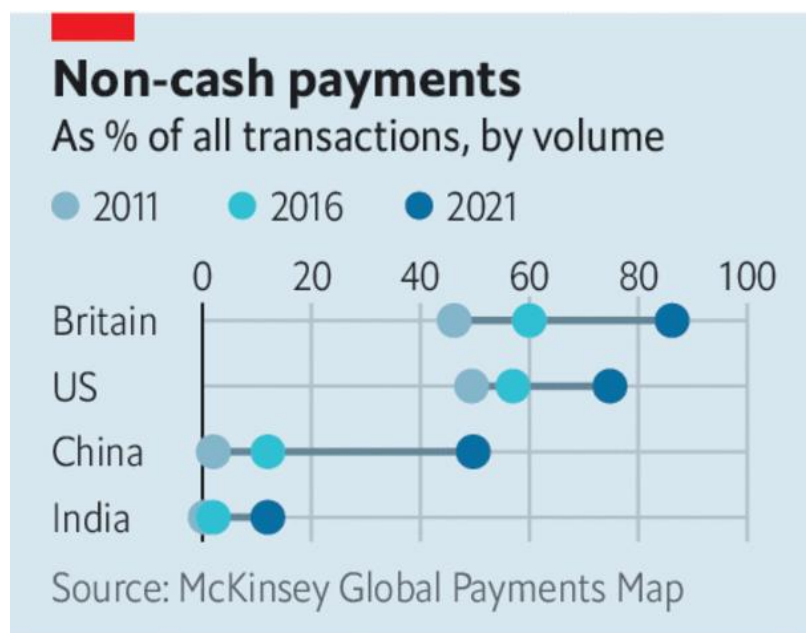
Alipay (together with Tencent's WeChat Pay) has transformed how people in China use money. In fact, China has consistently ranked number one in mobile payment markets (whether in transaction volume or penetration rate) in the world, and both players have built eco-systems around their mobile payment tools.<sup>14</sup> The race to transform payments is now going global. Cross-border retail spending (including tourism) and remittances will hit \$5 trillion in 2023; business-to-business payments are worth eight times that, according to the Economist. The West's legacy system, including the Visa-Mastercard duopoly and SWIFT,<sup>15</sup> a messaging system for bank payments, is the dominant incumbent. China is the most advanced challenger, with Alipay and WeChat Pay, its card network, UnionPay, and Cross-Border Interbank Payment System (CIPS), its more expansive alternative to SWIFT. And China isn't alone. Some countries are also building multilateral payment linkages that allow citizens to use their domestic favourites abroad. In third place is India, whose ambition to deploy UPI globally has grown. GrabPay of Malaysia/Singapore is usable across much of Southeast Asia. China is leading the creation of an Asian payments system, with the yuan as the primary currency. As technology cheapens possible alternatives to the dollar, they may come to challenge the West's grip on international finance.

<sup>14</sup> Yiping Huang, Xue Wang, Xun Wang; Mobile Payment in China: Practice and Its Effects. *Asian Economic Papers* 2020; 19 (3): 1–18. doi: [https://doi.org/10.1162/asep\\_a\\_00779](https://doi.org/10.1162/asep_a_00779).

<sup>15</sup> <https://www.wsj.com/articles/swift-banking-system-sanctions-biden-11645745909> (March 1, 2022).



The competition among the three blocs is heating up fast. Alipay is now accepted by 2.5 million merchants overseas, from Dubai to Washington, DC. UnionPay, which is already the world's largest card network by transaction volume, is accepted by 65 million merchants globally, compared with Visa's 100 million. (Most of them are outside China.) India's UPI has been linked with Singapore's fast payment system, allowing consumers in both countries to pay in the other using their domestic platform. India is in talks with more than 30 other countries to export its payments kit, which would link their systems too. In November four central banks, including China's, successfully tested a cross-border system for settling transactions using CBDCs (central-bank digital currencies).



The Economist

### Some Insights into Differences Across Regions

1. Means of payment differ within regions. Eastern Europe uses more cash (35.9%) than Western Europe (15.3%) (<https://www.pymnts.com/cash/2017/global-cash-index-reports-strong-cash-usage-in-europe/>) Within China, Eastern cities use more online payment than Western cities. (<https://www.statista.com/statistics/1147688/china-city-distribution-of-mobile-payment-users/>) US residents in the Northeast and Upper Midwest own more credit cards and have higher credit scores. (<https://www.businessinsider.com/credit-card-use-across-the-us-2018-8>)
2. Means of payment differ within age groups. In US, senior citizens prefer Amex and paper-based checks, Generation X likes credit cards, Generation Y and Z embrace online payment. (<https://blog.clover.com/how-different-age-groups-prefer-to-pay/>) Chinese seniors who prefer cash feel left behind as mobile payment become more difficult to learn





while other generations mainly use digital wallets.

(<http://en.people.cn/n3/2019/0409/c90000-9565055.html>) In EU, 65+ seniors prefer cash, young and middle age group of 25-39 likes to pay by credit cards.

(<https://www.ecb.europa.eu/pub/pdf/other/ecb.spacereport202012~bb2038bbb6.en.pdf>)

3. China did not have a well-developed commercial banking system as compared to EU and USA. Hence, the installed base of credit card users has been historically lower in China than in EU and US. (<https://www.politico.com/story/2019/04/02/china-us-credit-card-companies-1309803>)
4. EU has not allowed the development of “super Apps” like Tencent and Alibaba, aiming to create fair competition for the entire ecosystem of European developer. (<https://techcrunch.com/2021/05/01/this-week-in-apps-eu-rules-apples-a-monopoly-spotify-and-facebook-team-up-att-arrives/>)
5. The coronavirus pandemic has accelerated the shift from cash to digital wallets. (<https://www.cnbc.com/2020/12/03/covid-19-pandemic-accelerating-the-shift-from-cash-to-digital-payments.html>)
6. Use of Cryptocurrencies is forbidden due to Chinese Government Ban. In June 2021, China has banned crypto mining operations and ordered major banks not to do business with crypto companies. (<https://www.voanews.com/east-asia-pacific/voa-news-china/why-china-cracking-down-bitcoin>)
7. US companies have been somewhat open to crypto currency, including Microsoft, PayPal, Overstock, whole Foods, Etsy, Starbucks, Newegg, Home Depot, Rakuten (HQ in Japan), Twitch.



(<https://www.gobankingrates.com/money/business/10-major-companies-that-accept-bitcoin/>)

8. EU's key regulatory concerns related to cryptocurrency include: a threat to financial stability and monetary policy, no credible contribution to own funds, widespread use but no adequate regime.

([https://www.europarl.europa.eu/RegData/etudes/STUD/2020/648779/IPOL\\_STU\(2020\)648779\\_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2020/648779/IPOL_STU(2020)648779_EN.pdf))

#### Terminology:

- Automated clearing house (ACH)
- Real-time gross settlement (RTGS) – a type of payment system where settlement occurs instantaneously, without a waiting period,

For others, see [A glossary of terms used in payments and settlement systems](#) by the Bank for International Settlements

#### Readings:

William N. Goetzmann, [Money Changes Everything: How Finance Made Civilization Possible](#) (2016)

[Payment Systems Explained](#) at Payments Systems Regulator, a regulatory body for the payments industry in the United Kingdom (2023)

[Fast retail payment systems](#), BIS Quarterly Review March 2020, Bank for International Settlements

[The Federal Reserve Payments Study: 2022 Triennial Initial Data Release](#)

[Where Digital Payments, Even for a 10-Cent Chai, Are Colossal in Scale](#), New York Times (March 1, 2023)