



4-2024

## Advantages and Disadvantages of the Chinese Digital Yuan

Mikayla Cheng

Follow this and additional works at: <https://scholarsarchive.byu.edu/sigma>



Part of the [International and Area Studies Commons](#), and the [Political Science Commons](#)

---

### Recommended Citation

Cheng, Mikayla (2024) "Advantages and Disadvantages of the Chinese Digital Yuan," *Sigma: Journal of Political and International Studies*: Vol. 41, Article 4.

Available at: <https://scholarsarchive.byu.edu/sigma/vol41/iss1/4>

This Article is brought to you for free and open access by the Journals at BYU ScholarsArchive. It has been accepted for inclusion in Sigma: Journal of Political and International Studies by an authorized editor of BYU ScholarsArchive. For more information, please contact [ellen\\_amatangelo@byu.edu](mailto:ellen_amatangelo@byu.edu).

---

---

# Advantages and Disadvantages of the Chinese Digital Yuan

Mikayla Cheng

## Introduction

While digital monetary transactions are by no means a new concept, China's rapid progress toward a completely cashless society through the release of its digital yuan marks a pivotal point in monetary history. In recent years, China has advanced significantly in promoting the digital payment systems including Alipay and WeChat Pay. As of 2021, over 87% of mobile internet users in China had adopted mobile payments, with urban areas reaching an almost 90% adoption rate (Slotta 2023a). Digital transactions in the Asia Pacific region have the fastest predicted growth rates in the world: 109% from 2020 to 2025 and 76% from 2025 to 2030 (PricewaterhouseCoopers 2021). In 2014, China took the next step in digital payment technology by proposing and implementing a fully digital, government fiat, legal tender currency known as Digital Currency Electronic Payment (DCEP), or the digital yuan (Yeung and Mullen 2021). The rollout of the digital yuan began with pilot programs in four cities: Shenzhen, Suzhou, Xiong'an and Chengdu (Li and Gao 2022), but has since expanded to more than 15 cities (Reuters 2022). China is also testing the digital yuan outside its mainland borders: from August to September 2022, the People's Bank of China (PBoC) engaged in a 40-day trial to test trade settlements with Hong Kong, Thailand, and the United Arab Emirates (Feng 2022).

Many speculate about the true motivations of China's leadership with respect to the digital yuan. Although the digital yuan currently constitutes only a small percentage of all digital transactions in the country, some believe that China is in the process of achieving a fully cashless society (Smialek 2021). While the Chinese government has not verified any of these speculative claims, nor is it incentivized to do so, former PBoC president Li Lihu reported in a livestream that "it is estimated that the digital Yuan

could replace 30%–50% of the cash in the country within two to three years” (NetEase 2022). Whether or not these expectations are realistic, it is inferred that achieving a fully cashless society is within the realm of possibility for China’s intended goals with the digital yuan. Understanding the implications of the adoption of digital yuan and a fully cashless society, especially in the context of China, is the focus of this paper.

## Thesis

The research questions I intend to explore are, what are the advantages and disadvantages of the implementation of China’s digital yuan system for Chinese citizens, and is the full implementation of the digital yuan a net advantage or disadvantage for Chinese citizens? I hypothesize that the advantages of China’s digital yuan system for the people of China are reduced domestic transaction costs, internationalization of the digital yuan, and increased financial inclusion, while its disadvantage is the centralization of transaction data.

First, the digital yuan system benefits the Chinese people through eliminating domestic transaction fees for merchants and providing a smoother transaction experience through its unified infrastructure with existing Chinese government systems. I show that the full transition to digital yuan eliminates merchants’ transaction fees, saving them billions of dollars annually. The government’s advanced facial recognition system would help reduce friction for each transaction and increase convenience for both merchants and consumers through faster transaction speeds and improved accessibility for those who have difficulty entering a PIN or handling cash and cards.

Second, the digital yuan system benefits the Chinese people through the gradual internationalization of the yuan. The employment of digital yuan in cross-border transactions would improve the speed and efficiency of international payments that would benefit Chinese businesses and individuals that engage in international trade. I demonstrate the ways in which the international payment system under fully implemented digital yuan overpowers the current international payment system through a comparative cost-benefit analysis between the two systems. I also examine the feasibility and possible extent of the digital yuan’s internationalization in African countries at the domestic level, and how such internationalization would increase the value of the jobs of the Chinese people.

Third, the digital yuan benefits the Chinese people through increasing financial inclusion. I examine the innovations of the PBoC and other tech companies that promote the inclusion of currently marginalized groups, such as the elderly population and rural population. These innovations include new forms of technology like digital yuan hardware wallets, smartwatches, wristbands, and walking sticks made possible through the ability of third parties to build on top of the digital yuan.

Lastly, the digital yuan is a drawback to the Chinese people through the increased centralization of transaction data it entails. I first evaluate the extent to which the centralization of data consolidates the CCP’s power and the feasibility of the CCP upholding its promise to guarantee consumer privacy regarding the digital yuan. I

then review successful instances in which the CCP used data to promote social welfare of the people including lifting more than 800 million people out of poverty (World Bank 2022), and how digital yuan transactions would harm those who engage in illegal and unpopular behavior. In addition, I explore how the digital yuan's infringement on consumer privacy disproportionately impacts ethnic and religious minorities. Finally, I conduct a comparative case study of the CCP's response to the COVID-19 pandemic, using it as a reference point to illustrate what unprecedented access to digital yuan transaction data could entail. I find that while tracking data may have been helpful to the CCP in successfully containing the virus, the CCP's privacy violations and data manipulation throughout the pandemic bodes ill for the likelihood that consumer privacy will be fully respected regarding digital yuan transaction data.

After analyzing the effects of the full implementation of the digital yuan, I evaluate whether the digital yuan is ultimately an advantage or disadvantage for the Chinese people through a cost-benefit analysis. I find that the collection of digital yuan transaction data as an additional layer of surveillance will not make a substantial difference in the CCP's ability to monitor and punish citizens' behavior in the long run because the CCP's current surveillance measures are already capable of comprehensive monitoring even in the absence of the digital yuan's transaction data. I therefore conclude that the digital yuan's advantages of reduced transaction costs, internationalization of the yuan, and increased financial inclusion outweigh its disadvantage of centralizing digital yuan transaction data.

## Historical Background

In the last decade, China has experienced a transformation of its payment systems. Until the mid-2000s, physical cash remained the most common transaction method, even with the invention of credit and debit cards. In fact, despite owning the world's most robust card network (UnionPay) that comprises 6.9 billion debit cards and 686 million credit cards, 99% of people in China regularly used cash in 2013 (Thunes 2023). At the time, only a paltry 34 million point-of-sale readers (machines used to read credit and debit cards) existed among China's population of 1.4 billion people. A report from Brookings explains this as a signal of merchants' unwillingness to pay the minimum 1% transaction fee demanded by electronic payment systems (Klein 2019). However, cash is not without its own issues: China's largest denomination of physical cash is the \$100 yuan note (roughly \$15 U.S. dollars), which may be inconvenient especially when purchasing items of high value (*ibid.*). It was not until QR codes became popular that smartphones became a viable alternative for the convenience of cash without the fees incurred by credit cards, and WeChat Pay and Alipay rose to dominate the transaction space. While these mobile payment platforms present several advantages over cash and cards, they are not without their own flaws. For example, their implementation is still founded on the traditional banking system and controlled by a few private Chinese technology companies. The Chinese government has sought to further modernize its payments system by introducing

the digital yuan, which allows individuals and businesses to conduct transactions directly through the central bank without the need for commercial banks or private payment processors.

According to an article by Weixin (WeChat), the first trials of the digital yuan were conducted in October 2020, in which 200,000 randomly selected Chinese citizens across the cities of Shenzhen, Suzhou, Xiong'an and Chengdu received 200 yuan (~\$30 USD) (John 2020). In each city, 50,000 randomly selected residents received digital yuan 'red envelopes' that contained 200 digital yuan that could be used to pay for goods and services at participating merchants. 47,573 individuals claimed the money and transacted almost \$1 billion yuan in aggregate (Weixin 2020). The trials were a step forward in proving the digital yuan's ability to deliver on its promises through convenience and absence of transaction fees.

In 2021, a collaboration between PBoC and Meituan (a Chinese shopping platform) further expanded the trials by opening digital yuan access to all residents within nine major Chinese cities, and as of January 2022, 260 million people (18.4% of China's population) used it (Liao 2022). According to a report from the World Economic Forum, one resident said, "I've always wanted to try the digital yuan and experience how different it is from Alipay and WeChat Pay, after seeing it so much on TV. It's really easy to use, whether it's paying or topping up" (Fries 2021). While China has not released official survey poll results of citizen opinion on the digital yuan, trial results have shown that millions of people have used it for online shopping, utility payments, transportation costs, and more, suggesting that its ease of use has made it a practical alternative to the dominant payment platforms (Reuters 2020). However, questions have been raised concerning the meaning of "controlled anonymity" and the extent of which government surveillance will affect the lives of digital yuan users (Lucero and Jiang 2021).

China is not alone in its development of a central bank digital currency (CBDC). As reported by the International Monetary Fund, approximately 100 countries are currently exploring CBDCs, including the Bahamas, Sweden, India, and Nigeria (Georgieva 2022). The common themes of these digital currencies include financial stability and privacy considerations, with countries taking varying approaches. It appears, however, that China's digital yuan has seen the most progress in terms of adoption and transaction volume with over one hundred million users and transactions worth billions of yuan (ibid.)

## **The Digital Yuan**

The independent variable of my paper is the implementation of China's Central Bank Digital Currency, or digital yuan system. The implementation of the digital yuan refers to the transition from the old to new state of China's currency and, for the purpose of this paper, is measured by whether or not it is present. Measuring the implementation of digital yuan as a binary outcome is an oversimplification; one could instead measure the implementation by the percentage of physical cash

and reserves that are replaced with digital yuan. However, while the reality is that China is currently in the midst of the transition, this paper focuses on the potential final outcome of China's initiative: the replacement of all physical cash. With the full implementation of the digital yuan, a government-backed e-wallet with unrivaled compatibility would be offered alongside existing payment methods like credit cards, WeChat Pay and Alipay. The digital yuan will likely have the advantage in several areas, including reduced transaction costs and integration with existing systems.

According to the Deutsche Bank, there are several distinguishing characteristics of the digital yuan (Deutsche Bank 2021). First, the PBoC is responsible for issuing digital yuan and ensuring its security for users. Second, the digital yuan will not offer interest, which is consistent with its role as a physical cash replacement. Third, conversion between digital yuan and bank deposits can only be implemented by authorized banks rather than non-bank entities or individuals. With banks as the only intermediaries allowed, the PBoC can more effectively track and manage the flow of digital yuan.

The People's Bank of China is effectively controlled by the Chinese Communist Party (CCP) and already dominates over 90% of China's credit card industry (Horowitz 2018). With the addition of the digital yuan as a replacement for physical cash, the PBoC will be able to track data on the location, time, amounts and individuals in nearly every monetary transaction in China. The digital yuan is designed to work alongside popular Chinese payment services like WeChat Pay and Alipay, rather than in competition. Notably, the digital yuan would provide features that these services do not offer including the ability to conduct small transactions anonymously, similar to physical cash (Gill 2021). However, Mu Changchun, the research director of the PBoC, claims that while it is possible for the digital yuan to attain limited anonymity, it is impossible to attain total anonymity because of the digital yuan's requirement of retaining user identification for payment processes (Singh and Bansal 2021). Additionally, for larger transactions, like funds transferred between provincial governments and towns, digital yuan could be utilized to prevent corruption through the currency's traceability (ibid.). Digital yuan will not constitute 100% of transactions in China. There will still be alternatives to the digital yuan, including foreign credit cards that are not associated with China, and commodities (e.g., gold) and gifts. Existing payment methods such as Alipay and WeChat pay through bank accounts will still be available and unrestricted by the government. Considering the patterns of China's capital controls in recent years (Yeung 2021), this paper assumes that as the digital yuan becomes more fully adopted, China will see modest reductions in capital controls. Thus, the internationalization of the digital yuan will be a slow and gradual process.

There have been concerns that, after the launch of the digital yuan, Chinese citizens might move money en masse from their bank accounts to government-backed e-wallets. While digital yuan wallets were never meant to replace bank accounts, it is possible that citizens will preemptively store some amount of money in their digital wallet, similar to how U.S. citizens can add money into their Venmo accounts for easy access (Bloomenthal et al. 2023). At the scale of the population, withdrawing even a relatively small sum of money could put strain on the Chinese banking system, which

is a crucial pillar of the Chinese economy. To preempt these disruptions, the PBoC is considering implementing constraints on consumers. According to South China Morning Post, “The PBoC told the IMF that it is likely to limit e-yuan to small, retail transactions by setting maximum daily and yearly limits on payments and that it will only process large amounts by appointment. The PBoC said it may apply fees for large-sum or high-frequency transactions. It will also offer no interest on accounts” (Tudor-Ackroyd 2020). However, since the threat of bank destabilization due to withdrawals is only present during the initial phase of the digital yuan rollout (ibid.), it is predicted that these constraints will only be temporary. Between the gradual nature of the digital yuan rollout and the temporary constraints on digital yuan wallets, a mass transfer of money from banks to digital yuan wallets is unlikely. Thus, the banking industry will retain its essential status in citizens' day to day lives and has little to fear with respect to disruption by the digital yuan. Finally, it is important to note that even if the current known constraints on consumer spending may be acceptable to most Chinese citizens, this does not necessarily prevent the government from imposing future constraints. Therefore, while the digital yuan may reduce transaction costs, promote internationalization of the yuan, and increase financial inclusion, constraints on consumer spending and the lack of interest on accounts may stand as significant costs to Chinese citizens' privacy and consumer autonomy (Bloomberg Intelligence 2021).

## **Advantages of the Digital Yuan**

In this section, I will illustrate three advantages of the digital yuan: decreased domestic transaction costs, opportunities for internationalization, and increased financial inclusion of Chinese citizens.

### **Domestic Transaction Costs**

First, the digital yuan system reduces domestic transaction costs. Domestic transaction costs refer to the required monetary cost of processing each digital yuan domestic transaction as well as the convenience of each transaction for people who currently use digital payment systems (this does not typically include the elderly or rural populations). Domestic transaction costs are measured by the cost per transaction as a percentage of the total transaction. A broader definition of transaction costs includes barriers to using the digital yuan such as the lack of internet coverage, a cell phone, or the ability to navigate digital platforms. I demonstrate that the digital yuan reduces transaction costs for merchants and increases the seamlessness of transactions through its unified infrastructure with the Chinese government.

#### *Transaction Fees for Merchants*

What makes digital yuan appealing from the merchant's perspective is the ability to avoid the ~0.6% transaction fee incurred by WeChat Pay and Alipay (Oceanpayment 2022) while maintaining no transaction fees for consumers (Ledger Insights 2022). To evaluate the potential cost savings of migration to the digital yuan, Table 1 illustrates



a hypothetical full substitution of credit cards and mobile payments (WeChat Pay and Alipay) with digital yuan. Given that credit cards and mobile payments respectively constitute 18% and 54% of transaction volume (Best 2023), and there was an estimated total transaction volume of \$6.15 trillion USD throughout China domestically in 2021 (Republic of China 2022), I calculated the transaction fees saved by merchants assuming that they used digital yuan instead. I did this by multiplying the percentages by the total transaction volume, yielding \$1.11 T and \$3.32 T. Since WeChat Pay and Alipay have an approximate transaction fee of 0.575% (the average of 0.6% for WeChat Pay and 0.55% for Alipay), these payment methods incur \$38.8 B and \$19.1 B transaction costs, respectively. Thus, the full implementation of the digital yuan system would create a domestic transaction cost savings of \$57.9 B U.S. dollars annually, directly into the hands of the people.

It is also important to note that 100% substitution may never be reached. Therefore, it is useful to examine various stages of digital yuan rollout, which is also shown in Table 1. Figure 1 shows the decrease in transaction fees over the course of the digital yuan rollout. Figure 2 shows the progressive shrinkage of other payment types as the digital yuan gains market share during its rollout; one may consider the diminishing credit card and mobile payments sectors of Figure 2 as the portions that generate transaction fees. Overall, this analysis shows that billions of USD can theoretically be saved by merchants in aggregate through using digital yuan. The increase in savings of Chinese merchants through the digital yuan would enable them to lower the prices for goods and services because the merchant would be able to transfer the savings from lower transaction fees to consumers. Consequently, the purchasing power of Chinese consumers would increase, thus stimulating China’s domestic economy.

**Table 1: Digital Yuan Rollout Plan (all \$ figures in trillions)**

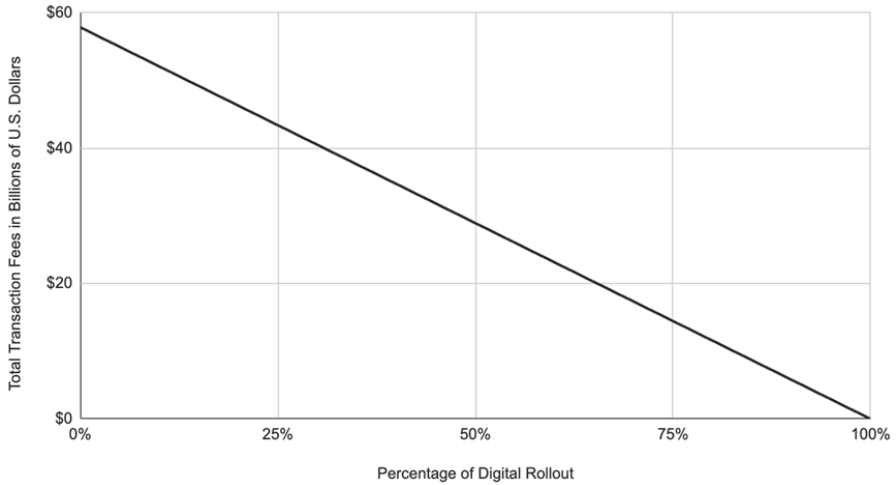
% Rollout	Cash/Debit	Credit Card	Mobile Payments	Digital Yuan	Total Fees
0%	\$1.72	\$1.11	\$3.32	\$0.00	\$0.58
20%	\$1.34	\$0.89	\$2.66	\$1.23	\$0.46
40%	\$1.03	\$0.66	\$1.99	\$2.46	\$0.35
60%	\$0.69	\$0.44	\$1.33	\$3.69	\$0.23
80%	\$0.34	\$0.22	\$0.66	\$4.92	\$0.11
100%	\$0.00	\$0.00	\$0.00	\$6.15	\$0.00

Sources: Best 2023; People’s Republic of China 2022; Sampi Marketing 2022. Computed by author.

\* This table is based on China’s total transaction volume as \$6.15 trillion U.S. (People’s Republic of China, 2022), and assumes constant transaction volume distribution across various payment sectors throughout the rollout of the digital yuan: 28% cash-like payments (debit card, cash, prepaid card), 18% credit card transactions and retailer/bank financing, and 54% of E-wallet, digital/mobile wallet (Best, 2023). E-wallet, digital/mobile wallet refers to all mobile payment types except for digital yuan. Credit card transaction fees are assumed to be 3.5%, while mobile payment transaction fees are assumed to be 0.575% (the average of the transaction fee for WeChat Pay and Alipay, which are by far the largest mobile payment platforms) (Sampi Marketing, 2022).

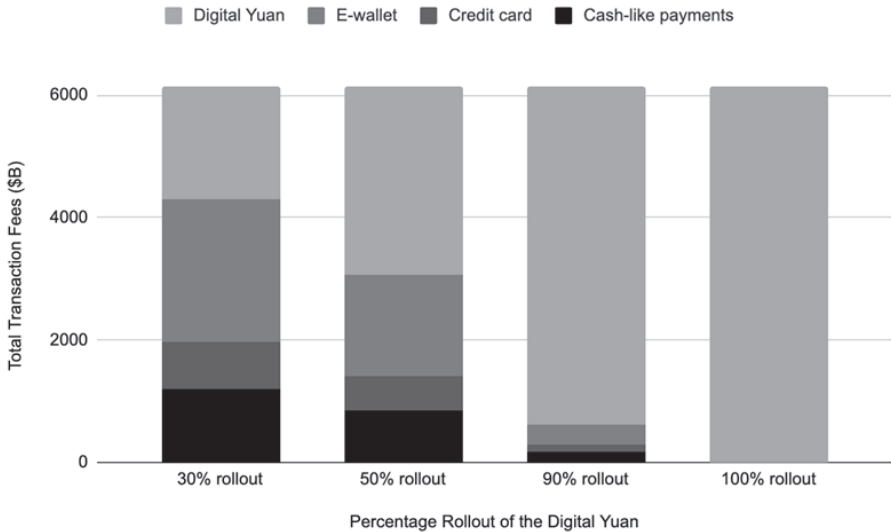


**Figure 1: Percentage of Digital Yuan Rollout and Total Transaction Fees**



Sources: Best 2023; People’s Republic of China 2022; Sampi Marketing 2022. Computed by Author.

**Figure 2: Digital Yuan Rollout Distribution**



Sources: Best 2023; People’s Republic of China 2022; Sampi Marketing 2022. Computed by Author.

\* Transaction fees go down as the credit card and mobile payments sectors shrink over the course of the Digital Yuan’s rollout. Credit cards cause more transaction fees than mobile payments. As digital yuan is rolled out, there are less transaction costs for merchants.

### *Unified Infrastructure with Chinese Government*

Beyond reduced transaction fees, the digital yuan also presents advantages in convenience due to its unified infrastructure with the Chinese government. For example, Alipay has long attempted to push a facial recognition feature in its payments app. However, it has yet to be fully trusted by consumers in its current form, due to concerns over its accuracy and reliability (Tang, 2022). In contrast, the Chinese government is known to have collected significant amounts of facial data from which they may train accurate facial recognition models (Qian et al. 2022). As demonstrated during the COVID-19 pandemic, China mastered 95% accuracy in facial recognition of citizens wearing masks (Yang 2020). With the digital yuan, the government would theoretically be able to introduce a facial recognition feature that far outpaces Alipay and other private companies' offerings due to the vast amount of data that the Chinese government collects. Studies show that fast facial recognition can speed up transactions in stores by up to five seconds per person, which cumulatively amounts to hours of time saved per day for both consumers and merchants (Skift Meetings 2022). Furthermore, facial recognition improves accessibility for those who have difficulty entering a PIN or handling cash and cards. Therefore, the reduction of friction for each transaction increases convenience for both merchants and consumers.

In addition, the introduction of the digital yuan will provide more opportunities for innovation and competition in the digital payment space, since any new or existing company can develop new payment solutions or services on top of the digital yuan (Klein 2022). In contrast, Alipay and WeChat Pay are proprietary payment systems controlled by private companies that can have the final say on what features can be developed on top of their systems. Although significant innovations in payment solutions on top of the digital yuan have yet to emerge, it is likely they will eventually bring new, creative conveniences to users in a similar way to how online banking paved the way for Venmo.

### **Internationalization**

Second, the digital yuan system creates opportunities for internationalization. Internationalization refers to China's geopolitical significance based on its financial autonomy and is measured by the amount of digital yuan adopted by international businesses and other countries. The greatest limitation to the internationalization of the digital yuan is China's tight capital controls. However, this paper assumes that capital constraints will gradually be relaxed as an essential precondition for the moderate internationalization of the digital yuan to occur. Under these assumptions, Table 3 demonstrates the ways in which the international payment system under fully implemented digital yuan overpowers other international payment systems through a comparative cost-benefit analysis. Other popular payment systems include the international credit card processors VISA and Mastercard, the Unified Payments Interface (UPI) developed in India, and the dominant international financial messaging system in the world: SWIFT (Society for Worldwide Interbank Financial Telecommunications). I then assess the extent to which the internationalization of the digital

yuan will lead to increased demand for Chinese goods and services, as well as create job opportunities for Chinese citizens.

**Table 3: Cost-benefit comparison of the international payment system under full implementation of the digital yuan and current international payment system.**

	<i>MasterCard</i>	<i>VISA</i>	<i>UPI</i>	<i>SWIFT</i>	<i>Digital Yuan</i>
<i>Used by consumers</i>	X	X	X		X
<i>Used by institutions</i>				X	X
<i>High Volume of Transactions</i>	X	X	X		X
<i>No Currency Conversion Fees</i>			X		X
<i>Internationally Used</i>	X	X		X	X
<i>Strict Privacy Controls</i>				X	
<i>No Transaction Fees</i>			X		X
<i>Instantaneous Transactions</i>	X	X	X		X

Sources: Best 2022; Elad 2023; Corporate Finance Institute 2023; Mastercard 2023.

A comparison of the digital yuan with other international payment networks and processors. Overall, the digital yuan strikes a balance between versatility and efficiency, with privacy concerns being its major disadvantage.

### *International Transaction Costs*

While China is a top trading partner in the world, its currency only constitutes roughly 2% of the world's reserve currency (IMF 2022). However, China's digital yuan enables China to modestly challenge the hegemony of the U.S. dollar through its reduced transaction costs and instantaneous transaction speed (Aredy 2021). To take credit card transactions as an example, the current transaction fee for a cross-border credit card transaction ranges from 3% to 7%. With digital yuan, that cost is reduced to 0% (Kiogi 2022). Whether the digital yuan will achieve lower international transaction costs through subsidies by the government or by the efficiency of its implementation is currently unclear, but the lower fees will nonetheless galvanize adoption in the short term. The elimination of this transaction fee would incentivize other countries to engage in more trade with China, and thus bolster the Chinese economy.

Secondly, international payments typically require 1 to 4 business days for processing, while digital yuan transactions are relatively instantaneous. The speed of digital yuan would lead to an increased liquidity for yuan users due to virtually eliminating settlement time in international transactions (Kagan 2022). These key advantages of the international payment system under full implementation of the digital yuan will help Chinese businesses more easily expand beyond the domestic market. The improved convenience of the digital yuan ultimately increases demand

for Chinese goods and services, creating more job opportunities for Chinese citizens. Thus, while other logistical challenges including shipping costs, custom barriers, and trade barriers remain, the decrease of friction in international transactions enhances China's strategy to strengthen its domestic economy and the economic livelihoods of its citizens.

One clear path to internationalization of the yuan is the Belt and Road Initiative (BRI), China's initiative to promote economic development through the building of infrastructure in Asia, Europe, and Africa. If other states were to adopt the digital yuan as the primary means of international commerce, especially with regards to BRI, China could reinforce a separate international financial network, independent of Society for Worldwide Interbank Financial Telecommunications (SWIFT) that processes more than 80% of international transactions worldwide (Raymaekers 2019). As illustrated in Table 3, the weaknesses of the current international payment system under SWIFT are the exclusion of consumers, currency conversion fees, transaction fees, and no instantaneous transactions. On the other hand, the international payment system under full implementation of the digital yuan addresses each of these weaknesses: it is used by consumers, supports a high volume of transactions, incurs no currency conversion fees, incurs no transaction fees, and has instantaneous transaction speed.

The improved convenience of the Chinese yuan makes it an appealing option to Chinese privately-owned and government-owned international businesses for their cross-border transactions. Furthermore, as the yuan becomes gradually more internationalized, the demand for yuan as a reserve currency would increase, making the yuan a more enticing currency option for countries to hold and use in international transactions and investments. Consequently, this would incentivize more countries to form swap lines with China to strengthen their own economic stability. For example, as of 2021, China established a 350 billion yuan swap line with the UK that enabled it to trade pounds for Chinese yuan (Reuters, 2021), proving the yuan is a viable alternative currency for other countries. Overall, increased usage of the digital yuan would strengthen the yuan's reputation as an international currency and China's credibility as an economic partner, which would boost the overall economic welfare of Chinese citizens. Assuming the gradual relaxation of China's capital controls, the internationalization of the Chinese yuan will provide a way for China and the international community to diversify its options for cross-border transactions. The dual benefit of internationalization is that China's economy and reputation will be strengthened while Chinese citizens are simultaneously protected from the risks of relying too heavily on a U.S.-dominated financial system.

#### *Digital Yuan in Africa*

Not only would the digital yuan increase China's influence on the broad international stage, but it would also promote China's soft power within specific regions. For example, there is ample evidence that China has turned its attention toward gaining influence in Africa: Chinese investors have heavily invested in

Africa's mobile finance sector through platforms like Alipay and digital payment companies founded in Africa; in 2020, approximately 50% of all smartphones in Africa were made in China (Tremann et al. 2021). China's broad reach in Africa's cell-phone market can be attributed to its success in tailoring its products and infrastructure to African consumers, including camera improvements for portraying darker skin (ibid.). In 2020, Huawei launched the Mate 40, a smartphone with a pre-installed digital yuan wallet that utilizes China's digital yuan network. While it is improbable that the Mate 40 would attain popularity in Africa due to both its expensive cost (\$1700 USD) and the lack of access to Google apps (Olander 2020), the launch of this phone marks an important milestone in China's efforts to establish the digital yuan abroad. China's significant public investment in Africa and influence over Africa's smartphone industry places it in a favorable position to implement the digital yuan in Africa when the opportune moment arises.

The digital yuan also opens the opportunity for China to further promote its presence in Africa by reducing the high costs of sending and receiving remittances. If other countries see the success of digital yuan in Africa, they would be more enticed to adopt digital yuan. Overall, the gradual internationalization of the digital yuan would strengthen Chinese currency relative to other currencies, leading to cheaper imports and the ability to dedicate the Chinese workforce to more advanced product development. Internationalization has already enabled China's economy to shift away from basic manual labor towards the design and creation of world-class products, as demonstrated by top companies like Huawei and China's impressive strides in military technology. Thus, internationalization of the yuan through the digital yuan would further increase the value of the jobs of the Chinese people.

The employment of digital yuan in cross-border transactions would benefit Chinese businesses and individuals by improving the speed and efficiency of international trade payments. This theoretical chain of events follows a similar path to events that occurred in Singapore, which embraced low tariffs, promoted free trade, and reduced capital restrictions to become one of the most internationally embraced economies in the world (Zarrolì 2015). Although this future for China is far from certain, it is clear that achieving even a portion of this hypothetical scenario would be a significant win for Chinese citizens and businesses in foreign markets. However, the caveat is that the internationalization of the Chinese yuan would enable the Chinese government to have greater control and monitoring over capital flows, limiting Chinese citizens' ability to move their money abroad.

## **Financial Inclusion**

One of the touted benefits of the digital yuan is increased financial inclusion for China's citizens. Financial inclusion refers to the overall accessibility to financial services and products given to individuals and businesses, especially those who have been historically marginalized from the financial system like the elderly and rural populations. Financial inclusion is measured by the percentage of people who have access to financial services (like saving accounts) that empower them to build assets,

manage finances, and improve their financial welfare. Overall, the full implementation of China's digital yuan would increase financial inclusion of Chinese citizens who have previously been excluded from the financial system, especially rural and elderly citizens.

#### *Rural Citizens That Lack Internet Coverage*

Of the 37% of China's population that lives in rural areas, many still do not have access to smartphones or a reliable internet connection (World Bank 2021). The digital yuan offers a way for those without smartphones, an internet connection, or battery power in their smartphones to pay using near field communication (NFC), a technology that utilizes radio frequencies to communicate wirelessly over short distances. While such transactions will be limited in amount and frequency, the ability to pay offline is an advantage for the significant portion of the population that lives in less developed rural areas and lacks internet coverage (ibid.).

In 2022, China's smartphone penetration rate reached 72% and is predicted to reach 82.8% by 2027 (Slotta 2023b). Despite the rapid and broad reach of smartphones among China's population, these statistics indicate that there were still roughly 398 million people (28% of China's 2022 population) in 2022 that did not have access to a smartphone, and roughly 242 million people (17.2% of China's projected 2027 population) that will not have access to smartphones in 2027 (ibid.). To address this disparity, the PBoC has developed a payment device to make the digital yuan accessible to those who do not have mobile phones: the hardware wallet. Resembling a credit card or debit card in appearance, the digital yuan hardware wallet allows users to make digital yuan payments without access to a phone or internet service (Le and Ge 2021). Utilizing NFC technology, the hardware wallet can store digital yuan and enables the user to spend the digital yuan near point-of-sale terminals (ibid.). In the first trial for the digital yuan hardware wallet conducted at Tongren Hospital in Shanghai, one hardware wallet user remarks, "It's the first time to spend with digital renminbi, and it feels very convenient, and I can see the balance, so I feel at ease" (ibid.). The inclusion of China's rural population in the digital yuan system through the variety of empowering devices would contribute to building a more unified domestic economy in China. The digital yuan would not only bring increased convenience for individual rural consumers, but it would also be a stepping stone for strengthening the economy in rural China as a whole.

#### *Elderly Citizens*

Even if the capital for implementing digital yuan is provided, the transition to digital yuan will likely be difficult for certain groups within China, especially the elderly. The South China Morning Post reports that the current trend towards a cashless economy is already causing "tens of millions of older people" to be left behind, with "state media repeatedly reporting on the nightmarish experiences they face because of their difficulties navigating a smartphone" (Wang 2020). In addition, one must consider how changes over time to the digital yuan system or interface, especially if frequent, could cause confusion among the populace in general. For example,

if the constraints discussed under the transaction costs section are implemented and change frequently, it may be a source of surprise and complexity for some Chinese citizens who adopt the digital yuan system.

One population sector that is vital to consider is China's rapidly aging society that reached 264 million people (18.7% of China's population) in 2021 and is predicted to reach 38.8% by 2050 (Slotta 2022). As of December 2019, individuals above 45 years old made up 15% of smartphone users in China (Slotta 2022). The elderly Chinese population currently face a 'digital divide' as there are several inconveniences they face when using a smartphone including reading small text, typing, eye-hand coordination, and understanding complex user interfaces. To promote implementation of the digital yuan, China has focused on catering to the needs of elderly citizens.

Alongside hardware wallets, the PBoC and tech companies like Antgroup, Tencent, and Huawei are in the process of creating wearable devices like bracelets, wristbands, and smartwatches that would also incorporate the digital yuan wallet to provide additional accessibility (Bloomberg 2021b). These devices with a built-in digital yuan chip enable the immediate transfer of currency from an e-wallet without any internet connection (Shenzhen Daily 2021). To empower the elderly citizens who do not have access to a smartphone or have trouble using the digital yuan interface, the PBoC developed a walking stick with an embedded digital yuan chip that allows near-field communication (NFC) transactions without internet connection (Bloomberg 2021a). These innovations can help mitigate the difficulty of using digital yuan, but still present a learning curve to the elderly, especially those without mobile phones.

## **Disadvantages of the Digital Yuan**

In this section, I will illustrate how the digital yuan may infringe on the privacy of consumers despite the CCP's promise to uphold individual consumer privacy. While the CCP's access to data has historically enabled it to promote social welfare in the country, including lifting hundreds of millions of people out of poverty, its access to digital yuan transaction data raises substantial consumer privacy concerns from Chinese citizens.

### **Centralization of Transaction Data**

The transition to digital yuan entails increased centralization of transaction data, which refers to the Chinese government and CCP's ability to access monetary transaction data at both the national and individual levels. Centralization of transaction data is measured by the percentage of access the government has to all the monetary transactions that occur in China. The increase of transaction data enables the CCP to enhance current social surveillance systems including SkyNet and the Social Credit System with the added dimension of financial transaction data. On the one hand, the CCP can leverage its unprecedented access to consumer data to implement and improve effective social policies, including policies that have lifted



more than 800 million Chinese people out of poverty. On the other hand, this data access demonstrates how the digital yuan would further erode consumer privacy. Through analyzing consolidation of the government, social welfare programs, and the CCP's response to COVID-19, I examine the extent to which data can enhance the effectiveness of government and promote social welfare.

### *Consolidation of the Government*

Currently, 96% of China's domestic electronic monetary transactions are controlled by payment providers in the private sector (Tudor-Ackroyd 2020). While China's government can already exert control over domestic electronic monetary transactions through WeChat Pay, Alipay and other payment platforms, it must partner with the private technology companies to do so. Thus, China's government has long viewed the monopoly of private technology companies over financial transactions as a potential point of weakness in China's financial system. For China's government, the digital yuan marks a transition toward direct control over transaction data, which would allow the government to monitor economic activity across the nation in real-time (Murray 2020).

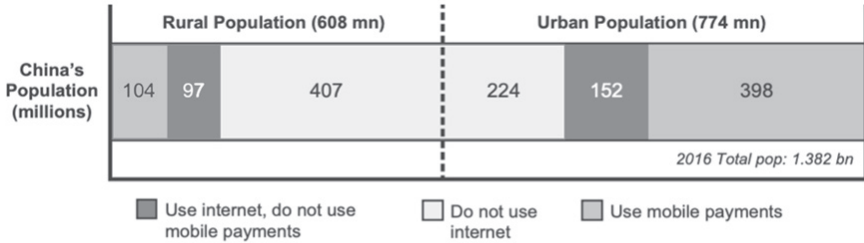
As the digital yuan fully replaces physical cash and coins, nearly every monetary transaction in China will be visible to the government. This will be a benefit to the government in upholding its authoritarian structure but may be perceived by Chinese citizens as an infringement of privacy. With the digital yuan's increased granularity and breadth of China's access to people's financial behaviors, China would become the first country to have real-time information about nearly all economic activity. For example, with digital yuan data, the CCP can track illegal behavior and use this method to identify and prevent illegal activities like criminal activities, terrorism, and gambling. The CCP's access to digital yuan data is essentially a means to reduce crime, guaranteeing greater protection and safety for the Chinese people. However, whether participating in illicit activities or not, many Chinese citizens have concerns about the lack of privacy with regards to their transaction data. Those especially concerned about their privacy may be forced into using alternative currencies like commodities or other gifts to avoid surveillance.

There exists a larger debate about whether the consolidation of the Chinese government is beneficial for the Chinese people, but in the context of the digital yuan, the debate lies in the control of financial data. Since there are no checks and balances on the power of the CCP due to China's authoritarian government structure, many fear that China will not keep its promise to uphold consumer privacy regarding the digital yuan. Historically, the CCP ideology has been that control is good for the people and keeps China united (Maizland 2022a). There are past examples of China's willingness to break promises in exchange for greater control. For example, China promised to allow Hong Kong fifty years of autonomy under the 'one country, two systems' agreement (ibid.). Despite this promise, Beijing enacted a law in 2020 that effectively bestowed power upon itself to control Hong Kong through silencing and punishing any who oppose or dissent against the CCP (ibid.). The digital yuan is yet

another way for the CCP to gain more control over its people by consolidating power through digital yuan transaction data.

*Social Welfare Programs*

**Figure 3: Rural-Urban Internet and Mobile Payments Penetration (2016)**



*Note: estimates of mobile payments users comes from 2016 year-end estimate of total mobile payment users and 2015 year-end percentages of online payment users in rural areas*

*Source: CNNIC*

Source: CGAP 2017

The digital yuan would also allow more effective and better targeted social welfare programs. Today, those programs are dependent on scores of cadres who report on the conditions of their local areas of jurisdiction. Manual inspection through cadres is the only way to reach remote areas of China due to the lack of digital penetration as shown in Figure 3. This graph shows that in 2016, roughly 504 million people (83%) of China’s rural population did not use mobile payments (CGAP 2017). Thus, as of 2016, more than a third of China’s population lived in a rural area and did not use mobile payments. Although digital penetration has increased in rural areas since 2016, there remains a sizable segment of the rural population for which the Chinese government does not have systematic electronic transaction data. In contrast, the CCP has access to the transaction data of any individual who uses digital payments through platforms like WeChat and Alipay.

Assuming that the digital yuan became accessible to rural citizens in China, they would be able to utilize the digital yuan in everyday purchases. Moving toward an entirely cashless economy would enable the CCP to better understand and address the needs of populations that the CCP typically has no information about. Consequently, increased access to their transaction data can promote the social welfare of the rural population. When digital yuan is implemented across the nation, those reports could be autonomously collected to provide highly precise reports that update on a weekly or daily basis. Budgets for food stamp equivalents, government sponsored housing and healthcare could be checked against transaction data from the local areas to evaluate their respective programs’ efficiency. Furthermore, China's poverty elimination programs would be able to track their progress on an individual

level, empowering China's government to help the citizens who need it most based on relevant data. Implementation of the digital yuan would increase the quality and efficiency of China's social welfare programs, and thus the overall economic well-being of its citizens.

However, the granularity with which the CCP can access transaction data creates significant privacy concerns. Most people in the world live under a government that watches for illegal activities; for example, the U.S. has antiterrorism laws that allow it to track international phone calls and monitor illegal activities. In contrast, the CCP's access to transaction data would allow it to not only track illegal activity like prostitution and drug exchange, but also mundane purchases such as buying a cup of coffee.

The CCP's access to digital yuan transaction data does not only hurt those that engage in illegal behavior, it also hurts those who engage in unpopular behavior. For example, the CCP may be able to reference transactions such as citizens purchasing antidepressants to deny them a job or lower their credit score. In particular, those on the margins of society, such as powerless ethnic and religious minorities, are the most threatened by this extra layer of surveillance. For example, a Ughyur who wants to send digital yuan back to Xinjiang could be subject to surveillance by the CCP and may undergo the risk of their transaction being interpreted as terrorism support. Digital yuan transaction data would also make it difficult for individuals to contribute to what they may believe to be good causes if the government disagrees. For example, CCP access to transaction data can impinge on transactions that benefit organizations that are unpopular among the CCP, like human rights organizations, legal services for refugees, and religious donations. Ultimately, an in-depth discussion of consumer privacy in China is beyond the scope of this paper, but it is clear that providing granular transaction data to the CCP would strengthen its grip over Chinese citizens and reduce consumer privacy.

#### *COVID-19 Case-Study*

One case study that demonstrates how access to the digital yuan financial transaction data may increase social welfare is the CCP's response to COVID-19 outbreak. The CCP's advanced COVID-19 data tracking system allowed the government to better achieve its goals of containing the virus through close monitoring of health status, travel history, and exposure risk of its citizens. As of March 2023, the U.S. had 1.1 million deaths due to COVID-19 (World Health Organization 2023a), whereas China had about 120,227 deaths (World Health Organization 2023b). These statistics demonstrate that in comparison to the U.S., China has attained a purportedly remarkable record in protecting the public health of its people. The key to China's ability to tamp down the spread of the virus was extensive tracking information. Just as this information led to policy outcomes that helped prevent the spread of disease, information about citizens' spending could help the government implement more effective programs that address social issues like poverty and corruption.

However, as illustrated by the backlash of Chinese citizens in response to COVID-19 policies, the COVID-19 case study also demonstrates how increased access

to financial information may lead to poor outcomes. Citizens felt trapped in their homes and sometimes ran short on food. Since relatively few Chinese citizens were sick with COVID, there remains little herd immunity in China and only marginally effective vaccines. Furthermore, there was a shortage of hospital beds during extreme outbreaks of the virus. Intense COVID-19 data tracking also hindered the privacy of the Chinese people and decreased their trust in the CCP. COVID-19 data allowed the government to impose strict lock-down regulations in various regions of China. In response, protests swept across China and hundreds chanted “Step down, Xi Jinping” and “Step down, Communist Party” (Gan 2022). The government's response to COVID-19 demonstrates that allowing the CCP to monitor digital yuan transaction data may lead to similar privacy violations and abuses of power.

Another potential concern in the government's response was data manipulation. For example, there have been several complaints among Chinese citizens that, after purchasing over-the-counter cold remedies, their COVID-19 health code had suddenly switched from green status to amber status despite no confirmed illness (Chingman and Qiao Long 2022). A former contact tracing official explained, “Within five minutes of you buying that medicine, your local neighborhood committee will know, regardless of whether you bought it online or in a street store” (ibid.). Like COVID-19 data, digital yuan data would provide detailed tracking over every purchase. One current affairs commentator, Wang Zheng, stated that China's government has already combined their Skynet video surveillance system with other data sources to “track the population's movements, contacts and transactions across the country” (ibid.). Citizens are already mulling over the implications; one citizen stated, “they are putting digital handcuffs on us,” (Tham, 2022). Similar to citizens' protests against the CCP's response to COVID-19 data, there could also be protests in response to the CCP's response to financial data from the digital yuan, especially if the government cracks down on certain behaviors it discovers through tracking data. Manipulation of digital yuan transaction data is also a possibility given the precedent of the manipulation of COVID-19 health codes. Thus, the digital yuan would add greater strength to the “digital handcuffs” already in place for its Chinese citizens.

## Evaluation

Based on my analysis of the full implementation of digital yuan, I find that the digital yuan is ultimately an advantage for the Chinese people. It has several key benefits, such as the elimination of transaction fees and the increased convenience of improved facial recognition and third-party innovations. In addition, the digital yuan presents a major benefit in terms of its opportunity to increase China's international monetary presence (conditional on China relaxing its capital controls) through low international transaction costs and significantly faster transaction speeds. Internationalization of the digital yuan may promote Chinese business abroad and the strength of the Chinese currency, which would benefit the Chinese people economically. Finally, the digital yuan benefits the Chinese people through

unprecedented financial inclusion. Even those without traditional bank accounts will be able to access digital yuan through their mobile phone numbers, and rural populations can take advantage of digital yuan features such as offline payments. Government officials have worked hand in hand with the People's Bank of China to develop solutions that ease the transition to digital yuan for the elderly, such as walking sticks and wearable devices that support transacting with the digital yuan.

To understand how the costs of the digital yuan compare to its benefits, it is important to evaluate the quantity of new information China is getting from the transaction data of the digital yuan and whether it substantially changes the ability of China to monitor and punish citizen behavior. Many Chinese citizens are concerned that the centralization of transaction data and integration with existing social surveillance systems will allow the government to constrain their behavior or use their data to find cause to arrest them. However, even without the digital yuan's transaction data, these existing systems are already capable of extensive monitoring. For example, through the Social Credit System and the Skynet Video Surveillance, the CCP can track the behavior of any human rights lawyer through social media, video surveillance, and facial recognition (Donnelly 2023). In fact, the CCP already exercises ubiquitous surveillance over the Xinjiang region: thousands of so-called 'suspicious' individuals are flagged for placement in detention centers through advanced facial-recognition cameras and artificial intelligence algorithms (Maizland 2022b). In addition, the CCP is also capable of conducting genetic surveillance through its extensive DNA database of Xinjiang citizens' biometric data (Wee 2019). Given the breadth of the CCP's existing surveillance capabilities, it is clear that it already possesses the means to enact punishments or outcomes according to its agenda without the financial data provided through digital yuan usage. Therefore, the collection of digital yuan transaction data as an additional layer of surveillance will not make a substantial difference in the CCP's ability to monitor and punish citizens' behavior in the long run. Overall, the benefits of reduced transaction costs, internationalization of the yuan, and increased financial inclusion outweigh the costs of centralizing digital yuan transaction data.

## Conclusion

The digital yuan presents a significant opportunity for China to become the world leader in modern payment technology, and China's citizens stand to benefit. As the rollout continues, the world will observe how companies and individuals utilize the new currency and what new innovations are developed as a result. On one hand, the digital yuan provides a more efficient and cost-effective way to make payments. The potential benefits of the digital yuan extend beyond China's borders as well. Countries in Africa, for example, may benefit from reduced remittance fees that encourage adoption of the digital yuan and promote Chinese business abroad. On the other hand, its adoption will be a major step for the government in solidifying its grip over China's financial sector and the personal information of Chinese citizens.

Realists fear that China's government will use the data to empower their surveillance systems and ability to micromanage the daily lives of Chinese citizens. However, the increase in the CCP's ability to monitor and punish citizens' behavior is relatively marginal given the effective surveillance systems it already has in place. At this point in time, the full implementation of the digital yuan seems like an overall advantage for the Chinese people, but it will be necessary to continue reevaluating the effect of centralizing transaction data in the hands of the CCP as the digital yuan increases in adoption. Ultimately, it is China's hope that the digital yuan will benefit its citizens and gain the respect of the international community.

## References

- Areddy, James T. 2021. "China Creates Its Own Digital Currency, a First for Major Economy." *The Wall Street Journal*. April 7. Accessed March 15, 2023. <https://www.wsj.com/articles/china-creates-its-own-digital-currency-a-first-for-major-economy-11617634118>.
- Best, Raynor de. 2022. "U.S. Payment Cards by Purchase Volume 2023." *Statista*. March 15. Accessed March 15, 2023. <https://www.statista.com/statistics/678109/purchase-volume-payment-cards-usa-by-type/>.
- Best, Raynor de. 2023. "China: Payment Methods in Retail." *Statista*. January 11. Accessed March 15, 2023. <https://www.statista.com/statistics/1296674/preferred-payment-methods-china/>.
- Bloomberg. 2021a. "Digital Yuan Goes Head to Head with Alipay, WeChat in Beijing." *Bloomberg*. September 14. Accessed March 15, 2023. <https://www.bloomberg.com/news/articles/2021-09-14/digital-yuan-goes-head-to-head-with-alipay-wechat-in-beijing>.
- Bloomberg. 2021b. "China's Digital Yuan Wallets Are 'Inclusive,' PBOC Official Says." *Bloomberg*. June 11. Accessed March 15, 2023. <https://www.bloomberg.com/news/articles/2021-06-11/china-s-digital-yuan-wallets-are-inclusive-pboc-official-says#xj4y7vzkg>.
- Bloomberg Intelligence. 2021. "How a Digital Yuan Threatens China Banks, Alipay and WeChat Pay." *Bloomberg*. December 7. Accessed February 21, 2023. <https://www.bloomberg.com/professional/blog/how-a-digital-yuan-threatens-china-banks-alipay-and-wechat-pay/>.
- Bloomenthal, Andrew, Jefreda Brown, and Amanda Jackson. 2023. "How Safe Is Venmo and Is It Free?" *Investopedia*. April 8. Accessed April 16, 2023. <https://www.investopedia.com/articles/personal-finance/032415/how-safe-venmo-and-wh-y-it-free.asp>.
- CGAP. 2017. "China's Alipay and WeChat Pay: Brief Reaching Rural Users - CGAP." December. Accessed March 28, 2023. <https://www.cgap.org/sites/default/files/researches/documents/Brief-Chinas-Alipay-and-WeChat-Pay-Dec-2017.pdf>.
- Cheng, Pangyue. 2022. "Decoding the Rise of Central Bank Digital Currency in China: Designs, Problems, and Prospects - Journal of Banking Regulation." *J Bank Regul*. Accessed February 21, 2023. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8860289/>
- Chingman and Qiao Long. 2022. "China's COVID-19 'Health Code' App Reaps Huge Datasets on Population." *Radio Free Asia*. January 27. Accessed March 15, 2023. <https://www.rfa.org/english/news/china/app-01272022102806.html>.
- Corporate Finance Institute. 2023. "Swift." *Corporate Finance Institute*. February 1. Accessed March 15, 2023. <https://corporatefinanceinstitute.com/resources/foreign-exchange/swift/>.
- Deutsche Bank. 2021. "Digital Yuan: What Is It and How Does It Work?" July 14, 2021. Accessed February 14, 2023. <https://www.db.com/news/detail/20210714-digital-yuan-what-is-it-and-how-does-it-work>.
- Dezan, Shira. 2022. "China Launches Digital Yuan App – All You Need to Know." *East West Bank*. October 5. Accessed March 15, 2023. <https://www.eastwestbank.com/ReachFurther/en/News/Article/China-Launches-Digital-Yuan-App-All-You-Need-to-Know>.
- Donnelly, Drew. 2023. "China Social Credit System Explained - How It Works [2023]." *Horizons*. April 6. Accessed April 16, 2023. <https://nhgloбалpartners.com/china-social-credit-system-explained/>.
- Economic Times. 2021. "Digital Currency: Yuan Comes with an Expiry Date: Spend or It Will Vanish" *Economic Times*. April 14. Accessed March 27, 2023. <https://bfsi.economictimes.indiatimes.com/news/policy/digital-currency-yuan-comes-with-an-expiry-date-spend-or-it-will-vanish/82059471>.



- Elad, Barry. 2023. "UPI Statistics - Transactions, Growth and Marketing Trends." *Enterprise Apps Today*. January 17. Accessed March 15, 2023. <https://www.enterpriseappstoday.com/stats/upi-statistics.html#:~:text=Unified%20Payments%20Interface%20or%20UPI%20has%20led%20to,transactions%20via%20UPI%20amounts%20to%20INR%2012.11%20trillion>.
- Feng, Coco. 2022. "China Tests Central Bank Digital Currency Use to Settle Trades via 'Bridge'." *South China Morning Post*. September 30. Accessed February 20, 2023. <https://www.scmp.com/tech/article/3194160/china-tests-central-bank-digital-currency-use-settle-trades-bridge-partners>.
- Fries, Tim. 2021. "China's Digital Yuan App Has Now Been Used by 139 Million People." *Tokenist*. September 16. Accessed February 21, 2023. <https://tokenist.com/chinas-digital-yuan-app-has-now-been-used-by-139-million-people/>
- Gan, Nectar. 2022. "Protests Erupt across China in Unprecedented Challenge to Xi Jinping's Zero Covid Policy." *CNN*. November 29. Accessed March 27, 2023. <https://www.cnn.com/2022/11/26/china/china-protests-xinjiang-fire-shanghai-intl-hnk/index.html>.
- Georgieva, Kristalina. 2022. "The Future of Money: Gearing up for Central Bank Digital Currency." *IMF*. February 9. Accessed February 21, 2023. <https://www.imf.org/en/News/Articles/2022/02/09/sp020922-the-future-of-money-gearing-up-for-central-bank-digital-currency>.
- Gill, Chris. 2021. "Digital Yuan Can Have 'Controllable Anonymity', PBOC Says." *Asia Financial*. March 23. Accessed February 20, 2023. <https://www.asiafinancial.com/digital-yuan-can-have-controllable-anonymity-pboc-says#:~:text=Mu%20Changchun%20said%20small%20transactions%20of%20the%20digital,limit%20and%20can%20only%20do%20small%20daily%20transactions>.
- Horowitz, Julia. 2018. "Why American Credit Card Companies Can't Break into China." *CNNMoney*. August 3, 2018. Accessed February 20, 2023. <https://money.cnn.com/2018/08/03/news/companies/mastercard-visa-amex-china/index.html>.
- IMF. 2022. "Currency Composition of Official Foreign Exchange Reserves (COFER)." *IMF*. December 20. Accessed February 21, 2023. <https://data.imf.org/?sk=E6A5F467-C14B-4AA8-9F6D-5A09EC4E62A4>.
- John, Alun. 2020. "Explainer: How Does China's Digital Yuan Work?" *Reuters*. Thomson Reuters. October 19, 2020. Accessed February 21, 2023. <https://www.reuters.com/article/us-china-currency-digital-explainer/explainer-how-does-chinas-digital-yuan-work-idUSKBN27411T>.
- Kagan, Julia. 2022. "Settlement Risk: Definition, 2 Main Types, and How to Reduce It." *Investopedia*. December 20. Accessed March 27, 2023. <https://www.investopedia.com/terms/s/settlementrisk.asp>.
- Kharpal, Arjun. 2022. "China Is Pushing for Broader Use of Its Digital Currency." *CNBC*. CNBC. January 12, 2022. Accessed February 14, 2023. <https://www.cnbc.com/2022/01/11/china-digital-yuan-pboc-to-expand-digital-yuan-use-but-challenges-remain.html>.
- Klein, Aaron. 2019. "Is China's New Payment System the Future?" *Brookings*. June 16. Accessed February 21, 2023. <https://www.brookings.edu/research/is-chinas-new-payment-system-the-future/>.
- Klein, Aaron. 2022. "China's Payments U-Turn: Government over Technology." *Brookings*. March 9. Accessed March 15, 2023. <https://www.brookings.edu/research/chinas-payments-u-turn-government-over-technology/>.

- Koigi, Bob. 2022. "Digital Yuan- a Better Solution for Remittance Fees." *Startup Weekly*. November 10. Accessed February 21, 2023. <https://startup-weekly.com/Digital-Yuan-a-better-solution-for-remittance-fees/>.
- Kshetri, Nir. 2022. "China's Digital Yuan: Motivations of the Chinese Government and Potential Global Effects." *Journal of Contemporary China* 32, no. 139 (March): 87-105.
- Le, Kelly and MengYuan Ge. 2021. "China Tests New Phone-Free DCEP e-RMB Card for Helping Rural Poor." *Forkast*. January 7. Accessed March 15, 2023. <https://forkast.news/china-dcep-erm-b-card-digitalyuan/>.
- Ledger Insights. 2022. "What Needs to Happen for Digital Yuan to Exit Pilot Mode?" *Ledger Insights - Blockchain for Enterprise*. January 11, 2022. Accessed February 21, 2023. <https://www.ledgerinsights.com/what-needs-to-happen-for-digital-yuan-to-exit-pilot-mode/>.
- Li, Yanping and Gao Yuan. 2022. "China to Expand Digital Yuan in Four Major Provinces: News." *Bloomberg Tax*. September 19. Accessed February 20, 2023. <https://news.bloombergtax.com/crypto/china-to-expand-digital-yuan-pilot-in-four-major-provinces-news?context=article-related>.
- Liao, Rita. 2022. "China's Digital Yuan Wallet Now Has 260 Million Individual Users." *TechCrunch*. January 18. Accessed February 14, 2023. <https://techcrunch.com/2022/01/18/chinas-digital-yuan-wallet-now-has-260-million-individual-users/>.
- Lu, Lerong and Hang Chen. 2021. "Digital Yuan: The Practice and Regulation of China's Central Bank Digital Currency (CBDC)." *Butterworths Journal of International Banking and Financial Law*. September 18. Accessed March 27, 2023. <https://kclpure.kcl.ac.uk/portal/en/publications/digital-yuan-the-practice-and-regulation-of-chinas-central-bank-digital-currency-cbdc.html>.
- Lucero, Karman and Jiaying Jiang. 2021. "China's Digital Yuan Ambitions Raise More Questions than Answers." *South China Morning Post*. August 15. Accessed February 21, 2023. <https://www.scmp.com/comment/opinion/article/3144703/chinas-digital-yuan-ambitions-raise-more-questions-answers>.
- Maizland, Lindsay. 2022a. "Hong Kong's Freedoms: What China Promised and How It's Cracking Down." *Council on Foreign Relations*. May 19. Accessed April 16, 2023. <https://www.cfr.org/backgrounder/hong-kong-freedoms-democracy-protests-china-crackdown>.
- Maizland, Lindsay. 2022b. "China's Repression of Uyghurs in Xinjiang." *Council on Foreign Relations*. May 29, 2022. Accessed April 16, 2023. <https://www.cfr.org/backgrounder/china-xinjiang-uyghurs-muslims-repression-genocide-human-rights>.
- Master Card. 2023. "Global Data Privacy Notice." *Mastercard*. March 15. Accessed March 15, 2023. <https://www.mastercard.us/en-us/vision/corp-responsibility/commitment-to-privacy/privacy.html>.
- Murray, Robert. 2020. "Understanding China's Digital Yuan." *Foreign Policy Research Institute*. October 13, 2020. Accessed February 21, 2023. <https://www.fpri.org/article/2020/09/understanding-chinas-digital-yuan>.
- NetEase. 2022. "The launch of the digital renminbi app is far more significant than you might imagine." 网易首页. January 6. Accessed February 20, 2023. <https://www.163.com/dy/article/GT394NV105373JJH.html>.
- Ocean Payment. 2022. "Wechat Pay/ Alipay Fees for Merchants." *Oceanpayment*. November 16, 2022. Accessed February 21, 2023. <https://www.oceanpayment.com/blog/19775/>.
- Olander, Eric. 2020. "China's Cryptocurrency Now Has a Foothold in Places like Africa with the Introduction of Huawei's Latest Phone." *The China Global South Project*. November 2. Accessed February 21, 2023. <https://chinaglobalsouth.com/2020/11/02/chinas-cryptocurrency-now-has-a-foothold-in-places-like-africa-with-the-introduction-of-huaweis-latest-phone/>.

- People's Republic of China. 2022. "China's e-Commerce Transaction Volume up 19.6% in 2021." *People's Republic of China*. September 1. Accessed March 15, 2023. [https://english.www.gov.cn/archive/statistics/202209/01/content\\_WS6310a75ec6d0a757729df883.html#:~:text=The%20transaction%20volume%20hit%2042.3%20trillion%20yuan%20about,11%20trillion%20yuan%20last%20year%2C%20the%20report%20said](https://english.www.gov.cn/archive/statistics/202209/01/content_WS6310a75ec6d0a757729df883.html#:~:text=The%20transaction%20volume%20hit%2042.3%20trillion%20yuan%20about,11%20trillion%20yuan%20last%20year%2C%20the%20report%20said).
- PricewaterhouseCoopers. 2021. "Payments 2025 & Beyond." *PwC*. Accessed February 20, 2023. <https://www.pwc.com/gx/en/industries/financial-services/publications/financial-services-in-2025/payments-in-2025.html>.
- Qian, Isabelle, Muye Xiao, Paul Mozur, and Alexander Cardia. 2022. "Four Takeaways from a Times Investigation into China's Expanding Surveillance State." *New York Times*. June 21. Accessed March 15, 2023. <https://www.nytimes.com/2022/06/21/world/asia/china-surveillance-investigation.html>.
- Raymaekers, Wim. 2019. "Cross-Border Payments Reinvented." *Swift*. March 8. Accessed March 8, 2023. <https://www.swift.com/news-events/news/cross-border-payments-reinvented>.
- Reuters. 2022. "China Central Bank Expands Digital Yuan Pilot Scheme to More Cities." *Reuters*. April 2. Accessed February 20, 2023. <https://www.reuters.com/world/china/china-central-bank-expands-digital-yuan-pilot-scheme-more-cities-2022-04-02/>.
- Reuters. 2020. "China to Issue 10 MLN Digital Yuan in First Public Test." *Reuters*. October 9. Accessed February 21, 2023. <https://www.reuters.com/article/china-yuan-digital-idUSL4N2H02C5>.
- Sampi Marketing. 2022. "Chinese Payment Systems Overview: Alipay." *Sampi Marketing*. December 7. Accessed March 15, 2023. <https://sampi.co/alipay-payment/#:~:text=This%20way%2C%20Ali%20Pay%20is,to%20all%20types%20of%20vendors>.
- Shenzhen Daily. 2021. "Digital Yuan Ready for Broader Rollout in Beijing." *Shenzhen Daily*. September 16. Accessed March 15, 2023. [http://www.szdaily.com/content/2021-09/16/content\\_24573740.htm](http://www.szdaily.com/content/2021-09/16/content_24573740.htm).
- Singh, Somya and Rajesh Bansal. 2021. "China's Digital Yuan: An Alternative to the Dollar-Dominated Financial System." *Carnegie India*. August 31. Accessed January 29, 2023. <https://carnegieindia.org/2021/08/31/china-s-digital-yuan-alternative-to-dollar-dominated-financial-system-pub-85203>.
- Skift Meetings. 2022. "How to Achieve Fast and Secure Check-in with Facial Recognition." *Skift Meetings*. May 19. Accessed April 16, 2023. <https://meetings.skift.com/achieve-fast-secure-check-facial-recognition/>.
- Slotta, Daniel. 2022. "China: Smartphone Users by Age 2019." *Statista*. December 19. Accessed March 15, 2023. <https://www.statista.com/statistics/1133033/china-smartphone-users-by-age/>.
- Slotta, Daniel. 2023a. "China: Mobile Payment Penetration Rate 2021." *Statista*. January 5. Accessed February 20, 2023. <https://www.statista.com/statistics/1243879/china-mobile-payment-penetration-rate/>.
- Slotta, Daniel. 2023b. "China: Smartphone Penetration Rate 2027." *Statista*. February 15. Accessed February 21, 2023. <https://www.statista.com/statistics/321482/smartphone-user-penetration-in-china/>.
- Smialek, Jeanna. 2021. "Still Getting Your Head around Digital Currency? So Are Central Bankers." *New York Times*. April 26. Accessed February 20, 2023. <https://www.nytimes.com/2021/04/26/business/economy/fed-digital-currency.html>.
- Steil, Benn, Benjamin Della Rocca, and Dinah Walker. 2021. "Central Bank Currency Swaps Tracker." *Council on Foreign Relations*. December 1. Accessed March 27, 2023. <https://www.cfr.org/article/central-bank-currency-swaps-tracker>.

- Tang, Leeloo. 2022. "Revisiting Facial-Recognition Payment: Old Problems Still Lingering." *Nielsen Norman Group*. March 20. Accessed February 21, 2023. <https://www.nngroup.com/articles/facial-recognition-payment/>.
- Tham, Engen. 2022. "China Bank Protest Stopped by Health Codes Turning Red, Depositors Say." *Reuters*. June 16. Accessed March 15, 2023. <https://www.reuters.com/world/china/china-bank-protest-stopped-by-health-codes-turning-red-depositors-say-2022-06-14/>.
- Thunes. 2023. "China: Payment Trends and Popular Payment Methods." *Thunes*. January 19. Accessed February 20, 2023. <https://www.thunes.com/china-payment-trends-and-popular-payment-methods/>.
- Trading Economics. 2023. "China - Rural POPULATION2023 Data 2024 Forecast 1960-2021 Historical." *Trading Economics*. March 27. Accessed March 27, 2023. <https://tradingeconomics.com/china/rural-population-percent-of-total-population-wb-data.html>.
- Tremann, Cornelia, Kerry Brown, Jingdong Yuan, and Mei Fong. 2021. "China's Digital Currency: Next Stop, Africa?" *Lowy Institute*. February 21, 2023. <https://www.lowyinstitute.org/the-interpreter/china-s-digital-currency-next-stop-africa#:~:text=Over%20the%20past%20two%20decades%2C%20China%20has%20conquered,mobile%20phone%20cameras%20that%20better%20capture%20darker%20skin>.
- Tudor-Ackroyd, Alison. 2020. "What Will China's Digital Yuan Mean for Alipay and WeChat Pay?" *South China Morning Post*. September 5. Accessed January 29, 2023. <https://www.scmp.com/business/banking-finance/article/3100285/what-will-chinas-central-bank-digital-currency-mean-alipay>.
- Wang, Xiangwei. 2020. "As China Goes Cashless, Its Elderly Pay the Price." *South China Morning Post*. December 12. Accessed January 29, 2023. <https://www.scmp.com/week-asia/opinion/article/3113561/china-goes-cashless-its-elderly-who-pay-price>.
- Wee, Sui-lee. 2019. "China Uses DNA to Track Its People, with the Help of American Expertise." *The New York Times*. February 21, 2019. Accessed April 16, 2023. <https://www.nytimes.com/2019/02/21/business/china-xinjiang-uighur-dna-thermo-fisher.html>.
- Weixin. 2020. "The 'Enjoy Luohu Digital RMB Red Envelope' Activity Has Come to a Successful Conclusion." *Weixin*. October 18. Accessed March 15, 2023. <https://mp.weixin.qq.com/s/srWGIBQM5FPDiQJzT9cqHg>.
- World Bank. 2021. "Rural Population (% of Total Population)." *World Bank*. Accessed February 21, 2023. <https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS>.
- World Bank. 2022. Lifting 800 million people out of poverty – new report looks at lessons from China's experience. *World Bank*. April 1, 2022. Accessed February 21, 2023. <https://www.worldbank.org/en/news/press-release/2022/04/01/lifting-800-million-people-out-of-poverty-new-report-looks-at-lessons-from-china-s-experience>.
- World Health Organization. 2023a. "United States of America: Who Coronavirus Disease (Covid-19) Dashboard with Vaccination Data." *World Health Organization*. March 27. Accessed March 27, 2023. <https://covid19.who.int/region/amro/country/us>.
- World Health Organization. 2023b. "China: Who Coronavirus Disease (Covid-19) Dashboard with Vaccination Data." *World Health Organization*. March 27. Accessed March 27, 2023. <https://covid19.who.int/region/wpro/country/cn>.
- Yang, Yuan. 2020. "How China Built Facial Recognition for People Wearing Masks." *Ars Technica*. March 18. Accessed March 15, 2023. <https://arstechnica.com/tech-policy/2020/03/how-china-built-facial-recognition-for-people-wearing-masks/>.
- Yeung, Karen. 2021. "Excess Liquidity Risks May See China Relax Overseas Investment Rules." *South China Morning Post*. March 4, 2021. Accessed February 14, 2023. <https://www.scmp.com/economy/china-economy/article/3124029/chinas-strict-capital-controls-may-be-eased-allow-investment>.

- Yeung, Karen and Andrew Mullen. 2021. "China's Alipay and WeChat Pay: Brief Reaching Rural Users - CGAP." *South China Morning Post*. June 6. Accessed March 28, 2023. <https://www.cgap.org/sites/default/files/researches/documents/Brief-Chinas-Alipay-and-WeChat-Pay-Dec-2017.pdf>.
- Zaroli, Jim. 2015. "How Singapore Became One of the Richest Places on Earth." *NPR*. March 29. Accessed March 27, 2023. <https://www.npr.org/2015/03/29/395811510/how-singapore-became-one-of-the-richest-places-on-earth>.
- Zeiger, Heather. 2021. "Why China Is Making a Bold Gamble with Digital Currency." *Mind Matters*. April 22. Accessed February 20, 2023. <https://mindmatters.ai/2021/04/why-china-is-making-a-bold-gamble-with-digital-currency/>.