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The Rise and Fall of Paper Money in Yuan China, 1260-1368

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THE RISE AND FALL OF PAPER MONEY IN YUAN CHINA, 1260-1368

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Abstract

Following the Mongol invasion of China, the Yuan (1260–1368) dynasty was the first political regime to introduce a precious metal standard and deploy paper money as the sole legal tender. Drawing on a new dataset on money issues, prices, warfare, imperial grants, taxation, natural disasters, and population, we find that a silver standard initially consolidated the Chinese currency market. However, persistent fiscal pressures eventually compelled rulers to ease the monetary standard, and a fiat standard was adopted. We show that inflation was high in the early and late periods of the dynasty but remained moderate for nearly half a century. We find that military pressure, particularly civil war, generated fiscal demands that led to the over-issuance of money. By contrast, natural disasters and imperial grants did not trigger the over-issue of money. Warfare was much more likely to increase paper money issues under the fiat standard than during the silver standard period.

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Keywords: Paper money, silver standard, fiat money, Yuan China

JEL codes: E42, N15, N45

1. Introduction

Yuan China (1260 to 1368) was the first minority-led dynasty that ruled the entire Chinese empire. The Yuan were a Mongol dynasty that ruled for only around a century, but they had a long-lasting influence on China's culture, economy, and politics.[1] At the time, the Chinese (Han) people regarded the Mongols as unsophisticated, and viewed their arrival as disturbing China's economy, culture, and society.[2] However, the Yuan brought about the territorial unification of China after a century-long split caused by warfare, developing the sciences and practice of medicine, geography, and astronomy. They also improved the social status of merchants and artisans, and developed China's infrastructure and transportation systems.[3] By introducing silver-convertible paper money, the Mongols combined their long traditions of using silver as a medium of exchange with China's existing paper money regime, which fostered domestic trade as well as international commerce, and enabled China to de-

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[1] The earlier foreign rulers of the Sui (581–619 CE) and Tang (705–907 CE) were descendants of the hybrid ethnic minorities Xianbei-Chinese. The Mongols were not the first ethnic-minority group that dominated parts of China, but they were the first to control North and South China together, subjugating the ethnic Chinese to their political and social dominion. Kublai, the first Mongol who became emperor in 1271, had been in power as Khan in North China and the Mongol homelands since 1260. He formally established the Yuan dynasty in 1271 (hence the Yuan dynasty is commonly dated 1271–1368). We follow Rossabi in considering the Yuan to have, *de facto*, lasted for 1260 to 1368. See Rossabi, *Khubilai Khan*, pp. 53-75.

[2] Rossabi, *Khubilai Khan*, pp. 177-88.

[3] Biran, 'The Mongol Empire'; Rossabi, *Khubilai Khan*, pp. 120-124; von Glahn., 'State formation in China'.

part from an iron and copper coin-based economy into a silver-backed paper money economy.[4]

As the first political regime in history that pegged paper money to precious metals, and the first that deployed fiat money as the sole legal tender, the silver standard implemented by the Yuan was centuries ahead of the gold standard or fiat money systems later introduced in Europe. A comprehensive study of the Yuan's paper money regime provides insights into how the first precious metal standard operated under an imperial regime and suggests the factors that correlated with money issuance under the different monetary standards operated under the Yuan.

Based on a wealth of printed primary sources, we constructed a new and comprehensive dataset of the Yuan dynasty's annual money issues, price indexes, imperial grants, population, taxation, warfare, and natural disasters. The data series, substantiated with qualitative historical evidence, enable us to study the evolution of the Yuan empire's monetary regimes, examine the relationship between paper money

[4] von Glahn, *Fountain of fortune*, p. 56.

issues and the government's fiscal constraints, and investigate the factors that explain the over-issuance that eventually led to hyperinflation as the dynasty collapsed.

Despite its importance in Chinese economic history, the Yuan's monetary regime has drawn less interest than other dynasties. Early studies on Yuan's paper money focused on its formats and designs, or in estimating issuance totals.[5] When more historiographical sources became available, scholars began to delineate the evolution of the Yuan's paper money regime or concentrated their studies on exploring its fiscal structure and taxation system.[6] Although these studies formed valuable work about the Yuan's monetary regime from different perspectives, several questions were missed that are needed to understand the Yuan's monetary regime. In this paper, we concentrate on the reasons for over-issuance and the role of the silver standard.

Using our dataset, we test the relationship between warfare, imperial grants, natural disasters, and money issuances. We find that pegging to silver effectively regulated the Yuan's paper money issuance, but persistent fiscal constraints gradually com-

[5] Yang, *Money and credit in China*; Wu, *Notes in reading history*; Tullock, 'Paper money-a cycle in Cathay', pp. 393-407; Peng, *The monetary history of China*, pp. 568-602.

[6] von Glahn, *Fountain of fortune*, pp. 55-70; idem, 'Origins of paper money in China'; idem, 'Monies of account and monetary transition in China'; Ye, 'Circulation Institution of Paper Money'; Miyazawa, 'The fiscal statistics on the paper currency in Yuan Dynasty'; idem, 'Public finance in Yuan China; Takahashi, 'Research on monetary history'.

pelled Yuan rulers to abandon silver convertibility. In 1276, just 16 years after implementing the silver standard, the Yuan's paper money became nominally convertible (i.e. often inconvertible, when no silver was available at a given exchange bureau), and it became inconvertible in 1310. Nonetheless, inflation remained moderate, except during the dynasty's early years, and again during its final two decades. We show that fiscal motivations associated with warfare – and in particular, civil war – coincided with over-issuance. In addition, we find that the money supply elasticity varied little between the full and nominal silver standard eras but increased substantively in the fiat era.

The Yuan's monetary regime was innovative and successful in unifying China's currency and stabilizing its prices for a long time. Ultimately, however, the state could not manage a fiat money system, due to China's comparatively low level of state capacity and institutional development, which contrasts with the (much later) situation in Western Europe. During the French Wars, beginning in the late eighteenth century, a century of prior collaboration between the Bank of England and the Treasury meant that the Bank of England was successfully able to suspend convertibility for a generation. Convertibility was later restored without ever resorting to systematic monetary financing of government deficits. This exceptional situation was possible

due to the combination of a high level of fiscal and monetary capacities in the United Kingdom.[7] Absent such features, Yuan China's experiments with paper money were destined to fail.

2. Historical Background

China had a long history of using commodities, metal, or paper as media of exchange. The first paper money, the *jiaozi* 交子, appeared around 1010, during the Northern Song (960–1127 CE) dynasty.[8] The *jiaozi* was first issued by private merchants in the Sichuan province, and was then convertible to iron coins. However, the government took over the business after several exchange suspensions. The government usually issued *jiaozi* every three years, with each batch of issuance circulating for three years, and then being exchanged for a new issuance.[9]

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[7] O'Brien and Palma, 'The bank restriction act'; idem, 'Not an ordinary bank'; Bonfatti et al., 'Monetary capacity'.

[8] It was denominated in *guan*, which is the unit account of copper coins. The denominations of *jiaozi* were 500 *wen* and 1 *guan*. The *wen* 文 was the smallest unit account of copper coins. In the Song Dynasty, a string of 770 *wen* copper coins is called one *guan* (string, 貫). See Peng, *The monetary history of China*, p. 400; von Glahn, 'Monies of account and monetary transition in China', p. 465.

[9] Peng, *The monetary history of China*, p. 381.

In 1105, the Northern Song government issued an additional paper money, *qianyin* 錢引, in parallel to the *jiaozi*. The *qianyin* was pegged to copper coins, iron coins, and state-monopolized commodities, such as iron and salt. Its circulation expanded from Sichuan to its neighboring provinces.[10] After the Song had to retreat to South China in 1127, the Southern Song regime was established, issuing the third and fourth paper money notes – the *guanzi* 關子 and *huizi* 會子.[11] In principle, the issuance of *huizi* should be convertible to copper coins or iron coins. In practice, over-issuance transformed it in fiat money. However, the circulation of *jiaozi*, *qianyin*, and *guanzi*, remained only regional, in contrast with the later situation under the Yuan, when paper money circulated widely in the country.

In North China, the frontier rulers *Liao*, *Xixia*, and *Jin* also issued their currencies. Usually, these were copper coins, iron coins, paper money, and silver ingots. Although silver did not widely circulate during the Song, it started to be employed in

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[10] During 1130-60, one *guan qianyin* equaled to 400 *wen* copper coins or 800 *wen* iron coins. We reckon that the *jiaozi* and *qianyin* were exchanged at par from this exchange rate. See Peng, *The monetary history of China*, p. 400.

[11] There were four denominations of the *huizi*: 200 *wen*, 300 *wen*, 500 *wen*, and 1 *guan*. The *huizi* was issued every two to three years, and it had an expiration date. When the old *huizi* notes expired, they could be exchanged for new ones. The *huizi* issued in Shanxi and Sichuan was pegged to silver from 1137 to 1168. In other regions, the *huizi* was pegged to copper or iron coins. Ibid, pp. 381-3.

tax payments, and functioned as a unit of account in market transactions.[12] To finance increasing government expenditure, usually caused by warfare, these monies issued by Song and other frontier political regimes were frequently over-issued or heavily debased, and it was not until the Mongols defeated the *Jin* and controlled North China that a tumultuous situation began to improve.

In 1234, the Mongols defeated the *Jin* and conquered Northern China. After becoming the Khan of the Mongol Empire in 1260, Kublai promulgated that a new paper money, the *zhongtongchao* 中統鈔, pegged to silver, was to be issued to replace circulating notes.[13] The *zhongtongchao* became widely accepted as the Mongol's territory expanded from north to south China. A paper money economy, backed by silver, replaced a previously chaotic monetary system that mixed various types of paper money with copper coins, iron coins, and silver ingots.

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[12] Silver was cast in the form of silver bar or silver ingot. One silver sycee was known as 1 *ding* 錠 silver, which usually equaled to 50 *liang* 兩 silver. *Liang* was the unit account of silver, with one *liang* equal to c.a. 37 g. of silver. Therefore, one silver sycee or one *ding* silver equalled 1.85 kg. The Song government also briefly coined silver and gold coins but did not circulate widely. See Peng, *The monetary history of China*, p. 400; von Glahn, 'Monies of account and monetary transition in China', p. 463; idem, 'Cycles of silver', p. 19.

[13] *Zhongtong* is the title of Kublai's reign from 1260 to 1263. *Chao* means paper money.

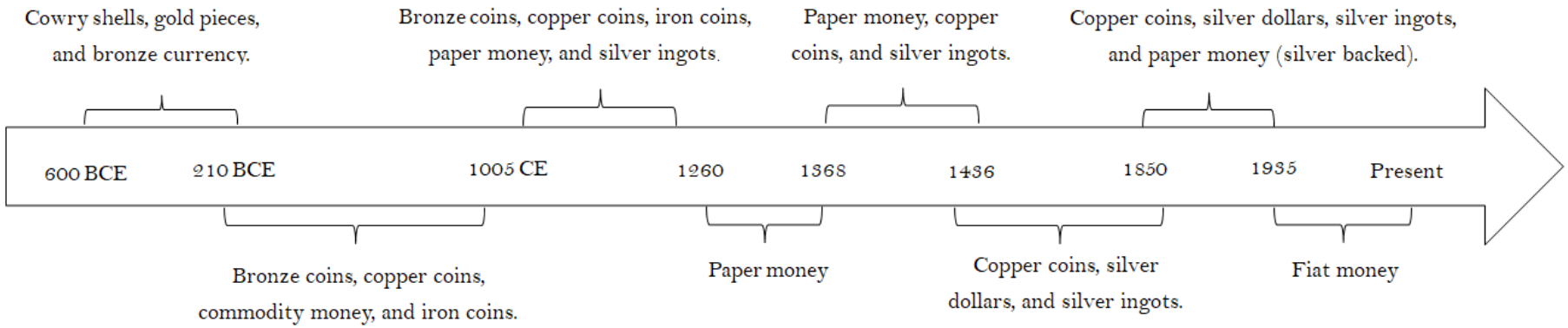

Figure 1. The evolution of currency formats from 600 BCE to the present.
Source: von Glahn, *The economic history of China*, pp. 1-294.

In 1271, Kublai established Mongol dominance over Mongolia, China, and Korea and founded the Yuan Empire (1271–1368). At the same time, the *zhongtongchao* was declared the sole legal tender, while all the other metallic currencies were abolished.[14] Although pegged to silver, due to the long custom of using copper coins, the *zhongtongchao* was denominated in '*wen*' or '*guan*,' both units of account for copper coins. There were 10 denominations of the *zhongtongchao*, which varied from 10 *wen* to 2 *guan*, with *zhongtongchao* 2 *guan* being equal to 1 *liang* (also known as *tael*) of silver.[15]

As the Yuan's territory expanded to the south, the government increased the issuance of *zhongtongchao*, in order to withdraw the Southern Song's *huizi*, with an exchange rate of *zhongtongchao* 1 *guan* for *huizi* 50 *guan*. Besides unifying South China, Kublai started several wars to conquer southeast Asia and Japan. Increasing government expenditure on military campaigns and public construction compelled the government to issue more *zhongtongchao*, and the prudent monetary policy Kublai

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[14] Although the Yuan government prohibited the use of silver, in fact there is evidence that uncoined silver was used as a medium of exchange. See Peng, *The monetary history of China*, p. 506.

[15] In the Yuan dynasty, a string of 1,000 *wen* copper coins was called one *guan* (string). The 10 denominations of *zhongtongchao* were 10 *wen*, 20 *wen*, 30 *wen*, 50 *wen*, 100 *wen*, 200 *wen*, 500 *wen*, 1 *guan* and 2 *guan*. See von Glahn, *Fountain of fortune*, p. 58.

had initially implemented gradually eased after 1271.[16] Below, we find that prices grew considerably over the following years.

In 1287, seven years before Kublai's death, the government issued a new paper money, the *zhiyuanchao* 至元鈔, to tackle the depreciation of the *zhongtongchao*. The government mandated that the value of the *zhiyuanchao* was to be five times the value of the old money. It could be exchanged for silver at the value of 1 *liang* of silver to 2 *guan zhiyuanchao*.[17] Although the government allowed the *zhongtongchao* to circulate along with the *zhiyuanchao*, this deliberate devaluation led to an 80 per cent discount on the *zhongtongchao*.[18]

The third paper money, the *zhidachao* 至大鈔, was issued by the third Yuan emperor, Külüg (r.1307–1311), in 1310. With respect to the prior monies, the *zhidachao* was equivalent to five *guan zhiyuanchao* or 25 guan *zhongtongchao*. However, Külüg deceased suddenly only one year after its issuance, resulting in the abandonment of the *zhidachao*. In 1311, Külüg's successor, Ayurbarwada Khan (r.1311–1320), re-

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[16] Rossabi, *Khubilai Khan*, pp. 177-205; von Glahn, *Fountain of fortune*, p. 58.
[17] *Yuanshi*, chapter 93.
[18] Contemporary official scholars Wang Yun (1227–1304) and Hu Zhiyu (1227–95) documented that the retreat from the silver-convertibility from 1276 destroyed *zhongtongchao* to function as a store of value and as a means of exchange and resulted in its devaluation. See von Glahn, *Fountain of fortune*, pp. 61-3.

stored the first paper money, *zhongtongchao*, and the second paper money, *zhiyuanchao*, for circulation. Amid a succession of political struggles with several emperors ascending and being dethroned with a quick turnover, these two paper monies circulated for 40 years. In 1352, the last Khan, Toghon Temür (r.1333–68), issued the fourth as well as the last version of Yuan's paper money, the *zhizhengchao* 至正鈔. With the fall of the empire, the new currency depreciated heavily. After 1356, paper money was rejected by the people and driven out of circulation. When the Yuan government collapsed in 1368, paper money was scrapped, and barter was observed in all prefectures and counties.[19]

As the sole legal tender, paper money proliferated across the social stratum.[20] It was used as tax payment, granted imperial grants, and dispensed as official salaries and other expenditures.[21] In private transactions, people could use paper money to purchase all types of commodities and for small transactions, including paying for

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[19] von Glahn, *Fountain of fortune*, p. 70.

[20] During the brief circulation of the third paper money, *zhidachao*, two types of copper coin, known as *zhida tongbao* 至大通寶 and *dayuan tongbao* 大元通寶, were issued. However, these three currencies were abolished in less than two years. Besides, in 1350, two decades before the Yuan regime collapsed, a new copper coin, *zhizheng tongbao* 至正通寶, was announced, along with the new paper money, *zhizhengchao*. Because of heavily discounted paper money, *zhizheng tongbao* and copper coins that issued by previous dynasties were preferred by people to paper money. See Peng, *The monetary history of China*, p. 527.

[21] This information appears in the *yuanshi*. We consulted the modern published edition. See Song, *yuanshi* 元史 *(The history of the Yuan)*.

transportation and salaries.[22] Foreign merchants who came to China were required to convert their precious metals into paper currency as soon as they set foot in China.[23]

Table 1 lists the paper money issued under the Yuan regime. The Yuan government issued four paper monies in total. Except for the *zhidachao*, denominated in the unit account of silver, *liang*, other paper monies were denominated in *guan*, the unit account of copper coins. Moreover, it shows that when new money was issued, the old money was deliberately depreciated, mostly due to the inflation problem caused by the old money.[24]

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[22] Paper money was accepted in all of China except for the remote province of Yunnan, which used cowry shells as money. Cowry shells were used for tax payment, with 20 cowry shells equal to one *qian* gold piece. See Peng, *The monetary history of China*, pp. 505-10.

[23] Rossabi, *Khubilai Khan*, p. 122.

[24] Based on contemporary evidence, von Glahn finds that the exchange rate between *zhongtongchao* and *zhiyuanchao* could deviate from the official exchange rate from time to time. We also find that the value of *zhiyuanchao* relative to *zhongtongchao* decreased over time. However, it is not clear whether this also applied to other paper monies from the historiographical sources, such as the *yuandianzhang* and the *yuanshi*. For the consistency of analysis, we decided to use the official exchange rate in our analysis in this paper. See von Glahn, *Fountain of Fortune*, p. 65.

Table 1. Yuan's paper monies and their official exchange rates

	Period of circulation	*Zhongtongchao* *(guan)*	*First zhiyuanchao* *(guan)*	*Zhidachao* *(liang)*	*Second zhiyuanchao* *(guan)*	*Zhizhengchao* *(guan)*	*Silver* *(liang)*
Zhongtongchao	1260-1286	1	-	-	-	-	0.5
First zhiyuanchao	1287-1309	5	1	-	-	-	0.5
Zhidachao	1310	25	5	1	-	-	1
Second zhiyuanchao	1311-1351	5	1	-	1	-	1
Zhizhengchao	1352-1368	10	2	-	-	1	1

Notes: The unit accounts for silver, and for the *zhidachao* it is *liang*, while the unit accounts for other paper monies is *guan*.

Sources: Wu, *Notes in Reading History*, p. 293; Miyazawa, 'Public finance in Yuan China', p. 55.

Table 2 shows that the value of *zhongtongchao* relative to silver depreciated over time. In 1260, 2 *guan zhongtongchao* could be exchanged for 1 *liang* of silver. This ratio was to become 25 to 1 in 1309 — corresponding to an annual depreciation rate of approximately 5 percent. Besides this, Table 2 demonstrates that although the government forbade using silver in private transactions, large transactions such as property purchases were also settled with silver.

Table 2. Exchange rates between silver and *zhongtongchao (liang/guan)*

	Government		Private
	Buy	Sell	
1260	2	2	-
1267	-	-	1.5
1273	1.95	2	-
1282	2	2.05	6.32
1287	10	10.25	-
1306	-	-	20
1309	25	25	52.7
1346	-	-	27

Source: Li, *'The Prices, Taxation, and Fiscal System in Yuan China'*, p. 61.

We divide the Yuan's monetary regimes into three stages: full silver convertibility period (1260–76), nominal silver convertibility period (1277–1309), and fiat standard (1310–1368). During the first of these, the issuance of paper money was backed by a quantity of silver at a fixed exchange rate. When there was excessive paper money in

circulation, the government bought the extra paper with silver.[25] However, when the former Song's fiat money was integrated into Yuan's paper money system in 1276, government expenditures rose, and all the silver reserves had to be transported to the summer capital, Khanbaliq. Thus, the new issuance was no longer fully backed by reserves and was only convertible when the local exchange bureau had silver. Therefore, the monetary standard after 1276 entered the period of a nominal silver standard.[26] When the Yuan government began to print the third paper money, *zhidachao*, in 1310, silver did not play the reserve role, and thus, the monetary system changed to *de jure* fiat money after 1310.[27]

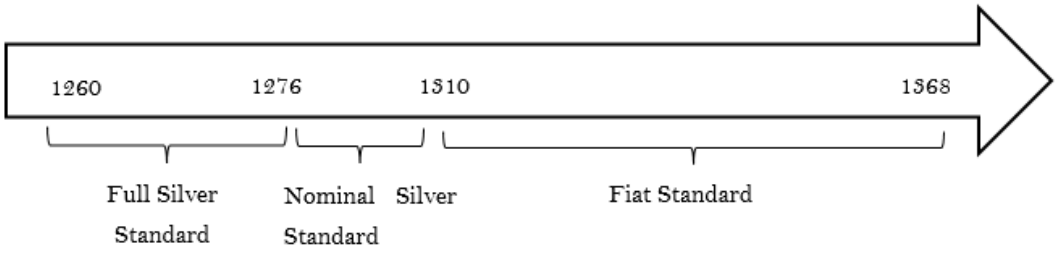

Figure 2. Monetary standards during the Yuan dynasty.
Source: Peng, *The monetary history of China*, pp. 501–28.

[25] This is a standard practice deployed since the Southern Song government. Ibid, p.44.
[26] The Mongols transported the silver they collected from China to western Asia, where it earned a higher return. See von Glahn, *Fountain of fortune*, p. 60.
[27] Ibid.

Figure 3 plots the locations of silver exchange bureaus in the 1290s. It shows that the government set up exchange bureaus at provincial-level cities, *lu* 路, or prefecture-level cities, *fu* 府 and *zhou* 州. People could exchange paper money for silver at a discount of 70 to 80 percent of face value, bring spoilt (damaged) notes, and obtain new notes in exchange by paying a small commission fee of three per cent.[28] Among the 65 silver exchange bureaus, six were in the capital, Dadu, three in Yangzhou—one of the wealthiest cities at the time, with the Yangtze River and the Grand Canal flowing through—and the rest in one city each. As the figure shows, most exchange bureaus were located in East China, which was more economically advanced and politically significant. For people who lived in west or central China, there were fewer places for them to redeem silver. Given the size of China, it would have been costly for people who lived in the West or those who lived in smaller towns to travel to the cities to exchange silver.

[28] von Glahn, *Fountain of fortune*, p. 58; Vogel, *Marco Polo was in China*, p. 112.

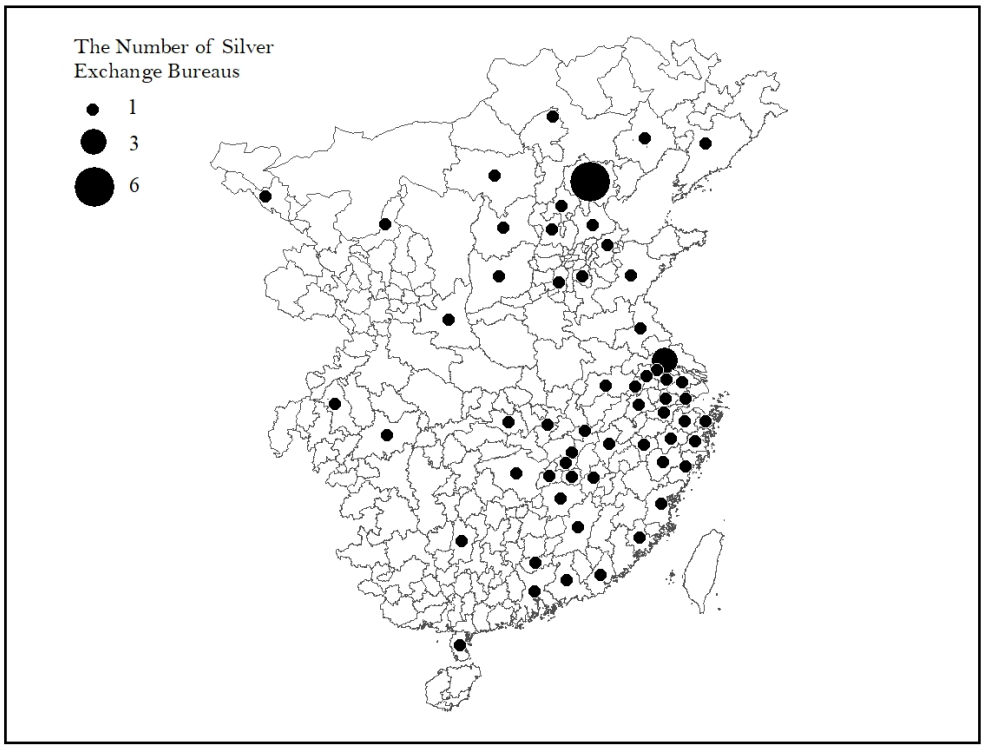

Figure 3. Location of silver exchange bureaus, around the 1290s.
Notes: Based on the administrative division in 1290, the map only covers the Central Plains region. We obtained the data for administrative districts as given by Robert Hartwell, 'Hartwell China Historical Studies GIS'.
(http://doi.org/10.7910/DVN/29302).
Source: *yuandianzhang 元典章 (The Collection of Laws of the Yuan Dynasty)*, p.321.

3. Data and sources

We construct a new, comprehensive dataset in this paper. Its variables have been collected by us from primary and secondary sources that are systematized together here for the first time. The period covers 1260 to 1355. The main variables include annual money issuance, prices, imperial grants, population, taxation, warfare, and

natural disasters. We then compute several derivative series, such as price indexes and real annual per capita money issuance.

Paper money issues

Our measures of nominal annual paper money issues come mainly from the *yuanshi*, one of the official Chinese historical works known as *ershisishi* 二十四史 (Twenty-four histories). According to Wilkinson, the *yuanshi* is an incomplete but "essential resource for modern historians studying the Yuan period. The fact that it is unpolished may be a blessing as it remains in its original and near-original state."[29] As an important historiographical source about the Yuan period compiled by contemporary scholars, the *yuanshi* has been widely used in studying China's history and economic history.[30] Its chapters '*shihuozhi* 食貨志 (Food and Commerce Treatise)' and '*benji* 本紀 (Imperial Biographies)' record the annual paper money issues of the Yuan dynasty from 1260 to 1332. Although this book was written by contemporary scholar-officials, it has two problems in recording the money supply. First, it does not record paper money issued after 1332 and therefore, does not allow us to trace

[29] Wilkinson, *Chinese history*, p. 871.
[30] See Tullock, 'Paper money-a cycle in Cathay'; von Glahn, *Fountain of fortune*; Vogel, *Marco Polo was in China*; and Peng, *The monetary history of China.*

the last three decades of annual issuance. Second, the book does not consider *chaoben* 鈔本 (paper money reserves), which were put into circulation as paper money after 1330, and therefore underestimates paper money in circulation after that year.[31] To overcome these caveats, besides the *yuanshi*, we relied on Liu, who considered the 1333-1350s money issues, and studied the Yuan dynasty's reserves of paper money.[32]

Based on historiographical sources such as the *xu wenxiantongkao*, *yuanshi*, and *yuandianzhang*, Liu divided the Yuan money reserves into broad and narrow reserves. The narrow reserves were the silver held by the central government to issue paper money. The broad reserves included silver and a paper money reserves printed in patterns that were different from those of normal paper money. The broad reserves were allocated to local exchange bureaus to stabilize prices.[33]

According to Liu, the paper money reserves were not allowed to be printed for issuance or to finance government expenditure before 1331. However, when public finances deteriorated, the government started printing paper money reserves and cir-

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[31] Peng did not consider paper money reserves. Our estimates improve on this in other ways as well, such as extending the time period. See Peng, *The monetary history of China*, pp. 514-28.
[32] Liu, 'Money reserves in the Yuan Dynasty', pp. 135-143.
[33] Ibid, pp.135-9.

culated them as normal paper money.[34] Based on this finding, we do not consider paper money reserves as part of the money supply before 1331 but do account for it as part of the money supply from 1331.[35] This is shown in Table A1 of the Appendix.

Based on Liu's findings and the information documented in the *yuanshi*, we collate annual paper money issues from 1260 to 1355, and plot the results in Figure 4.[36] Here is worth mentioning that although the Yuan government issued different types of paper money, the government used the *zhongtongchao* as the unit of account to document fiscal revenues and expenditures. Based on this, we deploy the *zhongtongchao* as the unit account in our analysis, and we exchange other paper monies into the *zhongtongchao* units based on the government-stipulated exchange rate.[37]

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[34] Ibid.
[35] No exchange rate is recorded between paper money and paper money reserves. According to Liu, the key difference between paper money reserves and paper money in circulation is that during the fiat standard the former could be exchanged for silver directly, while paper money in circulation could not. See ibid, p. 140.
[36] Note that the unit of the vertical axis is 1,000 *ding*. Hence, the value for 1310, for instance, corresponds to around 36.3 million *ding*.
[37] Table 1 shows the government exchange rates between different monies.

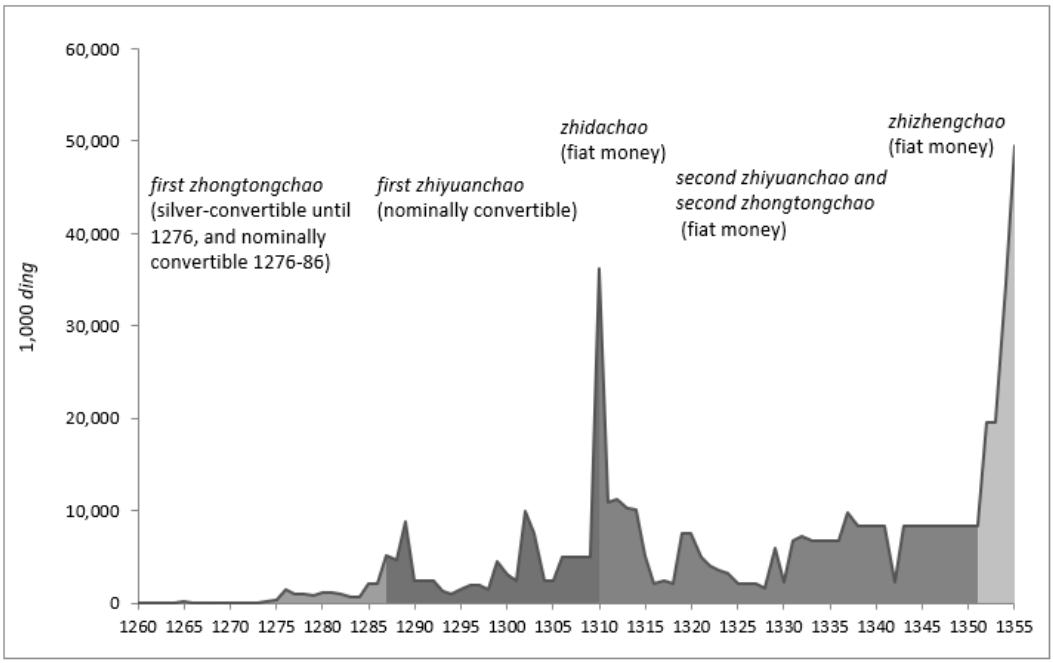

Figure 4. Annual nominal money issues, 1260–1355.
Notes: *ding* 錠 was the unit of account of silver, with 1 *ding* of silver being equal to 50 *liang* of silver. The Yuan government used *ding* as the unit of account to record fiscal revenues and expenditures, and regulated that 1 *ding* was equal to 50 *guan*. *zhongtongchao*. Our last year is 1355 because no data exists after that year. Table A1 is our dataset of the annual money issues.
Sources: *yuanshi*, chapters 35, 36, 39, 42 to 44, and 93 to 95; Liu, 'Money reserves in the Yuan Dynasty', pp.142-3.

As shown in Figure 4, despite initially modest quantities, the issuance of the *zhongtongchao* increased steadily over time. The first surge occurred in 1276, when Kublai and his government used the *zhongtongchao* to recall the *huizi*.[38] Based on the exchange rate between the *zhongtongchao* and the *huizi*, which was 1 *guan zhong-*

[38] von Glahn, *The Economic History of China*, p. 263.

tongchao to 50 *guan huizi*, the Yuan government needed to issue at least 5 million *ding zhongtongchao* to redeem 273 million *guan* of *huizi* which was in circulation. These numbers are consistent with the data we collected, which shows that, on average, the annual issuance of *zhongtongchao* soared from less than 500,000 *ding* between 1260 and 1275, to more than 1 million *ding* from 1276 to 1287. Besides exchanging *huizi*, a surge in money issuance after 1276 may also be attributed to Kublai's expenditures on construction projects, entertainment, and military campaigns.[39]

The issuance of the second paper money, *zhiyuanchao*, was intended to tackle the depreciation of the *zhongtongchao*. During its 23 years in circulation, the annual issuance of the *zhiyuanchao* remained relatively stable, fluctuating from 2 million to 10 million *ding*. This can be attributed to the fact that the second Yuan emperor, Temür Khan (r.1294-1307), called off most wars.[40] Compared with the *zhongtongchao* and the *zhiyuanchao*, the third paper money type, the *zhidachao*, only circulated for one year. However, the magnitude of the issues was striking. The annual issuance of *zhidachao* in 1310 was 36 million *ding*, soaring from 5 million *ding* when *zhiyuanchao*

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[39] Rossabi, *Khubilai Khan*, p. 179.
[40] Hsiao, 'Mid-Yüan Politics', p. 557-8.

circulated. There are two reasons for the issuance boom of *zhidachao*. First, it was a fiscally-motivated response to a regime change. It followed the enthronement of the third Khan, Külüg (r.1307–1311), who usurped the throne with a military coup. However, only one year later, Külüg died suddenly, and the *zhidachao* was abandoned. Second, the *zhongtongchao* was used to measure value in public finance and private transactions, and other paper monies were converted to the *zhongtongchao*. Since the government stipulated that 1 *guan zhidachao* was valued at 25 *guan zhongtongchao*, the nominal value of money issues soared.

From 1311 to 1350, both the *zhongtonchao* and the *zhiyuanchao* were reintroduced, and the issuance of paper money varied from 2 million to 11 million *ding*. The last paper money type, the *zhizhengchao*, was issued in 1352.[41] Compared with the previous issues, the annual issuances were even more striking. Within two years, the annual issuance soared from 20 million to 50 million *ding*. Contemporary scholars Wang Yun wrote that unrestrained printing of paper money after 1352 propelled the market to use copper coins as a medium of exchange — including those issued by

[41] The *zhizhengchao* was also named as *zhongtong jiaochao*.

previous dynasties — and blamed paper money, which they accused of meaning nothing but the empty script.[42]

Figure 5 plots the nominal money stock from 1260 to 1355. As the figure shows, the totals remained modest initially, but under the *zhiyuanchao*, the stock began to increase considerably. The spike observable in 1310 is due to the issuance of *zhidachao*. As this type of paper money was not issued in 1311 (in fact, this currency was abolished in April 1311), the spike disappeared.[43] The re-issuance of *zhongtongchao* and *zhiyuanchao* during 1311–1352 stabilized the growth of the money stock. Still, this trend became even more precipitous during the circulation of the last paper money, *zhizhengchao*. By the time that the Yuan regime collapsed around 1368, paper money in circulation was worth more than 170 million *ding* of *zhongtongcao*, compared with less than 2 million *ding zhongtongchao* when the Mongols had proclaimed dominance over the whole of China, around a century earlier, in 1271.

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[42] von Glahn, *Fountain of fortune*, p. 70.
[43] *yuanshi*, chapter 23.

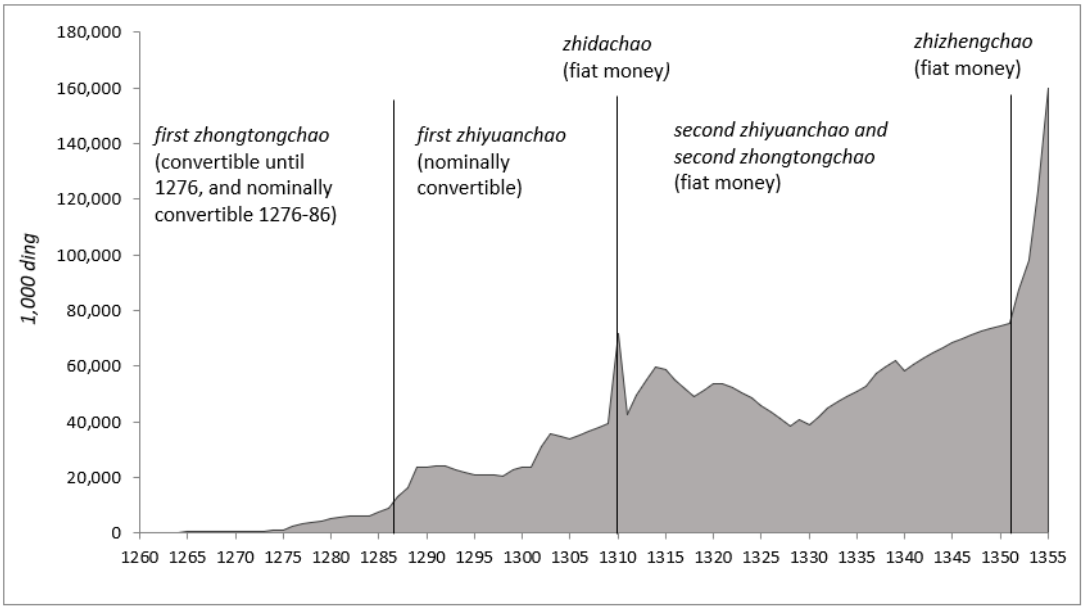

Figure 5. Nominal paper money stock issued by the Yuan governments, 1260–1355.
Notes: This figure is based on the assumption that the stock of paper money corresponds to annual issues plus 90 percent of the previous year's stock. The general qualitative shape of this figure would remain similar if an alternative assumption were used. We do not consider copper coins since they were not issued as legal tender except for 1310/1 and 1352–68.
Sources: *yuanshi*, chapters 35, 36, 39,42 to 44, and 93 to 95; Liu, 'Money reserves in the Yuan Dynasty,' pp.142–143; Peng, *The monetary history of China*, p. 493; and Vogel, *Marco Polo was in China*, p. 221.

Price indexes

To assess the value of real money issues over time, we construct four price indexes: a barebones CPI, a respectability CPI, a government monopolies CPI, and a precious metals CPI. We have data for 12 goods, relying on Li, who collected comprehensive data on various market and state-monopolized commodities from contemporary official memoranda such as the *yuanshi*, *yuandianzhang*, *daming huidian*, and from many

contemporary private studies offered by distinguished scholars of the time.[44] The sources that Li examined make his work credible for studying prices during the Yuan period. We have a dozen observations of each product's price and interpolate or extrapolate missing ones. We plot the resulting price indexes in Figure 6.

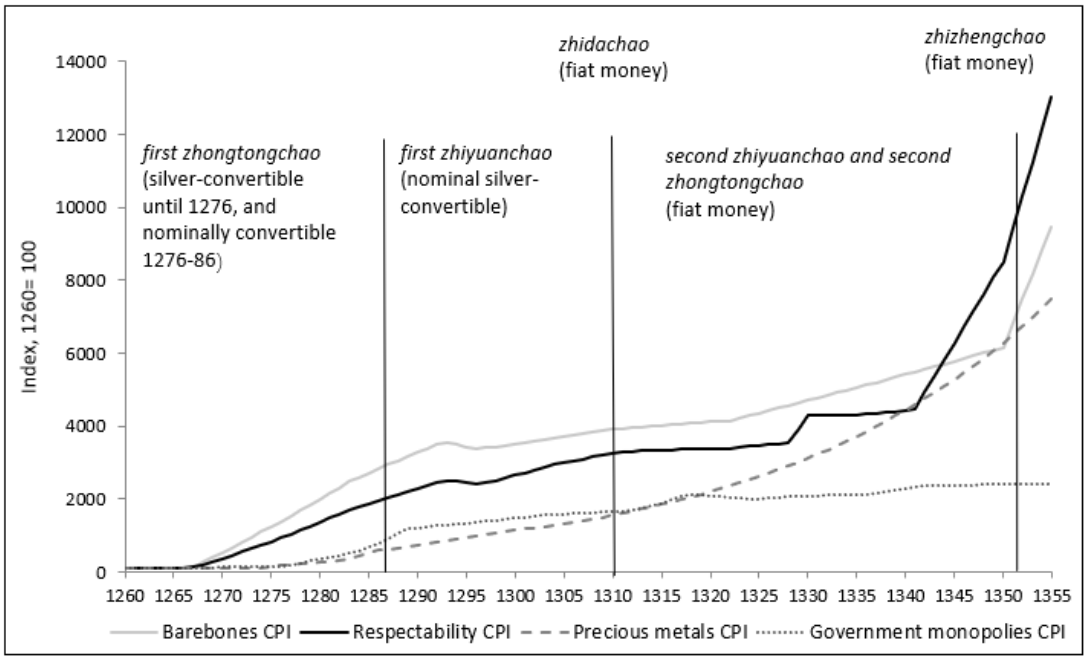

Figure 6. Four price indexes, 1260–1355.

Notes: The barebones CPI consists of three commodities: rice in South China (45%), millet in North China (45%), and cotton (10%). Our respectability CPI has seven products: rice in South China (35%), rice in North China (10%), millet in North China (25%), salt (10%), cotton (10%), tough silk, *juan* 絹(5%), and horses (5%). The precious metals CPI consists of gold (50%), silver (50%) and corresponds to government-listed prices. The government monopolies CPI consists of certificates for horses (1/3), salt (1/3), and tea (1/3). The base year for the indexes is 1260. Prices for horses and salt in the government monopolies CPI are government-listed figures,

[44] Li, *'The prices, taxation, and fiscal system in Yuan China'*, pp. 12-71.

while prices for horses and salt in the respectability CPI are market prices. Figure A1 of the Appendices plots the dataset for the individual observed prices.
Source: Our calculations are based on the underlying data collected by Li, *'The prices, taxation, and fiscal system in Yuan China'*, pp. 12-71.

As Figure 6 illustrates, the empire began to experience inflation in the 1270s, when the issuance of *zhongtongchao* began to grow. The price level also indicates the period from the 1290s to the 1330s enjoyed price stability, despite the large increase in nominal monetary stock. When dividing the whole period into three sub-periods, namely, 1260-1290, 1290-1340, and 1340-1355, we find that the corresponding inflation rates were 11.0 per cent, 1.8 per cent, and 4.5 per cent, measured by the respectability CPI.[45] Besides this, we find that during the last decade for which data is available, 1346-1355, the compound inflation rate was 12.7 per cent, corresponding to an approximate doubling of the price level from 1260 to 1355. All four price indexes increased over these 96 years, but at different magnitudes, as seen in the figure.

We can now construct Figure 7, which shows annual real paper money issued, by combining the respectability CPI with the nominal money issuances discussed earlier.

[45] These percentages were calculated using the familiar compound growth formula.

The magnitude of real monetary injections varied greatly over time. Still, it was only noticeably high during the brief issuance of the *zhidachao* in 1310 and more moderate during the issuance of other paper monies.

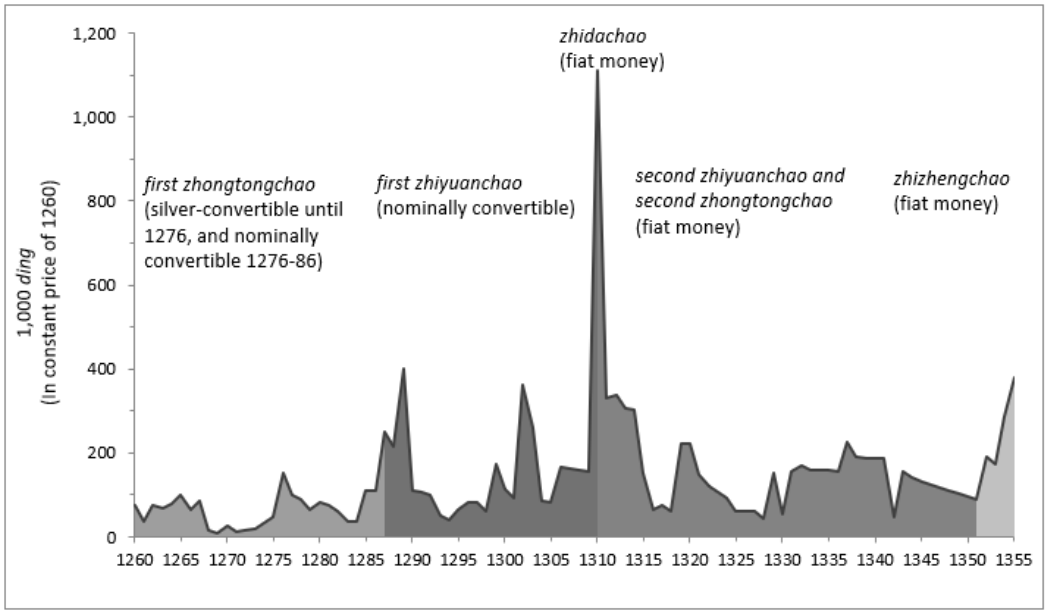

Figure 7. Annual real paper money issues, 1260–1355.
Note: The unit is constant prices of 1260.
Sources: *yuanshi*, chapters 35, 36, 39,42 to 44, and 93 to 95; and Liu, 'Money reserves in the Yuan Dynasty,' pp.142-3.

Imperial grants

The Mongol Khans had a tradition of granting gold, silver, and livestock to Mongol nobles, usually as a pacification policy. After the establishment of the Yuan Dynasty, this tradition continued, and the recipients expanded from Mongol nobles to monks

and officials. According to several scholars, these imperial grants were an important government expenditure, triggering the over-issuance of paper money.[46] We construct a dataset on imperial grants based on 47 *benji* in the *yuanshi*. *Benji* documented each emperor's major achievements and deeds, recording important events during their reigns every month. In particular, they give us the value of imperial grants for every month. This information includes who visited the emperor and what kinds of grants in silver, gold, or paper money, as well as their amount, were given. Some imperial grants may be missing from the records, but our dataset based on the *yuanshi* includes the most important ones. Based on this detailed information, we compiled Figures 8 and 9.

Figure 8 shows that imperial grants comprised fixed annual and occasional (ad hoc) grants. Fixed annual grants were usually set each year during an emperor's reign. There were also occasional imperial grants, typically occurring when an emperor was enthroned, when other Mongol nobles presented themselves before an emperor, or when emperors rewarded imperial bodyguards or other soldiers for their service. The early reign of Kublai coincided with the period of the strict silver standard

[46] Hsiao, 'Mid-Yüan Politics'; Peng, *The monetary history of China*; Shi, 'An Examination of Imperial Grants in Yuan', p. 144.

(1260-1275). During this time, imperial grants remained low and stable, with fixed grants occupying most of the total. However, Kublai granted more occasional grants from 1285 until the last year of his reign in 1294. Kublai's successors typically kept fixed imperial grants low, but occasionally they granted substantial grants. One of the primary reasons for this change was because of the politically volatile imperial power. From 1294 to 1333, nine emperors ascended the throne, each having reigned for an average of four years, and some having been assassinated. To win the support of the Mongol nobles, emperors resorted to ad hoc grants.[47] During the reign of the last Yuan emperor, Toghon Temür (enthroned in 1333), the tendency to issue substantial grants gradually ceased. Our findings are consistent with qualitative historical documentation and other studies on the Yuan's imperial grants.[48]

[47] Hsiao, 'Mid-Yüan Politics', p. 521.
[48] Shi , 'An Examination of Imperial Grants in Yuan', p. 144.

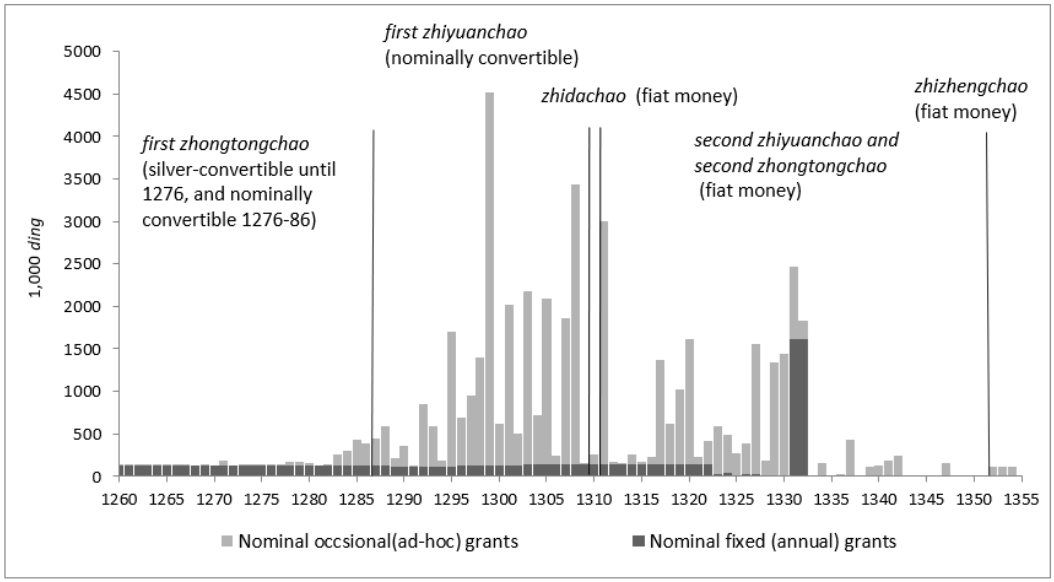

Figure 8. Fixed (annual) and occasional nominal imperial grants, 1260–1355.
Source: yuanshi, chapters 1 to 47.

The composition of the imperial grants over time, shown in Figure 9, shows that paper money constituted the largest part of the imperial grants throughout the Yuan dynasty. While silver grants occupied approximately one-tenth of the total grants in the early Yuan period, their proportion diminished as the government loosened the silver standard.

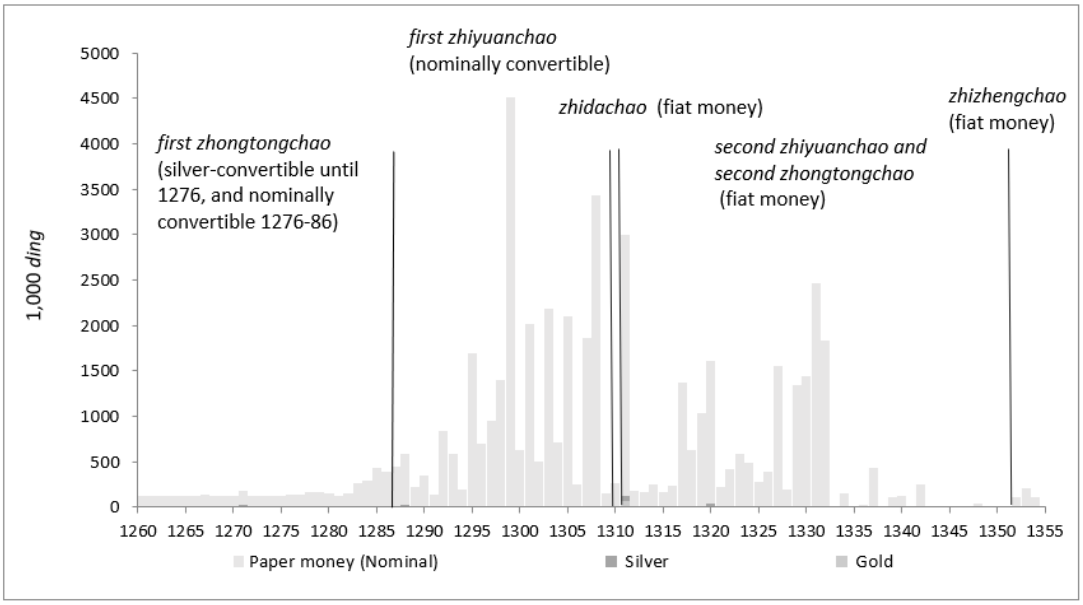

Figure 9. Composition of the nominal value of imperial grants,1260–1355
Source: *yuanshi*, chapters 1 to 47.

Population

Our population dataset is based on Wu, who systematically studied the population of the Liao, the Jurchen of Jin, and Yuan China.[49] Wu recorded household data in 1236, 1252, and 1261–1275 by relying on comprehensive primary data in *yuanshi*, *yuanwen-lei* 元文類 (A collection of poems and articles of the Yuan dynasty), and an array of local gazetteers. He additionally estimated the number of households in 1290, 1330, and 1341 based on the same sources. We interpolated missing years' data based on

[49] Wu, *Chinese Demographic History (Volume III)*, pp. 282-333; pp. 383-391.

Wu's data for periods 1276–1289, 1291–1329, and 1331–1340. Wu did not estimate household data after 1340 but argued that there was a population decline in the previous three decades. Therefore, we relied on Cao, who studied the demographic history of Yuan's successor, Ming (1368–1644).[50] Cao's data were compiled from county and prefecture annals as well as the *daminghuidian* 大明會典(Collected Statutes of the Ming Dynasty), and he recorded the number of households in 1393. Therefore, we interpolated the missing years' data from 1342 to 1393 based on the information in his work.

Figure 10 plots our resulting estimate for the annual household numbers under Yuan control from 1260 to 1355. Household numbers remained relatively unchanged between 1260 and 1275. Household growth accelerated with South China integrated into the Yuan's domain. By the end year of Kublai's regime in 1294, the number of households reached 14 million. Population figures during the mid-Yuan period (1290–1333) remained unchanged but started to recover after 1330 and peaked in 1341.[51] After that, the population started to decline.[52] Scholars such as Wu and Ge found that the average size for each household was 4.5 to 5. For the construction of

[50] Cao, *Chinese Demographic History (Volume IV)*, p. 3.
[51] Ge, *A History of Population Development in China*, pp. 218-20.
[52] Wu, *Chinese Demographic History (Volume III)*, pp. 392.

our dataset, we multiplied the household numbers by 5 to estimate the number of individuals.[53]

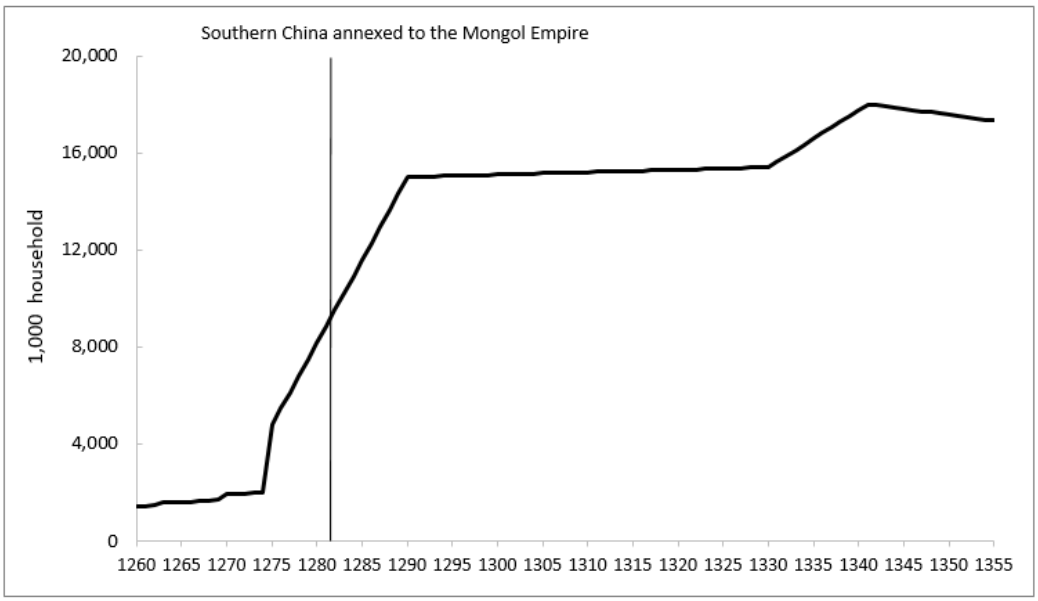

Figure 10. Number of households (annual) for territories under Yuan control 1260–1355.
Note: 1282 corresponds to the approximate year of the Yuan's annexation of Southern China.
Sources: Data for 1236, 1290, 1252, 1261–75, 1330, and 1341 is from Wu, *Chinese Demographic History (Volume III)*, pp. 282-333 and pp. 383-91. Data for 1393 is from Cao, *Chinese Demographic History (Volume IV)*, p .3.

Based on our population and money stock data, Figure 11 shows money stock per capita from 1260 to 1355 in nominal and real terms. In nominal terms, the growth of paper money per person increased moderately during the circulation of the first

[53] Wu, *Chinese Demographic History (Volume III)*; Ge, *A History of Population Development in China.*

zhongtongchao (1260-86), which lasted for 27 years. This trend accelerated when the first *zhiyuanchao* and *zhidachao* were issued but slowed down after 1311 when the *zhongtongchao* and *zhiyuanchao* were re-issued. When the last paper money, the *zhizhengchao*, was issued in 1352, paper money possessed per capita surged from 40 *guan* per person to 90 *guan* per person in three years. Unlike the nominal money stock per capita, the value in real terms depended on the price level and varied from 0.2 to 2.5 *guan* over time. The initial spike in real money stock per capita was mainly due to a relatively small population (by comparison with the later periods) and the low-price level.

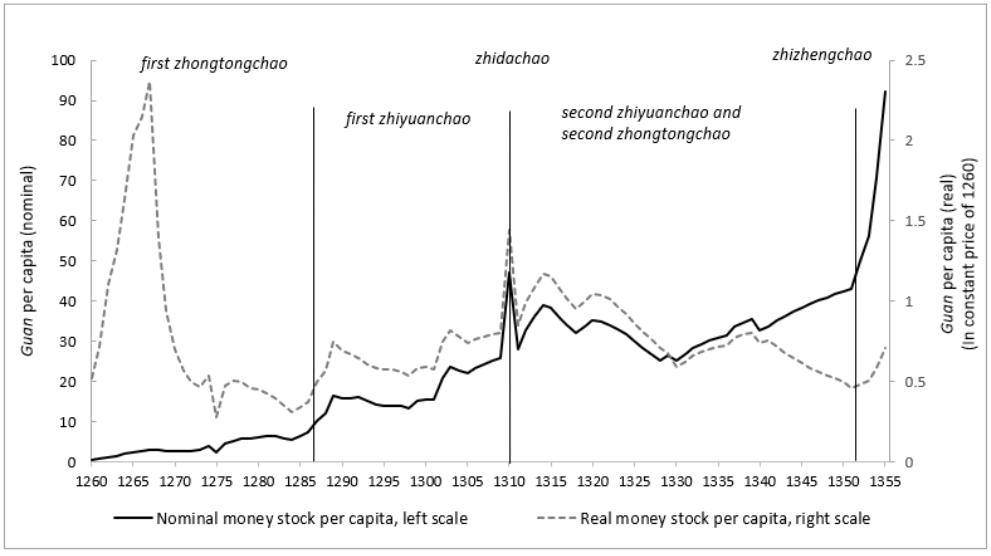

Figure 11. Money stock per capita, nominal and real, issued by the Yuan governments, 1260-1355.

Notes: We derive real money stock using the respectability CPI we constructed to deflate nominal money stock. Real money stock is in constant prices of 1260.

Sources: Wu, *Chinese Demographic History (Volume III)*, pp. 282-333 and pp. 383-91; Cao, *Chinese Demographic History (Volume IV)*, p. 3; *yuanshi*, chapters 35, 36, 39, 42 to 44, and 93 to 95; and Liu, 'Money reserves in the Yuan Dynasty', pp. 142-3.

Taxation

We collected taxation data from the *yuanshi* (chapters 17, 22, and 24). Unlike the data on money issues, which were systematically recorded in chapters of the *shihu-ozhi* in the *yuanshi*, taxation data were scattered in the chapters of the *benji*. We traced data on three years of taxation revenue and expenditure for 1292, 1308, and 1311. Based on this information, and the data for money issuance, we show taxation surplus and annual money issuances in Table 3.

Table 3. Tax surplus and annual paper money issuances for 1292, 1308, and 1311 (unit: 1,000 *ding*)

	Revenue	Expenditure	Tax surplus	Annual money issuance
1292	2,979	3,638	-659	2,500
1308	4,000	13,400	-9,400	5,000
1311	4,000	18,000	-14,000	10,900

Sources: *yuanshi*, chapters 17, 22, 24, and 93 to 95.

As the table shows, the Yuan government suffered from chronic fiscal deficits. Contemporary observers recorded that military campaigns, imperial grants, and natural

disasters were major factors that caused the deficits.[54] For these three years, a comparison of annual paper money issuance with taxation surplus shows that the government issued more paper money when public finances deteriorated. The evidence suggests that despite a period of non-negligible success lasting for decades, in the long run, Yuan China did not have the fiscal capacity and political foundations required for a fiat money system to be viable – as would later be the case in Western Europe and elsewhere, beginning with England.[55]

Warfare

Our warfare data are coded from Chen et al..[56] Originally written in 1939, this ten-volume work, *Zhongguo lidai tianzai renhuo biao* 中國曆代天災人禍年表 (A chronicle of natural and man-made disasters in China), collected natural and man-made disasters (such as war) occurring from 221 BCE to 1911 CE. Chen et al. collected data from the *benji* 本紀 (Imperial biographies), and the *wuxingzhi* 五行誌 (Monographs on five elements) in the *ershiwushi* 二十五史 (Twenty-five histories) primary source. Chen et al. also consulted additional primary sources, namely

[54] *yuanshi*, chapter 22.
[55] Bonfatti et al., 'Monetary capacity'; O'Brien and Palma, 'The bank restriction act'; idem, 'Not an ordinary bank'.
[56] Chen et al., *A Chronicle of Natural and Man-made Disasters in China*, pp. 1068–1220.

the *huiyao* 會要 (Government manuscript compendium), and the *huidian* 會典 (Imperial edicts) for different dynasties, as well as contemporary private historical works. Chen et al. recorded natural disasters of floods, droughts, and other disasters, and classified man-made disasters into domestic warfare, external warfare, and others.[57] The colossal number of primary sources deployed by Chen et al. gives this work credibility, and it is widely used by scholars such as Gu and Kung, or Brook, to study the history of China.[58] Based on the information provided in this book, we collected the number of wars referring to each year.

To explore which types of warfare impacted money issuance, we classify types of warfare into the following three categories: 'External warfare', which is the warfare that Yuan engaged against Japan or southeast Asia countries; 'unification warfare', the wars that Yuan fought with the Southern Song to declare legitimacy over all Chinese territories; and 'civil warfare', which includes rebellions, riots, and royal family military conflicts for a power struggle. As Figure 12 illustrates, unification wars dominated warfare from 1260 to 1278, when Kublai fought with the Southern

[57] Besides Chen's work, we also examined the *Zhongguo lidai zhanzheng nianbiao 中國曆代戰爭年表 (A chronology of wars in Chinese history)*. We did not rely on this book to collect warfare data because Chen's list of wars is more comprehensive. See *Zhongguo junshi bianxiezu* 中國軍事史編寫組 (Chinese Military History Writing Group), *A chronology of wars in Chinese history*.

[58] See Gu and Kung, 'Malthus goes to China'; Brook, 'Profiling the climate history of the Yuan and Ming dynasties'.

Song regime to unify the nation. During Kublai's thirty years of reign, from 1264 to 1294, he initiated a series of external warfare to conquer South Asia and Japan. Unlike external war and unification war, which gradually ceased after Kublai passed away, civil warfare persisted throughout the Yuan dynasty, and it in fact intensified as the dynasty declined. Many Chinese treated the Mongols as crude barbarians, and were discontent with their earlier expropriations and tax policies.[59]

Those discrimination policies intensified the conflicts between the Mongols and the southern Chinese, and therefore, the southern Chinese initiated most of the rebellions during the Yuan dynasty. There were 13 administrative regions under the Yuan regime. During the years that warfare intensified, such as around 1275 and around 1355, two-thirds of China's regions were involved in fighting. According to contemporary observers, those wars were costly and triggered the government to issue substantial amounts of paper money.[60]

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[59] Rossabi, *Khubilai Khan*, pp.180-8.
[60] Peng, *The monetary history of China*, p.598.

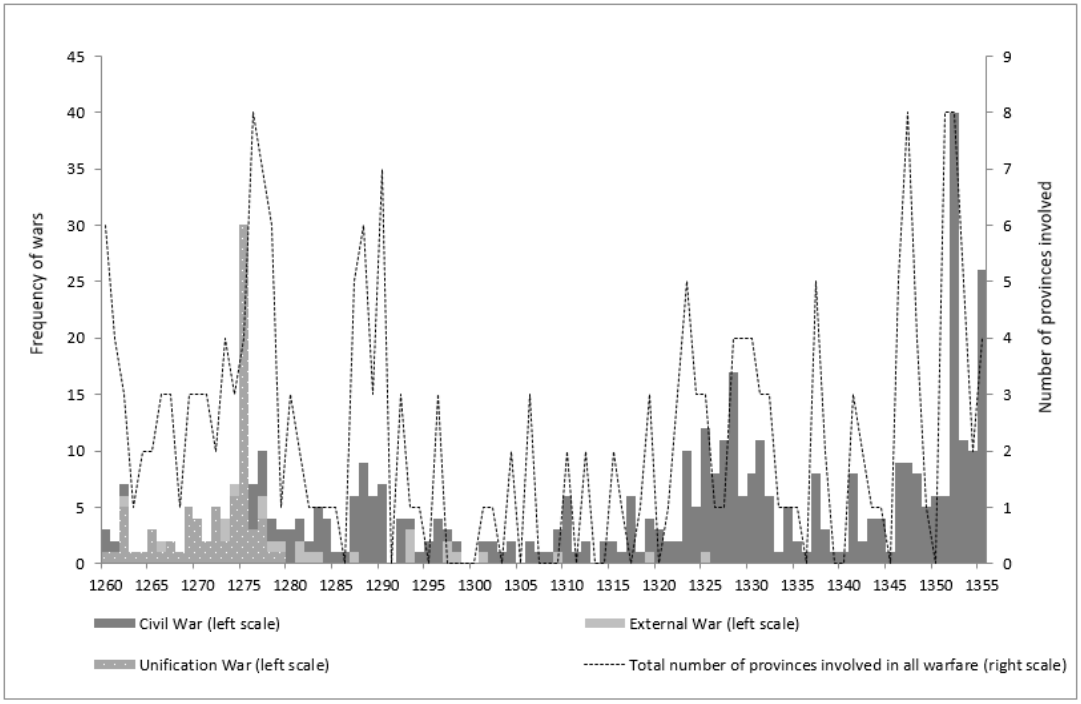

Figure 12. Warfare by types and number of provinces involved.
Source: Chen et al., *A Chronicle of Natural and Man-made Disasters in China*, pp. 1068–1220.

Natural disasters

Besides imperial grants and military campaigns, contemporary observers documented that natural disasters also increased the burden on public finance. We constructed a dataset on natural disasters to study the relationship between money is-

suance and natural disasters.[61] Our data for natural disasters are collected from Chen et al., the same source that we deployed in constructing the warfare dataset.[62]

Figure 13 plots the frequency of natural disasters between 1260 and 1355. As the figure shows, Yuan China was calamitous. After the initial years of tranquillity, from 1285, the empire began to suffer from various natural disasters. Flood and drought were the two most frequently documented disasters, followed by locust plague, famine, endemic disease, earthquake, and others. Catastrophes culminated around 1325, and began to decline after that. The Black Death is not mentioned in contemporary sources, but endemic disease appeared more frequently in 'other disasters' from 1350.

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[61] For example, *yuanshi* recorded a locust plague in 1329 that caused 670,000 households to suffer from famine. To provide aid, the government sent 90,000 *ding* paper money and 5,000 *shi* grains. See *yuanshi*, chapter 33.

[62] Chen, *A Chronicle of Natural and Man-made Disasters in China*, pp.1068–1220.

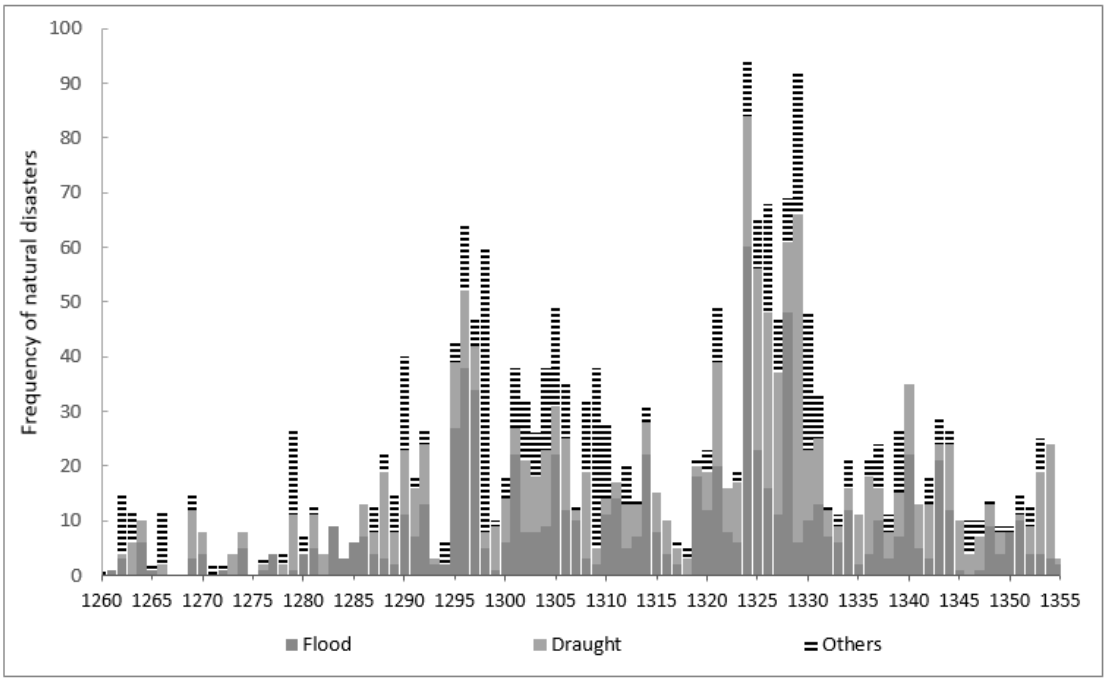

Figure 13. Frequency of Natural Disasters.
Source: Chen et al., *A Chronicle of Natural and Man-made Disasters in China*, pp. 1068–1220.

4. A statistical analysis of paper money issues

Contemporary observers and scholars documented that warfare, imperial grants, and natural disasters were major causes of the fiscal actions observed.[63] This section examines how these factors correlate with the quantities of paper money issued. We also explore the silver standard's role in regulating paper money issues.

[63] Hsiao 'Mid-Yüan Politics', p. 521; Peng, *The monetary history of China*, p. 514.

We first examine the relationship between total warfare, imperial grants, natural disasters, and money issuance.[64] The period covered by our data corresponds to 1260 to 1355. Our dependent variable in equation (1) is the natural logarithm of paper money issuance in year *t* under the sovereignty of emperor *j*. Our right-hand-side variables are 1) the natural logarithm of the sum of the current and past two years' total warfare, 2) the natural logarithm of the sum of the current and past two years' natural disasters, 3) and the natural logarithm of the sum of the current and past two years' imperial grants. We control for population $(Pop)_t$, as a measure for the size of the economy, and we include a time trend *t*, as well as emperor fixed effects for each emperor *j* ruling at year t. ε_t is a random error.[65]

$$\ln(Issues)_t = \alpha + \beta_1 \ln\left(\sum_{h=0}^{2} TotalWar_{t-h}\right) + \beta_2 \ln\left(\sum_{h=0}^{2} Grants_{t-h}\right) + \beta_3 \ln\left(\sum_{h=0}^{2} Disaster_{t-h}\right) + \beta_4 \ln(Pop_t) + \beta_5 t + \sum_{j=1}^{10} \gamma_j Emperor_{t,j} + \varepsilon_t \quad (1)$$

[64] Our dependent variable does not include zeros. The right-hand-side variables number of wars, imperial grants, and natural disasters include zeros for some years. To avoid $\ln(0)$, we use an inverse hyperbolic sine transformation, $IHS(x) = \ln(x + \sqrt{(x^2 + 1)})$. Note that zeros in these variables are infrequent, and correspond to counts, not dummies; this is the type of situation when the IHS transformation is most reasonable. We checked that our results are robust to arbitrarily changing the unit of the untransformed variable by multiplying it by very large numbers. As the results have an elasticity interpretation, we abuse notation in what follows and simply refer to natural logarithms.

[65] We use Philips-Perron unit root test to examine the stationarity of the variables in Equation (1). We found that *ln(Issues)* is nonstationary and we add a time trend to solve this problem. Table A4 shows results for the test. *Ln(nominal issues)* is stationary after the trend is added.

Next, employing equation (2), we divided total warfare into three sub-categories (external, unification, and civil war), and examined the impact of different types of wars on money issuance. Our dependent variable in equation (2) is the natural logarithm of paper money issuance in year t under the sovereignty of emperor j. Our independent variables are 1) the natural logarithm of the sum of the current and past two years' external wars, 2) the natural logarithm of the sum of the current and past two years' unification wars, 3) the natural logarithm of the sum of the current and past two years' civil wars, 4) the natural logarithm of the sum of the current year and past two years' natural disasters, and 5) the natural logarithm of the current and past two years' imperial grants. We control for population $(Pop)_t$, a time trend, t, and emperor fixed effects. ε_t is a random error.

$$\begin{aligned}\ln(Issues)_t = \sigma &+ \delta_1 \ln\left(\sum_{h=0}^{2} ExternalWar_{t-h}\right) + \delta_2 \ln\left(\sum_{h=0}^{2} UnificationWar_{t-h}\right) \\ &+ \delta_3 \ln\left(\sum_{h=0}^{2} CivilWar_{t-h}\right) \\ &+ \delta_4 \ln\left(\sum_{h=0}^{2} Grants_{t-h}\right) + \delta_5 \ln\left(\sum_{h=0}^{2} Disaster_{t-h}\right) + \delta_6 \ln(Pop_t) + \delta_7 t \\ &+ \sum_{j=1}^{10} \eta_j \, Emperor_{t,j} + \varepsilon_t\end{aligned} \tag{2}$$

Table 4 reports the regression results for equations (1) and (2). As Specification (1)

shows, the impact of total warfare on nominal issues is statistically significant at the 5 per cent critical value, with a 1 per cent increase in total warfare correlating with a 0.41 per cent increase in nominal money issuing, *ceteris paribus*. The impact of imperial grants and natural disasters on money issues is not statistically different from zero at conventional significance levels. We interpret this as evidence against the common argument that these two factors were the cause of the over-issuance of money. Specification (2) shows the impact of total warfare, imperial grants, and natural disasters on real money issues. We reject at conventional levels of significance that total warfare impacted real money issues for the period as a whole. However, the impact from natural disasters is significant at the 10 per cent critical value: a 1 per cent increase in natural disasters correlates with a 0.33 per cent increase in money issuing, *ceteris paribus*.

Table 4. Money issues and their correlates, 1260–1355

	(1) *ln(nominal issues)*	(2) *ln(real issues)*	(3) *ln(nominal issues)*	(4) *ln(real issues)*
ln(total war)	0.406**	0.256		
(sum of the current year and previous two)	(0.162)	(0.163)		
ln(external war)			0.0264	-0.0189
(sum of the current year and previous two)			(0.141)	(0.146)
ln(unification war)			0.258***	0.142

(sum of the current year and previous two)			(0.0934)	(0.124)
ln(civil war)			0.300**	0.328***
(sum of the current year and previous two)			(0.122)	(0.124)
ln(nominal grants)	0.00173		0.00838	
(sum of the current year and previous two)	(0.0234)		(0.0251)	
ln(real grants)		0.0304		0.0224
(sum of the current year and previous two)		(0.0438)		(0.0406)
ln(natural disasters)	0.168	0.328*	0.203	0.310*
(sum of the current year and previous two)	(0.168)	(0.180)	(0.178)	(0.166)
ln(population)	1.153***	0.501	0.983***	0.221
	(0.308)	(0.397)	(0.344)	(0.346)
Year trend	0.0351	-0.0130	0.0492*	-0.00544
	(0.0259)	(0.0282)	(0.0265)	(0.0236)
Constant	-53.54*	16.98	-68.45**	12.47
	(28.70)	(30.76)	(29.16)	(26.85)
Emperor FE	Yes	Yes	Yes	Yes
Observations	94	94	94	94

Notes: ***, **, and * denote significance levels at 1%, 5%, and 10%, respectively. Numbers in parentheses are robust standard errors. We use three serial correlation lags in the New-ey-West standard errors, following Greene, *Econometric analysis*, p. 960.

Specifications (3) and (4) show that not all wars were alike. When splitting warfare among types, we find that the impact of unification wars is statistically significant for nominal money issues at the 1 per cent critical value, and the impact of the civil war is significant for both nominal and real money issues at the 5 and 1 per cent critical values, respectively. In Specification (3), keeping other variables constant, a 1

per cent increase in the sum of the current and previous two years' unification wars correlates with a 0.26 per cent increase in nominal money issued. Similarly, a 1 per cent increase in civil war, ceteris paribus, is associated with a 0.30 per cent increase in nominal money issued. In Specification (4), the impact of civil wars is significant for real money issues, with a 1 per cent increase in civil wars correlating with a 0.33 per cent increase in real money issuance. The impact of natural disasters on money issuing is also significant in real terms, with a 1 per cent in natural disasters correlating with a 0.31 per cent increase in real money issuance.[66] We reckon that the impact of external warfare on money issues is not significant because its frequency decreased to nearly zero after Kublai passed away in 1294. Civil wars were more intensive than external and unification wars, lasted longer, and involved more provinces.

We now explore the relationship between money issues and monetary regimes. Using the full silver standard (1260–75) as a baseline, we compare whether money issues under the nominal silver standard (1276–1310) and the fiat standard (1311–1355) were statistically different from those under the full silver standard. As before,

[66] We show in the Appendix (Tables A5 and A6) that our results remain similar if we use only one lag instead of two to build the right-hand side variables, or if we include a late Yuan (1345-1355) dummy as a right-hand side variable.

we control for the population, as an approximate measurement of the size of the economy, add a time trend t, and emperor fixed effects for each emperor j ruling at year t. ε_t is the random error. The results are shown in Table 5.

$$\ln(Issues)_t = v + \lambda_1 NominalSilverStandard_t + \lambda_2 FiatStandard_t + \lambda_3 Pop_t + \lambda_4 t + \sum_{j=1}^{10} \mu_j Emperor_{t,j} + \varepsilon_t \quad (3)$$

Table 5. Money issues under three different monetary standards, with the full silver standard (1260–76) as a baseline

	(1)	(2)
	ln(nominal issues)	*ln(real issues)*
Nominal silver standard	1.100*	0.965*
(1276-1309)	(0.580)	(0.536)
Fiat standard	3.009***	2.931***
(1310-1355)	(0.564)	(0.528)
ln(population)	0.586	0.0612
	(0.567)	(0.551)
Year trend	0.0479	-0.00733
	(0.0302)	(0.0308)
Constant	-58.48*	19.46
	(31.49)	(32.44)
Emperor FE	Yes	Yes
Observations	96	96

Notes: ***, **, and * denote significance levels at 1%, 5%, and 10%, respectively. Numbers in parentheses are robust standard errors. We use three serial correlation lags in the Newey-West standard errors, following Greene, *Econometric analysis*, p. 960.

Specification (1) in Table 5 shows that compared with the nominal money issued under the full silver standard, the elasticity of the average nominal money issues during the nominal silver standard doubled, and the elasticity of the average nominal money issues under the fiat standard quadrupled, all else constant. For money issued in real terms, compared with the real money issued under the full silver standard, the elasticity of the average real money issues during the nominal silver standard dou-

bled, and the elasticity of the average real money issues under the fiat standard tripled, conditional on the included controls. The above results suggest that compared with the full silver standard, the issuance of paper money increased significantly under the nominal silver standard and the fiat standard.

To understand the impact of warfare on money issued under various monetary standards, we now employ Equations (4) and (5). In equation (4), φ_1 indicates the impact of total warfare on money issuing under the full silver standard, compared with the average impact on money issuing across the whole period (1260–1355). In turn, φ_2 estimates the impact of total warfare on money issuing under the nominal silver standard compared with the average impact of total warfare on money issuing across the whole period. φ_3 estimates the impact of the total warfare in fiat standard compared with the average impact of total warfare on money issuing across the whole period. We control for population, imperial grants, and natural disasters, add a time trend *t*, and consider fixed effects of emperor *j* at year *t*.

$$\ln(Issues)_t = \chi + \varphi_1 FullSilverStandard_t \times \ln\left(\sum_{h=0}^{2} TotalWar_{t-h}\right)$$
$$+ \varphi_2 NominalSilverStandard_t \times \ln\left(\sum_{h=0}^{2} TotalWar_{t-h}\right)$$
$$+ \varphi_3 FiatStandard_t \times ln\left(\sum_{h=0}^{2} TotalWar_{t-h}\right) + \varphi_4 \ln\left(\sum_{h=0}^{2} Grants\right) + \varphi_5 \ln\left(\sum_{h=0}^{2} Disaster\right) + \varphi_6 Pop_t + \varphi_7 t \quad (4)$$
$$+ \sum_{j=1}^{10} \omega_j Emperor_{t,j} + \varepsilon_t$$

Similarly, in equation (5), κ_1 estimates the impact of the civil war on money issuing under the full silver standard, compared with the average impact on money issuing across the whole period (1260–1355). κ_2 estimates the impact of civil wars on money issuing during the nominal silver standard, compared with the average impact of civil warfare on money issuing throughout the period. κ_3 in turn, estimates the impact of total warfare on money issuing under the fiat standard, compared with the average impact of total warfare on money issuing across the whole period. Note that some types of wars no longer took place in the later stages. Thus to consider interactions between regimes and wars, we focus on total wars and civil wars, which have always existed.[67]

[67] External wars subsided after 1294 and stopped from 1326. Unification wars stopped from 1280.

$$\ln(Issues)_t = \phi + \kappa_1 FullSilverStandard_t \times \ln\left(\sum_{h=0}^{2} CivilWar_{t-h}\right)$$
$$+ \kappa_2 NominalSilverStandard_t \times \ln\left(\sum_{h=0}^{2} CivilWar_{t-h}\right)$$
$$+ \kappa_3 FiatStandard_t \times \ln\left(\sum_{h=0}^{2} CivilWar_{t-h}\right) + \kappa_4 \ln\left(\sum_{h=0}^{2} Grants\right) + \kappa_5 \ln\left(\sum_{h=0}^{2} Disaster\right) + \kappa_6 Pop_t + \kappa_7 t \quad (5)$$
$$+ \sum_{j=1}^{10} \tau_j Emperor_{t,j} + \varepsilon_t$$

Specification (1) in Table 6 shows that the impact of total warfare on nominal money issuing is not statistically significant under the full silver and nominal silver standards but is significant under the fiat standard. Compared with the average impact of total warfare on nominal money issuing across the period, under the fiat standard, a 1 per cent increase in total warfare correlates with a 0.61 per cent increase in nominal money issuing. In real terms, Specification (2) shows that the impact of total warfare is statistically significant during the fiat standard, with a 1 per cent increase in total warfare correlating with a 0.50 per cent increase in real money issuing.

Specifications (3) and (4) indicate the impact of civil war on money issuing under different monetary standards. Similar to the results of total warfare, the impact of civil war on money issues is statistically significant during the fiat standard at 1 per cent significance level, both in nominal and real terms. Compared with the average impact of civil wars on nominal money issues across the whole period of 1260–1355,

a 1 per cent increase in civil war during the fiat standard correlates with a 0.58 per cent increase in nominal money issues and with a 0.50 per cent increase in real money issues. These results show that in nominal terms, interactions between total war and monetary regimes and between civil war and monetary regimes were only significant at the fiat standard but not during the full and nominal silver standards. In other words, it suggests that compared with the whole period, the impact of total war and civil war on nominal money issues is significant and positive during the fiat standard.

Table 6. Warfare and money issues under three monetary standards

	(1)	(2)	(3)	(4)
	ln(nominal)	*ln(real)*	*ln(nominal)*	*ln(real)*
ln(total war)×full silver standard	0.120	-0.123		
(sum of the current year and previous two)	(0.189)	(0.230)		
ln(total war)×nominal silver standard	0.261	0.0919		
(sum of the current year and previous two)	(0.203)	(0.209)		
ln(total war)×fiat standard	0.608***	0.497***		
(sum of the current year and previous two)	(0.179)	(0.167)		
ln(civil war)×full silver standard			0.166	0.482*
(sum of the current year and previous two)			(0.188)	(0.270)
ln(civil war)×nominal silver standard			0.133	0.105
(sum of the current year and previous two)			(0.171)	(0.172)
ln(civil war)×fiat standard			0.579***	0.496***
(sum of the current year and previous two)			(0.176)	(0.176)
ln(nominal grants)	-0.0113		-0.0106	
(sum of the current year and previous two)	(0.0208)		(0.0213)	
ln(real grants)		0.00464		-0.000825
(sum of the current year and previous two)		(0.0356)		(0.0339)

ln(natural disasters)	0.152	0.321*	0.0575	0.222
(sum of the current year and previous two)	(0.162)	(0.171)	(0.202)	(0.205)
ln(population)	1.073***	0.300	1.228***	0.566
	(0.389)	(0.433)	(0.391)	(0.409)
Year trend	0.0261	-0.0231	0.0220	-0.0200
	(0.0251)	(0.0267)	(0.0258)	(0.0259)
Constant	-39.67	34.63	-36.49	26.21
	(27.26)	(29.19)	(29.85)	(30.68)
Emperor FE	Yes	Yes	Yes	Yes
Observations	94	94	94	94

Notes: ***, **, and * denote significance levels at 1%, 5%, and 10%, respectively. Numbers in parentheses are robust standard errors. We use three serial correlation lags in the Newey-West standard errors, following Greene, *Econometric analysis*, p. 960.

The above econometric analysis shows that compared with the impact of natural disasters and imperial grants, the correlation between warfare, particularly civil war, and money issues was more significant and larger. When examining money issuances under different monetary standards, we find that compared with the full silver standard, nominal issues doubled during the nominal silver standard and quadrupled during the fiat standard. Finally, we examined the impact of total warfare and civil war on money issuing under different monetary standards. We found that compared with their average impact across the period, their impact was more significant (and had a much larger magnitude) during the fiat standard. In other words, under the fiat standard, total warfare and civil war were much more likely to increase nominal money issues.

5. Conclusion

The Yuan were the world's first regime that used paper money as the sole medium of exchange, marking a milestone in global financial history. This period was also a turning point in China's the monetary transition from copper coins to silver. For some time, China entered an age of fiat money with some similarities to modern monetary systems. To promote the circulation of paper money, the Yuan governments introduced the silver standard, the first precious metal standard in history.

Our paper explores the mechanism of paper money in Yuan China by deploying extensive primary and secondary sources. We show that the Yuan's paper money regime was stable and successful for nearly half of the century. However, as the Yuan court faced escalating fiscal deficits, a fiat money was established, with over-issuance and inflation becoming unavoidable. Our empirical results demonstrate that fiscal pressure due to civil wars was the most important factor driving the government to issue more paper money. Contrary to the traditional view of several previous historians, we found that the impact of the imperial grants and natural disasters was relatively unimportant. A full silver standard prevented the over-issuance of paper money resulting from the fiscal pressure of warfare, but only while it lasted. Its ex-

istence was endogenous to the overall geopolitical situation at any given moment. Prices in Yuan China followed a trend from stability to mild inflation and then to hyperinflation, driven by fiscally-motivated money issues caused by military expenditures.

Our study echoes the studies of the classical gold standard. Similarly to the classical gold standard, the full silver standard (1260-1275) in Mongol Yuan China proved a commitment mechanism that constrained the over-issuance of paper money – but only while it lasted. The nominal silver standard proved successful when measured by the price level, which remained stable into the first half of the fiat standard period. China's experience is informative for contextualizing European economic and political history, as it reveals what were some of the necessary conditions for the latter's later success.[68]

Our findings indicate that despite remarkable decades of comparative success, in the long run, the Yuan government could not manage the issuance and circulation of fiat

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[68] Studies concerning the gold standard have focused on three aspects of its performance: an international exchange rate arrangement, a provider of macroeconomic stability, and a constraint on government policy actions. Under this definition, the gold standard can be viewed as a form of constraint over monetary policy actions— a form of monetary rule. See Bordo and Kydland, 'The gold standard'; Eichengreen, 'Conducting the international orchestra'; Obstfeld and Taylor, 'Sovereign risk and the gold standard'.

money efficiently due to a low level of state capacity and institutional development.[69] This contrasts with Western Europe's (much later) situation, beginning with England.[70]

From its foundation in 1694, the Bank of England had extended large amounts of credit to support the British state and economy. In the wake of a landing of French troops in Wales in 1797, the Bank of England suspended the convertibility of banknotes into gold with the support of an Act of Parliament. This was possible due to the strong fiscal foundations and institutional credibility of the economy.[71] The British public accepted the Bank of England's fiat – essentially government debt repackaged as money – at only a moderate discount during the restriction period (1797-1821) because repayment of debt was credible. This was the case due to the combination of a largely independent Bank of England with strong fiscal foundations deriving from the existence of a political system that benefited from a well-functioning set of checks and balances.[72] By contrast, in China, the state's fiscal

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[69] von Glahn, *Fountain of fortune*, p. 79; Ma and Zhao, 'A silver transformation'; Palma and Zhao, 'The efficiency of the Chinese silver standard'.
[70] Palma, 'Money and modernization in early modern England'; O'Brien and Palma, 'The bank restriction act; idem, 'Not an ordinary bank'.
[71] Inflation always depends on credibility and expectations which are highly context-dependent; Sargent 'Four big inflations'; Sargent and Velde, 'Macroeconomic features'.
[72] Karaman and Pamuk, 'Different paths to the modern state'; Henriques and Palma, 'Comparative European institutions'.

capacity was lower, even though it varied considerably over the centuries. It was only during the later Ming and Qing dynasties that it would become exceptionally low.[73] Nonetheless, it must be emphasized that the adequate conditions for fiat money to emerge (especially on a permanent basis) only emerged several centuries after the long-lasting – even if ultimately unsuccessful – experiments of the Yuan.[74] Following the definite collapse of paper money under the fiscally-weak Ming regime, China would have to wait until several centuries later to return to paper money, influenced by Western technology and institutions.[75]

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[73] von Glahn, 'Modalities of the Fiscal State'; Brandt et al, 'From divergence to convergence'.
[74] In fact, it was only with the end of the Bretton Woods system in the early 1970s that all ties (direct or indirect) to gold reserves were completely and permanently (so far) cut.
[75] von Glahn, 'Modalities of the Fiscal State'; Palma and Zhao, 'The efficiency of the Chinese silver standard'; Ma, 'Money and Monetary System'.

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REPLICATION PACKAGE

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REFERENCES

Printed primary sources

Xu wenxiantongkao 续文献通考 (A Continuation of Comprehensive Examination of Literature). Volume 9, qianbikao 钱币考 (An Examination of Money), Wang Qi 王圻 (Shanghai, 1936).

Yuandianzhang 元典章 (The Collection of Laws of the Yuan Dynasty), Chen Gaohua 陳高華 Dang Baohai 黨寶海, Liu Xiao 劉曉, and Zhangfanet 張帆 (Tianjin, 2011).

Yuanshi 元史 (History of the Yuan), Song Lian 宋濂 (Beijing, 1976).

Secondary sources

Biran, M., 'The Mongol Empire and Inter-Civilizational Exchange', in B. Z. Kedar and M.E. Wiesner-Hanks, eds., *The cambridge world history.* (Cambridge, 2015), pp. 534–58.

Bonfatti, R., Brzezinski, A., Karaman, K. and Palma, N., 'Monetary capacity', *CEPR discussion paper.*

Bordo, M. D. and Kydland, F. E., 'The Gold Standard as a Commitment Mechanism', in, T. Bayoumi, B. Eichengreen, and M. Taylor, eds., *Economic Perspectives on the Classical Gold Standard* (Cambridge, 1995), pp. 55-100.

Brandt, L., Ma, D. and Rawski, T. G., 'From divergence to convergence: reevaluating the history behind China's economic boom', *Journal of Economic Literature*, 52,1 (2014), pp. 45-123.

Brook, T., 'Nine sloughs: Profiling the climate history of the Yuan and Ming dynasties, 1260–1644', *Journal of Chinese History*, 1 (2017), pp. 27-58.

Cao, Shuji 曹樹基, *Zhongguo renkoushi (disijuan): Mingshiqi 中國人口史,第四捲,明時期* (*Chinese demographic history, IV, the period of Ming*) (Shanghai, 2000).

Chen, Gaoyong 陳高傭 Gu Guixian 顧貴先, Li Wei 李偉, Min Naijie 閔乃傑, Ren Degeng 任德庚, Shen Mingzhang 沈明璋, Shi Zhigang, Zhou Weiguang 周渭光,

and Zou Liangjun 鄒良君, *Zhongguo lidai tianzai renhuo biao 中國曆代天災人禍年表 (A chronicle of natural and man-made disasters in China)* (Shanghai, 1986).

Eichengreen, B., 'Conducting the international orchestra: Bank of England leadership under the classical gold standard', *Journal of International Money and Finance*, 6.1 (1987), pp. 5-29.

Ge, Jianxiong 葛劍雄, *Zhongguo renkou fazhanshi 中國人口髮展史* (*A History of population development in China*) (Fujian, 1991).

Greene, W. H., *Econometric analysis* (London, 2011).

Gu, Y. and Kung J, K., 'Malthus Goes to China: The Effect of "Positive Checks" on Grain Market Development, 1736–1910', *The Journal of Economic History*, 81 (2021), pp,1137-1172.

Hartwell, R., 'Hartwell China Historical Studies GIS', (2015) http://doi.org/10.7910/DVN/29302 (accessed on 7 March 2022).

Hsiao, C., 'Mid-Yüan politics', in H. Franke and D. Twitchett eds., *The cambridge history of China* (Cambridge, 1994), pp. 490-560.

Henriques, A. and Palma, N., 'Comparative european institutions and the little divergence, 1385–1800', *Journal of Economic Growth*, 28,2, (2023), pp. 259-294.

Karaman, K. K. and Şevket P., 'Different paths to the modern state in Europe: the interaction between warfare, economic structure, and political regime', *American Political Science Review*, 107,3, (2013), pp. 603-626.

Li, Chunyuan 李春圓, *'Yuandai de wujia he caishui zhidu 元代的物價和財稅製度 (The prices, taxation, and fiscal system in Yuan China)'* (pub. Ph.D. thesis, Fudan University, 2014).

Liu, Sen 劉森, '*Yuandai chaoben chutan* 元代鈔本初探 (Preliminary study of the money reserves in the Yuan Dynasty)', *Journal of Henan University (Social Science)*, 2, (2007), pp. 135-43.

Ma, D., 'Chinese money and monetary system, 1800–2000, overview' in Gerard Caprio, eds., *Handbook of key global financial markets, institutions, and infrastructure, vol. 1* (Oxford, 2013), pp. 57-64.

Ma, D. and Zhao, L., 'A silver transformation: Chinese monetary integration in times of political disintegration, 1898–1933', *Economic History Review*, 73, 2, (2020), pp. 513-539.

Elvin, M., *The pattern of the Chinese past: A social and economic interpretation* (California, 1973).

Miyazawa, Tomoyuki 宮澤知之, '元朝財政統計の基準紙幣と商税 (The fiscal statistics on the paper currency and commercial tax revenue in Yuan Dynasty)',

13,14 世紀東アジア史料通信 (Newsletter on Historical Documents in the 13-14th Century East Asia), 14, (2010), pp. 1-10.

Miyazawa, Tomoyuki 宮澤知之, '元朝の財政と鈔(Public finance and the issuance of paper money in Yuan China)', 佛教大学(Buddhism university), *歷史学部論集 (Symposium of the Division of History Research)*, 2 (2012), pp. 43-64.

Obstfeld, M. and Taylor A. M., 'Sovereign risk, credibility and the gold standard: 1870-1913 versus 1925-31', *The Economic Journal*, 113, 487 (2003),pp. 241–75.

O'Brien, P. and Palma, N., 'Danger to the old lady of Threadneedle street? The bank restriction act and the regime shift to paper money, 1797-1821', *European Review of Economic History*, 24, 2 (2020), pp. 290-426.

O'Brien, P. and Palma, N., 'Not an ordinary bank but a great engine of state: the Bank of England and the British economy, 1694-1844', *Economic History Review* 76 (2023), pp. 305-329.

Palma, N., 'Money and modernization in early modern England', *Financial History Review*, 25, 3 (2018), pp. 231-261.

Palma, N. and Zhao, L., 'The efficiency of the Chinese silver standard, 1920–1933'. *The Journal of Economic History*, 81, 3 (2021), pp. 872-908.

Peng, Xinwei 彭信威, *Zhongguo huobishi* 中國貨幣史 (*The monetary history of China*) (Beijing, 2020).

Rossabi, M., *Khubilai Khan: His life and times, 20th anniversary edition* (California, 2009).

Sargent, T. J., 'The ends of four big inflations', in R. E. Hall, eds., *Inflation: causes and effects* (Chicago, 1983), pp. 41–97.

Sargent, T. J. and Velde, F. R., 'Macroeconomic features of the French Revolution', *Journal of Political Economy*, 103 (3), (1995) pp. 474-518.

Shi, Weimin 史衛民, '*Yuan suici kaoshi* 元歲賜考實 (An Examination of Imperial Grants in Yuan)' in *Yuanshi yanjiuhui* 元史研究會 (Yuan History Society) eds., *Yuanshi luncong* 元史論叢 *(A Symposium of the history of the Yuan)* (Beijing, 1986), pp. 144-154.

Takahashi, H., *Song Jin Yuan huobishi yanjiu: Yuanchao huobi zhengce zhi xingcheng guocheng* 宋金元货币史研究——元朝货币政策之形成过程*(Research on monetary history in Song, Jin, and Yuan China: Formation of monetary policy in Yuan China)* (Shanghai, 2010).

Tullock, G., 'Paper money-a cycle in cathay', *Economic History Review*, 2nd ser.,IX (1957), pp. 393-407.

Vogel, H. U., *Marco Polo was in China: new evidence from currencies, salts and revenues* (Leiden, 2012)

von Glahn, R., *Fountain of fortune: money and monetary policy in China, 1000-1700* (California, 1996).

von Glahn, R., 'Origins of paper money in China', in K. G. Rouwenhorst, and W. N Goetzmann, eds., *Origins of Value: The Financial Innovations that Created Modern Capital Markets* (New York, 2005), pp. 65-89.

von Glahn, R., 'Monies of account and monetary transition in China, twelfth to fourteenth centuries', *Journal of the Economic and Social History of the Orient*, 53, 3 (2010), pp. 463-505.

von Glahn, R., 'Cycles of silver in Chinese monetary history', in B. K. L. So eds, *The economy of lower Yangzi Delta in late imperial China: Connecting money, markets, and institutions* (Abingdon, 2013), pp. 17-71.

von Glahn, R., 'State formation in China from the Sui through the Song dynasties', in B. Z. Kedar and M.E. Wiesner-Hanks, eds., *The cambridge world history* (Cambridge, 2015), pp. 513-33.

von Glahn, R., *The Economic History of China: From Antiquity to the Nineteenth Century* (Cambridge, 2016).

von Glahn, R., 'Modalities of the fiscal state in Imperial China', *Journal of Chinese History*, 4,1 (2020), pp. 1-29.

Wilkinson, E. P., *Chinese history: a manual* (Cambridge, MA, 2000).

Wu, Han 吳晗, *Dushi zhaji 讀史札記 (Notes in Reading History)* (Beijing, 1956).

Wu, Songdi 吳鬆弟, *Zhongguo renkoushi, liao song jin yuan shiqi disanquan 中國人口史, 第三捲: 遼宋金元史集 (Chinese Demographic History, Volume III): Periods of Liao, Song, Jin, and Yuan)* (Shanghai, 2000).

Yang, Lien-sheng., *Money and credit in China: a short history* (Cambridge, MA, 1952).

Ye, Shichang 葉世昌, *'Yuandai de zhibi liutong zhidu* 元代的紙幣流通製度 (Circulation Institution of Paper Money in Yuan China)', *Zhongguo shehui jingjishi yanjiu 中國社會經濟史研究 (Researches in Social and Economic History of China)'*, 4 (1997), pp. 87-94.

Zhongguo junshi bianxiezu 中國軍事史編寫組(Chinese Military History Writing Group), *Zhongguo lidai zhanzheng nianbiao 中國曆代戰爭年表,下卷 (A chronology of wars in Chinese history, II)* (Beijing, 2003).

Appendix to:
"The Rise and Fall of Paper Money in Yuan China, 1260–1368",
by Guan, Palma & Wu

Table A1. Annual Nominal Paper Money Issues (1,000 *ding*)

Year	Annual paper money issues, 1260–1330				Annual paper money reserves		Annual money issues, 1330 onwards	Our estimation, 1260–1355
Year	*Zhongtongchao*	*Zhiyu-anchao*	*Zhida-chao*	*Zhizhengchao*	*Zhong-tongchao*	*Zhiyu-anchao*	*Zhong-tonchao*	*Zhongtongchao*
1260	73	0	0	0	-	-	-	73
1261	39	0	0	0	-	-	-	39
1262	80	0	0	0	-	-	-	80
1263	74	0	0	0	-	-	-	74
1264	89	0	0	0	-	-	-	89
1265	116	0	0	0	-	-	-	116
1266	77	0	0	0	-	-	-	77
1267	109	0	0	0	-	-	-	109
1268	30	0	0	0	-	-	-	30
1269	23	0	0	0	-	-	-	23
1270	97	0	0	0	-	-	-	97
1271	47	0	0	0	-	-	-	47
1272	86	0	0	0	-	-	-	86
1273	110	0	0	0	-	-	-	110
1274	247	0	0	0	-	-	-	247
1275	398	0	0	0	-	-	-	398
1276	1,420	0	0	0	-	-	-	1,420
1277	1,022	0	0	0	-	-	-	1,022
1278	1,023	0	0	0	-	-	-	1,023
1279	788	0	0	0	-	-	-	788
1280	1,136	0	0	0	-	-	-	1,136
1281	1,095	0	0	0	-	-	-	1,095
1282	969	0	0	0	-	-	-	969

1283	611	0	0	0	-	-	-	611
1284	630	0	0	0	-	-	-	630
1285	2,043	0	0	0	-	-	-	2,043
1286	2,182	0	0	0	-	-	-	2,182
1287	83	1,001	0	0	-	-	-	5,088
1288	0	922	0	0	-	-	-	4,608
1289	0	1,780	0	0	-	-	-	8,900
1290	0	500	0	0	-	-	-	2,501
1291	0	500	0	0	-	-	-	2,500
1292	0	500	0	0	-	-	-	2,500
1293	0	260	0	0	-	-	-	1,300
1294	0	193	0	0	-	-	-	969
1295	0	310	0	0	-	-	-	1,550
1296	0	400	0	0	-	-	-	2,000
1297	0	400	0	0	-	-	-	2,000
1298	0	300	0	0	-	-	-	1,500
1299	0	900	0	0	-	-	-	4,500
1300	0	600	0	0	-	-	-	3,000
1301	0	500	0	0	-	-	-	2,500
1302	0	2,000	0	0	-	-	-	10,000
1303	0	1,500	0	0	-	-	-	7,500
1304	0	500	0	0	-	-	-	2,500
1305	0	500	0	0	-	-	-	2,500
1306	0	1,000	0	0	-	-	-	5,000
1307	0	1,000	0	0	-	-	-	5,000
1308	0	1,000	0	0	-	-	-	5,000
1309	0	1,000	0	0	-	-	-	5,000
1310	0	0	1,450	0	-	-	-	36,259
1311	150	2,150	0	0	-	-	-	10,900
1312	100	2,222	0	0	-	-	-	11,212
1313	200	2,000	0	0	-	-	-	10,200
1314	100	2,000	0	0	-	-	-	10,100
1315	100	1,000	0	0	-	-	-	5,100
1316	100	400	0	0	-	-	-	2,100
1317	100	480	0	0	-	-	-	2,500
1318	100	400	0	0	-	-	-	2,100
1319	100	1,480	0	0	-	-	-	7,500
1320	100	1,480	0	0	-	-	-	7,500

1321	50	1,000	0	0	-	-	-	5,050
1322	50	800	0	0	-	-	-	4,050
1323	50	700	0	0	-	-	-	3,550
1324	150	600	0	0	-	-	-	3,150
1325	100	400	0	0	-	-	-	2,100
1326	100	400	0	0	-	-	-	2,100
1327	100	400	0	0	-	-	-	2,100
1328	31	311	0	0	-	-	-	1,585
1329	40	1,192	0	0	-	-	-	6,000
1330	50	450	0	0	-	-	-	2,300
1331	-	-	-	-	5	890	2,300	6,755
1332	-	-	-	-	4	996	2,300	7,284
1333	-	-	-	-	5	890	2,300	6,755
1334	-	-	-	-	5	890	2,300	6,755
1335	-	-	-	-	5	890	2,300	6,755
1336	-	-	-	-	5	890	2,300	6,755
1337	-	-	-	-	0	1,500	2,300	9,800
1338	-	-	-	-	0	1,200	2,300	8,300
1339	-	-	-	-	0	1,200	2,300	8,300
1340	-	-	-	-	0	1,200	2,300	8,300
1341	-	-	-	-	0	1,200	2,300	8,300
1342	-	-	-	-	0	0	2,300	2,300
1343	-	-	-	-	0	1,200	2,300	8,300
1344	-	-	-	-	0	1,200	2,300	8,300
1345	-	-	-	-	0	1,200	2,300	8,300
1346	-	-	-	-	0	1,200	2,300	8,300
1347	-	-	-	-	0	1,200	2,300	8,300
1348	-	-	-	-	0	1,200	2,300	8,300
1349	-	-	-	-	0	1,200	2,300	8,300
1350	-	-	-	-	0	1,200	2,300	8,300
1351	-	-	-	-	0	1,200	2,300	8,300
1352	0	100	0	1,900	-	-	-	19,500
1353	0	100	0	1,900	-	-	-	19,500
1354	-	-	-	-	-	-	-	34,500
1355	-	-	-	-	0	6,000	19,500	49,500

Notes: Before the issuance of the last paper money, the *zhizhengchao*, in 1352, the reason that the government did not record money issued in certain years was that if the amount of money issued in the current year was the same as for the previous year, the government did

not record it. See Liu 'Money reserves in the Yuan Dynasty', p. 143. Based on this argument, we add missing data from 1332 to 1355. Annual issues from 1260 to 1330, 1352, and 1353 are from *yuanshi*. Annual issues between 1331 and 1355 are compiled from Liu. We use *zhongtonghcao* as the unit of account and exchange other paper monies for *zhongtongchao* based on the official exchange rates recorded in *yuanshi*.

Sources: *yuanshi*, chapters 35, 36, 39, 42 to 44, and 93 to 95; Liu, 'Money reserves in the Yuan Dynasty', pp. 142-3.

Table A2. Household data, 1236–1393

Year	The Number of Households *(Hu)*
1236	1,100,000
1252	1,300,000
1261	1,418,499
1262	1,476,146
1263	1,579,110
1264	1,588,195
1265	1,597,601
1266	1,609,903
1267	1,644,030
1268	1,650,286
1269	1,684,157
1270	1,939,449
1271	1,946,870
1272	1,955,880
1273	1,962,765
1274	1,967,898
1275	4,760,000
1290	15,000,000
1330	15,400,000
1341	18,000,000
1393	15,500,000

Sources: Wu, *Chinese Demographic History (Volume III)*, pp. 282-333; pp. 383-391; Cao, *Chinese Demographic History (Volume IV)*, p. 3.

Table A3. Sources of fiscal revenue during the Yuan

Item	Description
Shuiliang (grain taxes)	Each household needed to submit one to four *shi* of in-kind goods, including millet, rice, or cotton. Households in the large and rich Jiangnan area (part of the lower Yangtze basin area) could pay in paper money as a replacement.
Kechai (household taxes)	Every two to five households needed to submit 1 *jin* of silk yarn plus silver or paper money.
Suike (gold, silver, cinnabar, jade, copper, iron, lead, tin, alum, sodium, carbonate, bamboo and wood taxes)	Depending on its natural endowments, each province needed to submit a certain quantity of metals, such as gold or silver, or chemicals, such as lead or mercury, to the central government every year.
Jiucuke (liquor and vinegar)	Liquor and vinegar were government monopolies. Merchants needed to buy these two products from the government.
Yanfa (salt monopoly system)	Salt was a government monopoly. Merchants needed to buy salt certificates (known as *yanyin*) from the government and collected the salt from salt fields using the certificates.
Chafa (tea monopoly system)	Tea was a government monopoly. Merchants needed to buy tea certificates (known as *chayin*) from the government and collected tea from tea fields using the certificates.
Shangshui (commercial tax)	Tax on trade and commerce, with a rate of 2 to 3 per cent.
Shibosi (maritime trade)	Tax on imported goods, with varying tax rates.
Ewaike (other)	Tax on livestock, property rents, business charters, and others.

Sources: *yuanshi*, chapters 93 to 97; Schurmann, *Economic structure of the Yuan dynasty*, p.11; and Kuroda, *A global history of money*, p. 76.

Table A4. Philips-Perron unit-root test

		Test statistic	1% Critical value	5% Critical value	10% Critical value	Result	Model
ln (nominal issues)	Z(ρ)	-4.808	-19.710	-13.660	-10.970	Nonstationary	1
	Z(τ)	-1.622	-3.517	-2.894	-2.582	Nonstationary	1
	Z(ρ)	-17.387	-27.230	-20.610	-17.430	Stationary	2
	Z(τ)	-3.088	-4.051	-3.455	-3.153	Stationary	2
ln (real issues)	Z(ρ)	-28.400	-19.710	-13.660	-10.970	Stationary	1
	Z(τ)	-3.923	-3.517	-2.894	-2.582	Stationary	1
	Z(ρ)	-39.198	-27.230	-20.610	-17.430	Stationary	2
	Z(τ)	-4.784	-4.051	-3.455	-3.153	Stationary	2
ln (total war)	Z(ρ)	-63.415	-19.710	-13.660	-10.970	Stationary	1
	Z(τ)	-6.313	-3.517	-2.894	-2.582	Stationary	1
ln (external war)	Z(ρ)	-85.272	-19.710	-13.660	-10.970	Stationary	1
	Z(τ)	-8.314	-3.517	-2.894	-2.582	Stationary	1
ln (unification war)	Z(ρ)	-14.589	-19.710	-13.660	-10.970	Stationary	1
	Z(τ)	-2.867	-3.517	-2.894	-2.582	Stationary	1
ln (civil war)	Z(ρ)	-35.879	-19.710	-13.660	-10.970	Stationary	1
	Z(τ)	-4.450	-3.517	-2.894	-2.582	Stationary	1
ln (nominal grants)	Z(ρ)	-27.696	-19.710	-13.660	-10.970	Stationary	1
	Z(τ)	-4.026	-3.517	-2.894	-2.582	Stationary	1
ln (real grants)	Z(ρ)	-18.676	-19.710	-13.660	-10.970	Stationary	1
	Z(τ)	-3.129	-3.517	-2.894	-2.582	Stationary	1
ln (natural disasters)	Z(ρ)	-40.233	-19.710	-13.660	-10.970	Stationary	1
	Z(τ)	-5.141	-3.517	-2.894	-2.582	Stationary	1
ln (population)	Z(ρ)	-3.564	-19.710	-13.660	-10.970	Nonstationary	1
	Z(τ)	-2.851	-3.517	-2.894	-2.582	Stationary	1

Notes: A time trend trend is excluded in Model 1; A time trend is included Model 2. The default of the number of the lags is to use $int\{4\left(\frac{T}{100}\right)^{\frac{2}{9}}\}$ lags. Based on this equation, we use 4 lags for the test. See, Stata Corp LP, *Stata Time-Series Reference Manual*, p.183.

Table A5. Money issues and its correlates, 1260–1355 (lag of one year's war)

	(1)	(2)	(3)	(4)
	ln(nominal)	*ln(real)*	*ln(nominal)*	*ln(real)*
ln(total war)	0.258*	0.136		
(sum of the current and previous year)	(0.137)	(0.132)		
ln(external war)			-0.0648	-0.122
(sum of the current and previous year)			(0.120)	(0.131)
ln(unification war)			0.265***	0.0994
(sum of the current and previous year)			(0.0862)	(0.136)
ln(civil war)			0.277**	0.293**
(sum of the current and previous year)			(0.111)	(0.118)
ln(nominal grants)	3.76e-06		-0.00269	
(sum of the current and previous year)	(0.0231)		(0.0214)	
ln(real grants)		0.0175		-0.00163
(sum of the current and previous year)		(0.0379)		(0.0318)
ln(natural disasters)	0.204*	0.267**	0.247**	0.289**
(sum of the current and previous year)	(0.109)	(0.122)	(0.0953)	(0.113)
ln(population)	1.146***	0.497	1.053***	0.256
	(0.335)	(0.434)	(0.321)	(0.363)
Year trend	0.0358	-0.0130	0.0455*	-0.00825
	(0.0277)	(0.0301)	(0.0254)	(0.0260)
Constant	-53.75*	18.08	-64.57**	16.29
	(30.33)	(32.07)	(27.74)	(28.66)
Emperor FE	Yes	Yes	Yes	Yes
Observations	95	95	95	95

Notes: The equations are:

$$\ln(Issues)_t = \alpha + \beta_1 \ln \sum_{h=0}^{1} (TotalWar_{t-h}) + \beta_2 \ln \sum_{h=0}^{1} (Grants_{t-h}) + \beta_3 \ln \sum_{h=0}^{1} (Disaster_{t-h}) + \beta_4 Pop_t + \beta_5 t + \sum_{j=1}^{10} \gamma_j \, Emperor_{t,j} + \varepsilon_t \quad \text{(A1)}$$

$$\ln(Issues)_t = \sigma + \delta_1 \ln\left(\sum_{h=0}^{1} ExternalWar_{t-h}\right) + \delta_2 \ln\left(\sum_{h=0}^{1} UnificationWar_{t-h}\right) + \delta_3 \ln\left(\sum_{h=0}^{1} CivilWar_{t-h}\right)$$
$$+ \delta_4 \ln \sum_{h=0}^{1} (Grants_{t-h}) + \delta_5 \ln \sum_{h=0}^{1} (Disaster_{t-h}) + \delta_6 Pop_t + \delta_7 t + \sum_{j=1}^{10} \eta_j \, Emperor_{t,j} + \varepsilon_t \quad (A2)$$

***, **, and * denote significance levels at 1%, 5%, and 10%, respectively. Numbers in parentheses are robust standard errors. We use three serial correlation lags in the Newey-West standard errors, following Greene, *Econometric analysis*, p. 960.

Table A6. Money issues and its correlates, 1260–1355

(including a late Yuan dummy)

	(1)	(2)	(3)	(4)
	ln(nominal)	*ln(real)*	*ln(nominal)*	*ln(real)*
ln(total war)	0.340*	0.178		
(sum of the current year and previous two)	(0.173)	(0.177)		
ln(external war)			0.0104	-0.0310
(sum of the current year and previous two)			(0.143)	(0.149)
ln(unification war)			0.271***	0.159
(sum of the current year and previous two)			(0.0889)	(0.117)
ln(civil war)			0.221*	0.258*
(sum of the current year and previous two)			(0.124)	(0.134)
ln(nominal grants)	0.0255		0.0368	
(sum of the current year and previous two)	(0.0317)		(0.0342)	
ln(real grants)		0.0730		0.0593
(sum of the current year and previous two)		(0.0550)		(0.0533)
ln(natural disasters)	0.199	0.357*	0.270	0.364**
(sum of the current year and previous two)	(0.176)	(0.188)	(0.183)	(0.172)
ln(population)	1.295***	0.709*	1.258***	0.491
	(0.325)	(0.405)	(0.381)	(0.364)
Late Yuan	0.659	0.840	0.754	0.662
	(0.479)	(0.506)	(0.505)	(0.471)
Year trend	0.0198	-0.0305	0.0300	-0.0204
	(0.0282)	(0.0301)	(0.0299)	(0.0261)
Constant	-36.70	35.30	-49.28	26.25
	(31.06)	(32.63)	(32.36)	(29.14)
Emperor FE	Yes	Yes	Yes	Yes
Observations	94	94	94	94

Notes: The late Yuan dummy is for the 1345-1355 years. The equations are:

$$\ln(Issues)_t = \alpha + \beta_1 \ln\left(\sum_{h=0}^{2} TotalWar_{t-h}\right) + \beta_2 \ln\left(\sum_{h=0}^{2} Grants_{t-h}\right) + \beta_3 \ln\left(\sum_{h=0}^{2} Disaster_{t-h}\right) + \beta_4 \ln (Pop)_t + \beta_5 \text{LateYuan} + \beta_6 t + \sum_{j=1}^{10} \gamma_j \, Emperor_{t,j} + \varepsilon_t \tag{A3}$$

$$\ln(Issues)_t = \sigma + \delta_1 \ln\left(\sum_{h=0}^{2} ExternalWar_{t-h}\right) + \delta_2 \ln\left(\sum_{h=0}^{2} UnificationWar_{t-h}\right) + \delta_3 \ln\left(\sum_{h=0}^{2} CivilWar_{t-h}\right) + \delta_4 \ln\left(\sum_{h=0}^{2} Grants_{t-h}\right) + \delta_5 \ln\left(\sum_{h=0}^{2} Disaster_{t-h}\right) + \delta_6 \ln (Pop)_t + \delta_7 \text{LateYuan} + \delta_8 t + \sum_{j=1}^{10} \eta_j \, Emperor_{t,j} + \varepsilon_t \tag{A4}$$

***, **, and * denote significance levels at 1%, 5%, and 10%, respectively. Numbers in parentheses are robust standard errors. We use three serial correlation lags in the Newey-West standard errors, following Greene, *Econometric analysis*, p. 960.

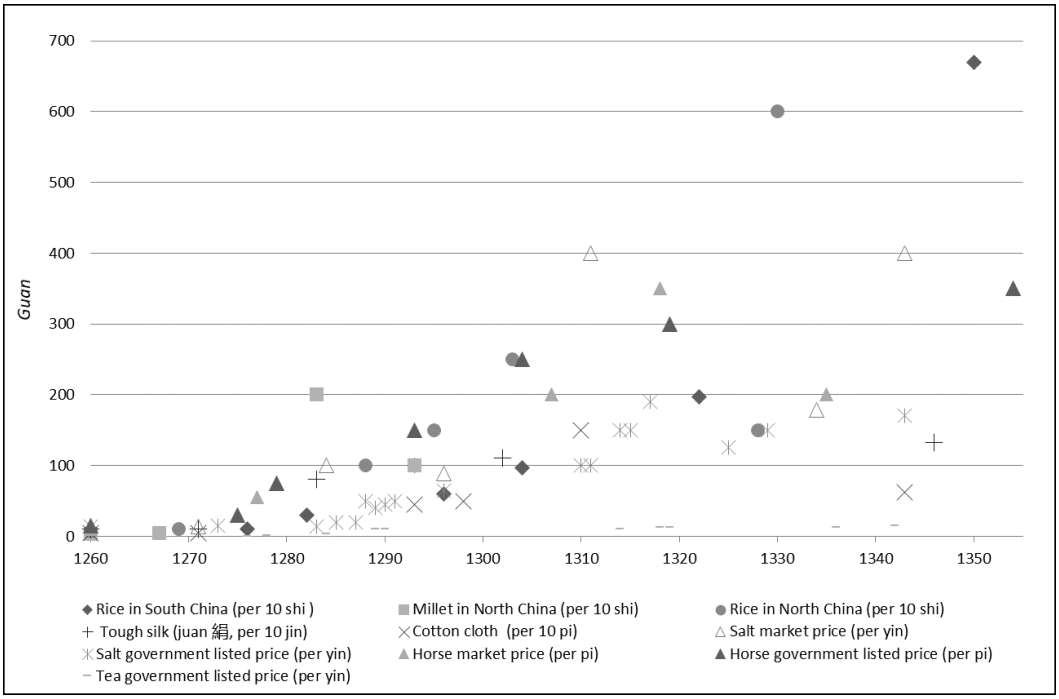

Figure A1. Price data.

Notes: *shi* 石 is a unit of volume with 1 *shi* = 100 litre; *Jin* 斤 is a unit of weight with 1 *jin* = 0.6 kg; *Pi* 匹 can be either a) a unit of length with 1 *pi* = 33 meters, or b) quantifier of horse numbers (a simple count); *yin* 引 means certificates for government monopolies, with 1 *yin* of salt = 240 kg and 1 *yin* of tea = 60 kg.

Source: Li, *'The prices, taxation, and fiscal system in Yuan China'*.

Figure A2. 1 *guan* note *Zhongtong yuanbao jiaochao* 中统交钞 issued by the Yuan.

Size: 34x20cm.

Preserved in the China Numismatic Museum in Beijing. Reproduced with permission.

Appendix references

Printed primary source

Yuanshi 元史 (History of the Yuan), Song Lian 宋濂 (Beijing, 1976).

Secondary sources

Greene, W. H., *Econometric analysis* (London, 2011).

Kuroda, A., *A global history of money* (London, 2020).

Li, Chunyuan 李春圓, *'Yuandai de wujia he caishui zhidu 元代的物價和財稅製度 (The prices, taxation, and fiscal system in Yuan China)'* (pub. Ph.D. thesis, Fudan University, 2014).

Liu, Sen 劉森, '*Yuandai chaoben chutan* 元代鈔本初探 (Preliminary study of the money reserves in the Yuan Dynasty)', *Journal of Henan University (Social Science)*, 2, (2007), pp. 135-43.

Schurmann, H F., *Economic structure of the Yuan dynasty: Translation of chapters 93 and 94 of the Yuan shih.* (Massachusetts, 1956).

StataCorp, L. P., *Stata time-series reference manual, release 10* (Texas, 2007).

Wu, Songdi 吳鬆弟, *Zhongguo renkoushi, liao song jin yuan shiqi disanquan 中國人口史, 第三捲: 遼宋金元史集 (Chinese Demographic History, Volume III): Periods of Liao, Song, Jin, and Yuan)* (Shanghai, 2000).