

Silver Fetters? The Rise and Fall of Chinese Price Level under Fluctuating World Silver Price, 1928-34

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Abstract

We show how silver standard transmitted world silver price fluctuations into China and made Chinese price level linked to world silver price. Inflation was transmitted between 1929 and 1931 when world silver price was falling; while deflation was transmitted during 1932 and 1934 when world silver price was rising. Using micro-level evidence and counterfactual simulations, we show that exchange rate was the main shock transmission channel, while silver stock played an insignificant role.

JEL Codes: C32, E32, N15

Key Words: the silver standard, Chinese economy, structural VAR, counterfactual response

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"... the main object of the currency reform of 1935 was to break the link between internal price levels and silver" (Chia-Ngau Chang, Deputy Governor of the Central Bank of China in 1935, 1958, p. 11)

"In the end extended suffering of more and more acute deflation proved the only way to change the general attitude (toward rising silver price)" (Arthur Young, Former Financial Adviser to China, 1971, p. 232)

1 Introduction

Silver was the basis of China's monetary system until November 1935. Although internally China made much use of copper currency, it was practically on a silver standard vis-à-vis foreign trade. Given that gold standard was the prevailing international monetary system before mid-1930s, the Chinese economy was equivalent to a floating exchange rate regime with respect to gold standard countries. The literature has emphasized this floating aspect of the Chinese currency, one example is the argument that being on the silver standard insulated China from the Great Depression (Friedman, 1992; Lai and Gau, 2003).

However, this view is only one-side story because it ignores the simple fact that silver standard, like the gold standard, is a strict form of fixed exchange rate. The silver standard shares many properties of a fixed exchange rate regime. In this paper we first show how silver standard transmitted external disturbances into China, as a fixed exchange rate should be. In the Chinese context, the external shocks were the fluctuations of the white metal. Being on a silver standard, shocks to world silver price were transmitted into commodity prices, making Chinese price level linked to world silver price.

China was vulnerable to the influences of international monetary system by the combination of two factors. On the one hand, silver was traded internationally and its price was determined by various factors irrespective of the Chinese economy. China and India were the most important purchasers of silver. Chinese demand for silver influenced the London, New York, and Bombay markets, but other factors driving changes in demand and supply of silver were also present and were beyond China's control (Shiroyama, 2008, p. 31). On the other hand, arbitrage mechanism had made pre-1945 China financially integrated with the world economy, and the exchange rate of the Chinese currency was tied to global silver prices (Ho et al., 2013).

This strong linkage between world silver price and internal price levels is not specific to China. Bojanic (2010) documents that for India in 1886-1893 and for Mexico in 1886-1905, when both countries were on the silver standard, the fall of silver price (and thus the depreciation of the rupee and peso, respectively)

translated into higher internal prices. The point is, countries adopting the silver standard fixed the values of their currencies to silver at the cost of internal price stability. They surrendered their internal prices to world silver markets in which they were price-takers. John Maynard Keynes had highlighted the conflict between stable exchange rates and stable internal prices in *A Tract on Monetary Reform* (1923). Even though Keynes was referring to the gold standard, his argument in regard to the trade-off between the internal and external stability of a currency also applies to the silver standard, a fixed exchange rate regime like the gold standard.

We next show that exchange rate was the channel through which world silver price affected the Chinese price level. By definition, price of silver was fixed in terms of Chinese currency under the silver standard. Prices of commodities fell as a direct consequence of the revaluation of the Chinese currency. Moreover, being a price-taker for both export and import commodities, changes in the silver exchange rate were quickly transmitted into China's commodity prices. Changes in world silver price could also affect Chinese price level by changing the silver stocks and thus China's money supply. This is the popular exposition of the Chinese silver standard. However, we do not find empirical evidence to support this view.

Although largely ignored by contemporaries and subsequent authors, the fact that silver standard could transmit shocks into China did not go unnoticed by critical observers. Commenting on the drainage of silver from China induced by rising world silver price in 1934, a contemporary expressed the concern that "It would indeed be a disaster of the first magnitude if her new-born attempt to establish her currency on a sound footing were to be frustrated *by circumstances beyond her control*" (Leavens, 1939, p. 296). Chang Su-min, a Ph.D. of University of Pennsylvania, who urged the Chinese government to abandon the silver standard, described the downside of the silver standard most clearly:

"China is the only country in the world that remains on the silver standard. Silver is a commodity in other countries but is a currency in China. The Chinese price level is strongly affected by the ups and downs in world silver prices. Both deflation and inflation are determined by non-Chinese factors. While the Chinese economy benefits from inflation, it suffers from deflation. This uncontrollable deflation and inflation is the fundamental drawback of the Chinese silver standard that shall dig its own grave" (Chang, 1935, p. 19).

The same concern finally led the Chinese government to establish a fiat money whose convertibility was no longer tied to silver but instead to the U.S. dollar and British pound at fixed exchange rates. As pointed out by Kia-ngau Chang, the then Deputy Governor of the Central Bank of China, "the main object of the currency reform of 1935 was to break the link between internal price levels and silver" (Chang, 1958, p. 11).

The rest of the paper is structured as follows. Section 2 discusses the transmission mechanisms through which international silver price affects the Chinese economy. Section 3 presents our methodology. Section 4 provides descriptive statistics. Section 5 discusses the relationship between China's foreign trade and the world silver price. Section 6 reports the main empirical results, followed by tests of robustness in section 7. Section 8 conducts simulations for two episodes of interest. The final section concludes.

2 How world silver price affected Chinese economy

2.1 The Chinese silver standard

Silver was the basis of the Chinese monetary system from as early as the thirteenth century until the currency reform of November 1935. Silver and copper cash circulated parallel and served different purposes. While wholesale commerce, long-distance trade and business involving a large sum of money were made upon a silver basis, copper cash was used in daily transactions and for the payment of wages. Same as a metallic system, there was free and unlimited coinage of silver. Silver coins were mostly imported and it was until 1914 of the early Republic did the government succeed in establishing a national silver coins. By contrast, the coinage of copper cash was the exclusive right of the government. Chinese dollar was fixed to silver. Until December 1932, the value of one ounce silver is constantly fixed at 1.268157 Chinese dollar. Realignment occurred in April 1933 and a new parity of 1.323921 was effective until November 1935. During the transition period between January 1933 and March 1933, the parity was kept at 1.294762.

China's silver-copper cash system was not bimetallism in the sense of the nineteenth century gold-silver bimetallism because exchange rate between silver and copper cash was not fixed but fluctuated constantly according to the market conditions.¹ The standard and weight of silver were managed by the private melting shops and private-sponsored Public Assay Office, and the exchange rates between varieties of silver and copper coins circulating in China were determined by their metallic contents. Banks kept their reserves in silver, and balanced their interbank accounts in silver. Starting from 1913, the rapid development of both Chinese and foreign banks substantially increased the supply of banknotes. The banks consented to converting into silver, upon demand, the banknotes they issued to their customers. A national law enacted in 1914 stipulated the banknotes to be secured

¹France during the bimetallic era, for example, effectively pegged the exchange rate between silver and gold at its legal ratio of 15.5 : 1.

by 60 percent cash reserve and 40 percent securities. However, it is not clear whether the law was strictly enforced. A Chinese central bank in the modern sense did not exist before 1935.

A consensus among historians is that the currency's linkage to silver limited the government's ability to manipulate the monetary system. It is believed that the free silver standard of China acted as a check on the excessive issuing of notes by the warlords and local governments (Chang, 1958, pp. 4-5). The public demand for redemption in silver made attempts of provincial governments to issue excessive notes result in depreciation of the notes and strong resistance to accepting the notes.

A prominent example is the Peking Banknote Agitation of 1916. In early 1916, informed by the Republic government's (led by the President Yuan Shikai) plan to raise revenues by issuing irredeemable banknotes under Bank of China and Bank of Communication, the public rushed to convert their banknotes into silver. In response, the government stopped in May 1916 the convertibility of banknotes to silver, froze withdrawal on deposits, and forced the acceptance of irredeemable banknotes in the private sector. The prescriptions were enforced in areas surrounding Peking, then under the control of Yuan's regime, but were resisted in Shanghai and nearby cities. Immediately following the announcement of the government decree, silver disappeared from circulation, and merchants were reluctant to exchange their goods for worthless banknotes. The foreign banks, under the extraterritoriality, refused to accept the banknotes. The harmful impact on the economy was soon felt and the government decree was publicly violated, as both the public and private sectors discounted or refused to accept the banknotes. In the end, the policy was abandoned and the government had to float loans several times during 1917-1923 to redeem these banknotes (Cho, 2009, pp. 159-163). The 1916 Agitation is an example that the silver standard enabled the private sector to safeguard itself from the abuse of government power.²

2.2 Theoretical consideration

History shows a stable and predictable relationship between world silver price and Chinese price level. Silver price dropped in 1920, after a rising trend during 1915-9. Silver in London declined from 61.50 pence in 1920 to 17.65 pence in 1930. Such a drastic change was due to the end of World War I and the uplift of Great

²For interested readers, the following references provide further historical background. For a general history of Chinese silver standard, see Richard von Glahn (1996). For modern Chinese currency, see Eduard Kann (1927). For monetary history of modern China, see Frank King (1965). For monetary policy and silver debates, see Loren Brandt and Thomas Sargent (1989) and Milton Friedman (1992).

Britain's ban on silver exports. During the same period China experienced a mild and steady inflation.

This strong linkage between world silver price and Chinese price level was also evident in the most volatile years (1929-1935). Silver price declined roughly 50 percent during the first two years of the Great Depression. Chinese price level was increasing during October 1929-August 1931 while price levels of major gold standard countries were declining significantly.

The tide reversed in 1931. Great Britain abandoned the gold standard and devaluated the pound in September 1931. The Scandinavian and several European countries followed up. The price of silver immediately jumped. In early 1933, the United States abandoned the gold standard, and there was a rapid rise in the price of silver in relation to the devaluated dollar. By the end of 1933, the Chinese dollar appreciated in relation to the major currencies to China's trade and finance. In June 1934, the U.S. congress passed the silver purchase act, which accentuated the already rising silver price since 1931. China found itself in deflation and economic depression amid a rising world silver price and its silver currency. At a time when other countries depreciated their currencies to check deflation and bring about recovery, China had seen the value of its silver currency rose out of line with the general level of commodity prices and brought severe deflationary effects. This contrasting economic trends caused by changes in silver price illustrated the vulnerability of the Chinese economy to silver fluctuations.³

To explain this linkage, the literature suggests two channels through which changes in silver price (hence, the external value of the Chinese currency) exerted their effects on the Chinese economy. One was through changes in exchange rate, which directly affected price level and economic activity (the exchange rate channel). The other was through changes in silver stocks, which had direct consequences for domestic money supply and domestic credit and subsequently influenced price level, employment, and general business activities (the monetary channel).

- Exchange rate channel: silver price falls → exchange rate depreciates → commodity prices rise → price level increases
- Monetary channel: silver price falls → silver inflows → silver stocks increase → money supply and domestic credit increase → price level increases (via trade balances: real depreciation → stimulus to exports → trade surplus → net silver inflows and stimulate price level)

³For studies exploring the effects of world silver price on the Chinese economy between 1929 and 1935, see T'ang (1936), Leavens (1939), Young (1971), Brandt and Sargent (1989), Myers (1989), Rawski (1989), Friedman (1992), Lai and Gau (2003), Burdekin (2008) and Shiroyama (2008).

By the exchange rate channel, an increase in world silver price drove up the external value of Chinese currency and caused deflation of commodity prices. This was so because under the silver standard the nominal price of silver was fixed in terms of Chinese currency. A rise in the price of silver called for the prices of other commodity to fall and this resulted in deflation. Analogously, a decrease in world silver price drove down the external value of Chinese currency and caused inflation of commodity prices. Moreover, being a price-taker for import and export commodities, changes in the silver exchange rate were quickly transmitted into the silver prices of import and export commodities. This made a decrease (increase) in the price of silver to be followed up by a rise (fall) in the prices of import and export commodities.

By the monetary channel, a drop in silver price and exchange rate tended to result in import of silver, increasing both bank reserves and supply of money, and hence, raising the general price levels. Conversely, rising silver price and exchange rate tended to result in outflow of silver, decreasing both bank reserves and money supply, thus causing a deflationary tendency. The silver flows and their monetary consequences were the results of arbitrage activities. Changes in world silver price also have implication for silver flows through trade balance. When silver price and exchange rate were high, imports into China were stimulated and exports from China were hindered. The inverse occurred when silver price and exchange rate were low. Trade balance was to be followed up by net silver flows which changed the stock of silver and money supply and had consequences for output and price level.

There is no study attempting to evaluate the relative importance of the two channels. A common practice is to choose either one of the two channels that best fits the chosen hypothesis. The monetary channel seems to dominate theoretical and popular expositions of the Chinese silver standard. For example, Shiroyama (2008, pp. 34-5) emphasizes the role of monetary channel in the 1920s. She argues that low world silver price caused silver to flood into China throughout the 1920s. The imported silver was converted into sycees (a particular form of Chinese silver bullion that backed the issue of banknotes) or coins, thus increasing money supply. Increases in silver stock provided the basis for credit expansion. The mild and steady inflation during this period was the consequence of this monetary channel. Similarly, T'ang (1936, pp. 61-78) and Young (1971, p. 176) argued that monetary channel was responsible for the Chinese economic misery between 1932 and 1935. For them, rise in silver price siphoned off large amount of silver, bringing about contraction in money and credit and thus causing deflation and depression to China. Friedman and Schwartz (1963, pp. 489-91) emphasized trade balance aspect of the monetary channel. They argued that appreciation of

the Chinese currency caused a decline in exports relative to imports. The deficit in the trade balance was met by export of silver, which in its turn contracted the internal money supply and caused deflation and recession.

In contrast, Kevin Chang (1988, p. 71) stressed the role of exchange rate channel in causing the Chinese economic difficulty between 1932 and 1935. He argued that "By international arbitrage, Chinese dollar prices of many commodities fell as a direct consequence of the appreciation of the Chinese currency, independent of China's money supply".⁴

3 Methodology

Our methodology follows closely Bernanke et al. (1997), Sims and Zha (2006), Bachman and Sims (2011), and Kilian and Lewis (2011). The method has been used to quantify the extent to which the endogenous policy response of the central bank to oil price shocks has contributed to real output contraction. This method is used here to quantify the exchange rate and monetary channels, through which fluctuations in silver price operate their effects on the Chinese economy.

Let SP_t be New York silver price, ER_t be Chinese exchange rate, ST_t be silver stocks, and WPI_t be Shanghai wholesale price index. Starting from the structural VAR of order p :

$$A_0 \cdot Y_t = A_1 \cdot Y_{t-1} + A_2 \cdot Y_{t-2} + \dots + A_p \cdot Y_{t-p} + \varepsilon_t \quad (1)$$

where $Y_t = \begin{pmatrix} SP_t & ER_t & ST_t & WPI_t \end{pmatrix}'$, K is the number of variables, A_0 is a $K \times K$ lower triangular matrix with ones on the diagonal, and ε_t is a $K \times 1$ vector of mutually uncorrelated structural shocks. Define the $K \times (K \cdot (1 + p))$ matrix

⁴Our distinction between exchange rate and the money as two different shock transmission mechanisms under the silver standard has its forerunners. Batchelder and Glasner (1995, 2012), in the context of gold standard, made a distinction between two explanations to the transmission of the Great Depression: the monetary theory of the Great Depression developed by Ralph G. Hawtrey and Gustav Cassel and the monetary theory based on the price-specie-flow mechanism represented by Milton Friedman and Anna Schwartz. According to the Friedman-Schwartz view, a country's money supply was determined by the quantity of gold reserves held by the banking system. The gold reserves in turn were determined by international gold flows that occurred when there was trade imbalance. A country's price level was the results of international gold flows and the associated changes in money supply. According to the Hawtrey-Cassel view, given the internationally determined value of gold, a country's price level is dictated by the conversion rate of its national currency into gold. A tight correlation between gold reserves and the supply of money was neither necessary theoretically nor observed empirically. The Hawtrey-Cassel view corresponds to our exchange rate channel, while the Friedman-Schwartz view corresponds to our monetary channel. Batchelder and Glasner (1995, p. 299) postulate that the Chinese experience during the early 1930s "demonstrates that shifts in the international supply or demand for a precious metal used as a monetary standard can cause inflation or deflation in countries without first altering the domestic quantity of money." Our empirical findings below are consistent with their assertion.

B as $B \equiv \begin{pmatrix} I_K - A_0 & A_1 & A_2 & \cdots & A_p \end{pmatrix}$. It can be shown that the contribution of variable i to the response of the exchange rate at horizon h to a silver price shock at date 0 is given by:

$$d_{ER,i,h} = \sum_{m=0}^{\min(p,h)} B_{2,mK+i} \cdot \theta_{i,1,h-m}, \quad h = 0, 1, 2, \dots, \quad i = 1, 2, \dots, K \quad (2)$$

where $B_{2,mK+i}$ refers to the $(2, mK+i)$ element of the matrix B , and $\theta_{i,1,h-m}$ refers to the $(i, 1)$ element of the $K \times K$ impulse response coefficient matrix at horizon $h-m$, denoted by Θ_{h-m} and defined in Lütkepohl (2005, p. 46).

To quantify the exchange rate channel, we create a hypothetical sequence of shocks to exchange rate which offsets the contemporaneous and lagged effects of world silver price on the exchange rate:

$$\varepsilon_{ER,h} = -B_{2,1} \cdot x_{1,h} - \sum_{m=1}^{\min(p,h)} B_{2,mK+1} \cdot z_{1,h-m}, \quad h = 0, 1, 2, \dots \quad (3)$$

where $x_{i,0}$, $i = 1, 2, \dots, K$ denotes the impact response of variable i to silver price shocks in the absence of hypothetical shocks. Given the hypothetical shocks to exchange rate, the counterfactual impulse response at the impact period $h = 0$ of variable i to silver price shocks becomes:

$$z_{i,0} = x_{i,0} + \frac{\theta_{i,2,0} \cdot \varepsilon_{ER,0}}{\sigma_2} \quad (4)$$

where σ_2 denotes the standard deviation of the exogenous exchange rate shocks. The corresponding values for the subsequent periods, $h = 1, 2, \dots$, are computed recursively as:

$$x_{i,h} = \sum_{m=1}^{\min(p,h)} \sum_{j=1}^K B_{i,mK+j} \cdot z_{j,h-m} + \sum_{j<i} B_{i,j} \cdot x_{j,h} \quad (5)$$

$$z_{i,h} = x_{i,h} + \frac{\theta_{i,2,0} \cdot \varepsilon_{ER,h}}{\sigma_2} \quad (6)$$

The difference between the actual and counterfactual responses measures the effects of world silver price on Chinese WPI working through the exchange rate. An analogous procedure is employed to quantify the monetary channel.⁵

Our counterfactual exercises involve a kind of policy regime changes, the evaluation of which requires taking expectations into account. A concern is that our

⁵An appendix that describes the methodology in great details can be obtained from the corresponding author.

construction of counterfactual is subject to the Lucas critique. The best way to solve the issue is to employ a structural model for our purpose. However, given the lack of a commonly accepted structural model for the metallic standards, here we employ a reduced-form approach, namely, the VAR model, for our counterfactual exercises. The VAR approach is not invulnerable to the Lucas critique, but the structural VAR model allows us to identify the one structural shock that is most important for our analysis: the world silver price shocks. Moreover, it allows us to accommodate the time-series facts about the Chinese economy in a flexible manner. Like the literature that employs this method, we assume that the policy changes contemplated are small enough not to affect the structure of the economy materially, and it takes some time for people to learn that policy was not going to respond in its usual way (Sims and Zha, 2006; Kilian and Lewis, 2011). The answer provided by the method is best regarded as a first-order approximation.

4 Descriptive statistics

The time series we employ include New York silver price, exchange rate, silver stocks, wholesale price index, exports, imports, nominal interest rate and money base. All series are of monthly frequency. New York silver price is expressed in cents per ounce. Exchange rates are expressed as US dollars per 100 Chinese dollars. Silver stocks are the sum of silver dollars, silver sycees and silver bar, expressed in thousand taels. We consider Shanghai WPI (1926=100) and Tientsin WPI (1926=100).⁶ Exports, imports, and money base are expressed in million Chinese dollars. Nominal interest rate is annualized and in percentage. Except for Tientsin WPI which is taken from Kong (1988) ed.: *Nankai Economic Indicators*, all the other series are taken from various issues of *Tongji Yuebao*.

Due to data restriction, the beginning year of our analysis is 1928. Our data end at September 1934, one month before the linkage between the exchange rate of the Chinese currency and the world silver price was disrupted by the measures of capital control adopted by the Chinese government (Ho et al., 2013).⁷ On

⁶Tientsin is a treaty port city in North China close to Peking (2 – 3 hours by train in the 1930s). There some are other treaty port cities also important in international trade, such as Canton (Guangzhou). We focus on Shanghai WPI and take Tientsin WPI for comparison. The reason to select Tientsin is simply because that is the only city with monthly statistical data; see Kong (1988) ed.: *Nankai Economic Indicators*. Using the data provided by Hsiao (1974), the proportions of China’s international trade that went through the principal ports between 1928 and 1932 were (in descending order): Shanghai (48%), Dairen (15%), Tientsin (10%), Canton (6%), Yangtze (5%), Tsingtao (4%), Harbin (3%), Antung (3%), Kowloon (3%), and Hankow (3%).

⁷This paper does not deal directly with the Great Depression, but covers a period of time that overlaps with the Great Depression. During the first two years of the Great Depression, from October 1929 to August 1931, China was less affected than any other major country. Several

October 14, 1934, the Chinese government issued an order, effective on October 15, to impose a 7.75% customs duty on exports of silver dollars and mint bars and a 10% customs duty on exports of other forms of silver. In addition, an equalization charge was imposed to make the exports of silver unprofitable.⁸

[Figure 1 about here]

Figure 1 plots New York silver price, Shanghai WPI and Tientsin WPI. New York silver price and Shanghai WPI (Tientsin WPI) are negatively correlated, with a correlation coefficient of -0.71 (-0.42). From 1928 to 1931, the falling New York silver price was accompanied by a rising Chinese WPI; from 1932 to 1934, the rising New York silver price was accompanied by a falling Chinese WPI.

[Figure 2 about here]

Figure 2 presents the scatter plots of the variables of interest. We divide the study period into two sub-periods, one from February 1929 to August 1931 and the other from September 1931 to September 1934. September 1931 is chosen as the dividing point because Shanghai WPI started to decline. The top panel shows the scatter plots for the whole period, the middle and bottom panels show the scatter plots for the two sub-periods, respectively. Table 1 reports the correlation between the variables for the whole period and the two sub-periods. The scatter plots show that world silver price was positively correlated with the exchange rate and negatively correlated with the Shanghai WPI. The relationships were stable across the two sub-periods. Our counterfactual simulations below shall demonstrate that silver price affected the Shanghai WPI primarily through the exchange rate. By contrast, there was no stable relationship between silver price and silver stocks. Nor was there a stable relationship between silver stocks and the Shanghai WPI. Silver prices were negatively correlated with silver stocks during the first sub-period, but the correlation turned positive during the second sub-period. The inverse is true for the relationship between silver prices and Shanghai WPI. As expected, silver stocks were negatively correlated with interest rate and were positively correlated with money base, but the relationship was weak at best.

[Table 1 about here]

studies have discussed China's economy performance during the Great Depression, especially why and how silver standard worked to insulate China from the Great Depression (Salter, 1934; Friedman and Schwarz, 1963; Wright, 1991; Lai and Gau, 2003). This is an important issue that deserves a separate treatment, see Ho and Lai (2012).

⁸For the computation of the equalization charge, see Leavens (1939, pp. 300-1).

5 Foreign trade and silver price

5.1 Stylized facts

In a preliminary VAR analysis, we find that impulse responses of imports and exports to a shock in silver price are either insignificant or of the wrong sign. To understand the general trend of China's foreign trade and its relationship to silver price, we inspect the trade data between 1864 to 1934.⁹ This is the longest annual trade data available for the silver standard era. Figure 3 plots the annual Chinese imports, exports, and New York silver price for that period. The data source for imports and exports is Hsiao (1974), and New York silver price is obtained from the Measuring Worth website.¹⁰

[Figure 3 about here]

Figure 3 shows that silver price fell steadily until 1914. During this period, both exports from China and imports to China were increasing, and imports grew even faster than exports. This is made even more clear by Figure 4, which shows export/import ratio was falling (and thus trade balances were worsening) in tandem with falling silver price. The changes in imports and exports were not consistent with the theoretical prediction. From 1928 to 1934, which overlaps with our study period, the changes in trade balances, if not invalidate the theoretical prediction, are even more obscure and complex.

[Figure 4 about here]

This anomaly concerning foreign trade balances and the world silver prices has been first noticed by Remer (1926), and later taken up by Cheng (1956). Remer (1926) observed that over the thirty years from 1885 to 1913, both imports and exports increased while Chinese exchange rate depreciated. Imports increased more rapidly than did exports so that trade balances actually worsened. To be in accordance with the theory, increasing exports and decreasing imports were to be expected. Remer (1926) found that prices of both imports and exports did rise during the thirty years, but the rise in prices did not bring the expected consequences.

5.2 Explanations

Remer (1926, pp. 636-9) offered some conjectures. His explanations for the slow response of Chinese exports to rising prices include: the commodities for exports

⁹For a recent review of China's foreign trade over the last 150 years, see Keller et al. (2011).

¹⁰<http://www.measuringworth.com/gold/>

were by-products of agriculture not for the market; the producers of the chief exports, the Chinese farmers, were uninformed as to market conditions; activity among brokers and middlemen made China better organized for trade than for production; Chinese producers were unable to provide great quantities of standardized goods. His explanations for the rapid growth of imports in the face of rising prices include: development of transportation had made imports cheaper in interior cities than they were; the habit and custom of Chinese consumers; the insistence of foreign merchants and of foreign government upon the rapid opening of China to foreign trade; and the advertising and selling methods of foreign businessmen in China.

In disagreement with Remer (1926), Cheng (1986) resorted to silver-copper cash bimetalism as an explanation for the trade anomaly. In the hinterland, copper cash (composed of 60% copper and 40% zinc) was the main median of exchange. Farmers and the labors were paid in copper cash, not in silver. During the thirty years before 1900, while the price of silver was falling, the silver price of copper cash increased by 34%. The appreciation of copper cash made import goods cheaper than domestic goods, thus stimulating the demand for imports. Though far from a formal proof, Cheng (1986, p. 17) provided some descriptive statistics that were consistent with his argument.

Cheng (1956, pp. 69-71) gave a detailed account of various factors that might have obscured the effects of silver prices on China's foreign trade during the early 1930s. Before 1932, the falling silver prices (and thus the Chinese currency) brought about a tremendous amount of overseas Chinese remittance and attracted silver inflows, which enhanced the Chinese purchasing power and the Chinese imports in these depreciation years even slightly increased. In 1932, the appreciation of Chinese currency failed to stimulate imports because furious conflict between Chinese army and the Japanese armed forces in the vicinity of Shanghai paralyzed the commercial activities of this great seaport. From 1933 to 1934, the stimulating effects of rising Chinese currency on imports were counteracted by a rise in international commodity prices and the increase in tariff rates. The actual general tariff rate increased from 3.8% in 1926 to 21.7% in 1933 and to 27.8% in 1934. The depreciation of Chinese currency before 1932 did not stimulate exports from China because China's main trade partners were in recession and their demand for Chinese products dropped substantially. Over sixty percent of Chinese exports went to Germany, Great Britain, Japan and the United States, which were severely hit by the Great Depression. Like Remer (1926), Cheng (1956) also resorted to the peculiar Chinese export system as an explanation why exports were less responsive to a falling exchange rate.

Obviously, the fact that various factors had obscured the effects of silver prices

explains why the impulse responses of trade variables to silver price shocks are either insignificant or of the wrong sign. Since the anomaly is an important and yet not fully solved issue, it deserves a separate treatment. In the subsequent analyses, we shall confined to the analysis of a VAR model that excludes trade variables. The present paper is therefore focused on the influence of silver price upon price level. The links between silver price shocks and real variables is left for future research.

6 Transmission mechanism and counterfactuals

6.1 Basic features

To begin with, we explore the linkage between New York silver price and Chinese WPI, ignoring for the moment the transmission mechanisms.¹¹ Table 2 reports the results of pair-wise Granger causality test. New York silver price Granger causes Shanghai WPI and Tientsin WPI at the 1% significance level. The causality is clearly from world silver price to Chinese price level, and not the other way around. It is also more difficult to make a case for the reverse causality for Tientsin WPI than for Shanghai WPI, because p-value for Tientsin WPI (0.94) is much large than Shanghai WPI (0.15).

[Table 2 about here]

To show that the above linkage between silver price and Chinese price level was a phenomenon over a long period, we redo the test using an extended data set from January 1921. The last two rows of Table 2 report the results using this longer sample. The results reconfirm the unilateral causality running from New York silver price to Shanghai WPI, and not the other way around.

Kreps (1934) suggested that as an important factor in the demand for silver, it was Chinese business conditions that determined silver price, and not the reverse. According to Kreps, between 1926 and 1932, industrialization, modernization, and war inflation caused an unfavorable balance of trade for China, and exerted downward pressure on the Chinese exchange rate and the price of silver. Kreps (1934) did not explain how downward pressure on exchange rate could lead to a fall in silver price, but his view explicitly postulated a causality running from a rising Chinese price level to the falling price of silver. Table 2 definitely rejects Kreps' conjecture.

¹¹Since all the variables except nominal interest rate are integrated of order one, and there is no cointegrating relationship between the variables, we employ the logarithm difference of the variables in the Granger causality test and VAR analysis.

It takes time for a shock to silver price to be fully transmitted into Chinese price level. To visualize the transmission dynamics, the upper panel of Figure 5 plots the accumulated impulse response of Shanghai WPI to a shock to New York silver price, and vice versa.¹² The solid line represents the point estimate, while the dashed line represents the confidence interval computed from 500 Monte Carlo repetitions. Shocks to New York silver price have significant effects on Shanghai WPI, and the shocks are completely transmitted 2 months following the shock; on the contrary, shocks to Shanghai WPI have only insignificant effects on New York silver price.

[Figure 5 about here]

Similarly, the lower panel of Figure 5 plots the impulse response of Tientsin WPI to a shock to New York silver price, and vice versa. Since Tientsin is a coastal but less international city while Shanghai is a cosmopolitan with intensive foreign trade and financial connections, it takes longer time for a silver price shock to be fully transmitted into Tientsin WPI and its accumulated effects are also smaller.

6.2 Quantify the exchange rate and monetary channels

Having established the causal link between world silver price and Chinese price level, we proceed to explore the transmission mechanisms. For that purpose, we estimate a structural VAR model which includes four variables: New York silver price, exchange rate, silver stocks, and Shanghai WPI. We follow the common practice to check seasonality and find that there is some seasonality in New York silver price, exchange rate, and the silver stocks. We add to the VAR model three dummy variables, which correspond to the dummies for January, June and December, respectively, to capture these particular seasonal effects. Since our sample covers a period of time that overlaps with the Great Depression, it is interesting to see whether there is a structural break in the VAR coefficients. The likelihood ratio test of Sims (1980) is used to test for these cross-equation restrictions. The statistic equals 9.23 (below the critical value $\chi_{0.05,20}^2 = 31.41$), implying the stability of VAR coefficients.

Figure 6 plots the impulse responses of endogenous variables to a shock in world silver price. A one-standard-deviation shock in New York silver price causes New York silver price to increase by roughly 5 percent. The exchange rate appreciates immediately by roughly the same magnitude. In fact, the response of exchange rate follows closely the response of New York silver price. The response of Shanghai

¹²Since we employ logarithm difference of the time series (multiplied by 100) in the VAR analysis, the units for the vertical axis in all of the impulse response functions throughout the text are the growth rate of the original series.

WPI is negative and significant. The strong linkage between New York silver price and Shanghai WPI found in the bivariate Granger causality test also carries over to the four-variable VAR model. The response of silver stocks was negative but insignificant. This disapproves the importance of silver stocks as a transmission mechanism.

[Figure 6 about here]

Since we presume exchange rate and silver stocks as two transmission variables, it is necessary to examine further their dynamics. The solid line in Figure 7 represents the response of exchange rate to silver price shocks. Since exchange rate is ordered second in the VAR model (just next to the silver price which is on the first position), the impulse response of exchange rate on the impact period is attributed solely to world silver price shocks. In the subsequent periods, exchange rate responds to all lagged endogenous variables, including its own lags, by construction of the VAR model. Using equation (2), the response of exchange rate can be decomposed into four components, which are represented by the dotted and dashed lines in Figure 7. Each component stands for the contribution of one of the four endogenous variables to the response of exchange rate. Summing the dotted and dashed lines one obtains exactly the solid line. Figure 7 shows that silver price is the dominant force driving the response of exchange rate, followed by the dynamics of the exchange rate itself. Exchange rate responds mildly to the Shanghai WPI and is not responsive to silver stocks.

[Figure 7 about here]

Lower panel of Figure 7 plots the response of silver stocks to world silver price shocks and the decomposition of the response. On impact, shocks in silver price bring down silver stocks. However, the negative effects exerted by silver price are offset by the positive effects of exchange rate, making silver stocks hardly move on balance. Subsequently, silver stocks decreases, mainly in response to world silver price. Exchange rate and Shanghai WPI also contribute to the response of silver stocks, but their effects are dominant by the effects of world silver price.

Now we can answer our main question of interest: what was causing the observed strong linkage between silver price and the Chinese price level? Was it because silver price had a direct impact on the external value of the Chinese currency and thus had an implication for general commodity prices? Or was it because silver price first affected money supply which in turn changed the Chinese price level?

We begin with the exchange rate channel. We conduct a thought experiment that shuts down the exchange rate channel, using the method described in section

3. Under the silver standard, a country fixed the value of its currency to a certain amount of silver. The price of silver was fixed in terms of domestic currency and could not change. In this sense, it is a form of fixed exchange rate regime. Since the Chinese currency was fixed to silver, and silver flows were unconstrained, fluctuations in silver price would quickly cause Chinese exchange rate to change accordingly. The impulse response function, shown in Figure 6, clearly demonstrates this. The thought experiment of shutting down the exchange rate channel in fact assumes that Chinese currency is not fixed to silver, or it becomes floating relative to silver, so that fluctuations in silver price exert no effect on the Chinese currency. The purpose of this thought experiment is to quantify the impacts of silver price on the Chinese price level arising from the simple fact that Chinese currency was tied to silver.

Left panel of Figure 8 reports the results. The solid line in Figure 8 represents the actual response to silver price shocks, while the dashed line represents the counterfactual response. The difference between the two lines thus quantifies the effects of the exchange rate channel. The figure shows that the response of silver price is almost unaffected in the thought experiment. This is a further evidence that silver price is exogenous to the Chinese exchange rate. Since we only shut down the response of exchange rate to silver price, and allow exchange rate to respond to other endogenous variables, the response of exchange rate needs not be zero. Nevertheless, the response of exchange rate is indifferent from zero in the counterfactual scenario, implying that silver price is indeed the dominant factor affecting the exchange rate. In the absence of the exchange rate channel, Shanghai WPI would be much less affected by the silver price shocks.

To be concrete, the cumulative changes in Shanghai WPI to a one-standard-deviation shock to world silver price is -1.78 percent. It becomes -1.19 percent in the counterfactual scenario. In other words, the deflationary effects of rising silver price would be much milder if the Chinese exchange rate does not move accordingly. This finding justifies the fear of the Chinese policymakers who deemed the rising silver price since 1932 being extremely harmful, their decision to impose capital controls since October 1934 which effectively delinked the Chinese exchange rate to silver price, resulting in the eventual departure from the silver standard in November 1935 to avert the silver-induced deflation spiral.¹³

[Figure 8 about here]

¹³The counterfactual response of silver stocks is lower than the actual response. The decomposition of response of silver stocks, shown in Figure 7, indicates that a change in exchange rate induces a corresponding change in silver stocks. In the counterfactual scenario, we have created negative shocks to exchange rate to offset the positive impact of silver price shocks on exchange rate. These negative shocks to exchange rate in turn cause silver stocks to decrease in the counterfactual scenario.

Now we turn to the monetary channel. We conduct a thought experiment that makes silver stocks unresponsive to silver price shocks. The thought experiment assumes that changes in silver price do not induce silver flows into or out of China, and therefore have no consequence for money supply. The presence of monetary channel requires two conditions. First, silver price must strongly affect silver stocks. Second, Shanghai WPI must respond to silver stocks. Figure 6 has shown that the response of silver stocks to a silver price shock is indifferent from zero, so the first condition is not satisfied. A decomposition of the response of Shanghai WPI (not reported) also invalidates the second condition.

Right panel of Figure 8 reports the results. It is evident that the response of silver price and exchange rate are unaffected in the counterfactual scenario. In the absence of monetary channel, the Shanghai WPI would be almost the same as it actually was. This implies that monetary channel is not systematically important in the transmission of silver price shocks. By construction, we have created a hypothetical sequence of positive shocks to silver stocks, which, together with the dynamics of silver stocks, cause silver stocks to increase in the counterfactual scenario.

6.3 Micro-level evidence

Our counterfactual simulations imply that exchange rate had substantial influence on the Shanghai WPI. Is there any reason to believe in this result? In fact, an observation has long been made that prices of Chinese import and export and commodity prices in treaty port cities tended to fluctuate with foreign commodities prices and silver exchange rate (Cheng, 1986, p. 1). The reason is that China was a price-taker for both import and export goods. According to Cheng (1986, p. 4), before 1870s, domestic goods had an advantage over import goods because production costs and transportation costs of import goods were higher than domestic goods. Prices of import goods were made lower than their foreign counterparts in order to compete with Chinese domestic goods. The situation changed after 1870s. Increased productivity in industrial countries, lower transportation costs, and further opening of foreign trade made import goods far more competitive than the domestic goods. The price of import goods followed their foreign counterparts, only denominated in silver price.

The case for the prices of export goods was not better. Before 1860s, China was dominant in the markets of tea and silk, its two most important export goods. But the situation changed after 1880s when India joined the tea market with lower production costs and standardize quality. The Chinese tea quickly lost its market. The instable quality of Chinese silk and competition from European silk

production forced down the price of Chinese silk in the world market. It is fair to say that prices of export goods were determined outside China. The case for the other Chinese export goods, such as cotton, bean, sugar and leather for which Chinese production was small, could only be worse.

The fact that China was a price-taker in both import and export goods made Chinese import and export prices as well as commodity prices in treaty port cities highly dependent on the foreign commodity prices and the silver exchange rate. Figure 9 shows the export and import price indices for Shanghai, as well as the New York silver price. Figure 9 indicates that the falling prices of silver before mid-1931 were associated with rising prices of import and export goods, and rising prices of silver after mid-1931 were associated with the falling prices of import and export goods. Moreover, the adjustment of export price to silver exchange rate was slower than the adjustment of import price, an observation also made by Remer (1926) for the pre-1914 period. Figure 9 is consistent with the explanation that being a price-taker in international trade, China's silver exchange rate was the main force driving the prices of import and export goods.

[Figure 9 about here]

We further examine the items making up the Shanghai WPI. Table 3 shows the commodities in the index numbers of wholesale prices in Shanghai. The index is made up of 155 commodities, classified into 8 groups: cereals (22 items, weights 14.2%), other food products and provisions (31 items, weights 20.0%), textile fibres and manufactures thereof (38 items, weights 24.5%), metals (12 items, weights 7.7%), fuels and lighting (13 items, weights 8.4%), building materials (11 items, weights 7.1%), chemicals and preparations thereof (10 items, weights 6.5%), and miscellaneous (18 items, weights 11.6). The index can also be classified according to the origin of goods: domestic goods (weights 54.2%) and foreign goods (weights 45.8%). The index is computed using simple arithmetic average. There is no information on the fraction of traded goods making up the index, but the weight of foreign goods (45.8%) provides a lower bound for its value. Given this large fraction of traded goods in the WPI, it is reasonable to expect that the strong dependence of import and export prices on silver exchange rate also carries over to the WPI.

[Table 3 about here]

Figure 10 plots Shanghai WPI and indices for each group of commodities. The plots end at December 1933, the last observation we have from the Chinese government publication. A vertical line indicating the date from which the index

starts to fall. Figure 10 indicates that the overall WPI and the individual WPI share the same general trend. They increase steadily until the middle of 1931 and fall steadily thereafter.¹⁴

[Figure 10 about here]

7 Robustness

We have conducted a battery of robust tests, here we report only the main findings. In quantifying the exchange rate channel, the hypothetical shocks offset only the response of exchange rate to silver price, but not the response of exchange rate to other variables. Alternatively, one can construct a hypothetical sequence of shocks that offsets all endogenous dynamics in the exchange rate such that the exchange rate remains unchanged over time. Similarly, one can construct a hypothetical sequence of shocks that offsets all endogenous dynamics in the silver stocks to quantify the monetary channel.¹⁵ Our results are robust to such a modification in the counterfactual simulation.

In our benchmark model, we use a single lag of one month. The lag length is chosen in a standard way. Data limitation forces us to be parsimonious to obtain efficient estimates. Moreover, the long-run relationship between the Chinese exchange rate and the metallic value of the Chinese dollar also suggests that a lag of one month is optimal (Ho et al., 2013). Admittedly, a single lag of one month is different from the usual VAR analysis. One concern is that the lag length may be too short to give the data a chance to show delayed effects. Specifically, the VAR model may not be able to pick up changes in the silver stocks and the associated effects. The reason is that the effect of a shock to monetary policy tends to take a year or longer to reach its peak (Eden, 2005). To deal with this issue and at the same time to be parsimonious, we experiment with using lags 1 plus 4, lags 1 plus 7, lags 1 plus 12, lags 1 plus 4 plus 7, lags 4 plus 7 plus 10, and lags 1 plus 4 plus 7 plus 10. We find that including other lags indeed induces delayed responses, but does not change our benchmark result that exchange rate is important in the transmission of world silver price shocks while silver stocks are not.

¹⁴The only index that does not fall after 1931 is the price index for the group chemicals and preparations thereof (Group 7). This group consists of 10 items of goods and 9 of them are foreign goods, indicating the items are overwhelmingly foreign goods. The items include acid, soda ash, potassium chlorate, alum, paraffin, alcohol, and dyes. According to Kreps (1934), "The sudden rise of the domestic prices of chemicals in 1931 marks the end of a bitter conflict by gigantic American, German, and British chemical concerns to control the Chinese market." Since this group of goods constitutes only 6.5% of the items making up the wholesale price index, it does not effect the general pattern of the WPI.

¹⁵This is the counterfactual experiment conducted by Bernanke et al. (1997), Sims and Zha (2006), and Bachman and Sims (2011).

In the main text, we take the stock of silver as the money variables. For robustness, we consider two other measures of money variable: the growth of money base and nominal interest rate. We redo the counterfactual simulations using these variables as the money variable one at a time. The results are similar to the benchmark results.

Recall that silver stocks are the sum of silver dollars, silver sycees and silver bars. We also consider alternative model specifications by using components of the silver stocks. Using silver sycees and silver bars as money stock gives qualitatively the same results. Using silver dollars as money stock, we obtain an unexpected result that money stock increases following a positive shock in silver price. Even so, our benchmark results retain.

8 Historical simulation

As a further illustration, we consider two episodes of silver price fluctuations: from February 1929 to February 1931 when silver price was declining and from May to 1933 to September 1934 (end of data) when international silver price started rising after U.S. abandoned the gold standard in March 1933. The two episodes exhibit distinct trends in world silver price that result in different trends for Shanghai WPI. This is the reason for focusing on these two episodes. The thought experiment we conduct here is the same as Section 6, only it is for a concrete episode. This makes the effects of silver price on Shanghai WPI easier to understand. The purpose of the historical simulation is to show that if Chinese currency was not tied to silver, Shanghai WPI would not have moved in tandem (though in opposite direction) with world silver price, first rise during the first episode and then fall during the second episode, and Shanghai WPI would be more stable than it actually was.

Figure 11 reports the simulations. The solid lines in the figures depict the actual paths of the variables. Scenario 1 represents the case in which the estimated silver price shocks are fed into the VAR system while the other shocks are set to zero. Here exchange rate and silver stocks are allowed to respond to changes in silver price and the induced changes in the other variables. This scenario is intended to isolate the portion of each episode that results solely from the silver price shocks and the associated transmission channels. Scenario 2 represents the simulation in which the silver price shocks are fed into the VAR system, all the other shocks are shut off, and the exchange rate is not allowed to respond to changes in silver price. This scenario eliminates the effects of silver price shocks that work through the exchange rate channel. Similarly, Scenario 3 eliminates the effects of silver prices shocks that work through the monetary channel.

[Figure 11 about here]

Let us begin with the first episode (Feb. 1929-Feb. 1931) shown in left panel of Figure 11. For New York silver price, exchange rate, and Shanghai WPI, Scenario 1 traces closely the actual series, implying that for this episode, it is primarily the silver price shocks that account for the variations in these variables. Scenario 3 also traces closely to historical data, implying that monetary channel is not an important channel that transmits these shocks into China. In contrast, Scenario 2 sees a stable exchange rate and a milder inflationary trend in Shanghai WPI. In other words, had Chinese currency not been tied to silver, the declining silver price during this episode would have not depressed the Chinese exchange rate and resulted in an inflationary trend in Shanghai WPI.

Right panel of Figure 11 shows the second episode (May 1933-Sept. 1934). For New York silver price, exchange rate, and Shanghai WPI, Scenario 1 follows the actual series, even though not as closely as depicted in left panel. Again, this indicates that fluctuations in silver price account for most of the variations in exchange rate and Shanghai WPI. Scenario 3 is indistinguishable from Scenario 1, denouncing the importance of the monetary channel. Scenario 2 sees a stable exchange rate and a milder deflationary trend in Shanghai WPI. The Chinese exchange rate would have remained stable and the Shanghai WPI would have deflated less in this episode, had Chinese currency been delinked from silver.

Admittedly, price of silver was an important, but not the only factor having affected China's price level during the study period. One factor is world commodity prices, which began to fall after 1929 due to the Great Depression. The decreases in world commodity prices were transmitted into decrease in Chinese prices. Between 1929 and 1931, the effects of falling world commodity prices on the Chinese prices were offset by the steady falling of silver exchange rate and the Chinese prices continued to rise. Between 1932 and 1934, the rising prices of silver reinforced the effects of falling world commodity prices and put substantial downward pressure on the Chinese prices and brought about price deflation (Myers, 1989). This explains why the prediction based on silver price shocks alone sometimes deviates from the actual series.

Another factor that had affected China's price level was the great Yangtze River flood in the summer of 1931. This flood was one of the greatest natural disasters on record and affected millions of people. It caused a temporary rise in the prices of cereals and other food products in the summer of 1931, as shown in Figure 10. With the aid of an American credit of US \$9.2 million for wheat and flour and the government emergency program, the impacts of the flood on price were temporary and under control (Young, 1971, p. 78).

Overall, the fact that some other factors might have also affected the Chinese price level had not obscured the strong linkage of China's price level to silver price.

9 Conclusion and discussion

We provide the first systematic investigation of how international silver price shocks were transmitted into the Chinese WPI. We find that exchange rate is an important transmission mechanism, while silver stocks are not. The merely fact that the Chinese currency was tied to silver made Chinese price levels subject to the up and down in silver prices.

Clearly, the constraint imposed by the free silver standard on the government means that the Chinese economy lacked an institutional arrangement to halt silver inflows and outflows, not to mention counteracting the resulting inflationary or deflationary pressures. The Chinese government can hardly be said to have controls over the supply of money in the modern sense prior to the currency reform of November 1935. Our empirical study shows that such an institutional defect had existed all the time.

From 1929 to 1931, China was under inflationary pressures when world silver price was on a downward trend; while during 1932 to 1934, China suffered from deflationary pressures when silver price was rising. During 1929 to 1931, this institutional defect may be benign as it may have contributed to China's initial wave of industrialization that occurred in Shanghai and a few cities along the Yangtze River (Shiroyama, 2008, p. 38). The mild inflation at that period was in general beneficial to the economy. The fall of silver price expanded the market for Chinese exports, shielded domestic industries from competition of imported goods, and attracted foreign investments (Coble, 1986, p. 85). Therefore, the public and the policymakers was slow in gaining awareness of the institutional defect. It was the rising world silver price since 1932, further stimulated by the U.S. abandonment of gold standard in 1933, and the American Silver Purchase Act of June 1934, and the resulting deflationary spiral that made explicit this major institutional defect of the silver standard.

The defect was so obvious that finally forced policymakers to figure out an alternative monetary regime. As H. H. Kung, the then Minister of Finance recalled, the Chinese authorities began to plan a currency reform when the U.S. silver purchase policy was enacted (Russell, 1972, p. 201). Arthur Young, financial adviser to the Nanking government, recalled that it was the extended suffering of acute deflation that changed the public's previous benign attitude toward rising silver price (Young, 1971, p. 232). The departure from silver was welcomed, as it dispelled the anxiety among the business community that deflation might persist

through further increases in world silver prices (Chang, 1958, p. 7).

In the long run, it is unclear whether freeing the government from the constraint of silver standard is a blessing or a curse. Budgetary institutions to prevent the abuse of this newly gained power and sustainable fiscal deficits are preconditions for a successful management of a fiat money system. These conditions were not available to the Nationalist government. In fact, the potential dangers of the new system did not go unnoticed by the leading Chinese bankers in Shanghai (Chang, 1958, p. 8). Even the designers of the reform had proposed for the independence of the Central Bank and urged the government to reduce its dependence on deficit financing.

As pointed out by Young (1971, p. 152), one among the draftsmen of the plan, before the currency reform of 1935, inflation was not a feasible option to do away with debt payments. Banknotes were redeemable in silver on demand, and an issue of fiat money would have promptly forced inconvertibility. Although in 1935 the government had never thought of an inflationary solution, the currency reform of 1935 did make such a solution technically possible and practically attractive and finally led to the eventual financial collapse of the Nationalists when a total confrontation with Japan started in mid-1937.

Admittedly, the price indexes we use can be criticized as representing the situation at Shanghai and at most other trade port cities, rather than in the countryside and China as a whole. We therefore call for caution in interpreting our results. China was a complex economy having both independent and integrated markets that coexisted in ways still not fully understood. To understand what precisely happened to Chinese economy in the early 1930s, Myers (1989) surveyed economic situations in several urban centers and rural areas. The mosaic, if there is one, he provided resembles more like a Rashomon than The Blind Men and the Elephant. This complexity is a given constraint to any exploration of the Chinese economy.

In the debate about the impact of the American Silver Purchase Act (ASPA, 1934) on the China, Friedman and Schwarz (1963) and Friedman (1992) argued that ASPA substantially reduced China's monetary stock and caused deflation, while Brandt and Sargent (1989) and Rawski (1993) disagreed with the Friedman's view and argued that the total Chinese money supply did not decline but continued to grow rapidly following the U.S. silver purchase. Both sides of the debate believed silver price affected China by changing supply of money, and they differ only in whether Chinese money supply had actually decreased or increased. However, our analysis above suggests that they might have misplaced their focus because silver price affected Chinese price level primarily through exchange rate, not through money supply. This important issue concerning the effects of ASPA and their

transmission mechanisms is left for future research.

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Table 1: Correlation between Variables of Interest

From February 1929 to September 1934			
	Exchange Rate	Shanghai WPI	Silver Stocks
World Silver Price	0.99	-0.65	-0.03
	Shanghai WPI	Interest Rate	Money Base
Silver Stocks	-0.65	-0.45	0.30
From February 1929 to August 1931			
	Exchange Rate	Shanghai WPI	Silver Stocks
World Silver Price	1.00	-0.96	-0.68
	Shanghai WPI	Interest Rate	Money Base
Silver Stocks	0.53	-0.10	0.60
From September 1931 to September 1934			
	Exchange Rate	Shanghai WPI	Silver Stocks
World Silver Price	0.98	-0.75	0.67
	Shanghai WPI	Interest Rate	Money Base
Silver Stocks	-0.95	-0.76	0.15

Table 2: Granger Causality Tests

Null Hypothesis	N=	F-statistic	p-value
January 1928 – September 1934			
New York silver price does not Granger cause Shanghai WPI	79	9.848	0.00
New York silver price does not Granger cause Tientsin WPI	79	7.357	0.00
Shanghai WPI does not Granger cause New York silver price	79	2.089	0.15
Tientsin WPI does not Granger cause New York silver price	79	0.005	0.94
January 1921 – September 1934			
New York silver price does not Granger cause Shanghai WPI	143	2.506	0.01
Shanghai WPI does not Granger cause New York silver price	143	1.625	0.09

Table 3: Commodities in the Index Numbers of Wholesale Prices in Shanghai

Commodities	Number of Items	Percentage %	According to Degree of Processing				According to Origins		
			Raw Materials	Producers' Goods	Consumers' Goods	Total	Domestic Goods	Foreign Goods	Total
1. Cereals	22	14.2	9	-	13	22	17	5	22
2. Other Food Products & Provisions	31	20.0	4	-	27	31	20	11	31
3. Textile Fibres & Manufactures Thereof	38	24.5	8	12	18	38	23	15	38
4. Metals	12	7.7	4	7	1	12	2	10	12
5. Fuels & Lighting	13	8.4	6	2	5	13	4	9	13
6. Building Materials	11	7.1	5	6	-	11	6	5	11
7. Chemicals & Preparations Thereof	10	6.5	-	10	-	10	1	9	10
8. Miscellaneous	18	11.6	6	6	6	18	11	7	18
Total	155	100	42	43	70	155	84	71	155
Percentage (%)			27.1	27.7	45.2	100.0	54.2	45.8	100.0

Source: Sheng, Jun (1931), *Reports on the Revised Index Numbers of Wholesale Prices* (Xiu Zheng Wu Jia Zhi Shu Bao Gao).

Figure 1: New York Silver Price and Wholesale Price Index in Shanghai and Tientsin

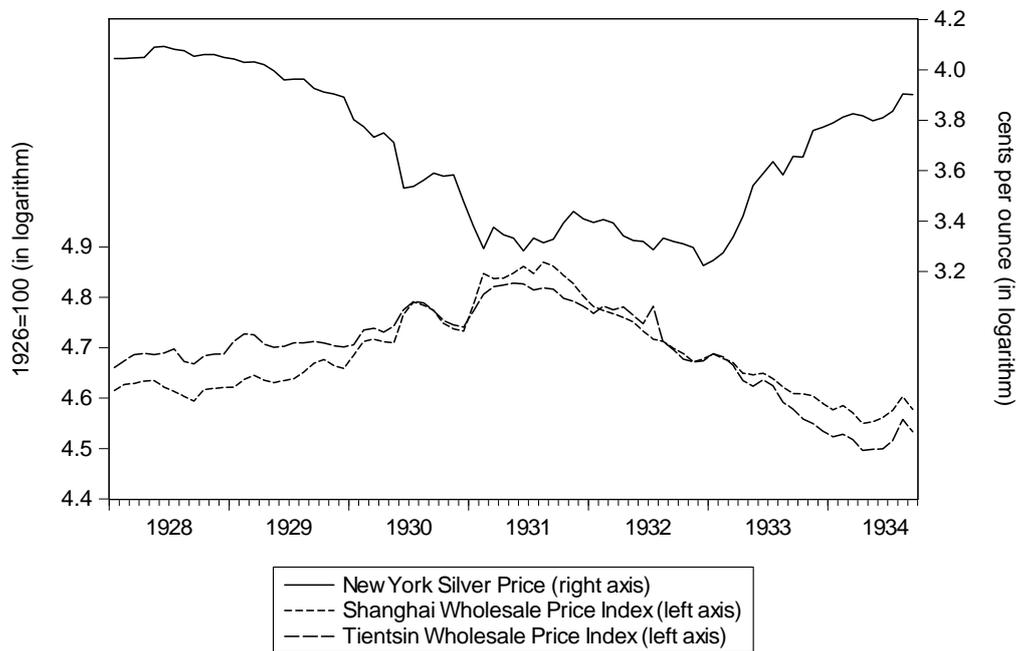
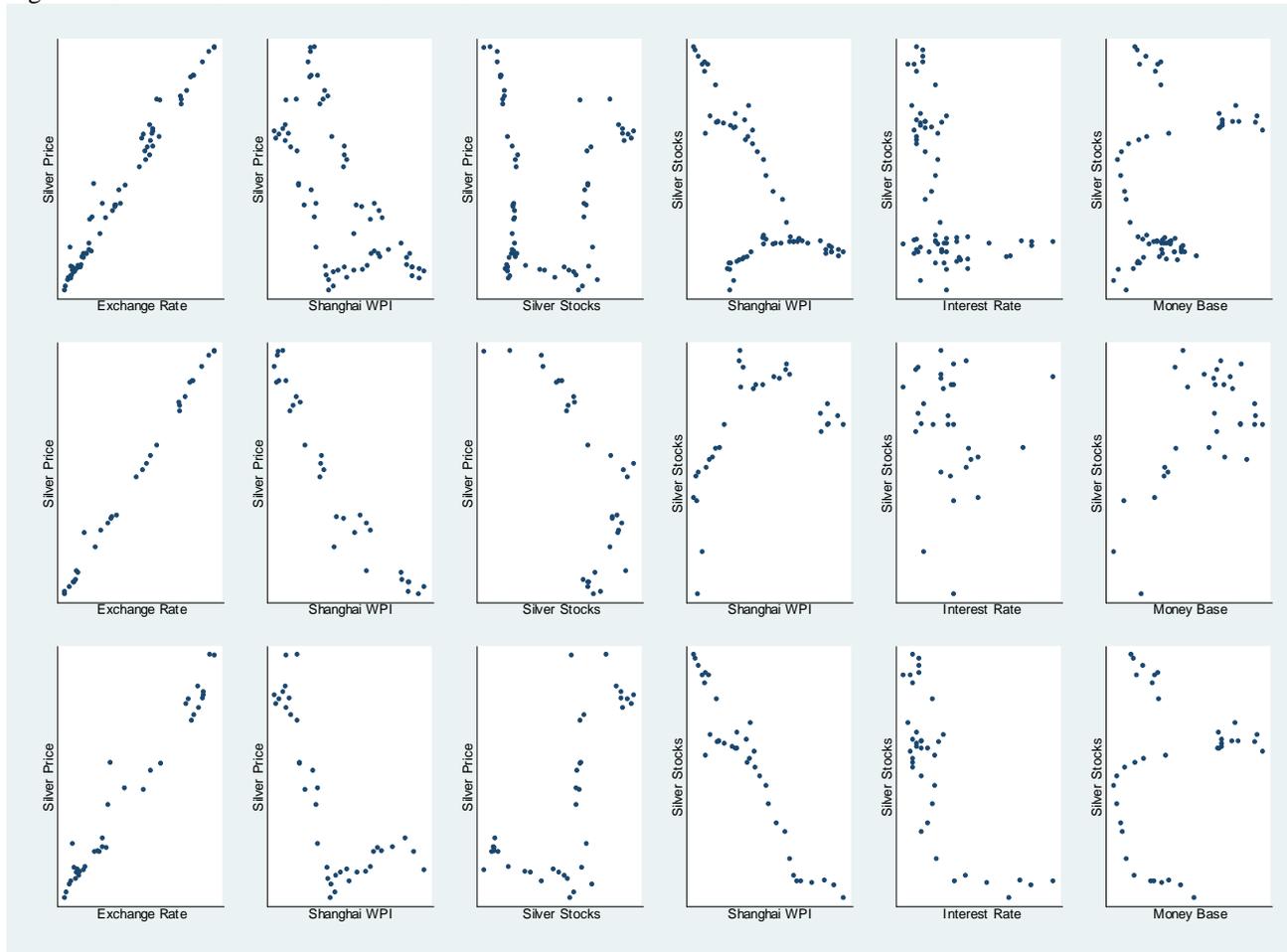


Figure 2: Scatter Plots of Variables of Interest



Note: The upper panel displays the period from 1929M02 to 1934M09. The middle panel displays the period from 1929M02 to 1931M08. The lower panel displays the period from 1931M09 to 1934M09.

Figure 3: China's Import, Export, and New York Silver Price

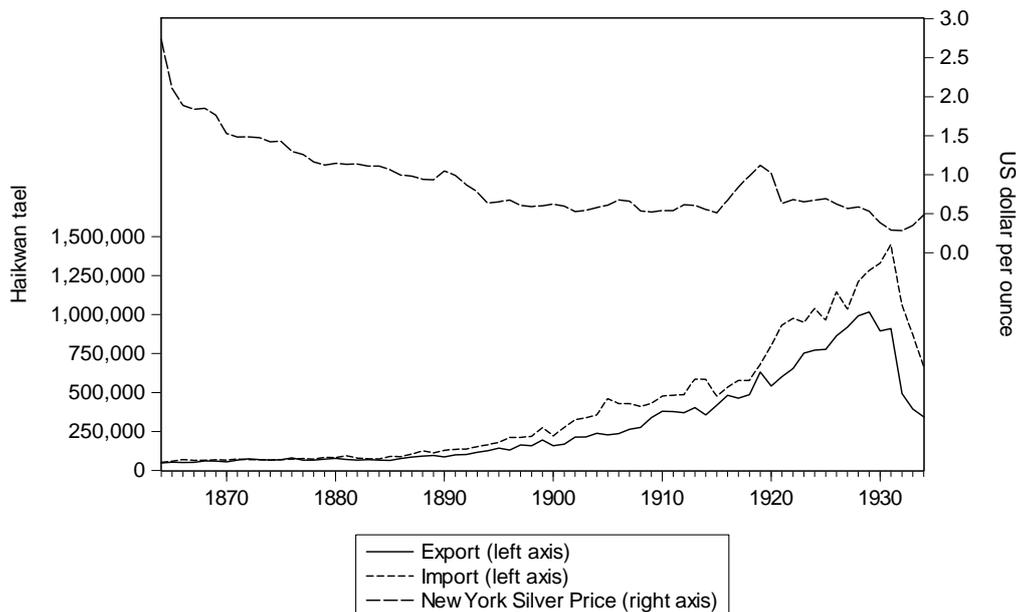


Figure 4: China's Export/Import Ratio and New York Silver Price

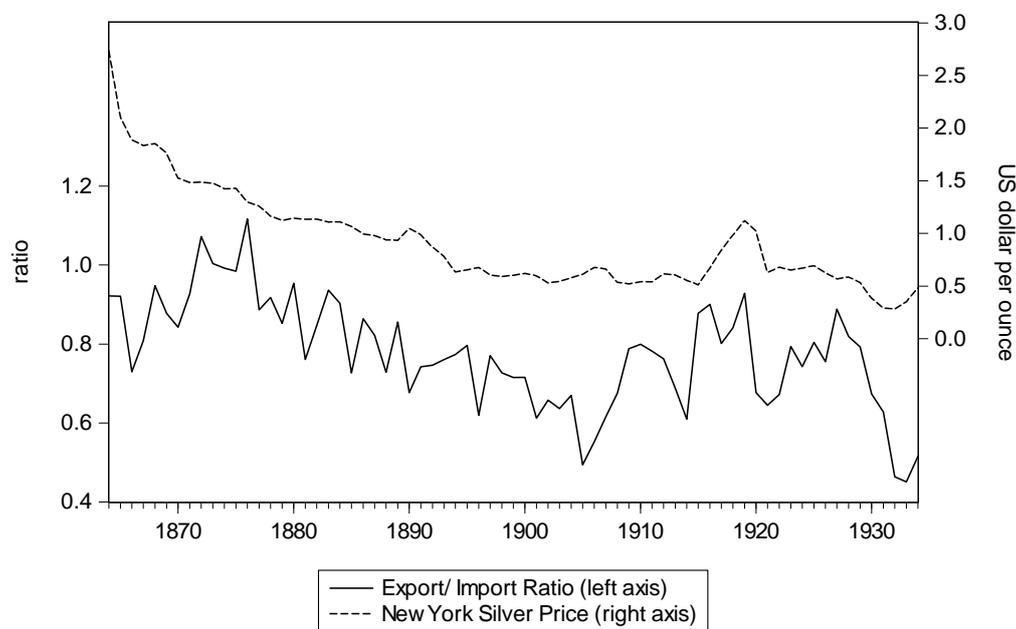


Figure 5: Impulse Responses of Chinese WPI to New York Silver Price Shocks

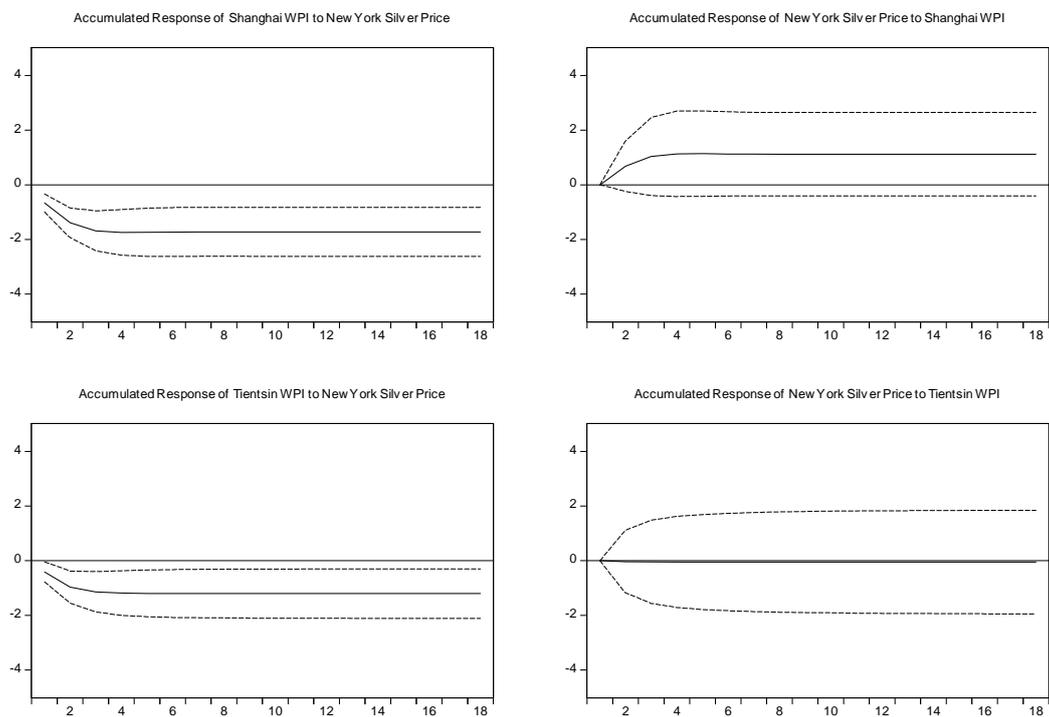


Figure 6: Impulse Responses to World Silver Price Shocks

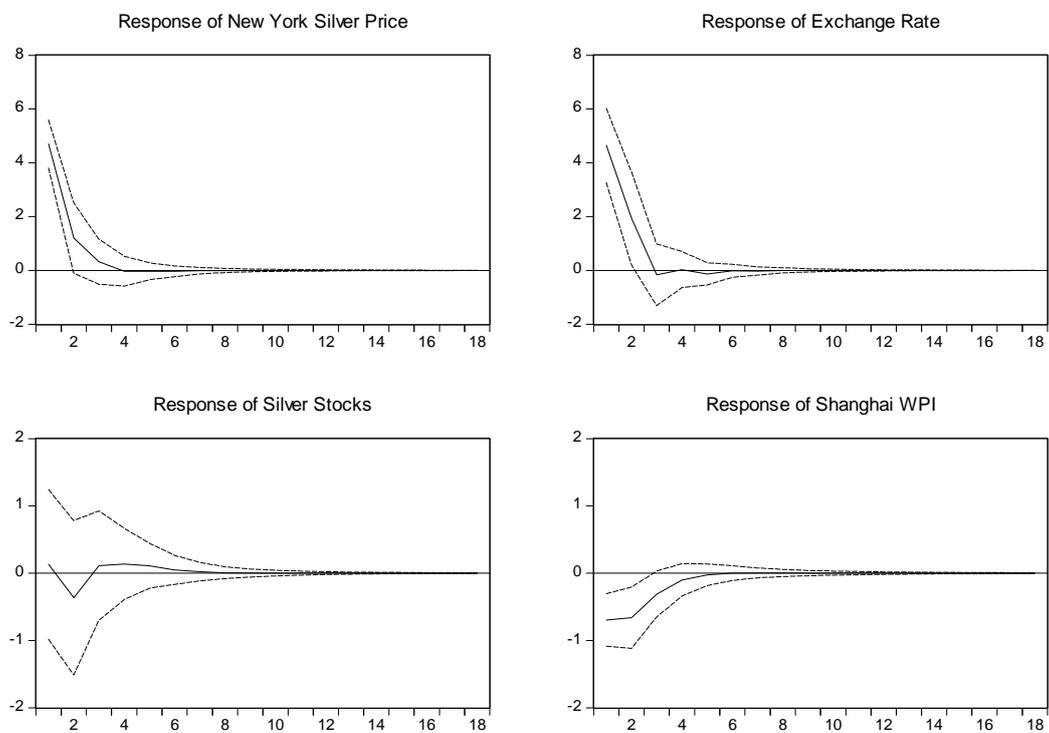


Figure 7: Decomposition of Responses

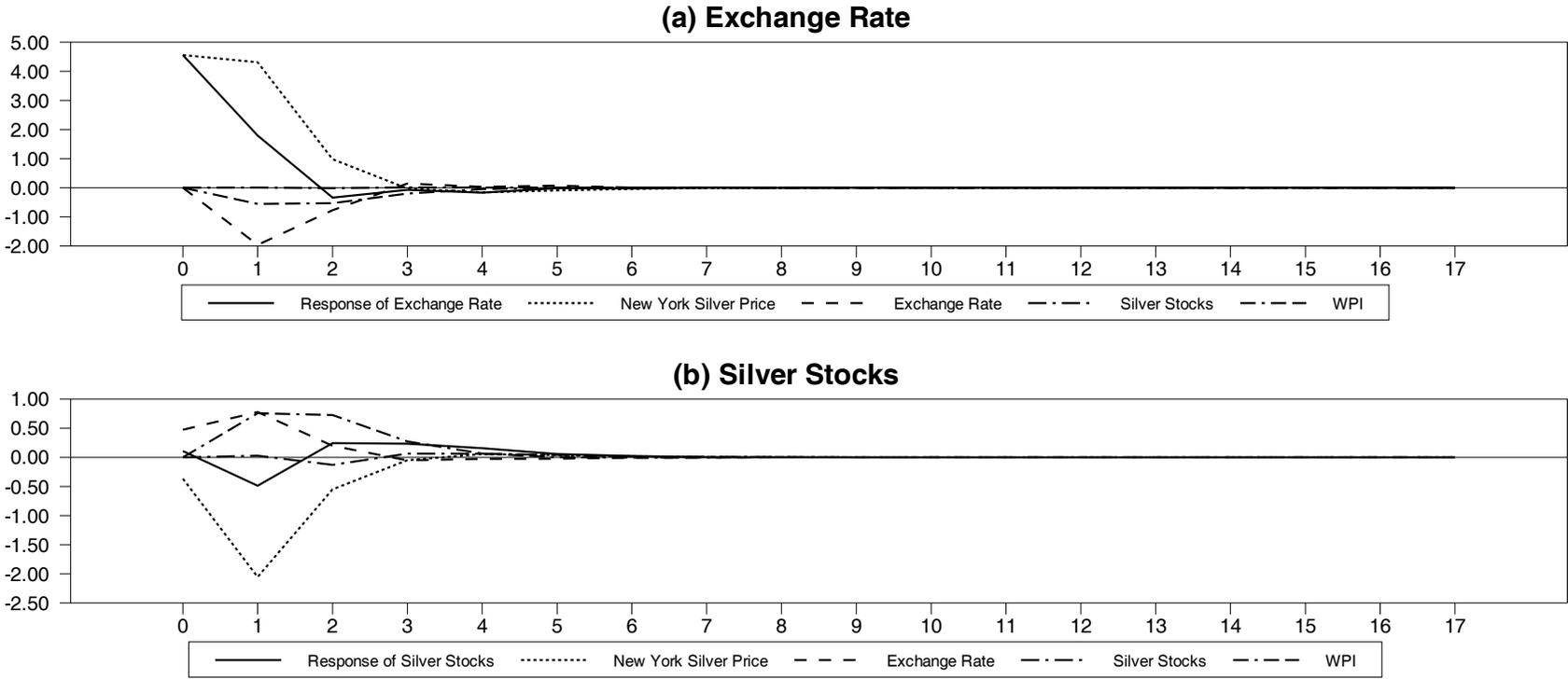
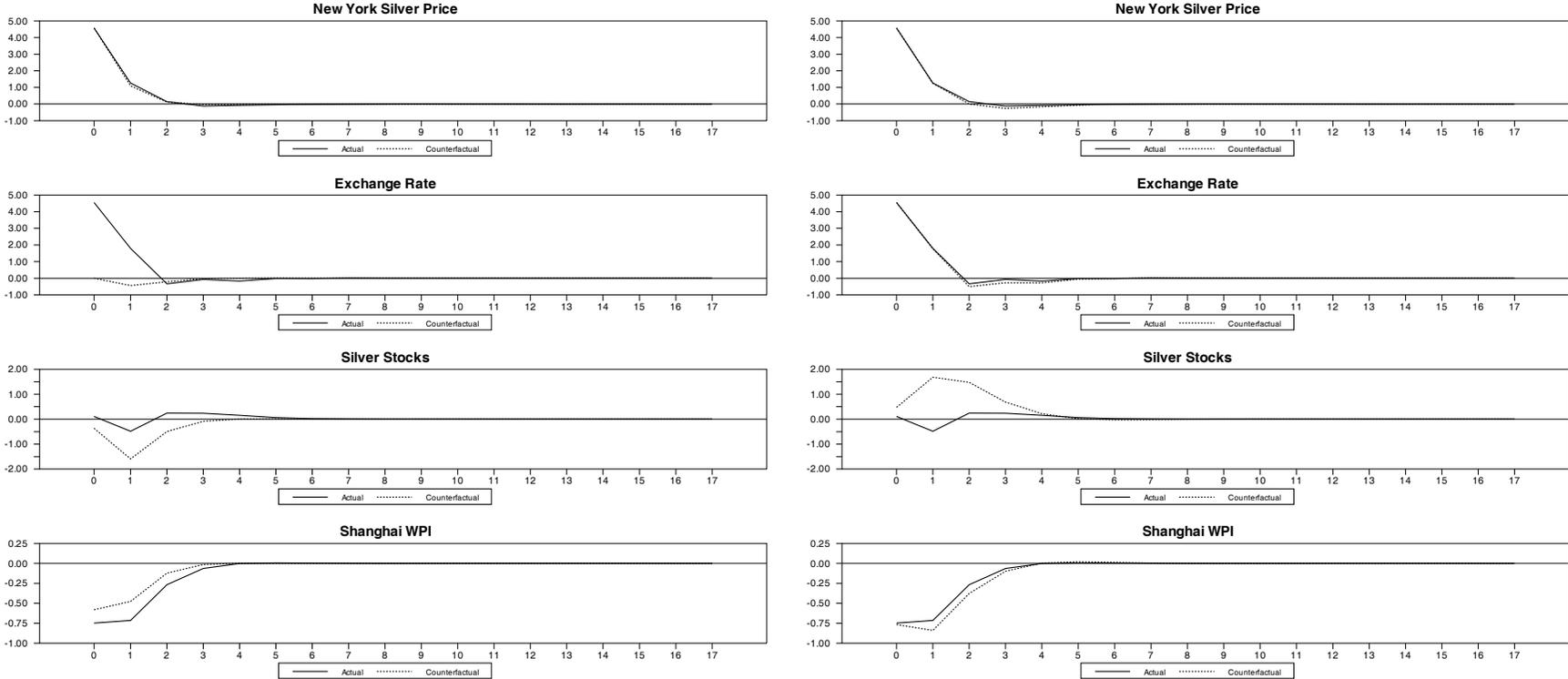
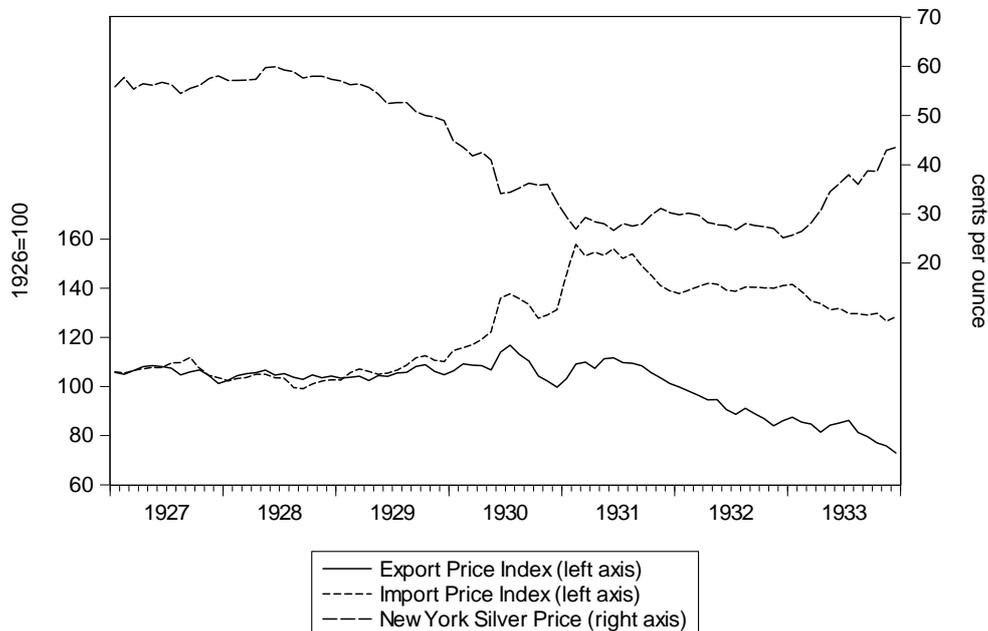


Figure 8: Counterfactual Responses



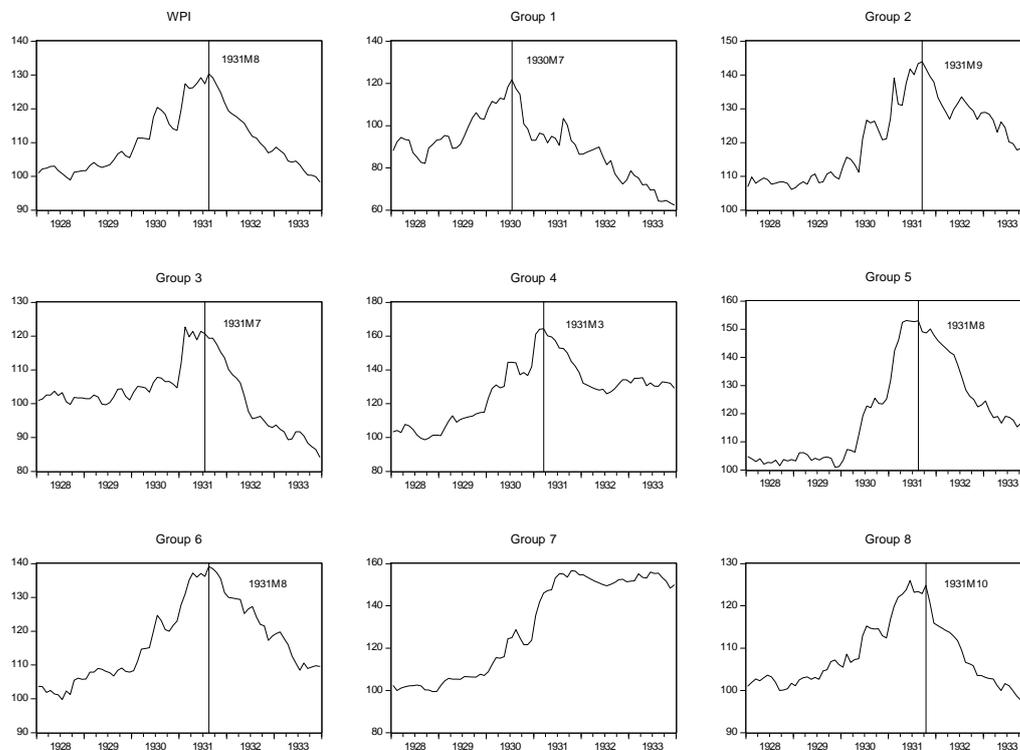
Note: Left panel: the exchange rate channel is shut down. Right panel: the monetary channel is shut down.

Figure 9: Export and Import Price Indices of Shanghai



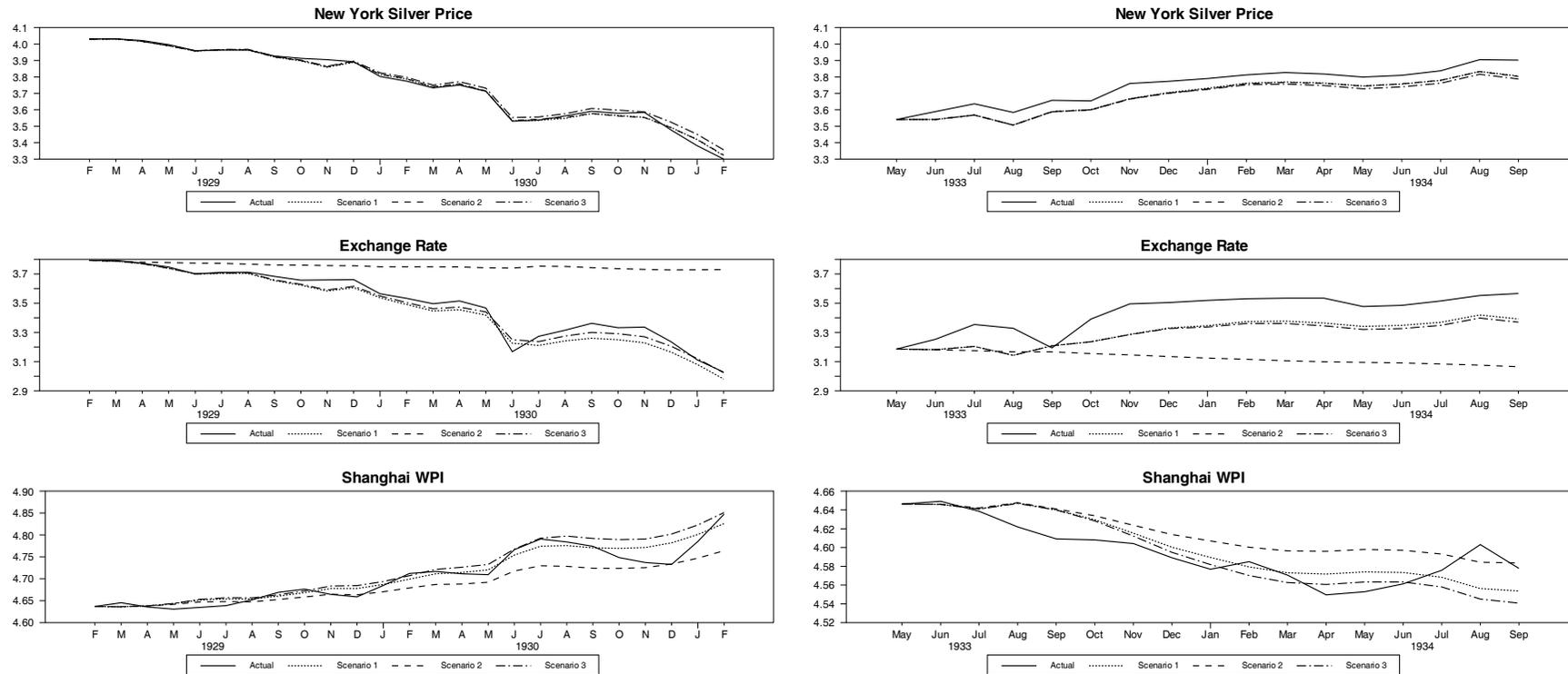
Source: Directorate-General of Budget, Accounting and Statistics (1972), *Statistic Summary* (Zhong Hua Min Guo Zheng Fu Tong Ji Ti Yao).

Figure 10: Shanghai Wholesale Price Index and Indices for Each Group of Commodities



Source: Directorate-General of Budget, Accounting and Statistics (1972), *Statistic Summary* (Zhong Hua Min Guo Zheng Fu Tong Ji Ti Yao).

Figure 11: Simulating Silver Price Shocks



Note: Left panel: February 1929 to February 1931. Right panel: May 1933 to September 1934.