

**Effect of the Monetary Policy in the United States on the International
Share of the U.S. Dollar: 1914–1945**

Li Wang* and Ronghua Zhang
Business School, Shanghai Jian Qiao University, Shanghai, China

*Corresponding author: Li Wang, Business School, Shanghai Jian Qiao University,
No. 1111, Hucheng Ring Road, Pudong New Area, Shanghai 201396, China

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The United States Dollar (USD) replacement of the sterling as the dominant currency is not only the result of the "invisible hand," but also the "visible hand." This study analyzes the effect of the monetary policy in the United States (U.S.) on the international share of the USD from 1914 to 1945 using the Bayesian technique, to estimate the time-varying parameter vector autoregressive (TVP-VAR) model. The study posits two main findings. First, the time-point impulse response shows that the increase in the U.S. interest rate results in an increase in the international share of the USD, implying that this increase has an expansion effect on the USD, and the effect has no time-varying characteristics. Second, the equal time interval impulse response shows that the effect of the monetary policy on the share of the USD is greater in the short term.

Keywords: Monetary policy in the U.S., Dominant currency, Share of U.S. Dollar

JEL: E42, E52

Introduction

Before World War I, the sterling was the only and most important reserve currency in the world (Paul Krugman, 1984). From 1860 to 1914, approximately 60% of the world's trade was in sterling (Barry Eichengreen, 2005). After the establishment of the Federal Reserve System (FRS) of the United States (U.S.) in 1914, the use of United States Dollars (USD) in global trade and foreign lending increased significantly. From 1917 to 1930, the FRS provided policy support such as USD credit preference, to facilitate the use of USD and accelerate their expansion in countries around the world (Barry Eichengreen and Marc Flandreau, 2009; Gita Gopinath and Chaim Jeremy, 2018). In terms of trade and credit, the USD took over the sterling's position as the number one currency during World War I. The USD replaced sterling as the dominant international currency for the first time in the mid-1920s (Eichengreen and Flandreau, 2009; Benjamin J Cohen, 2012).

Barry Eichengreen, Arnaud J. Mehl, and Livia Chitu (2017) put forth two hypotheses regarding international currency choice and currency substitution: the "Mars" and "Mercury" hypotheses. The "Mars hypothesis" holds that currency choice depends on geopolitical factors and emphasizes strategic, diplomatic, and military forces. The "Mercury hypothesis" holds that international currency choice is mainly controlled by economic factors and emphasizes economic motivations such as security, liquidity, network effects, trade connections, and financial connections (Eichengreen 2017). Based on the mechanism of the "Mercury hypothesis," this study holds that the replacement of sterling by the USD as the dominant currency is not only a result of the market mechanism of the "invisible hand" (Krugman, 1984; Kiminori Matsuyama, Nobuhiro Kiyotaki, and Akihiko Matsui, 1993) but also that of the "visible hand," monetary policy. As the designer of the market mechanism, the FRS contributes significantly to the international share of the USD (Eichengreen and Flandreau, 2010). The FRS adopted different monetary policies during different periods, to expand the USD, and finally replaced sterling as the dominant currency.

This study analyzes the effect of the monetary policy in the U.S. on the international share of the USD using the Bayesian technique, to estimate the time-varying parameter vector autoregressive (TVP-VAR) model. The study's two main findings are as follows. First, the time-point impulse response shows that the increase in the U.S. interest rate increases the international share of the USD, implying that this increase has an expansion effect on the USD and that the effect has no time-varying characteristics. Second, the equal time interval impulse response shows that the effect of the monetary policy in the U.S. on the share of the USD is greater in the short term.

This paper proceeds as follows. Section 2 elucidates the fact that the monetary policy in the U.S. supported the international share of the USD from 1914 to 1945. Section 3 presents the TVP-VAR empirical model and describes the data used in the estimation. Section 4 analyzes the results of impulse responses. Section 5 concludes the paper.

Effect of the monetary policy in the U.S. on the USD

In the 1870s, the GDP of the U.S. surpassed that of Britain and it became the world's largest economy, and in the 1900s, the per capita GDP of the US exceeded that of the U.K. as shown in Table 1. However, exports of US surpassed U.K. happened in 1915 after the establishment of the FRS as shown in Table 2. Before 1914, the U.S. did not have a central bank such as the Bank of London. In 1873, 1884, 1890, 1893, and 1907, the U.S. experienced grave banking crises. The banking crisis in 1907 forced the U.S. to implement banking system reforms (Milton Friedman and Anna Jacobson Schwartz, 1971). Therefore, the U.S. passed the Federal Reserve Act on December 23, 1913, which actuated the U.S. banking system reform. The Federal Reserve Act stipulated two important tasks for the FRS: acting as the lender of the last resort to overcome frequent banking crises and managing the gold standard system, to avoid significant fluctuations in the macroeconomy (Ben Shalom Bernanke, 2017).

Gopinath and Jeremy (2018) suggest that a small policy change will significantly change the international status of the currency. Monetary policy significantly supports the holding and use of currency by reducing its internal risk. The currency share will be further expanded through the network effect (Dong He and Xiangrong Yu, 2016) following the continuous expansion of the use of currency in the international market. Network externalities make each country more inclined to adopt the currency used by other countries, which presents nonlinear characteristics (Menzie Chinn and Jeffery Frankel, 2005). The stronger the economic ties between a country and other countries, the greater the possibility of using its currency in cross-border trade (Barry Eichengreen and Domenico Lombardi, 2015). Simultaneously, network ties between countries are persistent and affect the international position of the currency (Flandreau and Jobst, 2009; Shin-ichi Fukuda and Masanori Ono, 2016).

Table 1: Per Capita GDP of the U.S. and U.K. (1990 International Dollar)

Year	U.S.	U.K.
1872	252 4	331 9
1901	446 4	445 0
1929	689 9	550 3
1945	117 09	705 6

Notes: The data source is from NBER.

Table 2: Exports of the U.S. and U.K. from 1900 to 1945 (Billion U.S. dollars)

Year	U.S.	U.K.
1872	0.474	1.731
1901	1.552	1.701
1915	2.82	2.379
1929	5.324	4.148
1945	9.897	1.814

Notes: The data source is from NBER.

Table 3: Overseas Investment of the U.S. and U.K. (Million US dollars)

	1914		1938	
	U.S.	U.K.	U.S.	U.K.
Europe	709	1129	2386	1139
West Coast	900	8254	4454	6562
Latin America	1649	3682	3496	3888
Asia	246	2873	997	3169
Africa	13	2373	158	1848
Total	3514	18311	11491	17335

Notes: The data source is from Maddison (2001).

FRS was established in 1914, after which it not only regulated economic development and financial stability in the U.S. but also encouraged the banking industry to expand the scale of acceptance bills by adjusting the interest rate of the commercial bills and preferential measures in the U.S. (Eichengreen and Flandreau, 2009; Eichengreen, 2010; Gopinath and Stein, 2018). Consequently, the U.S. international investment and loans developed rapidly, resulting in the expansion, holding, and use of the USD in the world, and increasing its international proportion. As shown in Table 3, overseas investment of U.S. was much lower than U.K. in 1914, but the gap between overseas investment in the U.S. and the U.K. has narrowed significantly in 1938.

In this section, in conjunction with the world political and economic environment, we elucidate the fact that the monetary policy in the U.S. significantly supported the international position of the USD, from 1914 to 1945.

The period during World War I

Before World War I, the USD was rarely used in international transactions; there was no central bank to rediscount acceptance bills, purchase bonds in the open market, or ensure market liquidity. However, everything changed after the establishment of the U.S. FRS (Eichengreen, 2005). During World War I, the FRS encouraged banks to expand the scale of acceptance bills, to allow for the trade manufacturers worldwide to use the USD as a trade credit currency. Banks were allowed to operate trade credit instruments promulgated by the Federal Reserve Act formulated in 1913. Subsequently, a huge USD acceptance bill market was established (Flandreau and Jobst, 2009).

After the outbreak of World War I, Britain passed a bill allowing the Ministry of Finance, rather than the Bank of England, to issue 1- and 10-pound notes. From 1915, the circulation of gold in Britain began to decline gradually. However, the total value of money achieved from the circulation increased from 200 million pounds in

1914 to 580 million pounds at the end of World War I in 1918. Paper money accounted for 321 million pounds, which resulted in a large outflow of gold from Britain. Therefore, gold was prohibited from being exported from Britain in 1919 (Martin Weale, 2000). In contrast, the U.S. was both a capital exporter and had a high gold inflow. By 1925, the scale of gold reserves in the U.S. was approximately six times that of Britain (Eichengreen, 1984).

The U.S. government replaced the private sector and became a major dealer in the international market by controlling financial institutions. Regarding the international debt positions of Britain and the U.S., World War I changed Britain from a creditor to a debtor country. After the war, the British government owed \$4.7 billion in debt (Eichengreen, 1984). World War I transformed the U.S. from a net debtor with long- and short-term debts totaling \$3.7 billion in 1914, to a net creditor with the same amount of creditor's rights at the end of 1919. After the U.S. announced its participation in the war, the funds of American allies, meant to buy American goods, came mainly from loans provided by the U.S. government. The FRS had become a sales window for government bonds. Moreover, the supply of dollars was sufficient (Friedman and Schwartz, 1971) as the U.S. government assumed responsibility for financing the trade deficit of the allies.

The period during the banking crisis in the 1920s

After World War I, the international economic and financial advantages transferred from Britain to the U.S., and the development of its financial institutions and financial scale was not coordinated with its "international responsibility." Therefore, the U.S. government tried to develop new forms of financial institutions and change this uncoordinated situation. At the same time, the international conference, especially the Genoa Economic and Financial Conference held in 1922, played an imported role for the reconstruction of the international monetary system. The U.S. expressed its willingness to participate in the international economic policy coordination meeting, and proposed to re-establish the fixed exchange rate, the convertibility of international currencies, and the free flow of goods and gold. A resolution accompanying the Genoa Conference Convention states that the success of any international economic coordination plan depends on the participation of the U.S.. Without policy coordination between Europe and the U.S., any plan to stabilize prices cannot be fully effective, and therefore their cooperation should be invited (Eichengreen, 1984). After the Genoa Conference, Austria, Danzig, Hungary, Bulgaria, Estonia, and Greece all passed new regulations authorizing their central banks to hold all foreign exchange reserves in the form of foreign bills, and then many other countries authorized their central banks to hold part of their foreign exchange reserves in this form (Eichengreen and Flandreau, 2009). In the 1920s, the FRS formulated a new monetary policy standard to replace the automatic adjustment of the gold standard to promote domestic economic stability, international trade balance, and prevent financial crisis through the central bank, for the first time in the history of the U.S. (Friedman and Schwartz, 1971).

The relative risk of currencies had a significant impact on the international status of the USD and sterling (Rey H el ene, 2001). Demanders usually choose a currency with lower expected risk (Wanyu Chung, 2016). The expected risk of the currency is not only reflected in the political and economic stability of its issuing country but also in the gold reserves and their convertibility into gold during the gold standard period (Mariko Hatase and Mari Ohnuki, 2009; Mark D. Troutman, 2010; Benjamin, 2012). The monetary policy standard reform of the FRS not only reduced the domestic financial risk but also maintained the convertibility between the USD and gold through policy intervention resulting in a large gold inflow during this period and enhanced the international reputation of the USD, which replaced sterling as the dominant currency for the first time in the 1920s (see Chi u, Eichengreen and Mehl, 2014); the proportion of the USD in the public debt of 28 countries had risen to 51.09%, while the proportion of Britain decreased to 42.31% by 1929.

As shown in Figure 1, from the perspective of the proportion of sterling and the USD in the public debt of 28 countries, sterling accounted for about 76.8% in 1914, while the USD accounted for about 10.2%. After the establishment of the U.S. FRS, the proportion of the USD rose rapidly. In contrast, the proportion of sterling decreased almost at a corresponding rate. By 1926, the proportion of the USD surpassed that of sterling and became the leading currency in public debt in 28 countries. At the time, the proportion of sterling accounted for about 45.3%, whereas that of the USD accounted for approximately 48.3%. Since then, the scale of the USD expanded gradually until 1932, when the proportion of the USD reached about 60.9%. In contrast, the proportion of the British pound fell to 29.4%. However, the proportion of the USD in the public debt of various countries fell during the financial crisis in 1933, following the depreciation of the USD. Although the proportion of sterling rebounded, it was still lower than that of the USD. In 1940, the proportion of the USD started rising again. After World War II and the establishment of the Bretton Woods system, the proportion of the USD reached 57.3%.

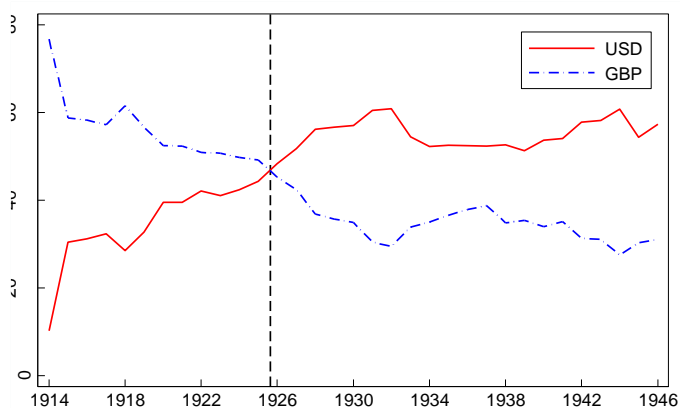


Figure 1 Proportion of the USD and GBP (%). The data is the arithmetic mean of the proportion of the USD and GBP in the public debt of 28 countries such as France (see Appendix A for the list of all countries). Source: Livia Chițu, Barry Eichengreen, and Arnaud Mehl (2014).

Furthermore, sterling's convertibility into gold stopped in the early 1920s, following a large amount of gold flowing out from Britain, which increased the expected risk of sterling and reduced the trust of the international demand side (Eichengreen, 2005). In contrast, the FRS reformulated the monetary policy standard to replace the automatic adjustment of the gold standard, so that the dollar remained convertible to gold. The expected risk of the USD is lower than that of sterling, which enhances the trust of the demanders in the USD. Bankers and businessmen reduced the number of sterling accounts and continued to increase their holdings of USD, which significantly promoted the use of USD in international trade and lending, resulting in the significant expansion of the USD as a means of valuation and payment in private sector trade (Eichengreen, 1984; Eichengreen, 2005). For example, India separated its rupee from the sterling during this period and established a link between the rupee and the USD. Simultaneously, the U.S. government actively promoted the construction of a currency group, transforming the USD from a regional currency to an internationally dominant currency (Leslie Pressnell, 1978).

Benjamin (2012) suggests that international currency choices are influenced by large-scale geopolitical factors. When a country is powerful, other governments believe that using its currency for international transactions is in their geopolitical interest. Eichengreen (2017) found that military alliances increase the proportion of one country's currency in the foreign exchange reserves of other countries by 30%. At the beginning of World War I, the British government relaxed its monetary ties with the monetary union countries (Pressnell, 1978). Taking advantage of the favorable opportunity of the Pacific regional market far away from the influence of Europe and the pound, the U.S. built an international regional market network, flexibly used the regional market to form a regional currency group, and promoted the dollar to become a regional international currency. Network externalities make each country more inclined to use the currency used by other countries. Moreover, the use of international currencies presents nonlinear characteristics (Chinn and Frankel, 2005). Therefore, according to Eichengreen and Flandreau (2009) and Benjamin (2012), the USD replaced the sterling as the dominant international currency for the first time in the mid-1920s.

The period from the great depression to World War II

Following the outbreak of the Great Depression, Britain stopped convertibility between sterling and gold again in 1931, while the U.S. resumed convertibility between the USD and gold less than a year after it had briefly stopped its convertibility in 1933. The convertibility of sterling and the USD into gold was stopped successively, which made the demand for the two currencies swing in the international currency

market (Mark, 2010; Benjamin, 2012). However, in the face of the economic recession and the large outflow of gold from the U.S., the FRS actively intervened in the currency market and adopted policies such as increasing the discount rate and authorizing the American Renaissance Finance Corporation to acquire newly mined and foreign gold. Friedman and Schwartz (1971) point out that when the U.S. gold stock decreased between September and October 1931, the FRS doubled the discount rate on October 9 and October 16, 1931. This intervention increased the bank interest rate from 1.5% to 3.5%. Simultaneously, the FRS actively intervened in the market, raised the gold price, and created a large gold inflow. Meanwhile, on October 25, 1931, the Renaissance Finance Corporation (RFC) was authorized to acquire newly mined gold, and a few days later, the RFC was authorized to purchase foreign gold. These policies have resulted in the production of a large amount of gold that flowed into the U.S. (Friedman and Schwartz, 1971; Eichengreen, 1984).

As shown in Figure 2, the U.S. government adopted a policy of increasing the discount rate, authorizing financial companies to purchase domestically newly mined gold and foreign gold successively and pursuing measures of urging gold standard countries to repay their debts with gold. This resulted in a significant increase in the U.S. gold reserves since 1934—a significant increase of \$1.34 billion during that year—and a sustained and rapid upward trend. In 1940, the scale of U.S. new gold reserves reached its highest, with an additional \$4.37 billion that year, 3.26 times higher than that in 1934. In contrast, Britain's gold reserves decreased significantly in 1934, down to \$1.134 billion that year and showed a sustained and rapid downward trend. At the end of 1940, the decline of British gold reserves reached the largest, with a decline of \$4.74 billion, which was 4.18 times that in 1934.

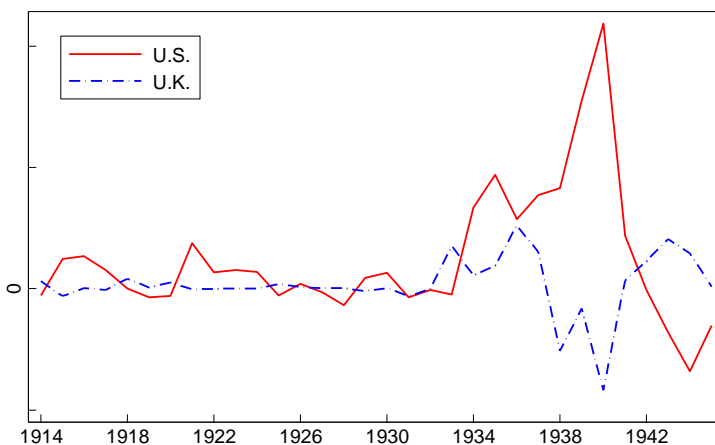


Figure 2. Change in gold reserves (USD million). (1) The sample period is from 1914 to 1945, and the data source is from NBER. (2) The change in U.K. gold

reserves is calculated as the change in U.K. gold reserves (in pound sterling) divided by the nominal exchange rate between the bilateral exchange rate (1 U.S. dollar to pound sterling).

Simultaneously, the U.S. FRS asked France and other gold standard countries to pay off their dollar debts, which were paid off with \$500 million worth of gold (Postan, 2002). Therefore, the U.S. gold inflow increased significantly, between 1934 and 1941. By the end of 1938, the U.S. held 60% of the world's gold stock, whereas the U.K. held only 12% (Postan, 2002).

In the interwar period, a series of international conferences were held with the aim of resolving war debts, restoring the economy, and reconstructing the international monetary system and economic order. The Lausanne Conference held in 1932 aimed to solve the issues of reparations and war debts. The U.K. demanded the termination of reparations and publicly requested the U.S. to cancel its war debts, whereas the U.S. insisted and established an imperial tariff preference system at the Ottawa Conference, abandoning free trade policies. In 1933, the U.S. launched the "New Deal" to strengthen government intervention in the economy. At the London Conference held on debt collection and refused to attend the meeting. In the same year, Britain passed the Import Duties Act, raising tariffs in the hope of consolidating its trade position. In 1933, Britain asked the U.S. again to reduce its war debt, although the U.S. hoped that other countries will abandon tariff barriers and resume free trade. In 1934, the U.S. passed the Reciprocal Trade Agreement Act, which resulted in a 44% decrease in average tariffs. This Act further enhanced the U.S. foreign trade. At the same time, the U.S. constructed the U.S. dollar group, including countries such as Canada, the Philippines, and some other countries in Latin America. In 1936, the U.S., Britain, and France signed the Tripartite Currency Agreement, agreeing to reduce exchange rate fluctuations and work together to maintain the stability of monetary relations. In 1939, the U.S. dollar group was further developed into the U.S. dollar zone, including most countries in the Americas (Ma, 2011).

World War II broke out in September 1939, during which Britain and its allies entered a state of war, and the U.S. was neutral from September 1939 to November 1941. Britain and other participating countries ordered a large number of war materials from the U.S.. Therefore, the use of the USD in international trade, international credit, and international reserves was further promoted. After World War II, the establishment of the Bretton Woods system marked that the U.S. dollar had become the dominant international currency.

Empirical test

In the previous text, we analyzed the process of the U.S. dollar replacing the sterling as the dominant currency from a historical perspective and proposed that the process was not only the result of market mechanism of the "invisible hand," but also U.S.

government policy of the "visible hand," playing an important role in promoting this process. In this section, we employ the TVP-VAR model to testify the role of the monetary policy in the U.S. in promoting the international position of the USD.

TVP-VAR Model

The TVP-VAR model was first constructed by G.E. Primiceri (2005) and then widely used in macroeconomic research such as Jouchi Nakajima (2011). The TVP-VAR model integrates the idea of randomness and the vector autoregressive (VAR) model to examine the nonlinear impact of exogenous shocks on macroeconomic variables. Hence, the TVP-VAR model has two advantages: (1) incorporating random volatility into model estimation can significantly improve the estimation performance and avoid the heteroscedasticity problem in parameter estimation, and (2) the model can effectively describe whether the influence of exogenous factors on endogenous variables has structural change.

The standard VAR model can be written as shown in equation (1),

$$Ay_t = F_1y_{t-1} + F_2y_{t-2} + \dots + F_sy_{t-s} + u_t \quad t = s+1, \dots, n \quad (1)$$

where y_t denotes the $k \times 1$ matrix vector of observable variables; A, F_1, \dots, F_s are all $k \times k$ coefficient matrices; and u_t denotes the $k \times 1$ matrix vector of exogenous shocks.

In the model, u_t is subject to $(0, \Sigma)$ distribution as follows.

$$\Sigma = \begin{pmatrix} \sigma_1 & 0 & \dots & 0 \\ 0 & \ddots & \ddots & \vdots \\ \ddots & \ddots & \ddots & 0 \\ 0 & \dots & 0 & \sigma_k \end{pmatrix}$$

Simultaneously, assume A is a lower triangular matrix.

$$A = \begin{pmatrix} 1 & 0 & \dots & 0 \\ a_{21} & \ddots & \ddots & \vdots \\ \ddots & \ddots & \ddots & 0 \\ a_{k1} & \dots & a_{k,k-1} & 1 \end{pmatrix}$$

The reduced-form VAR model is shown in Equation (2).

$$y_t = B_1y_{t-1} + B_2y_{t-2} + \dots + B_sy_{t-s} + A^-\Sigma\varepsilon_t \quad \varepsilon_t \sim N(0, I_k) \quad (2)$$

Where $B_i = A^-F_i, i = 1, \dots, s$. The $k^2s \times 1$ dimensional coefficient matrix β_t is obtained by arranging B_i in rows. We can rewrite Equation (2) as Equation (3).

$$y_t = X_t\beta + A^-\Sigma\varepsilon_t \quad \varepsilon_t \sim N(0, I_k) \quad (3)$$

Where $X_t = I_k \otimes (y'_{t-1}, \dots, y'_{t-s})$, and \otimes denotes the Kronecker product.

As the coefficient matrices β, A^- , and Σ in Equation (4-3) are all time-invariant, the TVP-VAR model, as in Equation (4), can be obtained.

$$y_t = X_t \beta_t + A_t^- \Sigma_t \varepsilon_t \quad t = s+1, \dots, n \quad (4)$$

In the TVP-VAR model, β_t , A_t^- and Σ_t in Equation (4) are time-varying coefficient matrices. Let $a_t = (a_{21}, a_{31}, a_{32}, a_{41}, \dots, a_{k,k-1})'$ be the vector of the lower triangular matrix A_t , $h_t = (h_{1t}, \dots, h_{kt})'$ and $h_{jt} = \log \sigma_{jt}^2$, $j = 1, \dots, k$, $t = s+1, \dots, n$. Simultaneously, we assume that all parameters in Equation (4-4) follow a random walk process.

$$\beta_{t+1} = \beta_t + u_{\beta t}, \quad a_{t+1} = a_t + u_{at}, \quad h_{t+1} = h_t + u_{ht},$$

$$\begin{pmatrix} \varepsilon_t \\ u_{\beta t} \\ u_{at} \\ u_{ht} \end{pmatrix} = N \left(\mathbf{0}, \begin{pmatrix} I & 0 & 0 & 0 \\ 0 & \Sigma_\beta & 0 & 0 \\ 0 & 0 & \Sigma_a & 0 \\ 0 & 0 & 0 & \Sigma_h \end{pmatrix} \right), \quad t = s+1, \dots, n$$

Where $\beta_{s+1} \sim N(\mu_{\beta_0}, \Sigma_{\beta_0})$, $a_{s+1} \sim N(\mu_{a_0}, \Sigma_{a_0})$, $h_{s+1} \sim N(\mu_{h_0}, \Sigma_{h_0})$. Furthermore, we assume that Σ_β , Σ_a , and Σ_h are diagonal matrices.

The data

The TVP-VAR empirical model of this study has four endogenous variables, including the *U.S. nominal interest rate*, *bilateral exchange rate* (priced at 1 U.S. dollar to sterling), the *U.S. net outflow of gold*, and *international share of the USD*. The exogenous shock is the U.S. monetary policy shock.

The estimation adopts the annual data for the period from 1914 to 1945. The U.S. nominal interest rate adopts the U.S. long-term interest rate, and the bilateral exchange rate adopts a logarithm. The data source for the U.S. long-term interest rate and bilateral exchange rate comes from the NBER. The U.S. net outflow of gold is calculated as the growth rate of net gold exports, and the data on net gold exports are from the NBER. The international share of the USD adopts the arithmetic mean of the share of the USD in the public debt of 28 countries; the data is from Chițu, Eichengreen and Mehl (2014).

Parameter setting and estimation results

Based on Nakajima (2011), we assume that Σ_β , Σ_a , and Σ_h are diagonal matrices; the previous mean and standard deviation of the parameters are set as follows:

$$\mu_{\beta_0} = \mu_{a_0} = \mu_{h_0} = 0$$

$$\Sigma_{\beta_0} = \Sigma_{a_0} = \Sigma_{h_0} = 10 \times I$$

$$(\Sigma_{\beta})_i^{-2} \sim \text{Gamma}(40, 0.02)$$

Table 4: Estimation Results

Variables	Mean	Std.	95% Up	95% Down	Geweke	Ineff.
$(\Sigma_{\beta})_1$	0.002 3	0.000 3	0.001 8	0.002 8	0.552	3.75
$(\Sigma_{\beta})_2$	0.002 3	0.000 3	0.001 8	0.002 8	0.386	2.53
$(\Sigma_{\alpha})_1$	0.005 6	0.001 6	0.003 4	0.009 5	0.411	9.30
$(\Sigma_h)_1$	0.005 7	0.001 7	0.003 4	0.009 9	0.691	9.41
$(\Sigma_h)_2$	0.005 5	0.001 6	0.003 4	0.009 6	0.031	7.85

$$(\Sigma_{\alpha})_i^{-2} \sim \text{Gamma}(40, 0.02)$$

$$(\Sigma_h)_i^{-2} \sim \text{Gamma}(40, 0.02)$$

where $(\Sigma_{\beta})_i$, $(\Sigma_{\alpha})_i$, and $(\Sigma_h)_i$ represent the i th element on the diagonal of the diagonal matrices Σ_{β} , Σ_{α} , and Σ_h , respectively. The lag order of the model is set as one. The posterior distribution of parameters is further obtained using Monte Carlo Markov chain sampling to draw 10,000 data points. As presented in Table 4, the inefficient factor (INEFF) values were all less than 50, indicating that the parameter estimation was effective and robust.

Impulse response analysis

Based on the adjustment of the monetary policy in the U.S. between 1914 and 1945, we selected four time points. The first time point was 1917 when the U.S. nominal interest rate rose and the U.S. entered World War I. The second time point was 1928 when the U.S. nominal interest rate rose, and as described above, the FRS formulated a new monetary policy standard to replace the automatic adjustment of the gold standard in the 1920s. The third time point was 1931 when the FRS began and continued to increase the nominal interest rate to prevent gold outflow. The fourth time point was 1942 when the U.S. entered World War II and adjusted the interest rate of treasury bonds.

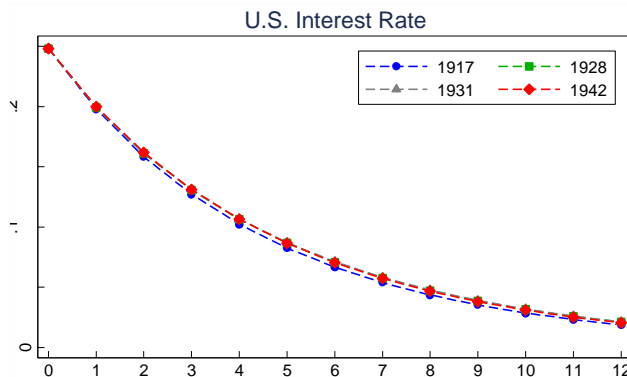
Time point impulse response analysis

According to Figure 3, in 1917, 1928, 1931, and 1942, the adjustment of the monetary policy in the U.S. drove the U.S. interest rate to rise by about 0.25% immediately, and then gradually returned to the initial nominal interest rate level after 12 periods. Under the four time points, the responses for the bilateral exchange rate are similar; the

increase in the U.S. interest rates at the four time points caused the USD to appreciate by 0.01% in the shock period.

The appreciation of the USD caused by an increase in the U.S. interest rate results in a decrease in the U.S. net outflow of gold. The declining trend and amplitude of the U.S. gold outflow at the four time points were consistent. In the shock period, the U.S. gold outflow decreased by 0.44% and further gradually adjusted upward. From the impulse response for the international share of the USD, we find that the upward trends at the four time points are similar. As the gold outflow declined in the shock period, the share of the USD rose by 0.42% at the four time points. This result is consistent with the history of the interwar period. In the face of the large outflow of gold from the U.S. in 1931, the FRS actively intervened in the currency market and doubled the discount rate, this intervention increased the bank interest rate from 1.5% to 3.5%, which resulted in a significant increase in the U.S. gold reserves and the proportion of the USD started rising again by the end of the 1930s.

Therefore, from the time point impulse response, we find that the effect of the U.S. monetary policy on the international share of the USD has no time-varying characteristics. An increase in the U.S. nominal interest rate causes an increase in the bilateral exchange rate in the short term, resulting in a decline in the U.S. gold outflow, which expands the international share of the USD. The monetary policy in the U.S. significantly supported the expansion of the USD from 1914 to 1945.



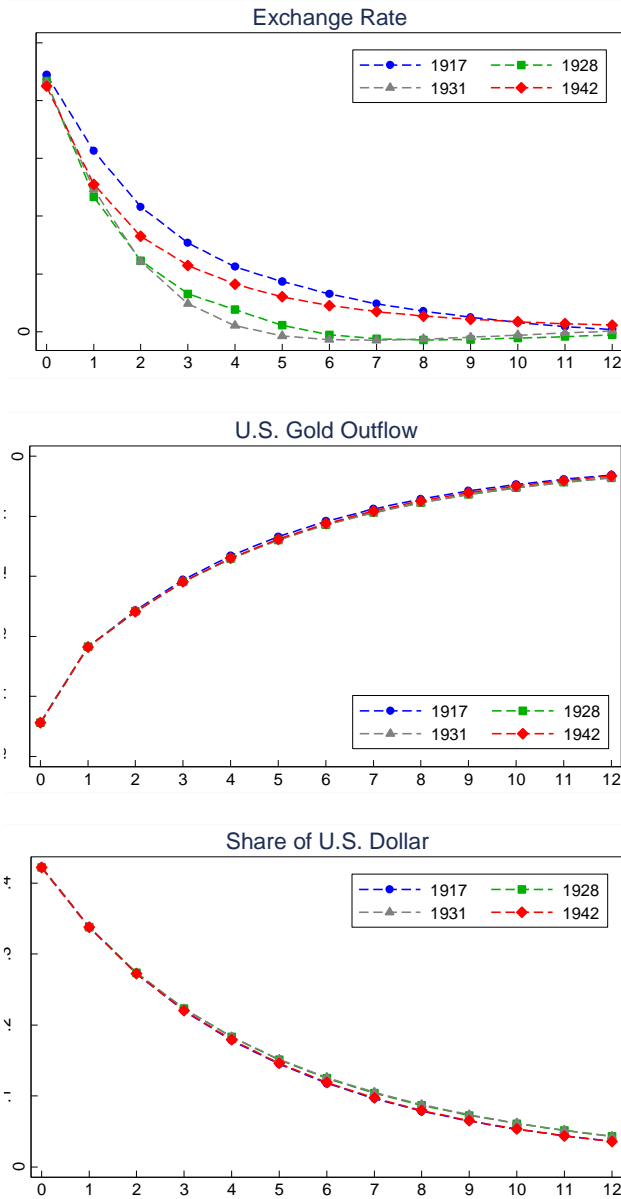


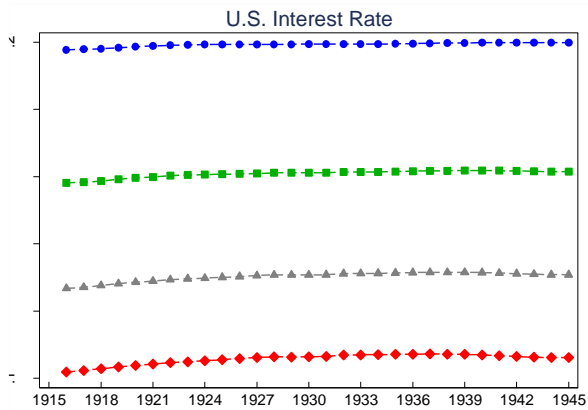
Figure 3. Time point impulse response

Equal time interval impulse response

Figure 4 shows the interval impulse responses of the endogenous variables under a U.S. nominal interest rate shock. We selected one, two, three, and four equal time intervals to track the changes. We find that the monetary policy in the U.S. has a greater effect on the international share of the USD in the short term and has less effect on the share of the USD in the four periods.

Specifically, the increase in shock on the U.S. nominal interest rate one period ahead causes the U.S. interest rate to rise by 0.20%, resulting in the bilateral exchange rate increasing by 0.006%, which results in the decline of the U.S. gold outflow by 0.32% and an increase in the international share of the USD by 0.34%. The increase in the U.S. nominal interest rate in the four periods causes the U.S. interest rate to rise by 0.10%, resulting in the bilateral exchange rate increasing by 0.002%, which results in the decline of the U.S. gold outflow by 0.17% and an increase in the international share of the USD by 0.18%.

Therefore, from the equal time interval impulse response, we find that the effect of the monetary policy in the U.S. on the international share of the USD is more significant in the short term and weaker in the medium and long term.



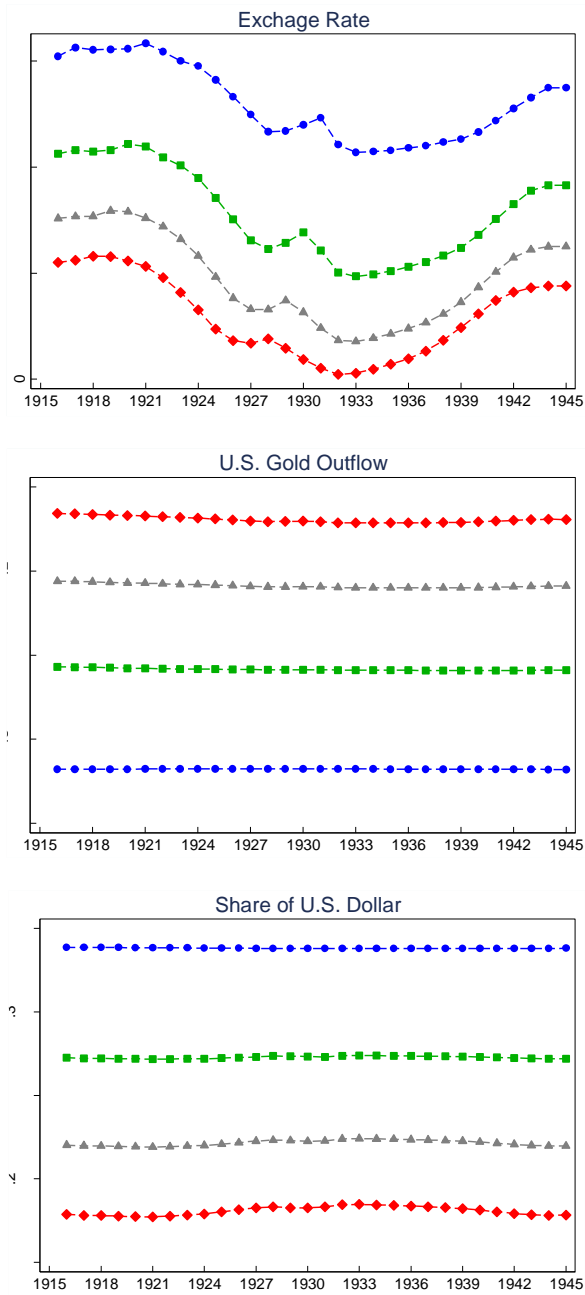


Figure 4. Equal interval impulse response

Conclusion

This study holds that the replacement of sterling as the leading international currency by the USD is not only the result of the "invisible hand" of the market but also that of the active policy support of the U.S. government. In 1872, the U.S. GDP surpassed that of Britain and the country became the world's largest economy. However, in the following 30 years, the international proportion of the USD was still low and could not compete with the pound. After the establishment of the U.S. FRS, a series of monetary policy reforms and adjustments were adopted, promoting the expansion and use of the USD in the world. During World War I, the U.S. adopted preferential credit policies to encourage American commercial banks to open overseas branches and other related policies to promote the holding and use of the USD by international traders and financial institutions. In the 1920s, when the pound was decoupled from gold, the U.S. government maintained the dollar linked to gold, which reduced the inherent risk of the dollar and enhanced the international public's trust in the USD. In the 1920s, the USD replaced the British pound as the leading international currency for the first time.

During the Great Depression of the 1930s, gold flowed in and out of Britain and the U.S., and the sterling pound and the USD stopped being convertible into gold successively, which made the risk expectation of the international currency market for the two currencies and the corresponding currency demand swing. Thus, the USD and the pound were both leading international currencies in this period. Subsequently, the U.S. government restored the convertibility between the dollar and gold and adopted policies such as raising the discount rate and authorizing the American Renaissance Finance Company, to acquire domestically newly mined gold and foreign gold, to further reverse the outflow of gold into a substantial inflow of gold. This measure not only reduced the international risk embedded in the USD but also made a large amount of USD outflow to the world while purchasing gold, thus promoting the international proportion of the USD. In conclusion, after the Bretton Woods Conference, the USD officially replaced the British pound as the leading international currency.

The Bayesian technique was employed to estimate the TVP-VAR model and obtained two main results. First, the time-point impulse response shows that the increase in the U.S. interest rate results in the appreciation of the USD, resulting in a decline in the U.S. gold outflow and an increase in the international share of the USD. Therefore, an increase in the U.S. nominal interest rate has an expansion effect on the USD. Moreover, the effect has no time-varying characteristics. Second, the equal time interval impulse response shows that the effect of the U.S. monetary policy on the share of the USD is greater in the short term than in the medium and long term.

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Disclosure statement

No potential competing interest was reported by the authors.

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