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<tr>
<td>Author(s)</td>
<td>Hori, Masahiro</td>
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The Great Depression and the Gold Standard
— An expository example of Cliometrics —

Masahiro Hori*

Abstract
As an example of Cliometrics, this paper empirically reexamine a recent breakthrough in the study of the Great Depression. Eichengreen’s view that the structural flaws in the interwar gold standard caused the Depression is statistically evaluated. Regression analyses on the interwar US monetary policies suggest that the Fed was golden fettered in the sense that it contractionarily reacted to gold outflows, and that it did not actively cope with pressing domestic predicaments, including banking problems, during the on-gold period. Analyses on international data confirm some findings from the US analyses, and further illustrate that the monetary policies of the countries on the gold standard were firmly tied with the tight policy of the United States through a direct linkage of interest rate parity.

Key-words: Great Depression, Gold Standard, Policy Reaction Function.

*Assistant professor, Nagasaki University. The unedited version of this paper was a part of author’s unpublished dissertation at University of California at Berkeley. I would like to thank Christina Romer, Barry Eichengreen, and James Wilcox for their work as the dissertation Committee.
Despite its worldwide nature, research on the Great Depression until the 1970s, with the notable exception of Kindleberger (1973), mostly ignored the international aspects of the Depression. In a series of papers, Eichengreen convincingly demonstrated the importance of the role of gold (reserve) standard, the interwar system of international finance, in understanding the World Depression (see Eichengreen (1992), *Golden Fetters*, for example), and revived interest in its international aspects. He argued that there were serious technical and structural flaws in the reconstructed gold standard, and that the misguided belief of policymakers throughout the world — that the gold standard should be preserved at any cost — severely limited their policy options and contributed to a world monetary contraction after the late 1920s. The success of his internationalist approach to the Depression is really remarkable; it not only created a new focus for research, but also successfully turned several leading students on the Depression into internationalists [see Temin (1989, 1991), Bernanke and James (1991), and Bernanke (1993)].

In this paper I empirically evaluate the importance and mechanism of the gold standard through an examination of interwar policy reaction functions for both on-gold and off-gold observations. In spite of the consensus that the Golden Fetters played a substantial role in the international propagation of the Great Depression, there are only few empirical efforts to statistically tie the actual policy actions of monetary authorities to the interwar gold standard. Eichengreen, Watson and Grossman (1985) and Wheelock (1989) are a few noticeable preceding studies on the policy reaction functions of the interwar period. The former substantiated violations of the 'rules of the game' by the Bank of England under the interwar gold standard, and the latter focused on Federal Reserve behavior from 1924 to 1933.
and revealed its ineffectiveness.1) My analysis below extends their basic idea — the policy reaction analysis — to widen the period of US policy observation (including both on-gold and off-gold observations), and to broaden the range of country observations, i.e., the world policy reactions.

Specific focus on the United States is warranted, not only because it is the world’s largest economy, with around forty percent of world total gold reserves in the early 1930s, but also because it experienced the most severe depression in the world. It is even considered by some as the country that transmitted the depression to the rest of the world.2) An examination here on world monetary policies is also meaningful, since there are few empirical efforts that show the direct linkage between monetary policies and the interwar gold standard using international data, despite the consensus that the dedication of policymakers to preserving the gold standard hampered the proper functioning of monetary policies and propagated the Great Depression.3)

1) Supporting Toma’s (1989) conclusion, Wheelock argues that the Fed’s operating targets, such as discount rate and open-market operations, had no significant impact on total Federal Reserve Credit outstanding. Thus, one of the main implications of his analysis is that the Fed’s failures during the depression were due to its policy strategy to judge the monetary conditions by discount loan volume and interest rate, rather than to its misguided operations in discount rate and government security purchase policies themselves. Here, although I would not argue against the possible importance of his story, my analyses below concentrate mainly on the misguided operations in discount rates, since the rate policy itself was contractionary even aside from the effects on the FRC outstanding. As will become apparent, I believe one of the most important channels through which monetary policies affect real economy is interest rates.

2) See Friedman and Schwartz (1963), Fremling (1985), and Romer (1993).

3) Eichengreen (1990) shows that the degree of synchronization of business fluctuations was greater on the gold standard than off, and argues that the differences in the degree of synchronization in turn reflect differences in the degree of convergence of monetary policies. My analysis in this section directly captures the convergence of monetary policies on the gold standard.
Through an examination of monetary policy reactions of the interwar period, including both on-gold and off-gold observations, I will try to find some clues to a few important questions: first, were the monetary authorities, including those of the United States, really fettered in gold? Secondly, did the States hold a special position in the propagation of the Depression? More precisely, did the United States transmit the Depression to the rest of the world?

I start the first section by enumerating the proposed principal objectives and structural changes of the interwar US monetary policy. By estimating rules of thumb reaction functions of the Fed policy, I evaluate the relative significance of those objectives and changes, and argue that the departure from the gold standard in March 1933 was the most significant timing of structural change in the interwar Fed policy.

The second section follows the connection between the Fed policy decisions and the gold standard up until the departure. By examining an ordered probit analysis of the Fed policy reaction, I trace, one by one, the source of the Fed's decision to change its discount rate and show that, though there is significant evidence that the Fed was concerned about the preservation of the gold standard, its tight policy in 1929 was mainly due to domestic considerations. Only after the Britain's departure from the gold standard was the Fed literally fettered in gold and forced to tighten policy to suppress gold outflow.

The third section extends the analysis to a correlation between international monetary policies and the gold standard by utilizing cross-country (panel) data from the League of Nations. A pseudo policy reaction analysis of the international discount rate operations by authorities illustrates that the central banks on the gold standard might have been fettered not only by
actual flow of gold reserves but also by the dedication to keep their gold per.\textsuperscript{4} The analysis also suggests that the monetary policies of the countries on the gold standard were firmly tied with the policy of the United States through a direct linkage of interest parity.

I Regression Analysis of US Policy Reactions during the Interwar Period

After the heated controversy in the wake of the dispute of Friedman and Schwartz vs. Temin, the currently accepted story or consensus of the Great Depression is that “inept” monetary policy exacerbated the Great Depression. In spite of the consensus, there seems to have been insufficient empirical efforts to study the source of ineptness; there are still disputes over the (misguided) Fed's policy objectives during the Depression. This section presents a time-series regression analyses of Federal Reserve monetary policy to evaluate the significance of coexisting policy objectives.

For this purpose, I estimate a few monetary policy reaction functions that are familiar from the target-instruments literature. Some authors have argued that such reaction functions should be derived as a first-order condition of a central bank’s maximization problem, assuming the existence of an objective function with a set of policy targets.\textsuperscript{5} However, disputes over the competing policy objectives and suggested systematic changes in the Fed’s policy behavior — important components of the subject of this paper — cast doubt on whether it is appropriate to model the central bank policy dur-

\textsuperscript{4} For this purpose, they had to follow cautious monetary policies to prevent imaginary capital flight.

\textsuperscript{5} Roubini (1988) is a good example.
ing the interwar period as optimizing behavior. Instead, I utilize a 'rule of thumb' reduced-form policy reaction function with several policy objectives as arguments. I first try to identify the timing of systematic changes in the Fed's policy reaction, then test the alternative hypotheses about the Fed's objectives. I will focus in particular on the applicability of Eichengreen's argument that monetary authorities were golden fettered.


Students on US monetary policy during the interwar period disagree over the policy objectives of those days. Chandler (1958) argues that the Fed had developed three major policy objectives by 1924: promoting business activity, curbing stock market speculation, and assistance to monetary reconstruction abroad. Friedman and Schwartz (1963) emphasize the importance of domestic considerations. They argue that the Fed responded to objectives like limiting fluctuations in economic activity, preventing financial crises, and curbing stock price speculation. Wicker (1966) claims that the Fed's primary policy objective during the 1920s was the re-establishment of the international gold standard, and especially in 1924 and 1927, the Fed tried to assist Great Britain in returning to the gold standard. The international explanation by Eichengreen and others should be considered as an extension of Wicker's claim to the US in 1930s and to the rest of the world.

6) Eichengreen himself argues that the world monetary contraction began with mistaken policies by several countries, notably the United States, and not with the gold standard; this contraction was greatly exacerbated and internationally transmitted by the working of the gold standard, however.
Wheelock's (1989) study on the Fed's policy reaction in the 1920s empirically compared the above competing hypotheses and proved that both domestic and international considerations were important. My regressions below differ from his contribution in a few important respects: first, the estimation period is extended to cover both the worsening and the recovering phase of the Great Depression, and second, the policy reaction is examined not only on the open-market operation basis but also on the discount rate change basis.

The first modification is necessary, since my concerns are mainly on the change of policy stance from the on-gold policy to the off-gold. Although Eichengreen's international argument is widely accepted as the explanation of the world depression, there are still disputes over the role of the gold standard in the US Depression. Was the United States just one country that suffered from the structural flaws of the international financial system, or was it a special that receded independent of gold and infected the world through its system? A longer-period examination that covers both the on-gold and the off-gold policy reactions may give us some clues to solve this important question.

The second modification were made just to see the results of my analysis is not susceptible to the choice of policy instruments. Wheelock used open-market operations in government securities as the indicator of the Fed's response to specific policy objectives, arguing that the operations in government securities alone probably give the best measure of the Fed's policy intent. However, the open-market operations were, of course, only one of several instruments at the Fed's command. Eichengreen et al. (1985) argue that bank rate is the most orthodox instrument of monetary control, and is the most visible and controversial of the central bank's instruments.
As such they argue, it is the variable most likely to yield information about policy formulation. I tried both of the two policy tools — the discount rate and the open-market operations in government securities — as my dependent variables of the policy reaction regressions.

Thus, the policy reaction functions, actually estimated in this paper, are basically in the following specifications.

Discount rate policy:

\[ \text{DNYDC} = f(\text{GIIP, GWPI, GSPI, DBSUS, GGDV@}) \]

Open-market operations:

\[ \text{GGSEC@} = g(\text{GIIP, GWPI, GSPI, DBSUS, GGDV@}) \]

The dependent variable for the discount rate policy function is the monthly first-difference of the Federal Reserve Bank of New York discount rate (DNYDC); that for the open-market operations is the monthly percent change of Federal Reserve government security holdings (GGSEC@).\(^7\)

Explanatory variables are chosen so that they can capture some elements of each competing hypothetical objective asserted by the scholars. The first variable upon which the change in the Fed’s policy tools depends is the monthly percent change of industrial production (GIIP), which is supposed to capture the Fed’s trials to limit business fluctuations. Inflation rate (GWPI) and percentage change of stock price (GSPI) are also included to examine the Fed’s attitude toward price instability and stock price speculation. The fourth variable, deposits at suspended banks (DBSUS), is the newly added element that was not included in the Wheelock analyses, and is expected to enter the function negatively, if the Fed takes active policies to

\(^7\) For the descriptions of the data used in this paper, see appendix at the end.
prevent financial crises. Since the financial crisis was one of the most outstanding features of the Great Depression, as discussed by Friedman et al. (1963) and Bernanke (1983), it is meaningful to see the relations between the financial crisis and the central bank policy.

The last explanatory variable, the percentage change of US gold stock (GGDV@), is included to capture the importance of international considerations. If the Fed cares much about the physical quantity of gold stock to keep the credibility of its gold per, the change is expected to work negatively on the discount rate change. Wheelock used the spread between bankers acceptance interest rates in New York and similar rates in London to capture the Fed's international considerations. Although the spread could be a proxy of international considerations in his open-market operation functions, it cannot be an argument for discount rate functions.

All explanatory variables are included in the regressions in the form of lagged three-month averages of monthly changes in each index. For example, for the September 1929 DNYDC observation, the observations of the explanatory variables are the average changes in each index from June to August 1929. By this transformation, we can avoid the unnecessary multicollinearity of the data and simultaneity problem of the regressions.8)

b) Estimation Period and Structural Changes in the FRB Policy Reaction

Data coverage of the regression analyses is from 1924 to 1941. Although scholars disagree about the specific objectives of policy, they all

8 ) I chose this particular transformation following the example of Wheelock (1989). To confirm the robustness of the results, I have tried several variations of the model, i.e., a model with simultaneous term or a model with different patterns of lags. Those kinds of modifications do not affect my qualitative conclusions below.
seem to believe that by 1924 at the latest the Fed had developed a systematic monetary policy with some varieties. The system established an Open Market Investment Committee in 1923, and by the end of that year had begun to employ open-market operations to achieve certain policy objectives. In 1924 and 1927, the Fed made large open market purchases and discount rate reductions that were followed by an increase in bank reserves and the money supply to combat recessions (F-S) or to help the UK return to the gold standard (Wicker).

After the establishment of the systematic policy in 1924, there were several occasions on which the Fed's policy pattern might possibly have changed. The first candidate for the timing of the changes is the death of Benjamin Strong, the governor of the Federal Reserve Bank, in October 1928. Friedman and Schwartz argue that there was a dramatic deterioration in the quality of Fed policy making with the death of Strong. The stock market crash in October 1929 might be another candidate. The Fed started anomalous open-market purchases in the wake of the stock market crash, and might have been released from the watch on speculations after the crash. In March 1930, the Open Market Investment Committee, which consisted of five Reserve Bank governors, was replaced by the Open Market Policy Conference, in which representatives of all twelve banks participated. Some argue that this replacement meant the loss of NY bank power, and resulted in the conservative monetary policy during the Depression.

Great Britain's departure from the gold standard in October 1931 is also a major candidate for the structural change. Since Britain's departure supposedly had major impact on the credibility of the gold standard system, the fear of undermining the system might have forced the Fed to change
priorities among policy objectives. The Glass-Steagall Act of 1932 removed the constraint by permitting government securities to serve as collateral for Federal Reserve note issues. In March 1932, the Fed began a new program of substantial open-market purchases.9)

The last and most probable timing of systematic change in the interwar Fed policy is America's departure from the gold standard, March 1933. Epstein and Ferguson (1984) argue that the lack of gold reserves did keep the Fed from open-market purchases in the fourth quarter of 1931. They argue further that, while the Glass-Steagall Act of 1932 lessened the problem for the System as a whole, some Reserve Banks were reluctant to continue the purchase program in 1932 because they lacked sufficient gold reserves. Eichengreen's international approach, the main focus of this paper, infers a large break at this point, and even Romer (1993), who emphasizes the uniquely American causes of the Depression, agrees that the US policy was dragged by gold outflow in the final phase of the Great Depression.

As a first step toward the source of "inept" monetary policy, I start my analyses by trying to identify these structural (or systematic) changes of the policy reactions by statistical tests. As the rule of thumb reaction functions examined in this paper are not necessarily invariant to changes of environments, uniform application of a single function may confuse the real objective of monetary authorities. Since there are several candidates for break-points of the policy reaction, I deliberately choose the proposed

9) Wheelock claims that the reasons behind the purchases are unclear, especially if fear of undermining the gold standard explains why purchases were not made immediately following Britain's departure from gold. Friedman and Schwartz argue that the Fed succumbed to pressure from Congress.
break, depending on the historical incidents rather than mechanically applying stepwise Chow-tests.¹⁰)

Figure 1-(1) A Result of CUSUM Test on the US Discount Rate Policy.

Figure 1-(2) A Result of CUSUM of Squares Test on the US Discount Rate Policy.

¹⁰) As alternative tests of model stability, I tried the CUSUM and the CUSUM of squares tests, which do not require a prior specification of when the structural change takes place, to search the timing of structural breaks in the discount rate policy function. Reflecting the limited power of those statistical procedures, the CUSUM test could not detect the structural changes with five percent significance; the CUSUM of squares tests indicate breaks on Strong’s death and on America’s departure from gold, however. See Figure 1 above.
The Great Depression and the Gold Standard

Table 1 Examination of Structural Changes in Policy Reaction Functions by Chow-Test

<table>
<thead>
<tr>
<th>(1) From 1924:1 to 1933:3 vs. from 1933:4 to 1941:12 (On vs. Off the Gold Standard)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) DNYDC</td>
</tr>
<tr>
<td>(i) Model with GWPI</td>
</tr>
<tr>
<td>F-value</td>
</tr>
<tr>
<td>6.8650</td>
</tr>
<tr>
<td>(ii) Model without GWPI</td>
</tr>
<tr>
<td>F-value</td>
</tr>
<tr>
<td>8.3545</td>
</tr>
<tr>
<td>(b) GGSEC@</td>
</tr>
<tr>
<td>F-value</td>
</tr>
<tr>
<td>4.0970</td>
</tr>
<tr>
<td>Significance</td>
</tr>
<tr>
<td>0.0007</td>
</tr>
<tr>
<td>F-value</td>
</tr>
<tr>
<td>4.0055</td>
</tr>
<tr>
<td>Significance</td>
</tr>
<tr>
<td>0.0016</td>
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</table>

<table>
<thead>
<tr>
<th>(2) From 1924:1 to 1928:9 vs. from 1928:10 to 1933:2 (Death of Benjamin Strong)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) DNYDC</td>
</tr>
<tr>
<td>(i) Model with OWPI</td>
</tr>
<tr>
<td>F-value</td>
</tr>
<tr>
<td>1.1142</td>
</tr>
<tr>
<td>(ii) Model without OWPI</td>
</tr>
<tr>
<td>F-value</td>
</tr>
<tr>
<td>0.6908</td>
</tr>
<tr>
<td>Significance</td>
</tr>
<tr>
<td>0.3597</td>
</tr>
<tr>
<td>Significance</td>
</tr>
<tr>
<td>0.6316</td>
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<table>
<thead>
<tr>
<th>(3) From 1924:1 to 1929:9 vs. from 1929:10 to 1933:2 (Stock Market Crash)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) DNYDC</td>
</tr>
<tr>
<td>(i) Model with OWPI</td>
</tr>
<tr>
<td>F-value</td>
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<tr>
<td>1.4056</td>
</tr>
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<td>(ii) Model without OWPI</td>
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<td>F-value</td>
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</tr>
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<td>Significance</td>
</tr>
<tr>
<td>0.2202</td>
</tr>
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<td>Significance</td>
</tr>
<tr>
<td>0.1130</td>
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</table>

<table>
<thead>
<tr>
<th>(c) Structural Change only on OWPI term after November 1929.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) DNYDC</td>
</tr>
<tr>
<td>F-value</td>
</tr>
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</tr>
<tr>
<td>Significance</td>
</tr>
<tr>
<td>0.0643</td>
</tr>
<tr>
<td>(b) GGSEC@</td>
</tr>
<tr>
<td>F-value</td>
</tr>
<tr>
<td>1.0809</td>
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<tr>
<td>Significance</td>
</tr>
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<table>
<thead>
<tr>
<th>(4) From 1924:1 to 1930:2 vs. from 1930:3 to 1933:2 (Open Market Investment Committee)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) DNYDC</td>
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<td>(i) Model with OWPI</td>
</tr>
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<td>F-value</td>
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<tr>
<td>1.7289</td>
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<td>(ii) Model without OWPI</td>
</tr>
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<td>F-value</td>
</tr>
<tr>
<td>2.0134</td>
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<td>Significance</td>
</tr>
<tr>
<td>0.1222</td>
</tr>
<tr>
<td>Significance</td>
</tr>
<tr>
<td>0.0831</td>
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</table>

<p>| (b) GGSEC@                                   |
| F-value                                      |
| 1.6324                                       |
| Significance                                 |
| 0.1462                                       |</p>
<table>
<thead>
<tr>
<th>(5) From 1924:1 to 1931:8 vs. from 1931:9 to 1933:2 (Britain's Departure from gold)</th>
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</thead>
<tbody>
<tr>
<td>(a) DNYDC</td>
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<td>(i) Model with OWPI</td>
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<td>F-value</td>
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<td>(ii) Model without OWPI</td>
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<td>F-value</td>
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<tr>
<td>0.2216</td>
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<tr>
<td>Significance</td>
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<tr>
<td>0.8795</td>
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<tr>
<td>Significance</td>
</tr>
<tr>
<td>0.9525</td>
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</table>

<p>| (b) GGSEC@                                   |
| F-value                                      |
| 1.6943                                       |
| Significance                                 |
| 0.1304                                       |</p>
<table>
<thead>
<tr>
<th>(c) Structural Change only on OWPI term after November 1929.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) DNYDC</td>
</tr>
<tr>
<td>F-value</td>
</tr>
<tr>
<td>3.2389</td>
</tr>
<tr>
<td>Significance</td>
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<tr>
<td>0.0748</td>
</tr>
<tr>
<td>(b) GGSEC@</td>
</tr>
<tr>
<td>F-value</td>
</tr>
<tr>
<td>2.0609</td>
</tr>
<tr>
<td>Significance</td>
</tr>
<tr>
<td>0.1541</td>
</tr>
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</table>

Notes: The specification of the model estimated is as follows:

(a) DNYDC*φ(t) + t(1)*GDP(t-1) + (2)*GSPL-1 + t(3)*DBSUS-1 + t(4)*GGDV@-1 + t(5)*GWPL-1
(b) GGSEC@+β(0) + t(1)*GDP(t-1) + (2)*GSPL-1 + (3)*DBSUS-1 + t(4)*GGDV@-1 + t(5)*GWPL-1

See the main text and appendix 1 for the definitions of variables.
Table 1 shows the results of F-tests to examine the structural (or systematic) change of the FRB monetary policy reactions. The candidates for break-points chosen are: 1) America’s departure from gold in March 1933; 2) death of Benjamin Strong, October 1928; 3) stock market crash, October 1929; 4) establishment of Open Market Investment Committee, March 1930, and 5) Britain’s departure from gold, September 1931.\(^{11}\)

Block (1) in the Table gives the results of the examination to see whether or not the departure from the gold standard brought significant change in the Fed monetary operations. I implemented the examination of this gold-related break first, since that should be supposedly the largest break if the international explanation of the Depression is really valid. All regressions of discount rate change and of government security purchase significantly indicate that there was a certain systematic change in the Fed’s reaction on that occasion. Since the result above unmistakably indicates a structural change after March 1933, I will examine other candidates as sub-divisions of the period before leaving the gold standard.

The F-test results of Benjamin Strong’s death in block (2) do not support the argument by Friedman and Schwartz that there was a dramatic deterioration in the quality of Fed policy after Strong’s death. The stock market crash, too, cannot be significantly supported as a turning point of the Fed’s reaction (see block (3)). Only when the change is restricted to the coefficients on the stock price (GSPI) is the hypothesis weakly supported.\(^{12}\) The replacement of the Open Market Investment Committee by

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11) The Glass-Steagall Act and the Fed’s new program of open-market purchases in 1932 could not be included, since the timing stands too close to the departure from gold, the largest break.

12) As will be discussed later, it is reasonable to assume that the Fed becomes concerned with the movements of stock prices only when the market is on a speculative bubble, and
The reaction function analyses in this paper may not be able to dismiss the importance of possible structural breaks. For example, the Friedman and Schwartz story about the death of Benjamin Strong is that had Strong not died, the Fed would have intervened to stop the massive waves of banking panics in the early 1930s. Given that no such wave of panics occurred between 1924 and 1928, it is impossible for the reaction function analysis to detect whether Strong would have intervened if the need had arisen. However, my analysis at least shows that Strong's death was not a significant enough to change the observed relations between policy actions and policy objectives. In this sense, the Fed's discount rate policy reaction did not undergo significant structural change until March 1933. 13)

**c) Regression Results and Interpretations.**

Based on the findings above, I consider the regression results of the Fed's policy reactions for two separate time periods: (a) monetary policy reactions until March 1933, on the gold standard, and (b) those after April 1933, after leaving the gold standard. The results of estimating discount rate policy reactions using OLS are shown in Table 2-(1). Equation (a)-(i) gives the primary result of discount rate policy reaction regression on the does not respond to them after the bubble bursts. If this is the case, the coefficient, particularly on the stock-price term, changes after a bubble crash.

13) My finding from formal statistical tests agrees with Wheelock's argument that there was no significant change in the Fed's policy strategy at least until 1933.
Table 2-(1) OLS Estimated Monetary Policy Reaction Functions:
Discount Rate

### (a) Monetary Policy Reaction Functions on the Gold Standard (Until March 1933)

<table>
<thead>
<tr>
<th>DNYDC</th>
<th>Intercept</th>
<th>GIIP(-1)</th>
<th>GWPI(-1)</th>
<th>GSPI(-1)</th>
<th>DBSUS(-1)</th>
<th>GGDV@(-1)</th>
<th>DW</th>
<th>R²</th>
<th># of Obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>0.2090</td>
<td>-0.0542</td>
<td>0.0539</td>
<td>0.0015</td>
<td>0.0070</td>
<td>1.706E-06</td>
<td>-0.0756</td>
<td>1.6910</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt;1.5280&gt;</td>
<td>&lt;2.5696&gt;</td>
<td>&lt;0.0304&gt;</td>
<td>&lt;0.9056&gt;</td>
<td>&lt;3.0178&gt;</td>
<td>&lt;2.6157&gt;</td>
<td>111</td>
<td></td>
</tr>
<tr>
<td>(ii)</td>
<td>0.2090</td>
<td>-0.0545</td>
<td>0.0542</td>
<td>0.0071</td>
<td>1.701E-06</td>
<td>-0.0761</td>
<td>1.6909</td>
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<td></td>
<td>&lt;1.6062&gt;</td>
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<td>&lt;1.0203&gt;</td>
<td>&lt;3.2063&gt;</td>
<td>&lt;3.2782&gt;</td>
<td>&lt;2.6157&gt;</td>
<td>111</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>DNYDC</th>
<th>Intercept</th>
<th>GIIP(-1)</th>
<th>GWPI(-1)</th>
<th>GSPI(-1)</th>
<th>DBSUS(-1)</th>
<th>GGDV@(-1)</th>
<th>DW</th>
<th>R²</th>
<th># of Obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(iii)</td>
<td>0.2330</td>
<td>-0.1045</td>
<td>0.0559</td>
<td>-0.0192</td>
<td>0.0384</td>
<td>1.67E-06</td>
<td>-0.0658</td>
<td>1.6621</td>
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<td></td>
<td></td>
<td>&lt;2.3455&gt;</td>
<td>&lt;2.8169&gt;</td>
<td>&lt;0.3913&gt;</td>
<td>&lt;2.0315&gt;</td>
<td>&lt;3.0024&gt;</td>
<td>&lt;2.5164&gt;</td>
<td>111</td>
<td></td>
</tr>
<tr>
<td>(iv)</td>
<td>0.2319</td>
<td>-0.09782</td>
<td>0.0522</td>
<td>0.03542</td>
<td>1.749E-06</td>
<td>-0.06098</td>
<td>1.6674</td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td>&lt;2.3850&gt;</td>
<td>&lt;3.0085&gt;</td>
<td>&lt;2.0558&gt;</td>
<td>&lt;3.3876&gt;</td>
<td>&lt;2.6514&gt;</td>
<td>&lt;2.6157&gt;</td>
<td>111</td>
<td></td>
</tr>
</tbody>
</table>

### (b) Monetary Policy Reaction Functions after leaving the Gold Standard (after April 1933)

<table>
<thead>
<tr>
<th>DNYDC</th>
<th>Intercept</th>
<th>GIIP(-1)</th>
<th>GWPI(-1)</th>
<th>GSPI(-1)</th>
<th>DBSUS(-1)</th>
<th>GGDV@(-1)</th>
<th>DW</th>
<th>R²</th>
<th># of Obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>0.2906</td>
<td>-0.0243</td>
<td>0.0043</td>
<td>-0.0119</td>
<td>0.0014</td>
<td>-2.77E-07</td>
<td>0.0083</td>
<td>2.1261</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>&lt;1.4292&gt;</td>
<td>&lt;0.9235&gt;</td>
<td>&lt;1.0229&gt;</td>
<td>&lt;0.4838&gt;</td>
<td>&lt;4.9055&gt;</td>
<td>&lt;0.7184&gt;</td>
<td>105</td>
<td></td>
</tr>
<tr>
<td>(ii)</td>
<td>0.2831</td>
<td>-0.0320</td>
<td>0.0021</td>
<td>0.0010</td>
<td>-2.61E-07</td>
<td>0.0128</td>
<td>2.0791</td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td>&lt;2.094&gt;</td>
<td>&lt;0.5018&gt;</td>
<td>&lt;0.3533&gt;</td>
<td>&lt;4.8108&gt;</td>
<td>&lt;1.1885&gt;</td>
<td>&lt;1.1885&gt;</td>
<td>105</td>
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</tr>
<tr>
<td>(iii)</td>
<td>0.2889</td>
<td>-0.02424</td>
<td>0.005558</td>
<td>-0.01119</td>
<td>-2.76E-07</td>
<td>0.007518</td>
<td>2.1264</td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td>&lt;1.4217&gt;</td>
<td>&lt;1.4547&gt;</td>
<td>&lt;0.9669&gt;</td>
<td>&lt;4.8836&gt;</td>
<td>&lt;0.6552&gt;</td>
<td>&lt;1.1391&gt;</td>
<td>105</td>
<td></td>
</tr>
<tr>
<td>(iv)</td>
<td>0.2822</td>
<td>-0.031598</td>
<td>0.003095</td>
<td>-2.61E-07</td>
<td>0.011969</td>
<td>2.0808</td>
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<td></td>
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<td>&lt;1.0872&gt;</td>
<td>&lt;4.8059&gt;</td>
<td>&lt;1.1391&gt;</td>
<td>&lt;1.1391&gt;</td>
<td>&lt;1.1391&gt;</td>
<td>105</td>
<td></td>
</tr>
</tbody>
</table>

Notes: See the main text and appendix 1 for the definitions of variables.
gold standard, until March 1933. The significantly positive coefficient on the industrial production term (GIIP) supports the view that the Fed acted to limit fluctuations in domestic economic activities. The coefficient on the wholesale price term (GWPI) is almost nothing, implying that price stability was at most of secondary importance.\(^{14}\)

The percentage change of stock price (GSPI) enters the function positively, supporting the view that the Fed managed the policy to curb stock market speculation, although the coefficient is not statistically significant. To incorporate the probable change in the coefficient, particularly on the stock variable after the stock market crash of October 1929, I tried other kinds of regressions with GSPIB, which takes the same value as GSPI until the crash and zero thereafter (see equation (a)-(iii)). This slight modification of the specification increases both the size and significance of the stock price coefficients, substantiating the view that the Fed was very concerned with stock price speculation before the crash and released from the objective after the bubble crash.

The coefficients on the bank failure term (DBSUS) are rather surprising. If preventing financial crises had been an objective of the Fed, the term ought to enter the function negatively, i.e., easy monetary policy facing difficulties in the financial sector. However, the estimated coefficients are unanimously positive for the “on-gold standard regressions” with sufficient statistical significance.\(^{15}\) It is absurd to conclude that the Fed had a

\(^{14}\) To see the possible contamination by including insignificant price term, I estimated the reaction functions excluding GWPI; the exclusion does not strongly affect the qualitative results below, however (see equations named (ii) and (iv) in Table 2).

\(^{15}\) These counterintuitive coefficients on the bank failure term, i.e., deposits at suspended banks, may trigger the memory of the aberrant behavior of the Bank Holiday observation. I tried regressions excluding the half-year observations around the Holiday, but the positive coefficients on the bank failure term were not affected.
policy to purposely exacerbate financial crises;\(^{16}\) the results at least seem to support the story that the Fed did not take responsibility of checking the banking crises, however.

The final term, GGDV\(\oplus\), is consistent with the hypothesis that the Fed was very much concerned with the gold flow when it was on the gold standard. The negative coefficients on the change of gold stock substantiate the Fed's reaction to two separate directions. When gold reserves were flowing in, the Fed lowered the discount rate to curb the inflow. Wicker's claim that the Fed desired to assist Great Britain's return to the gold standard in 1924 and 1927 fits into this case. But on the contrary, the Fed took a tight monetary policy when gold was flowing out from the United States, causing the tight monetary conditions in the deepening phase of the Great Depression.

Equations in block (b) report the estimated policy reactions after leaving the gold standard. The qualitative results concerning domestic business conditions, i.e., GIIP, GWPI, and GSPI, are not very different from those of the on-gold regressions, although the coefficients on the industrial production term have lost their statistical significance. The most noticeable changes are seen in the coefficients on the gold flow and on the bank suspensions. Significance of the gold flow coefficient has approached zero. At the same time, heretofore positive coefficients on the bank suspension terms have turned significantly negative. These changes seem to suggest that Fed could reduce the burden from gold and started to cope with the banking problems after the departure from the gold standard.

\(^{16}\) Anderson, Shughart, and Tollison (1988) argue that Fed officials purposely choose the tight monetary policy to cause the failure of nonmember banks.
The Great Depression and the Gold Standard

Table 2-(2) OLS Estimated Monetary Policy Reaction Functions: Government Security Purchase

<table>
<thead>
<tr>
<th>(a) Monetary Policy Reaction Functions on the Gold Standard (Until March 1933)</th>
<th>R2</th>
<th>DW</th>
<th># of Obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>GIIP(-1)</td>
<td>GWPI(-1)</td>
<td>GSPI(-1)</td>
</tr>
<tr>
<td>(i) GGSEC@</td>
<td>4.1445</td>
<td>-3.6561</td>
<td>4.2451</td>
</tr>
<tr>
<td>(ii) GGSEC@</td>
<td>3.3197</td>
<td>-3.0106</td>
<td>0.0924</td>
</tr>
<tr>
<td>(iii) GGSEC@</td>
<td>2.2923</td>
<td>-3.8926</td>
<td>2.6801</td>
</tr>
<tr>
<td>(iv) GGSEC@</td>
<td>1.3666</td>
<td>-3.3726</td>
<td>1.4194</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(b) Monetary Policy Reaction Functions after leaving the Gold Standard (after April 1933)</th>
<th>R2</th>
<th>DW</th>
<th># of Obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>GIIP(-1)</td>
<td>GWPI(-1)</td>
<td>GSPI(-1)</td>
</tr>
<tr>
<td>(i) GGSEC@</td>
<td>0.8911</td>
<td>0.1671</td>
<td>-0.2982</td>
</tr>
<tr>
<td>(ii) GGSEC@</td>
<td>0.6992</td>
<td>0.1114</td>
<td>0.0277</td>
</tr>
<tr>
<td>(iii) GGSEC@</td>
<td>0.8938</td>
<td>0.20074</td>
<td>-0.2787</td>
</tr>
<tr>
<td>(iv) GGSEC@</td>
<td>0.7106</td>
<td>0.1394</td>
<td>1.452E-07</td>
</tr>
</tbody>
</table>

Notes: See the main text and appendix 1 for the definitions of variables.
Table 2–(2) reports similar policy reaction regressions for the Fed's open-market operations in government securities. Reflecting the consistency of the Fed monetary policy operation, the information we can read from the open-market operation regressions is almost the same as that from the discount rate policy regressions. For the on-gold government security purchase regressions (2–(2)–(a)), the Fed increases its government security purchases to boost the domestic economy, and to check uncontrolled gold inflows. Coefficients on the deposits at suspended banks again contradict the objective of Fed to prevent financial crises. Regarding the off-gold observations (2–(2)–(b)), none of the explanatory variables can meaningfully explain a sizable part of the open-market operations, although the fact does not necessarily refute the findings from the discount rate regressions. A simple chart of monetary policy over the interwar period (Figure 2) sensibly illustrates that the seemingly mixed results from two distinct policy tools — discount rate and government security purchase — are quite reasonable. From the early 1920s to the departure from gold, the two different tools were moving in opposite directions, (rises in the discount rate and the selling of government securities) reflecting the consistency of the Fed’s policy. After the departure from gold, the Fed ceased to use open-market operations as a means of monetary policy implementation, and the amount of government security holdings by the Fed was kept constant despite the easy monetary policy (or low interest rates) that actually

17) Wheelock reports similar Fed’s policy reaction functions for the open-market operations. Although his qualitative conclusions from the regressions are largely the same as mine (a big difference is my inclusion of financial crisis term, and estimation period), the fits of his regressions are, somehow, far better than my regressions in terms of R-squared.
The Great Depression and the Gold Standard

Before leaving this section, it is useful to summarize the findings from the results of the OLS regressions of the Fed’s discount rate policy: 1) F-test results suggest that there were no statistically significant structural changes in the FRB policy reaction function up until March 1933, and that there was a large break after leaving gold; 2) Before the departure from the gold standard, US monetary policy was strongly influenced by the (in-and

18) Romer (1992) argues that the policy decision to let the gold inflow swell the US money supply in the mid- and late 1930s lowered (real) interest rates and stimulated the recovery from the Depression.
out-\(^{-}\) flow of gold, as well as by business conditions and stock prices; 3) Probably partly due to the golden fetters and partly due to ignorance, the Fed did not take responsibility in checking banking crises; after the departure from the Gold Standard, it could reduce the burden from gold and started to cope with the banking problems. All these findings seem to be consistent with the view that the US monetary authorities on the gold standard were always concerned about gold developments, i.e., inflow and outflow.

II Friction (or Ordered Probit) Model Analysis of Policy Reaction

Although the analysis above proves the existence of golden fetters even for the United States, a rough evaluation by estimated coefficients, which are manifested in the average structure, may confuse the actual source of the inept policy. As a counterexample against the gold explanation, the US was experiencing gold inflow for almost three years after early 1929. The Wheelock study proves Wicker's view that the Fed tried to assist Great Britain's return to the gold standard in the mid 1920s, and this observation may make the estimated coefficient on the gold term more significant than it actually was during the Depression. To clarify these points, I further examine the connection between Fed policy decisions and the gold standard one by one until the departure from gold.

It is obvious from our observations that the Fed did not adjust its discount rate continuously in response to economic conditions. The discount rate was altered only 24 times during the period from January 1924 to February 1933. Of these 24 changes, 9 were increases and the remaining 15 were decreases (see Figure 2). This discrete quality of our data suggests us to constitute a model that explicitly accounts for the discrete nature of the
dependent variable. For their analysis of Bank of England discount rate policy, Eichengreen et al. (1985) developed a model of the ordered probit to take care of the discreteness of the data. In this section, I utilize a similar kind of model with the ordered probit, a friction model, with the following structure.

\[ NYDC_t^* = X_t \beta + u_t \quad \text{and} \quad u_t \sim \text{Niid}(0, \sigma^2) \]

- if \( NYDC_t^* - NYDC_{t-1} > a_1 \), then \( NYDC_t = NYDC_t^* \), i.e., raise NYDC_t,
- if \( -a_1 < NYDC_t^* - NYDC_{t-1} < a_1 \), then \( NYDC_t = NYDC_{t-1} \), i.e., unchange NYDC_t,
- and if \( NYDC_t^* - NYDC_{t-1} < -a_1 \), then \( NYDC_t = NYDC_t^* \), i.e., lower NYDC_t,

where \( a_1 \) is a positive constant.

NYDC_t indicates the level of New York Federal Reserve Bank discount rate at time t. \( X_t \) is a vector of economic condition indicators at t, which affects \( NYDC_t^* \), the unobservable desired level of discount rate. Due to the frictional cost accompanying discount rate change, the Fed changes the rate only when the gap between actual and desired rates exceeds a certain threshold level, i.e., \( a_1 \). If the gap between the actual and the desired exceeds \( a_1 \), the upper boundary of acceptable gap, the Fed raises the level of discount rate.

---

19) The model actually used by Eichengreen et al. (1985) is a dynamic generalization of the static ordered probit, to take care of both the discreteness and the serial correlation in the data. Here, I use a model with ordinary (static) ordered probit, since I see no reason to assume serial correlation in the model structure above.

20) The friction model was originally developed by Rosett (1959). The model here is a slightly modified version of the original.

21) Here, I implicitly assume that the frictional cost of changing the discount rate is symmetric (upward and downward).
the discount rate. Conversely, if the gap falls behind \(-a_1\), the Fed lowers the rate. As long as the (unobservable) gap fits into the range between \(-a_1\) and \(a_1\), the Fed keeps the rate unchanged. As the vector of economic conditions, \(X_t\), I use the same set of independent variables used in the previous OLS regressions: industrial production, wholesale price, stock price index, deposits at suspended banks, and gold flows.

Suppose that we get observations of \(\#(\text{Raise}=1)=n_1\), \(\#(\text{Unchange}=1)=n_2\), and \(\#(\text{DOWN}=1)=n_3\), respectively. We can then easily derive the following likelihood function, where \(\Phi(*)\) is the distribution function of standard normal distribution, for the observations.

\[
\text{Likelihood} = \prod_{n_1} \left(1 - \Phi\left(\frac{\text{NYDC}_t + a_1 - X_t\beta}{\sigma}\right)\right)
\]

\[
+ \prod_{n_2} \left\{\Phi\left(\frac{\text{NYDC}_t + a_1 - X_t\beta}{\sigma}\right) - \Phi\left(\frac{\text{NYDC}_t - a_1 - X_t\beta}{\sigma}\right)\right\}
\]

\[
+ \prod_{n_3} \left\{\Phi\left(\frac{\text{NYDC}_t - a_1 - X_t\beta}{\sigma}\right)\right\}
\]

By taking a logarithm, we obtain the following log-likelihood function.

\[
\log(\text{Likelihood}) = \sum_{n_1} \log\left(1 - \Phi\left(\frac{\text{NYDC}_t + a_1 - X_t\beta}{\sigma}\right)\right)
\]

\[
+ \sum_{n_1} \log\left\{\Phi\left(\frac{\text{NYDC}_t + a_1 - X_t\beta}{\sigma}\right) - \Phi\left(\frac{\text{NYDC}_t - a_1 - X_t\beta}{\sigma}\right)\right\}
\]

\[
+ \sum_{n_3} \log\left\{\Phi\left(\frac{\text{NYDC}_t - a_1 - X_t\beta}{\sigma}\right)\right\}
\]

We can estimate \(a_1\), \(\beta\), and \(\sigma\) to maximize the log-likelihood function above.

In addition to the basic structure of the friction model above, I introduced one more assumption to the model that should be estimated. The assumption is that the Fed cares about the movements of stock prices,
The Great Depression and the Gold Standard

GSPI, only when the price passes a certain boundary level due to a speculative bubble. This idea is quite reasonable, since it is absurd to assume that Fed makes no distinction between the stock price movements of a speculative bubble and those of post-bubble. To incorporate this idea into the model, I searched the boundary level for real stock price, RSPI, by the maximum likelihood procedure (ML).

Table 3 ML Estimated Friction Model (Ordered Probit)

<table>
<thead>
<tr>
<th></th>
<th>(1) Estimate</th>
<th>(2) Estimate</th>
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<tbody>
<tr>
<td>Intercept</td>
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<td>3.2327</td>
</tr>
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<td>GSPI(-1)</td>
<td>0.3320</td>
<td>0.2107</td>
</tr>
<tr>
<td>GWDPI(-1)</td>
<td>0.4135</td>
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</tr>
<tr>
<td>GSPI(-1)</td>
<td>&lt;1.2899</td>
<td>&lt;1.8369</td>
</tr>
<tr>
<td>GSPIB(-1)</td>
<td>0.6109</td>
<td>&lt;2.5283</td>
</tr>
<tr>
<td>DBSUS</td>
<td>-8.66E-08</td>
<td>0.0000018</td>
</tr>
<tr>
<td>GGDV@(-1)</td>
<td>-0.5036</td>
<td>-0.3140</td>
</tr>
<tr>
<td>Bound</td>
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<td>2.0592</td>
</tr>
<tr>
<td>InvSIG</td>
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<td>1.1394</td>
</tr>
<tr>
<td>&quot;Estimated&quot; bound for RSPI</td>
<td>2.07</td>
<td>1.03</td>
</tr>
<tr>
<td>and until 1929:10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log of Likelihood Function</td>
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<td>-51.2466</td>
</tr>
<tr>
<td># of Observations</td>
<td>110</td>
<td>110</td>
</tr>
<tr>
<td>(fr.1924:1 to.1933:2)</td>
<td>(fr.1924:1 to.1933:2)</td>
<td></td>
</tr>
</tbody>
</table>

Notes: See the main text for the structure of the model and other details.

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22) RSPI is defined as the stock price index deflated by wholesale price index.
The result of the estimation using the ML procedure is shown in the column (1) of Table 3. Estimated coefficients are quite plausible and almost consistent with the results I obtained from the OLS regressions. For example, the positive coefficient on the change of industrial production, GIIP, suggests that the Fed was following counter-cyclical monetary policy. The statistically insignificant coefficient on the change of wholesale price, GWPI, again confirms that the Fed did not care much about the price movements. The coefficient on the financial crises term, DBSUS, now turns negative in this regression; it is barely significant, however, and suggests that the Fed did not have a strong sense of responsibility on financial crisis. The negative coefficient on the gold inflow again confirms that the US monetary authorities were fettered in gold. The coefficients on the stock price term become statistically significant after the introduction of the real stock price bounds. The estimated boundary level is 2.07; that leaves eight months around the crash in observations.23)

An ordered probit analysis of discount rate policy potentially gives us another interesting by-product with which to judge the source of policy decisions. Since we obtained the parameter estimates of the model, $\text{NYDC}_t^* = X_t^\beta + u_t$, we can calculate the expectation of unobservable desired level and change of discount rate, i. e., $E[\text{NYDC}_t^*] = X_t^{\hat{\beta}_{ML}}$ and $E[\text{NYDC}_t^* - \text{NYDC}_{t-1}] = X_t^{\hat{\beta}_{ML}} - \text{NYDC}_{t-1}$. By calculating these latent variables, we can guess the sources of month-to-month policy decisions made by the Fed. Figure 3 gives the movement of those latent variables during the regression period. Up and down spikes at the bottom of the figure show the timings of

23) Monthly observations included in the regression are from March 1929, from May to October 1929, and from April 1930.
the Fed's actual discount rate raise and decrease, respectively. Although the predictions of the model are not perfect, the movements of the gap (or desired change) roughly correspond to the policy decision by the monetary authorities, suggesting the usefulness of this latent variable.

One annoying bit of information we notice in the movements of the latent variables is the peculiar spike at April 1930. While the estimated desired rate peaks at that particular month, the Fed contrarily decreased the actual level of discount rate continually from November 1929 to July 1930. Since the undesirable spike is due to the rebound of stock prices after the crash, the obvious correction is to exclude all the observations after the crash, as it is suggested by the F-tests for the coefficients on stock price term. Following the lesson of my OLS regression, I introduced the variable GSPIB, the percentage changes of stock price index until the crash and zeros thereafter, and again applied the above-mentioned ML search pro-
Procedure to settle the boundary level. Encouragingly, the modification improved almost all statistical properties without affecting qualitative conclusions from the previous regression. The log-likelihood of the regression thus visibly increased, and, of course, the undesired spike at April 1930 disappeared (see column (2) of Table 3, and Figure 4). Noticeably, the estimated real stock price boundary level, under which any changes in stock price are overlooked, decreased from 2.07 to 1.03, increasing the numbers of stock price observations in the regressions (from eight months to forty-two months).

Figure 5 gives the decomposition of the movements of the latent variables (of the regression 3–(2)) into five independent variables. An examination of the figure produces an additional evidence for the reasons of the Fed’s policy decisions, on which there are intensive disputes among scholars. First, the negative values of the gold latent variable in mid–1924
suggests that the easy monetary policy of those days was initiated to stop gold inflow, or to assist Britain's return to the gold standard, as suggested by Wicker, and enhanced to limit recession after the summer, as argued by Friedman and Schwartz. The large role of the industrial production variable in late-1924 suggests that policy became contractionary after late-1924, because business conditions began to overheat and gold started to flow out in 1925. The calculations indicate that discount rate manipulations in 1926 are due to fluctuations in domestic prices (stocks and goods), rather than international considerations. A cut in the discount rate in August 1927 seems to have been triggered by business downturn and by the inflow of gold; the timing of the policy change in any case seems to have been a bit late, however.

The tight monetary policy in 1928 documented by Field (1984) and Hamilton (1987) was to fight against both stock price speculation and gold
outflows.\textsuperscript{24} The stock price index was surely on the swelling path of a speculative bubble, and the United States lost $474 million in gold reserves — more than 10% of total gold stock in the States — during the year from August 1927 to July 1928. On the contrary, the discount rate rise in late 1929 appears to be due solely to domestic considerations. Business conditions after late 1928 were overheating and, more importantly, the bubble pushed the stock price level run to an unacceptable high. Gold, meanwhile, was flowing into the US rather than flowing out, as pointed out by Romer (1993). Intermittent cuts in the discount rate after November 1929 were supported by every economic environment: both industrial production and wholesale prices were falling, and gold maintained its inflowing trend until September 1931. The analysis suggests that continuous discount rate raises in October and November 1931 can be explained only by the explosive gold outflow. At that stage, every economic condition included in the analysis other than gold flows were in favor of easy monetary policy. The Fed instead chose high interest rates to stop the gold outflows despite all other economic conditions. Seeing a pause of the gold outflow, the Fed could reduce the rate in early 1932, and kept the level of discount rate until February 1933, notwithstanding the gold outflow in mid–1932.

The ordered probit analysis in this section presents somewhat mixed findings. Although the estimated coefficients on the gold term indicate that the Fed was significantly concerned about the re-establishment and preservation of the gold standard, the decomposition of policy decision by estimated coefficients suggests that the tight (and inept) monetary policy

\textsuperscript{24} If anything, the decomposition calculated on the estimated coefficients (in figure 5) indicates that the contribution of one international factor, gold flow, was comparatively smaller than that of one domestic factor, stock price.
from late 1928 to mid 1931 — considered to be responsible for the onset of the Great Depression — was due mainly to domestic considerations. In this sense, it is more sensible to say that, although the golden fetters existed (and the Fed might have been mentally constrained by the fear of an imaginary gold shortage), the international constraint was not in fact binding. Only after the Britain's departure from the gold standard was the Fed really golden fettered.


This section extends the policy reaction analysis to the discount rate observations of international data, using cross-country data available in the *Statistical Year-Book of the League of Nations*. Since the main subject of this paper is the *international* aspects of the Great Depression, analyses using international observations are necessary and are expected to be fruitful. Below, I will present a) pseudo-monetary reaction functions of the monetary authorities, and b) simple data overviews that reveal the channel of international monetary policy inter-relatedness.

a) Pseudo-international Reaction Function and the Gold Standard

The policy reaction function analyses presented in the previous sections seem conceptually to be easily extended to the international data. However, it is not as straightforward as it looks. Since the policy objectives and weights assigned to them varies widely among monetary authorities, we cannot expect to be able to capture the true structure by regression analysis on international data. In this sense, I would call the following regressions pseudo reaction functions of international monetary policy, which seize the correlation between discount rate and policy objectives.
Data for the regressions comes from annual observations from 1929 to 1937 for twenty-four countries, which were first included in the international analysis by Bernanke and James (1991). Moreover, the basic specification for the regressions is almost the same as the rule of thumb policy reaction function that was used in the analysis of US monetary policy. The dependent variable, DRDS, is the annual first difference of the central bank discount rate for each country.\textsuperscript{25} Explanatory variables are the percent change of industrial production (GIIP), that of wholesale price (GWPI), a dummy variable to capture financial distress (PANIC: set equal to the number of months during the year that the country experienced serious banking problems\textsuperscript{26}), and the percent change of gold reserves at the central bank (GGLDC $).

Table 4 reports the OLS results of the total panel regression.\textsuperscript{27} Regression (1)\textsuperscript{a} covers all the data available for my analysis, i.e., from 1929 to 37 for twenty-four countries. To control the difference in discount

\begin{itemize}
  \item \textsuperscript{25} Due to data availability, percentage yield of bonds was used, instead of discount rate, for Canada and New Zealand.
  \item \textsuperscript{26} This dummy variable was originally utilized by Bernanke and James (1991) to examine the role of financial crises in the propagation of the world depression (see Table 5 for details). The use of this discretionary dummy may incur doubt about the robustness of the following analyses. I tried regressions with the changes of deposit-currency ratio as the alternative proxy for the financial crises, and got results qualitatively similar to the results presented below.
  \item \textsuperscript{27} The simultaneity problem between dependent and independent variables, especially for the annual data, suggests the use of instrumental variables in the regressions. However, I could not find reasonable instruments other than lagged independent variables, and the results with them did not have explanatory power worthy of reporting here. I excuse this flaw of my analysis by saying that the regressions are just an examination of the correlation rather than the structural relation.
\end{itemize}
Table 4  OLS Regressions of International Monetary Policy Reaction and the Gold Standard

<table>
<thead>
<tr>
<th>DRDS</th>
<th>(1) from 1929 to 1937</th>
<th>(2) On Gold Standard</th>
<th>(3) Off Gold Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(a)</td>
<td>(b)</td>
<td>(a)</td>
</tr>
<tr>
<td></td>
<td>(a)</td>
<td>(b)</td>
<td>(a)</td>
</tr>
<tr>
<td>GIIP</td>
<td>-0.003708</td>
<td>-0.6659</td>
<td>-0.01044</td>
</tr>
<tr>
<td></td>
<td>&lt;-0.6445&gt;</td>
<td>&lt;-1.3588&gt;</td>
<td>&lt;-0.6678&gt;</td>
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<tr>
<td>OWPI</td>
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<td>0.05276</td>
</tr>
<tr>
<td></td>
<td>&lt;-2.8350&gt;</td>
<td>&lt;-3.2259&gt;</td>
<td>&lt;-2.014&gt;</td>
</tr>
<tr>
<td>PANIC</td>
<td>0.007797</td>
<td>-0.01247</td>
<td>0.04389</td>
</tr>
<tr>
<td></td>
<td>&lt;-0.3526&gt;</td>
<td>&lt;-0.6595&gt;</td>
<td>&lt;-1.13257&gt;</td>
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<tr>
<td>GGLDCS</td>
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<td>-0.004938</td>
<td>-0.007707</td>
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<tr>
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<td>&lt;-4.0362&gt;</td>
<td>&lt;-2.5367&gt;</td>
<td>&lt;-1.475&gt;</td>
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<td>GSDUM</td>
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<td>0.2179</td>
</tr>
<tr>
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<td>&lt;-2.6832&gt;</td>
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<td>0.33396</td>
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<tr>
<td>R2</td>
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<td>0.1974</td>
<td>2.27689</td>
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<tr>
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<td>0.2179</td>
<td>0.24018</td>
<td>2.42716</td>
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<td></td>
<td>0.33396</td>
<td>0.41265</td>
<td>1.7505</td>
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<td># of Obs.</td>
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<td>78</td>
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<tr>
<td></td>
<td>129</td>
<td>117</td>
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</tr>
</tbody>
</table>

Notes: Model (a) are estimated by OLS with country dummies, (b) are after regression diagnostics.

Observations included in the case of "On-Gold" are as follows:

Australia : none
Austria : 1929-31
Belgium : 1929-34
Canada : 1929-31
Czechoslovakia : 1929-31
Denmark : 1929-31
Estonia : 1929-31
Finland : 1929-31
France : 1929-36
Germany : 1929-31
Greece : 1930-31
Hungary : 1929-31
Italy : 1929-33
Japan : 1929-31
Latvia : 1930-31
Netherlands : 1929-36
New Zealand : 1929-31
Norway : 1929-31
Poland : 1929-35
Rumania : 1930-31
Sweden : 1929-31
Spain : none
United Kingdom : 1929-31
United States : 1929-32
United Kingdom : 1930-31

See notes with Table 6 for "Off-Gold" observations.

Data excluded after the diagnostics are as follows:

(1)<b> Greece : 1931,33
Hungary : 1929,30
Rumania : 1930

(2)<b> Japan : 1931
Austria : 1932
Netherlands : 1937
Denmark : 1933
New Zealand : 1931

(3)<b> Germany : 1930-31
United Kingdom : 1930
United Kingdom : 1930
Czechoslovakia : 1933
Japan : 1933
Rumania : 1935

See text for the explanation of sample selection.
rate reactions between on-gold and off-gold observations, I included gold-standard dummy (GSDUM: set equal to one if the country was on the gold standard for more than six months during the year, and zero otherwise) in this total period regression. The estimated coefficients are a bit different from the US results, but still they are understandable. The positive coefficient on the wholesale price suggests central banks' reaction to the deflation, an important aspect of the Depression. However, the negative coefficients on industrial production and the positive coefficients on the financial crisis dummy, though they are both statistically insignificant, indicate that the interwar policy responses to domestic conditions were not well established. The significantly negative coefficient on the gold term supports the consensus view that the monetary authorities around the world were concerned about the gold flow and were in fact fettered in gold. The positive significant coefficient on the gold-standard dummy deserves special attention. Since the effects of gold flow were already controlled by the GGLDC$ term, the positive coefficient on the dummy can be regarded as a contractionary bias of the on-gold observations independent of gold flow. Some arguments against the gold-oriented explanations often resort to the fact that not a few countries were experiencing gold inflow in those days (see Fremling (1985), for example). However, if the countries on the gold standard had a bias toward contractionary monetary policy out of fear of illusory gold shortage, independent of the actual flow of gold — the gold standard can be not only a transmission mechanism but also a source of the depression.

Tables 4-(2)–(a) and (3)–(a) report the results of sub-divided regressions for on-gold and off-gold observations, respectively. Each observation was classified into the off-gold or on-gold group, relying on Table
### Table 5  A Calendar of Banking Crises and the Gold Standard Policies

<table>
<thead>
<tr>
<th>Year</th>
<th>1929</th>
<th>1930</th>
<th>1931</th>
<th>1931</th>
<th>1932</th>
<th>1933</th>
<th>1934</th>
<th>1935</th>
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<td></td>
<td></td>
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<tr>
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<td></td>
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</tr>
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<td>D</td>
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<td></td>
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</tr>
<tr>
<td>Canada</td>
<td>D</td>
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<td></td>
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<td></td>
</tr>
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<td>Czechoslovakia</td>
<td>D</td>
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<tr>
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<td>D</td>
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</tr>
<tr>
<td>Greece</td>
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<tr>
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<td>Norway</td>
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</tr>
<tr>
<td>Portugal</td>
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<td></td>
</tr>
<tr>
<td>Romania</td>
<td>D</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spain</td>
<td>D</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>United Kingdom</td>
<td>D</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note:
- A: month included in the FANIC banking variable in Fatas and James (1991)
- B: month in which foreign exchange control started
- C: month of devaluation
- D: month on Gold Reserve Standard with some loopholes, i.e., foreign exchange control or devaluation
- E: month on full-fledged Gold Reserve Standard

5\textsuperscript{28}) a calendar of international attitudes toward the gold standard and banking crises. Changes in the coefficients after the sample division are a bit mixed and not easy to interpret. Confusingly, the negative coefficient on the gold flow, which indicates the working of the golden fetters, increases its significance after leaving the gold standard, though the absolute size

\textsuperscript{28}) If a country is on the full-fledged gold reserve standard, i.e., dark gray shaded, more than 6 months in a year, the observation is classified into the on-gold observation group.
slightly decreases. Also contrary to my initial expectations, the coefficient on the production term increases its negative significance for the off-gold regression. Only the coefficient on the financial crises turn the sign from positive to negative, as expected, indicating the central banks' concern with financial crises after the emancipation from gold.

As is well known, the OLS estimator is vulnerable to the presence of "outliers." Since international regressions weight all the observations equally, irregular observations of minor countries might have twisted the results. To remove the contamination of unwelcome observations, I followed the regression diagnostics procedure suggested by Belsley, Kuh, and Welsch (1980) to detect influential observations,29) and tried regressions after excluding them. Column <b> in the table gives the results.

Despite the exclusion of many influential observations, the conclusions from the international regressions are very much robust. Almost all coefficients except those on the gold flow term increased in significance. Conflicting coefficients on the production term and on the price term again testify to the interwar authorities’ mixed attitude toward domestic conditions. The sign inversion of the financial crisis coefficient from on-gold to off-gold regression is again in line with my story that the central banks could cope with the banking problems after the release from their golden fetters. One noticeable change after the diagnostics that I should mention is the undermining of the significance of the gold flow coefficients. They are

29) The observations that I considered influential are those satisfy at least one of the following two relations:
1) the diagonal of the "hat matrix" > 2*(# of coefficients)/(# of observations),
2) studentized residual > 2.

Detected influential observations are reported at the bottom of Tables 4 and 6.
all still negative, and significant for the total observation regression; the statistical significance of the coefficients for the sub-divided regressions sizably shrunk, however, weakening the importance of gold flow in policy decisions. Although the loss of significance also dilutes the strange impression from the significance change of the gold flow coefficients reported in the previous paragraph, these should be regarded as evidence that gold flow itself was not necessarily a main channel through which monetary policies interrelated. On the other side, the coefficient on the gold standard-dummy (of the total period regression) affirms its significance, representing the contractionary bias of the on-gold observations independent of gold flow. Thus the total findings above can be summarized by stating that the monetary policy of the countries on the gold standard contained a contractionary bias, partly independent of the actual flow of gold, and still suggesting the importance of the golden fetters.

Another important question that should be addressed by the international observations is the possibly unique position of the United States, the largest economy that experienced the earliest and severest depression in the world. The regressions in Table 6 show the results from twenty-three countries excluding the United States (the rest of the world regression, hereafter). To see the special role of the United States, I included the first difference of the US discount rate, DUSRD, as an additional explanatory variable in the rest of the world regression. Qualitative results for the other explanatory variables are not noticeably different from those with full observations. The coefficient on the change of the US discount rate for the total period regression is significantly positive, suggesting resonance of discount rates in the world with the US rate. This time, the division of sample period into on-gold and off-gold unmistakably reveals the importance of the gold
Table 6  International Monetary Policy Reaction with US Monetary Policy

<table>
<thead>
<tr>
<th>DRDS</th>
<th>(1) from 1929 to 1937</th>
<th>(2) On Gold Standard</th>
<th>(3) Off Gold Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;a&gt;</td>
<td>&lt;b&gt;</td>
<td>&lt;a&gt;</td>
</tr>
<tr>
<td>GHP</td>
<td>-0.005192</td>
<td>-0.007834</td>
<td>-0.02327</td>
</tr>
<tr>
<td></td>
<td>&lt;-0.8910&gt;</td>
<td>&lt;-1.6059&gt;</td>
<td>&lt;-1.5688&gt;</td>
</tr>
<tr>
<td>GWPI</td>
<td>0.017</td>
<td>0.0149</td>
<td>0.02745</td>
</tr>
<tr>
<td></td>
<td>&lt;2.244&gt;</td>
<td>&lt;2.3373&gt;</td>
<td>&lt;1.1156&gt;</td>
</tr>
<tr>
<td>PANIC</td>
<td>-0.00266</td>
<td>-0.02356</td>
<td>0.03204</td>
</tr>
<tr>
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<td>&lt;-0.1118&gt;</td>
<td>&lt;-1.1359&gt;</td>
<td>&lt;0.83625&gt;</td>
</tr>
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<td>GGLDCS</td>
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<td>-0.008741</td>
</tr>
<tr>
<td></td>
<td>&lt;-4.0365&gt;</td>
<td>&lt;-2.4828&gt;</td>
<td>&lt;-1.862&gt;</td>
</tr>
<tr>
<td>GSDUM</td>
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<td>0.37216</td>
<td>0.676714</td>
</tr>
<tr>
<td></td>
<td>&lt;-2.9549&gt;</td>
<td>&lt;-2.7404&gt;</td>
<td>&lt;-3.8450&gt;</td>
</tr>
<tr>
<td>DUSRD</td>
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<td>0.3403</td>
<td>0.676714</td>
</tr>
<tr>
<td></td>
<td>&lt;-2.9954&gt;</td>
<td>&lt;-4.067&gt;</td>
<td>&lt;-3.8450&gt;</td>
</tr>
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<td>R2</td>
<td>0.221463</td>
<td>0.2753</td>
<td>0.399</td>
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<td>&lt;-4.0365&gt;</td>
<td>&lt;-2.4828&gt;</td>
<td>&lt;-1.862&gt;</td>
</tr>
<tr>
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<td>2.4196</td>
</tr>
<tr>
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<td>&lt;1.9676&gt;</td>
<td>&lt;1.9676&gt;</td>
</tr>
<tr>
<td># of Obs.</td>
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<td>186</td>
<td>74</td>
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<tr>
<td></td>
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<td>124</td>
</tr>
</tbody>
</table>

Notes: Model <a>s are estimated by OLS with country dummies, <b>s are after regression diagnostics.

Observations included in the case of "Off-Gold" are as follows:

<table>
<thead>
<tr>
<th>Country</th>
<th>Start Year</th>
<th>End Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>1930-36</td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td>1932-37</td>
<td></td>
</tr>
<tr>
<td>Belgium</td>
<td>1935-37</td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td>1932-37</td>
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</tr>
<tr>
<td>Czechoslovakia</td>
<td>1932-37</td>
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</tr>
<tr>
<td>Denmark</td>
<td>1932-37</td>
<td></td>
</tr>
<tr>
<td>Estonia</td>
<td>1932-37</td>
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</tr>
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</tr>
<tr>
<td>Germany</td>
<td>1931</td>
<td></td>
</tr>
<tr>
<td>Rumania</td>
<td>1930</td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>1931</td>
<td></td>
</tr>
<tr>
<td>Poland</td>
<td>1936-37</td>
<td></td>
</tr>
<tr>
<td>Russia</td>
<td>1935</td>
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</tr>
</tbody>
</table>

See notes with Table 4 for "On-Gold" observations.

Data excluded after the diagnostics are as follows:

<table>
<thead>
<tr>
<th>Country</th>
<th>Start Year</th>
<th>End Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greece</td>
<td>1931,33</td>
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<tr>
<td>Germany</td>
<td>1930-32</td>
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<tr>
<td>Rumania</td>
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<tr>
<td>Japan</td>
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<tr>
<td>Japan</td>
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<td></td>
</tr>
<tr>
<td>New Zealand</td>
<td>1931</td>
<td></td>
</tr>
<tr>
<td>United Kingdom</td>
<td>1930</td>
<td></td>
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<tr>
<td>Sweden</td>
<td>1932</td>
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</tr>
<tr>
<td>Spain</td>
<td>1929-35</td>
<td></td>
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<tr>
<td>United Kingdom</td>
<td>1933</td>
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<tr>
<td>United States</td>
<td>1933-37</td>
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See text for the explanation of sample selection.
tie. For the on-gold regression, the US rate significantly enters the regression, indicating strong co-movement of interest rates, while that for off-gold regression has almost no explanatory power.

In the friction model analysis of previous section, I argued that US monetary policy was principally domestically oriented, at least until Great Britain's departure from the gold standard. If the inference from my analysis is not wide of the mark, the strong correlation between world interest rates and US rates might be understood as an evidence that the Great Depression, and the deflationary monetary policy as the source of the Depression, originated in the Untied States and was transmitted to the rest of the world through direct linkage of monetary policy, rather than through actual gold exchanges.

b) A Linkage through Interest Rate Parity: Data Overviews

Before concluding my international analyses, I would like to present some charts which might informally attest to my story. Figure 6s show the correlation between countries' stock of gold reserves and monetary policies. Figure (1) simply illustrates that the change in gold reserve stock was not a perfect predictor of the change in money supply. If central banks follow the rule of the game literally, observations are expected to cluster around the 45 degree line. As pointed out by Eichengreen (1990), the positive association between domestic money supplies and international reserves depended ultimately on central bank preferences rather than on the mechanical linkages posited by theoretical models of the gold standard. Countries below the 45 degree line, especially the three gold-block countries (France, Belgium and the Netherlands), were deflationary in the sense that they absorbed a limited world gold supply and did not contribute properly to the
world money supply. Countries above the line\textsuperscript{30} also could not increase the world money supply, since they were all experiencing gold outflow, with a few exceptions like the United States and Rumania.\textsuperscript{31} The weak negative correlation between the changes in the gold stock and discount rate changes in Figure (2) seemingly supports the story that only countries that experienced gold inflow could follow an easy-money policy. However, the correlation must be discounted since it comes from projecting easy-money

\textsuperscript{30} It is a notable finding that the US and the UK belong to the countries above the line, since no one objects to the fact that US monetary policy was tight. Eichengreen et al. (1985) demonstrated that the UK violated the rules of the game toward contractionary direction. My interpretation of this finding is that currency in circulation, used in the chart, was not an apt indicator of monetary conditions, since the deposit-currency ratio was falling in almost all countries during the Depression, and that the chart understates the contractionary bias of the monetary authorities of those days.

\textsuperscript{31} Also note that Australia and Spain, which were exceptionally increasing their money despite gold outflow, were not on the gold standard as of 1930.
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Figure 6–(2) Stock of Gold Reserves and Discount Rate Policy.

observations of three gold block countries, which themselves were rather contractionary by the criteria of Figure (1). Once we exclude the three observations, the correlation disappears, and what we see are the central banks that followed policies more contractionary than that of the United States (the Fed cut the rate most decisively), irrespective of gold flow.

The finding from Figure 6–(2) that almost all countries' policies were more conservative than that of the US is surprising, since all scholars agree that the Fed's policy during the depression was tight and inept without objection. Some readers may argue that the monetary conditions should be judged on the real rate basis, since price instability was a characterizing feature of the Depression. Others may argue that it is unfair to compare the rate changes from 1929, since the US rate was temporally raised in 1929 to curb the stock market bubble. Figure 7–(1) clears these doubts by giving the scattered plot between discount rate levels and severity of deflation

Stock of Gold Reserves as of 1931 (1929 = 1.0)
Figure 7-(1) Discount Rate and Deflation as of 1930.

Figure 7-(2) Discount Rate Change and Recession from 1930 to 1931.
from 1929 to 1930. In those days, all countries — excluding a few off-gold countries — were suffering from deflation as severe as that of the United States. Still, the discount rates for the countries — with some exceptions, including the three gold-block countries — were kept higher than the US rate as of 1930. Figure 7-(2) gives the relation between discount rate changes and the depression from 1930 to 31. Despite the severe deepening of the recession and the larger room for rate reduction as of 1930, no country dared to cut its rates more than the US did. Monetary authorities around the world behaved as if they were tethered to the US policy.

What, then, is a possible source of these policy linkages? Absorption of limited gold resources by the United States (and resulting monetary contraction in the rest of the world) cannot be a source, since not a few countries followed the tight policy despite gold inflow; my regression analyses above also showed that gold flow was not a number one significant determinant of discount rate policy. Although a further detailed analysis is required for a decisive conclusion, the best guess at this point is the direct linkage through interest parity.

Imagine the world economy under perfect capital mobility, particularly in gold flow. The uncovered interest parity requires the holding of the relation

\[ \Delta E^e = i - i^{us} \]

where \( \Delta E^e \) stands for the expected rate of depreciation of the domestic currency, \( i \) for the domestic interest rate, and \( i^{us} \) for the US rate. If the government makes a commitment to fix the level of exchange rate, \( E \), and the commitment is credible, then the two interest rates have to be equalized. This is a well-known conclusion from the textbook-style Mundell-Fleming model that 1) perfect capital mobility, 2) fixed exchange rates, and 3) independent
Figure 7-(3) Discount Rate Change and Depression from 1931 to 1933

Figure 7-(4) Change in Discount Rate and Recovery from the Depression.
monetary policy cannot go together. Next, consider a case under which the country fixes its exchange rate at an unreasonably high level, and tries to keep the rate resistant to public expectations. Now, since people are expecting the eventual depreciation of the currency, $\Delta E_c > 0$, the authorities have to face a choice between devaluation as fulfillment of the expectation or an interest rate raise as proof of its strong commitments. In face of this crucial choice, what almost all countries chose was the latter until 1931; August 1931 more precisely. The countries stuck to preserving their gold per along with their dollar exchange rate in the presence of trust in dollars,\(^{32}\) and raised their interest rate higher than that of the States, risking their own domestic economy as seen in Figures 7-(1) and (2). Observations that only a few countries, noticeably the gold-block countries experiencing strong gold inflow, could follow the relatively easy policy — a lower discount rate — also seem to support the story, demonstrating that the credibility of their fixed-rate commitment was related to the discount rate policy.

The changes in discount rates after leaving the gold standard also behave in line with the interest parity story. Seeing the depressing influence of high interest rate policy, monetary authorities were forced to suspend the capital mobility or the fixed rate, which is incompatible with independent monetary policy. Figure 7-(3) is the scattered plot of discount rate policy and final phase of the world depression (from 1931 to 33). At this stage, all countries except a few\(^{33}\) (including the three gold-block countries)

\(^{32}\) Although the dollar itself eventually devalued in April 1933, the faith in the stability of the dollar was firmly rooted, at least until Britain’s departure from gold, as can be confirmed by the gold inflow to the United States.

\(^{33}\) The countries that remained on the gold standard until the end of 1933 were France, Belgium, Netherlands, Poland, and Italy in my sample. All those countries experienced currency appreciation from 1932 to 1934.
departed from the gold standard in either form of foreign exchange control or devaluation, and could cut discount rates independent of the US policy. Finally, Figure 7-(4), which shows the discount rate change after 1931 (to 1935)\textsuperscript{34)} and recovery from the Depression, demonstrates that the operation of monetary policies — the analytical focus of this section and shown to be correlated with US policy until 1931 — was an important determinant of the recovery from the world depression, hence of the severity as well.

V Conclusion

This paper tried to shed some light on the international view of the Great Depression, which has recently become the standard explanation of the interwar depression. Policy reaction functions of the US and world monetary policy were examined to statistically tie the policy actions of countries to the gold standard, which is considered to be responsible for the synchronized deterioration of the world economy in the early 1930s.

The simple regression analysis of the US monetary policy supports the view that the Fed was golden fettered in the sense that it reacted negatively to gold outflows. This role of gold may explain why it did not actively cope with domestic circumstances such as banking problems during the on-gold period. It also could explain why that misguided reaction pattern was changed after leaving the gold standard. However, the episode-by-episode account of the Fed's policy decision by the friction model analysis reveals that the inept monetary policy from late 1928 to mid 1931, which is responsible for the onset of the US depression, can be explained only by

\textsuperscript{34)} To incorporate the timing of discount rate cuts, I used the four-year average gap of discount rate from the rate of 1931, i.e., \((\text{rate in } 1935 + \text{rate in } 1934 + \text{rate in } 1933 + \text{rate in } 1932) - 4\text{rate in } 1931)/4\), as the horizontal axis.
domestic considerations. Thus, at least until mid 1931, the golden fetters for the United States were illusional, if anything, in the sense that the Fed was constrained at most for fear of illusory capital flight. Only after the devaluation of sterling undermined the faith in the stability of the dollar were the US monetary authorities truly fettered in gold.

Regression analyses of international (panel) data confirms and extends the findings from the US analyses. The countries on the gold standard seemed to be constrained and could not cope with domestic problems (particularly the financial crises), and could relieve the burden by leaving gold. Synchronization of world monetary policy with US policy on the gold standard period also should be noticed.

Domestically oriented US monetary policy and strong synchronization of on-gold world policies with US policy suggest a probability that the tight monetary policy initiated in the United States — along with its harmful influence — was transmitted to the rest of the world through the gold standard, or more precisely, through the interest rate parity with unreasonably fixed exchange rates. The countries on the gold standard could not cut their interest rates because they had to keep their rates higher than that of the US to avoid possible (imaginary) capital flight. However, a decisive conclusion on this question will have to wait for further detailed analyses.\(^{35}\)

\(^{35}\) Although the analyses in this paper revealed that the US monetary policy from 1929 to mid-1931 was domestically oriented, the continued deflation and the final devaluation of the US dollar in April 1933 suggest that the dollar also was unreasonably highly valued in terms of gold. Whether this devaluation was unavoidable sooner or later, implying that the US was just one country that suffered from the structurally flawed international financial system, or the US could have done something to check the demolition of the system — provides rich fodder for further research.
References


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________, *Statistical Year-Book of the League of Nations*, various issues.

Appendix 1 Data Definitions and Sources for the US Policy Reaction Analyses (Sec. I, II)

Definitions:

\(<1\>\text{DNYDC}\) monthly first-difference of the Federal Reserve Bank of New York discount rate.

\(<2\>\text{GGSEC}@\) monthly percent change of the Federal Reserve government security holdings (seasonally adj.).

\(<3\>\text{GIIP}(-1)\) lagged 3-month averages of monthly percent change of industrial production index (s. a.).

\(<4\>\text{GWPI}(-1)\) lagged 3-month averages of monthly percent change of wholesale price index.

\(<5\>\text{GSPI}(-1)\) lagged 3-month averages of monthly percent change of stock price index.

\(<6\>\text{GSPIB}(-1)\) the variable that takes the same value as GSPI\((-1)\) until the crash and zero thereafter.

\(<7\>\text{DBSUS}(-1)\) lagged 3-month averages of deposits at suspended banks.

\(<8\>\text{GGDV(@)}(-1)\) lagged 3-month averages of monthly percent change of US gold stock in constant dollars (s. a.)

\(<9\>\text{RSPI}\) stock price index deflated by wholesale price index.

Sources:


\(<1>,<2>,<5>,<6>,<8>\)
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<3>,<4>,<7>

Appendix 2 Data Definitions and Sources for the World Policy Reaction Analyses (Sec. III)

Definitions:

<1> DRDS annual first-difference of the central bank discount rate.

<2> GIIP annual percent change of industrial production index.

<3> GWPI annual percent change of wholesale price index.

<4> PANIC a dummy variable set equal to the number of months during the year that the country experienced serious banking problems.

<5> GGLDC$ annual percent change of gold reserves of central banks and governments in constant dollars.

<6> GSDUM a dummy variable set equal to one if the country was on the gold standard for more than six months during the year, and zero otherwise.

<7> DUSRD annual first-difference of the US discount rate.

Sources:


<1>,<2>,<3>,<7>


<5>


<4>