Crash! Expectational Aspects of the Departures of the United Kingdom and the United States from the Inter-War Gold Standard*

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This paper contains an investigation of the pressures on the UK and the USA to devalue their currencies against gold in 1931 and 1933, respectively. We derive time-series of realignment expectations for the pound and the dollar. Among our findings is that expectations are quite well explained by fundamental economic variables. The implication is drawn that macroeconomic events, some of them directly or indirectly under the influence of the authorities, were in part responsible eventually for jolting the UK and the USA off the gold standard. Furthermore, quantitative evidence is presented supporting the view that Federal Reserve monetary policy was constrained by international considerations.

Within the space of 19 months, beginning in September 1931 and ending in March 1933, both the United Kingdom and the United States departed from the gold-exchange standard system which had been reconstructed as an international regime following World War I. In this paper the commonalities of the experiences of these two central players in the “game” of the inter-war gold standard are examined, and, in particular, the extent to which macroeconomic events were responsible for encouraging the speculative runs against the pound and the dollar that encouraged both of them to abandon the gold standard. The paper also

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addresses the controversial matter of whether Federal Reserve policy was constrained by international considerations.¹

Some of our conclusions that are of general relevance to the economic history of the inter-war gold standard period are as follows. First, we are not in agreement with the view that the Federal Reserve was a free agent with respect to the choice of monetary policy; rather, we believe that its action were constrained by the American commitment to the gold standard. This is contrary to the view of Friedman and Schwartz (1963) but is in agreement with those of some more recent writers cited below. Second, our tests suggest that domestic and international factors were intertwined as causes of the United States suspending its adherence to the gold standard. Third, because we find systematic relationships between bank failures in the United States, dollar realignment expectations, and international gold flows going back for over 6 years, we think it is a misperception to treat President Roosevelt’s role in the Bank Panic of March 1933 as a single event, separate from what had gone before. While we do not deny that his election may have influenced expectations that the dollar was about to be devalued, we also note that, according to our calculations, these expectations were not that much different from those in some earlier episodes of dollar weakness such as 1931(10)–1932(6). Fourth, our calculations indicate that financial markets did not seriously question the adherence of the pound to gold at a fixed price until the summer of 1931. We believe that this finding sheds light on the debate over whether the United Kingdom was playing by the “rules of the game” from 1925 until that summer. While various economic historians have defined the rules and their violation in different ways, it is our assertion that the financial markets of the day were in fact the best judge. Thus, while the Bank of England may not have been following the rules exactly, it was not deviating from them sufficiently to seriously worry the financial markets.

The approach adopted in this paper involves using target zone methods to extract time series of unobserved realignment probabilities for the British pound from the observed interest rate differentials between the United Kingdom and the United States. As already noted, these realignment series show that the markets did not expect devaluations of the pound until mid-1931, consistent with the hypothesis of a speculative attack. However, it also seems that the expected devaluation of the pound is related to several key economic fundamentals, including the differential between money supplies and industrial production levels. The main lesson is that macroeconomic fundamentals between pairs of countries must move in tandem if exchange rate target zones are to remain credible in financial markets. While this lesson is not new, we do offer a demonstration of it as drawn from an important part of 20th century experimentation with pegged exchange rates.

Using interest differentials between France and the United States, a series for

¹ An excellent collection of papers on the classical gold standard can be found in Bordo and Schwartz (1984).
dollar devaluation expectations is also generated. Again these show little sign of tension until the pound left the gold standard, after which there are three clear episodes: a 9-month period during which the dollar was consistently expected to depreciate, followed by 7 months of tranquillity when no parity changes were expected, and finally 2 months of renewed dollar devaluation expectations.

A variety of techniques are used to relate devaluation expectations to two key economic determinants, the widespread United States bank failures and gold flows into and out of the United States. The results confirm the hypothesis of Brown (1940), who argued that increases in the money supply of the United States induced fears in Europe of American inflation at a time when American short-term liabilities to foreigners were still well in excess of the country’s free gold. The inflation expectations gave rise to devaluation expectations and the external gold drain as residents feared suspension of the gold standard, which was also a factor in the accelerating banking crisis of early 1932.

Our findings would seem to support the position that the Federal Reserve in this period was being hemmed in by commitment to the gold standard. And, therefore we come down on the side of Kindleberger (1986), Eichengreen (1992a), and Temin (1989) that US monetary policy was constrained by international considerations—a position that Friedman and Schwartz (1963) have strongly denied. The Federal Reserve found itself in a dilemma: if it increased the money base to “save the banks” it was not playing by the rules of the game given the preponderance of gold outflows at this time. However, if it did nothing, which turned out to be the chosen policy, this risked the bank failures that also put pressure on the dollar. Adherence to the gold standard quickly became untenable.

In short, we conclude that in both the United Kingdom and the United States domestic and international macroeconomic events, some of them directly or indirectly under the influence of the authorities, were responsible for both the countries leaving the gold standard during the inter-war period. Furthermore, as our results indicate that economic factors can to quite a large extent explain the 1933 American episode, we do not agree that the election of President Roosevelt was an important causal factor in it.

We proceed as follows: Section I sets out the theory of target zones and how it can be manipulated to reveal rationally held realignment expectations in financial markets. In Section II we empirically implement the target zone model to reveal realignment expectations for the pound and the dollar. In Section III attention is turned to modelling the determinants of realignment expectations, and finally, Section IV presents our conclusions.

I. REALIGNMENT EXPECTATIONS: THEORY

Krugman (1988, 1991) models an exchange rate that is restricted to a narrow band, such as between the gold points, as a “target zone.”² A target zone is

² Empirical investigation of gold standard as a target zone is undertaken by Hallwood et al. (1996), Giovannini (1993) and Flood et al. (1991).
credible, in the sense that the market believes that the exchange rate will be contained within it, if it is believed that the monetary authorities are committed to managing fundamentals, such as its discount rate and the monetary base, to that end. Thus, at the edges of the target zone monetary policy must be geared exclusively to the exchange rate and not towards influencing, say, domestic business conditions.

To investigate the credibility of the inter-war gold standard we need a measure of realignment expectations, and in this we follow the methodology of Svensson (1991, 1993) and Bertola and Svensson (1993). In natural logarithms, define the current exchange rate, \( s_t \), as

\[
 s_t = x_t + c_t,
\]

where \( c_t \) is the central parity and \( x_t \) is the proportionate deviation from parity. Taking time derivatives,

\[
 E_t \left[ \frac{ds_t}{dt} \right] = E_t \left[ \frac{dx_t}{dt} \right] + E_t \left[ \frac{dc_t}{dt} \right],
\]

so the rationally expected rate of change of the exchange rate is divided into the expected movement “within the band,” \( (E_t[dx_t]/dt) \), plus the expected rate of depreciation of the central parity, \( (E_t[dc_t]/dt) \).

Furthermore, for any given \( x_t \), the movement within the band is bounded by the gold import and gold export points,

\[
 (x^l_t - x_t)/dt \leq E_t[dx_t]/dt \leq (x^u_t - x_t)/dt,
\]

where \( x^l_t \) is the lower bound of \( s_t \), the gold import point, and \( x^u_t \) is the upper bound or gold export point.

On using Eqs. (2) and (3) we discover the so called “100%” confidence interval for realignment expectations,

\[
 (i_t - i^*_t) - (x^u_t - x_t)/dt \leq E_t[dc_t]/dt \leq (i_t - i^*_t) - (x^l_t - x_t)/dt,
\]

where \( i_t \) is the home country’s interest rate and \( i^*_t \) is a comparable interest rate in the foreign country. The term \( (i_t - i^*_t) \)— the interest differential—has been substituted for \( E_t[ds_t]/dt \) because we are assuming uncovered interest parity. As Svensson (1993, p. 766) points out, if agents arbitraging between national money markets demand a risk premium, the interest differential measures the expected change in the exchange rate plus the risk premium. Svensson also shows, however, that the risk premium must be small in any credible target zone.

Equation (4) defines the minimum and maximum bounds of the market’s rationally expected central parity realignment. Svensson called this the “simplest test” for realignment expectations. It is only when both the left and right sides of
the inequality signs are of the same sign that we reject the null hypothesis of no
realignment expectation.\footnote{The expected rate of realignment can be interpreted as the expected devaluation size multiplied by the frequency of realignment. Suppose that, conditional on there being a devaluation, the devaluation will be 5\%. An expected rate of realignment of 2.5\% (roughly the average for the sterling-dollar rate through the less credible early part of the classical gold standard, for the USA, 1879–1896—see Hallwood et al. 1996) implies that the expected frequency of realignment is 0.5 per annum. That is, the market expects a 5\% devaluation within the year to happen with a 50\% probability. Equivalently, the expected time to a 5\% devaluation of the dollar is two years. Thus, though the average expected rate of realignment may appear to be small it can be consistent with quite substantial devaluation expectations. Of course, when the confidence interval spans zero we cannot reject the hypothesis that the expected probability of a devaluation of any magnitude is zero.\note{The expected rate of realignment can be calculated if we know both the expected change in the exchange rate, \( E_t[\frac{ds}{dt}] \), which is easily calculated from the interest differential, and the expected movement of the exchange rate within the band, \( E_t[\frac{dx}{dt}] \). As far as the calculation of the latter is concerned, it is only necessary to mention that it is based on the theoretical proposition due to Krugman (1988, 1991) and to Miller and Weller (1991) that within a target zone the exchange rate should be a mean reverting—or stationary—time-series. Based upon this, Svensson (1993) calculates the expected movement of the exchange rate within the band as a linear function of the current deviation, \( x_t \), of the exchange rate from the central parity. Imposing rational expectations, the expected movement of the exchange rate within the band over the subsequent \( m \) months is the fitted value measured by the interest differential is 5\% and that the exchange rate is currently at the centre of the zone (i.e., \( x_t = 0 \) and, therefore, \( x_t = 0.5\% \) or approximately half the width of the historical gold points). It follows that \( 4.5\% \leq E_t[\frac{dc}{dt}] \leq 5.5\% \) and we are confident that depreciation of the central parity is expected. The idea that we are “100\%” confident derives from the fact that we are assuming the edges of the target zone, \( x_l \) and \( x_u \), are known for certain. But supposing that the exchange rate is again in the center of its zone but that the expected depreciation is only 0.25\%, we now calculate \( -0.25\% \leq E_t[\frac{dc}{dt}] \leq 0.75\% \). In this case the range of expectations spans both a possible appreciation of the central parity and a depreciation. 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As this range spans zero, we do not reject the null hypothesis that no realignment is expected.} One problem with the simplest test is that it supposes that the edges of the zone are known for certain, but this was probably not the case as the gold points varied (see Officer, 1993). Another problem is that it ignores the mean reverting tendency of the exchange rate within the band, which is strongly implied by the target zone theory. Svensson complements the former technique with that of the “drift adjustment method,” which uses an econometric estimate of expected reversion of the exchange rate to parity (Svensson, 1993, p. 768). This may be demonstrated in the following way.

Rearranging Eq. (2) we obtain a statement of the rationally expected realignment expectation as

$$E_t\left[\frac{dc}{dt}\right] = E_t\left[\frac{ds}{dt}\right] - E_t\left[\frac{dx}{dt}\right].$$

This realignment expectation can be calculated if we know both the expected change in the exchange rate, \( E_t[\frac{ds}{dt}] \), which is easily calculated from the interest differential, and the expected movement of the exchange rate within the band, \( E_t[\frac{dx}{dt}] \).

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from the regression,

\[ x_{t+m} - x_t = \alpha_0 + \alpha_1 x_t + u_t, \]

where if \( \alpha_1 \) is significantly less than zero, mean reversion is occurring.

The final step in implementing Eq. (5) is to take the 95% confidence interval for mean reversion (calculated using Eq. (6)) and combine it with the interest rate differential (the proxy for \( E_t[ds]/dt \)) to calculate the 95% confidence intervals for realignment expectations. This is Svensson’s drift adjustment method.

The main questions we address in this paper are: to what extent does the expected rate of realignment predict the currency crises in the United Kingdom and in the United States? and, more fundamentally, can the expected rate of realignment be explained using fundamental variables? In general terms this latter proposition may be considered in terms of the expression

\[ E_t[dc]/dt = f (z_{t-1}^1, z_{t-1}^2, \ldots, z_{t-1}^n), \]

where \( f \) denotes a general functional form and \( z_{t-1}^1, z_{t-1}^2, \ldots, z_{t-1}^n \) represent the fundamental determinants of the expected rate of realignment. In this paper we are guided by previous studies as to the relevant fundamental variables for each of our currencies. In Sections III and IV we propose methods for empirically testing (7).

II. REALIGNMENT EXPECTATIONS: EMPIRICAL EVIDENCE

We constrain our analysis of the pound–dollar rate to the interval May 1925 to August 1931, the latter being the last full month during which the pound/gold link was maintained. To examine dollar devaluation expectations we had to choose a currency to measure it against. The obvious choice was the French franc as France remained on the gold standard until 1936, and became the most important country remaining on gold following the American suspension. We use the franc/dollar rate from December 1926 (shortly after France had de facto settled on the gold standard) until February 1933, the last full month before the US interfered with the gold convertibility of the dollar. The exchange rate series were extracted from Einzig (1937); and short term interest rates were taken from the Board of Governors of the Federal Reserve (1943). Specifically, we use the 3 month UK Treasury bill–US commercial paper differential to provide the total expected change in the sterling–dollar exchange rate. For expectations of the franc–dollar rate we use the three month forward premium (computed by triangular arbitrage).

\[ \text{\footnote{For further discussion of the French franc exchange rate during some of this period see Eichengreen (1986, 1992b) and Sicic (1992).}} \]

\[ \text{\footnote{Ideally we would have used a differential between identical instruments. However, the US treasury bill market was undeveloped during this period, and the average spread between UK treasury bills and UK bankers’ acceptances was less than one basis point. We therefore chose to use the differential between the most liquid short-term instruments in each country.}} \]
based on sterling exchange rates taken from Einzig (1937)\(^8\) due to a lack of sufficiently comparable French interest rate data.\(^9\)

Table 1 shows mean reversion in the pound/dollar and franc/dollar rates, i.e., Eq. (6). Using the 95% confidence intervals derived from these equations we calculate the 95% confidence intervals for realignment expectations, i.e., Eq. (4). These are shown in Figs. 1 and 2. As explained earlier, in Fig. 1 it is only when both the upper and lower confidence intervals are in the positive section that we are 95% confident that markets expect devaluation of the pound (against the dollar). Similarly with Fig. 2, except that in this case markets expect dollar devaluation (i.e. fewer francs per dollar) when both the upper and lower bounds are in the negative section. We discuss these figures in greater detail below.

### III. EXPLAINING DEVALUATION EXPECTATIONS

#### The Experience of the United Kingdom

It is known that the United Kingdom was financing a basic (on current and long-term capital accounts) balance of payments deficit by a short term capital inflow throughout the 1925–1931 period. Furthermore, as the MacMillan Committee (1931) acknowledged, this practice was “precarious.” It was precarious because its continuation depended on international investors sustaining their

\(^8\) The Einzig data are sampled weekly. We extract data relating to the final week of each month to provide a monthly database. To avoid complications arising from instability in the foreign exchange markets after sterling’s departure from the system, the end-September 1931 observation of the franc-dollar forward rate is in fact that holding on September 19, rather than the September 26.  

\(^9\) We note that a forward premium rather than an interest rate differential is also used in Eichengreen (1982). Both approaches are equivalent if covered interest parity holds—an assumption made here and in Eichengreen. In our other work on the pound–dollar rate in the period up to 1931 we have found that it makes little difference whether we use interest rates or the forward premium (see Hallwood et al. 1996). However, the interest differential will contain liquidity, risk, and maturity premia unless very similar instruments are used. The forward premium will only contain a risk premium, and as we note in the text this should be small in a target zone. Furthermore, forward premium data are more sensitive to exchange rate expectations than are some interest rate series when the latter are changed only at fairly long intervals.
confidence in the value of the pound. According to our evidence in Fig. 1, they did so until the summer of 1931.

Just when did strong speculation against the pound first start? Cairncross and Eichengreen (1983) dissect the speculative runs of 1927, 1929, and 1931, commenting that they were of increasing severity, and we find some evidence for this in Fig. 1. In both 1927 and 1929 realignment expectations turned to favor devaluation of the pound, but not particularly significantly. In fact, the pound was generally weak against the dollar throughout the period 1925–1931, lying nearer to the gold export point than to the gold import point (for statistical evidence on this see Officer, 1993), and the mean realignment expectation over the period as an entirety was positive (i.e., more pounds per dollar).

But it is the final run on the pound, the one that led to Britain leaving the gold standard, that is of greater interest. It can be seen from Fig. 1 that it was not a long drawn out affair. The market’s confidence in the pound was sustained even up to the summer of 1931. Contemporary evidence (Einzig, 1937, the Federal Reserve Bulletin, and The Economist) points to a short sharp speculative attack which cost the Bank of England about $1 billion (at £1 = $4.86) over the period July–September 1931. Cairncross and Eichengreen (1983) support this view, although they do point out that on some bourses, as early as January, the forward pound had, for a while, moved outside of the gold export point. But they also point out

10 The marginal significance levels of devaluation expectations in the peak months of August 1928 and September 1929 were 11.5% and 14.9%.
that well into the summer of 1931 the financial press remained sanguine about the value of the pound. Cairncross and Eichengreen (1983) produce econometric evidence that strong speculation against the pound began only in midsummer 1931—being provoked by the collapse of Austria’s largest bank, Creditanstalt, and bank failures in Germany. These bank failures both reduced the Bank of England’s accessible foreign assets held in Austria and Germany, and alerted the markets to the possibility of inconvertibility crises in other countries, including the United Kingdom.

The Cairncross and Eichengreen (1983) econometric evidence is as follows: they estimate a monetary model of the balance of payments for the period 1926 to the beginning of 1931 for the determinants of the Bank of England’s gold and foreign exchange reserves. They then simulate it out-of-sample for the rest of 1931. Their main finding is that although the model predicts the behavior of reserves well during the in-sample period, in the third quarter of 1931 it over-predicts them (a case of missing reserves). Thus, in this quarter, on the basis of the actual monetary determinants of the UK’s balance of payments, the Bank of England’s gold and foreign exchange reserves should have risen when in fact they fell. As Cairncross and Eichengreen (1983) explain: “the conventional view, that the 1931 crisis is properly understood as a consequence of a scramble for liquidity only indirectly related to the fundamental determinants of Britain’s balance of payments position, remains the logical candidate” (p. 76–77). This view would appear to be consistent with our own finding that realignment expectations only
turned significantly (in a statistical sense) against the pound in July and August 1931—they account for the run on the gold reserves of the United Kingdom as foreign investors withdrew funds from London.

Nevertheless we may still want to investigate whether there were any motivating factors for the attack. Referring back to Eq. (7), we specifically ask whether realignment expectations can be explained by the kind of fundamental variables which enter into standard models of balance of payments and exchange rate determination as proposed by Cairncross and Eichengreen (1983): that is, we assume the $z$ variables consist of the relative money supplies, inflation, output, the current account and the real exchange rate. The evidence in this section suggests that macroeconomic events ultimately did play a significant role in pushing the United Kingdom off the gold standard. But it remains true that for the 6 years until mid-1931 macroeconomic variables behaved well enough for financial markets to believe that the United Kingdom would remain on the gold standard.

In econometrically implementing Equation (7) for the United Kingdom/United States relationship we use the projection equation:

$$E_t[dc_t]/dt = \beta_0 + \beta_1(\pi - \pi^*)_{t-1} + \beta_2(m - m^*)_{t-1} + \beta_3(ca - ca^*)_{t-1}$$

$$+ \beta_4(y - y^*)_{t-1} + \beta_5(dreal)_{t-1} + \epsilon_t,$$

(8)

where $\pi$ denotes the inflation rate, $m$ the money supply, $y$ income (proxied by industrial production), ca the current account ratio (exports/imports), and dreal the change in the real exchange rate. All variables are in logarithms, and an asterisk denotes a foreign variable. Seasonal dummies are also included in the estimated version but not reported.

The regression results for Eq. (8), shown in Table 2, have good explanatory power with a highly significant chi-squared test statistic for the explanatory variables taken together, and a reasonable $R^2$. Encouragingly, the significant explanatory variables bear signs that would seem to accord with economic intuition. For example, the money supply term is strongly significant and has a positive sign, suggesting that excessive domestic monetary expansion creates expectations of a devaluation (the inflation differential is perhaps insignificant because it captures the same information as the money supply magnitudes). The strong negative effect of relative industrial production indicates that an increase in output in the United Kingdom relative to that in the United States reduces the expected rate of devaluation, possibly because it increases the demand for money relative to supply. Both of the other variables (ca and dreal) are insignificant.

We can now answer two key questions. First, how well does the model fit...
experience in the crucial final few months? This is easiest shown in Fig. 3, where we report the actual rate of realignment expectations together with the fitted value from the equation reported in Table 2. From this figure it is clear that the upturn in devaluation expectations in the summer of 1931 is at least partially captured by the model based on fundamental factors. Second, which variables are driving this increased expectation of devaluation? Sequentially dropping variables from the model leads to the conclusion that differences in relative money supplies is the key cause. Plots of the money supply series (not reported) for the United Kingdom and United States show clearly that the authorities in the United Kingdom were sterilizing the effects of the gold outflow, and that the authorities in the United States, as has already been well documented elsewhere, were reducing the money supply against all the rules of the game. Thus it does seem that the refusal of the United Kingdom to allow the gold outflows to reduce the money supply, coupled with the contrarian strategy in the United States of tightening the monetary stance

<table>
<thead>
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<th>Table 2</th>
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<td>Fundamental Determinants of Realignment Expectations</td>
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<tr>
<td>Pound/Dollar</td>
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<tr>
<td>1925(7)–1931(8)</td>
</tr>
<tr>
<td>$(\pi - \pi^*)_{t-1}$</td>
</tr>
<tr>
<td>(0.19)</td>
</tr>
<tr>
<td>$(m - m^*)_{t-1}$</td>
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<td>(3.55)</td>
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<td>$(y - y^*)_{t-1}$</td>
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<td>(2.79)</td>
</tr>
<tr>
<td>$(ca - ca^*)_{t-1}$</td>
</tr>
<tr>
<td>(1.82)</td>
</tr>
<tr>
<td>$d_{real,t-1}$</td>
</tr>
<tr>
<td>(0.24)</td>
</tr>
<tr>
<td>Observations</td>
</tr>
<tr>
<td>$R^2$</td>
</tr>
<tr>
<td>Standard error of equation</td>
</tr>
<tr>
<td>$\chi^2$ test</td>
</tr>
</tbody>
</table>

**Notes.** Figures in parentheses under the coefficient estimates are t-statistics computed with Generalized Method of Moments standard errors. $\pi$ denotes inflation, $m$ denotes money supply (M1), ca denotes the current account ratio (exports/imports), $y$ denotes income, and $d_{real}$ denotes the change in the real exchange rate. All independent variables are lagged by one period and a * denotes a foreign (US) variable. The $\chi^2$ test is a test that the fundamental determinants are jointly insignificant. The figure in brackets after the test statistics is the marginal significance level.
at a time of gold inflows, contributed to initiating the speculative attack which ended the United Kingdom’s gold link.

The Experience of the United States

Like the United Kingdom, the United States had a crucial weakness as an international financial center during the period of the inter-war gold exchange standard: its short-term liabilities to foreigners were much greater than its available gold reserve. Only free gold reserves could be counted as “available,” as the Federal Reserve note issue required a minimum 40% gold backing, with the other 60% coming from eligible securities held by the Fed or from gold. As the Fed was short of eligible securities, free gold was even less than it otherwise might have been, as gold was needed to make up the difference. By January 1930 free gold was down to $600m (Friedman and Schwartz, 1963, p. 401, quoting an estimate made by Benjamin Anderson), while the New York banks’ short-term liabilities to foreigners were more than four times this amount (Board of Governors, 1943, p. 574). In fact, at almost $900m, short-term liabilities to France alone exceeded the amount of free gold. About $2,000m was owed to European countries, and it was France, the Netherlands, Switzerland, and Belgium (four of the countries that were later to form the gold block, along with Poland and Italy) that were to exchange their deposits for monetary gold held by the United States,

![Fitted devaluation expectations, sterling–dollar.](image-url)
$431 in 1931, $739 in 1932, and $219 in 1933 (Board of Governors, 1943, p. 540). By February 1932 free gold was down to $461 million (Brown, 1940, p. 1227), and short-term liabilities to foreigners were still about 2.5 times higher.

Counting from October 1931—the first full month after the United Kingdom abandoned the gold standard—until the suspension of the gold standard in the United States in April 1933 there are 18 complete months. We can divide this period into three successive phases (see Fig. 2); the 9 month period to June 1932 of statistically significant (or almost so) dollar devaluation expectations, the following 7 months to January 1933 of relative tranquility when no significant realignment expectations were recorded, and finally, the 2 month prelude-to-suspension of strong realignment expectations in February and March 1933. See Table 3.

The interesting aspects of these phases are:

[1] The 9 month period 1931(10)–1932(6): Over these months, the mean monthly realignment expectation was $-3.2\%$ (meaning dollar devaluation was expected—fewer francs per dollar), reaching highs of $-5.1\%$ in December 1931 and $-6.1\%$ in May 1932. These latter dollar devaluation expectations were the first to be statistically significant since the US banking crisis of 1907, and the worst since 1896, when Presidential candidate William Jennings Bryan campaigned to withdraw the United States from the gold standard and was only narrowly defeated.¹⁴ Gold outflows accompanied these negative dollar realignment expectations. The gold outflow of October 1931 was a record in United

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### TABLE 3

Three Phases of the Dollar after the UK Leaving and the US Suspension of the Gold Standard

<table>
<thead>
<tr>
<th>Phase</th>
<th>Mean realignment expectations (+: Dollar appreciation)</th>
<th>Change in US official gold stock, $M (+: inflow)</th>
<th>Banking crises(^a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1] 1931(10)–1932(6)</td>
<td>$-3.2%$(^b)</td>
<td>$-91$</td>
<td>Oct. peak month of losses is second crisis.</td>
</tr>
<tr>
<td>[2] 1932(7)–1933(1)</td>
<td>$+0.2%$(^c)</td>
<td>$+91$</td>
<td>Begins calm, ends with third crisis.</td>
</tr>
<tr>
<td>[3] 1933(2)–1933(3)</td>
<td>$-3.6%$(^d)</td>
<td>$-135$</td>
<td>Bank holidays.(^e)</td>
</tr>
</tbody>
</table>

\(^a\) As measured by deposits at suspended commercial banks.
\(^b\) All months significant or very close to 95% significance.
\(^c\) No months with significant realignment expectations.
\(^d\) All months having significant realignment expectations.
\(^e\) The bank holiday was proclaimed March 6, 1933 as a means of stemming further bank runs and failures. (Also suspended were gold convertibility of the dollar and gold exports from the US.)

**Sources.** Column 2: Fig. 2; Column 3: Board of Governors (1943, p. 537); Column 4: Friedman and Schwartz (1963) and Board of Governors (1943, p. 283).

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¹⁴ We make the observations in this sentence on the basis of our findings published in Hallwood *et al.* (1996). Our monthly data for the pre-WWI period in fact ended in 1908, but our annual data are continuous from 1879 to 1913.
States history to that point in time. Of these 9 months, 6 saw net outflows of gold from the monetary gold stock, and they were especially great in May–June 1932 as well as in the previous October. Brown (1940, p. 1222) saw this as two separate episodes of speculative attack, but our calculations of realignment expectations suggests that the entire period was one of continuous dollar weakness: mean realignment expectations in all 9 months were negative, 6 of them being statistically significant at the 95% level and the other 3 almost so.

The Bank of France was the major destination of the monetary gold outflow. But, by the spring of 1932, it had almost entirely withdrawn its balances from the United States. Accordingly, the French withdrawals coincide with the strong dollar devaluation expectations, and the weathering of these coincides with the cessation of French pressure against the dollar.

[2] Next came the 7 months to January 1933. This represented a tranquil period in the foreign exchange market—no significant monthly realignment expectations were recorded, and the mean value was very close to zero. Gold on a net basis returned to the United States in every one of these months for a monthly average of $91 m.

[3] The final 2 full months before suspension of the gold standard by the United States saw the reemergence of strongly significant negative realignment expectations, with mean values of $-2.9\%$ in February, and $-3.6\%$ in March 1933. Suspension coincides with the third banking crisis.

There can be little doubt that gold outflows from the United States were provoked by the question of continued adherence to the gold standard. First, as described above, there is the correlation between our calculations of realignment expectations and gold flows. More formally, in a linear regression, we find a significant, at the 1% level, and correctly signed (i.e., positive) relationship between contemporaneous changes in the gold stock of the United States and realignment expectations, although the $R^2$ is only 0.16. The low $R^2$ is only to be expected as official gold holdings would be affected by developments in the “above the line” balance of payments as well as changes in the preferences of foreign central banks for holding gold rather than dollars. Second, at least three experts on the financial history of this period suggest it. Thus, Friedman and Schwartz (1963) comment that: “France was strongly committed to staying on gold, and the French financial community, the Bank of France included, expressed the greatest concern about the United States’ ability and intention to stay on the gold standard” (p. 397). And Brown (1940) wrote that: “The uninterrupted large scale purchases of government securities [during spring 1932 after the passage of the Glass–Steagall Act] by Federal Reserve Banks [in an effort to stimulate the economy] seemed in the eyes of foreigners to be evidence of approaching inflation [sic] in the US. The gold outflow to the continental creditor countries was consequently sharply accelerated as this policy was vigorously pressed forward” (p. 1233).

Concurrent with dollar weakness and fluctuating official gold stock was the succession of American banking crises. Over the period from 1926(12) to 1933(2) there is a statistically significant, at the 1% level, negative relationship between
bank failures (measured either as number of banks or value of assets) and changes in official United States gold stocks.\textsuperscript{15}

This negative relationship indicates that losses of official gold and bank failures moved together and is consistent with the argument of Brown (1940). He suggested the following line of causation (pp. 1222–1240). The Federal Reserve, attempting to raise the money supply, induced fears in Europe of American inflation at a time when American short-term liabilities to foreigners were still well in excess of the country’s free gold. The inflation expectations gave rise to devaluation expectations and the external drain of gold. The external drain then stirred an internal gold drain as residents feared suspension of the gold standard. Finally, the internal gold drain was a factor in the accelerating banking crisis of Spring 1932.\textsuperscript{16}

In contrast with the United Kingdom where the lack of a clear theory to explain sterling’s departure from gold forced us to rely on a reduced form monetary approach in specifying the fundamental determinants of the expected rate of realignment, for the United States we focus on Brown’s hypothesis regarding the links between realignment expectations, changes in the gold reserve of the United States, and banking crises.\textsuperscript{17} Our first step involves estimating a vector autoregression (VAR) for the period 1926(12) to 1933(2).\textsuperscript{18} Our choice of the more powerful VAR method for this exchange rate, over the simple projection Eq. (8) used for the United Kingdom, is facilitated by the relatively small number of fundamental variables and the longer data sample (relative to the United Kingdom/United States relationship). The precise VAR used is

\begin{equation}
E_t[dc_t]/dt = \sum_{i=1}^{4} \alpha_i E_{t-i}[dc_{t-i}]/dt + \sum_{j=1}^{4} \beta_j \text{gold}_{t-j} + \sum_{k=1}^{4} \gamma_k \text{bankfail}_{t-k} + \epsilon_t
\end{equation}

\begin{equation}
\text{gold}_t = \sum_{i=1}^{4} \delta_i \text{gold}_{t-i} + \sum_{j=1}^{4} \eta_j E_{t-j}[dc_{t-j}]/dt + \sum_{k=1}^{4} \theta_k \text{bankfail}_{t-k} + \mu_t
\end{equation}

\begin{equation}
\text{bankfail}_t = \sum_{i=1}^{4} \phi_i \text{bankfail}_{t-i} + \sum_{j=1}^{4} \lambda_j E_{t-j}[dc_{t-j}]/dt + \sum_{k=1}^{4} \psi_k \text{gold}_{t-k} + \zeta_t
\end{equation}

\textsuperscript{15} There is no significant correlation between bank failures and dollar realignment expectations. It is true that the first banking crisis, beginning in late-1930, had no discernable effect on dollar realignment expectations. There seems to have been no real rush by foreigners to get out of dollar deposits at this time. Then, again, both the second and third banking crises were concurrent with dollar weakness, the latter in fact with American suspension of the gold standard.

\textsuperscript{16} Contrary to the view that declining gold reserves were an important factor forcing the United States off gold, Coleman (1992) argues that the United States was not forced off gold in 1933 by this factor. Rather, the new president, Roosevelt, wanted to move the United States out of depression and saw raising the price of gold as a vital step. The fact is, however, that expectations of dollar devaluation and gold outflows were correlated.

\textsuperscript{17} Furthermore, while it seems reasonable to expect that developments in the United States would have an important influence on the decision of the United Kingdom to leave gold, the size of the economy of the United States compared to that of France (the only reasonable choice as partner country), and the relatively closed nature of the United States mean that the reduced form approach of Eq. (8) is less applicable here.

\textsuperscript{18} The sample is terminated in 1933(2) because of the declaration of bank holidays in March 1933.
where devaluation expectations are taken from our calculations above, gold flows are measured by the change in official United States gold stocks, and banking crises (bankfail) are proxied by the deposits of suspended commercial banks. The lag length of 4 was determined by LM-tests from a more general model, although alternative lag lengths produce very similar results. One particularly useful feature of a system such as (9) is that it facilitates Granger causality tests. For example, gold flows would be deemed Granger causal to devaluation expectations (denoted $\text{gold} \rightarrow \text{devaluation}$) if the restrictions $\beta_j = 0$ ($j = 1$ to 4) could be rejected using a standard $F$-test. The results of the six combinations of Granger causality tests are given in Table 4.

The results of estimating (8) suggest three significant causal relationships. The most significant is between bank failures and devaluation. However, gold flows are also a significant determinant of devaluation expectations and of bank failures. This causality pattern does not fit particularly well the story put forward by Brown, but it is important to recognize that Granger causality tests are not designed to highlight contemporaneous causality. If foreign investors moved sufficiently quickly to ship gold out of the United States because of their devaluation fears, lagged expected realignment expectations might not explain gold flows in a monthly database.

To investigate this point further we calculate the impulse responses of the VAR expressed in (8). These are graphed in Fig. 4, together with ±2 standard error bars (computed using bootstrap methods). Ignoring the autoregressive tendencies given by the graphs on the leading diagonal, we interpret the results as follows. A shock to realignment expectations causes a purely contemporaneous gold flow in the expected direction but has no impact on bank failures (row one). Similarly, gold flows have a contemporaneous impact on bank failures, together with a lagged effect on realignment expectations (row two). Finally, in row three, bank failures have a lagged effect on realignment expectations but no independent impact on gold flows. These results are fully compatible with Brown’s hypoth-

<table>
<thead>
<tr>
<th>Direction of causality</th>
<th>Test statistic</th>
<th>Marginal significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold $\rightarrow$ Devaluation</td>
<td>3.9412</td>
<td>0.0067</td>
</tr>
<tr>
<td>Bankfail $\rightarrow$ Devaluation</td>
<td>7.4624</td>
<td>0.0001</td>
</tr>
<tr>
<td>Devaluation $\rightarrow$ Gold</td>
<td>0.6155</td>
<td>0.6560</td>
</tr>
<tr>
<td>Bankfail $\rightarrow$ Gold</td>
<td>1.1327</td>
<td>0.3501</td>
</tr>
<tr>
<td>Devaluation $\rightarrow$ Bankfail</td>
<td>1.2050</td>
<td>0.3185</td>
</tr>
<tr>
<td>Gold $\rightarrow$ Bankfail</td>
<td>2.6849</td>
<td>0.0401</td>
</tr>
</tbody>
</table>

Notes. The test statistics reported in column 2 are distributed as $F(4,58)$. The marginal significance of these statistics is reported in column 3.

19 Unreported unit root tests indicate that each of these variables is stationary.
Fig. 4. Impulse responses.
An increase in devaluation expectations causes gold to flow out of the US which in turn causes bank failures to rise. Both gold flows and bank failures serve to strengthen devaluation expectations with a lag.

Our findings throw light on what has been a disputed international aspect of the Great Depression: was the United States, in particular the Federal Reserve, hampered by its international commitments? Put differently, did the commitment of the United States to the gold standard constrain expansionary monetary policy during the Depression up until March 1933, when the United States suspended the gold standard? Kindleberger (1986) takes the view that the key constraints were international ones, but he does not analyze statistically the matter of international monetary constraints on Federal Reserve policy. Eichengreen (1990) has demonstrated international interactions between global money supply, key currency backing of non-key currencies, and the maldistribution of gold toward the United States and France. But this is not the same thing as demonstrating that the leading key currency country itself, the United States, was constrained by international monetary events. Eichengreen (1992a), inter alia, does show a keen awareness of the notion that United States monetary policy was most probably constrained by the fear of “endangering the gold parity” (p. 295). But it has never been demonstrated statistically that this was the case. In contrast, Friedman and Schwartz (1963) take the contrary position, arguing that the Federal Reserve could have undertaken substantial open market purchases if it had really wanted to. Epstein and Ferguson (1984) have challenged the latter’s position using data on the Fed’s open market operations.

Our evidence on United States monetary policy and international interactions supports the argument that the Federal Reserve’s monetary policy was constrained by international considerations. The evidence is as follows: first, the fact that bank failures cause devaluation expectations with a lag (on both the Granger causality and VAR tests) suggests a domestic cause of the weakening of adherence to the gold standard. In other words, even more stringent monetary

20 We appreciate that a common criticism of a standard VAR system is its nonstructural nature. However, since Brown’s hypothesis suggests no particular structure other than a certain ordering of the variables we were unable to impose further restrictions. It is well known that the ordering of variables in a VAR may change the properties of the impulse responses, and this is true in our case. Since we specifically chose the ordering to be in line with Brown’s hypothesis the strongest statement we can make is that the impulse responses provide evidence consistent with his story.

21 These results are robust to changes in the sample period. In particular, our conclusions are unchanged if we terminate the sample in November 1932, excluding the final banking crisis.

22 Friedman and Schwartz (1963) wrote “that a shortage of free gold did not in fact seriously limit the alternatives open to the [Federal Reserve] System. The amount was at all times ample to support large open market purchases. . . . The problem of free gold was largely an ex post justification for policies followed, not an ex ante reason for them” (p. 406).

23 However, one may want to treat the Epstein and Ferguson (1984) results with caution for two reasons: (a) many of the significance levels are low even for one-tailed tests; (b) such tests are not appropriate when the hypothesized sign could be reversed (e.g., their hypothesis is for a negative relationship between currency inflow and open market purchases, but if the Fed were to take inflows as a sign of confidence in the dollar the sign would be reversed).
contraction and resulting bank failures would have caused even greater fragility of the dollar on the foreign exchanges. Even more significantly for our argument, we also find a positive feedback from gold outflows to bank failures (a lagged effect on the Granger causality tests and a contemporaneous effect from the VAR). That is, an international interaction was adversely affecting the banking system. Furthermore, gold outflows were having a lagged effect on dollar devaluation expectations (this time from both of our tests), which must also have been a worry for the Fed. These findings would seem to support the position of Kindleberger and Eichengreen rather than that of Friedman and Schwartz. The Federal Reserve was indeed being hemmed in by the commitment of the United States to the gold standard. The Federal Reserve found itself in a dilemma: if it increased the money base to “save the banks,” which it did try to do with open market purchases in the spring and early summer of 1932, it was not playing by the rules of the game given the preponderance of gold outflows between September 1931—when sterling left gold—and June 1932. However, if it did nothing, which turned out to be the preferred policy, this risked the bank failures that, as we have shown, also put pressure on the dollar. Under these circumstances adherence to the gold standard was becoming untenable.

Furthermore, this evidence suggests that both domestic causes (banks → devaluation expectations) and international causes (gold → banks, and gold → devaluation expectations) were operative in the Bank Panic of 1933. Also, as these causal relationships are systematic across the period from 1926(12) to 1933(2), we do not think that the election of President Roosevelt represents a discontinuity in American inter-war financial history. But we do not deny that Wigmore (1987) (and references cited therein) may well be correct in arguing that the exact timing of the suspension of the gold standard by the United States was due to him.

IV. CONCLUSIONS

The pound was subjected to a short sharp speculative attack which, owing to the precariousness of its gold reserves and balance of payments, it was able to weather for less than 3 months. After the fall of the pound the attention of speculators turned to the dollar. But, largely owing to the greater strength of the United States balance of payments and gold reserve, it took 19 months for the dollar to fall. A 9 month phase to June 1932 of speculative attack was overcome and gold began to return to the United States for the 7 months to and including January 1933. Finally, however, another speculative attack combined with the third banking crisis lead to the United States suspending adherence to the gold standard.

What was driving exchange rate realignment expectations seem to be explained well by the relationships we have examined. We find support in our United Kingdom regression for the hypothesis that perverse monetary policies in the United Kingdom relative to the United States increased devaluation expectations. For the United States we focus on the huge gold flows and bank failures which
characterized the run up to gold suspension. We provide results from a VAR
analysis which were fully consistent with the hypothesis of Brown (1940) that
devaluation expectations caused a withdrawal of gold which in turn precipitated
waves of bank failures. In short, macroeconomic events, some of them directly or
indirectly under the influence of the authorities, were ultimately responsible for
both the United Kingdom and the United States leaving the gold standard during
the inter-war period. But this is not necessarily to say that the authorities
approximately played by the rules of the game for most of the inter-war
experience with the gold standard. Only towards the end did they deviate
sufficiently to bring the system down.

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