

Inflationary Expectations During Germany's Great Slump

Hans-Joachim Voth*

November 11, 1998

Abstract

Was the German slump inevitable? This paper argues that – despite the speed and depth of Germany's deflation in the early 1930s – fear of inflation is evident in the bond, foreign exchange, and commodity markets at certain critical junctures of the Great Depression. Therefore, policy options were more limited than many subsequent critics of Brüning's policies have been prepared to admit. Using a rational expectations framework, we find strong evidence from the bond market to suggest fear of inflation. Futures prices also reveal that market participants were betting on price increases. These findings are discussed in the context of reparations and related to the need for a regime shift to overcome the crisis.

JEL classification codes: E31, E43, E44, N14, N24

Keywords: Inflation, Great Depression, Rational Expectations, Uncertainty, Monetary Policy.

*Economics Department, Universitat Pompeu Fabra, c/Ramon Trias Fargas 25-27, 08005 Barcelona, Spain. Email: joachim.voth@econ.upf.es

1 Inflationary Expectations and Policy Constraints during the German Slump

The Great Depression is one of the largest discontinuities of the twentieth century. In most countries, including the United States, the period 1929-33 marked a watershed not only in economic terms—almost everywhere, the role of the state changed dramatically, with intervention in the economy becoming more widespread. Yet few countries saw more fateful repercussions than Weimar Germany, where the slump was crucial in undermining public support for democracy, thus paving the way for Hitler’s dictatorship.¹

Did incompetent policymaking turn the German recession that started in 1928 (Borchardt 1991: 146) into economic – and ultimately, political – disaster? Numerous authors have claimed as much (Holtfrerich 1990, Kroll 1959, Bombach 1976). Despite being faced with an ever-deepening crisis, neither credit expansion nor deficit spending were used on any significant scale before 1932. It is therefore not surprising that, in modern accounts of the Great Depression, the German cabinet under chancellor Brüning is often cited as an example of blatant mismanagement. Others suggested that the German government deliberately exacerbated the crisis to liberate the Reich from the yoke of reparations (Temin 1990: 82-3). Alternative interpretations have emphasized that any German government would have found it hard to act decisively during the early 1930s, and that options for a more active policy were largely conspicuous by their absence. Much of the more apologetic literature on “room for manoeuvre” during the Great Depression in Germany, citing the recent memory of hyperinflation and contemporary press comment, has argued that policymakers were constrained by fear of inflation (Borchardt 1985). Credit expansion could not be undertaken because of domestic anxieties and the constraints imposed on the exchange-rate regime as a result of the Dawes and Young Plans (Ritschl 1997). Fear of inflation became acute after the banking crisis in the summer of 1931. On July 24th 1931, Sir Horace Rumbold, the British ambassador to Berlin, wrote in his report to the Foreign Office: “By 17th July the fear of inflation was very strong”.² Hence, Germany could not have followed Great Britain in leaving the gold standard,

¹Feinstein, Temin and Toniolo 1997: 122. Borchardt (1991: 161-83) discusses the role of economic factors in Weimar’s collapse in more detail.

²Cit. acc. to Borchardt 1985: 241.

even if it had wanted too – the public would have immediately anticipated a repeat of the inflationary experience 1919-23. The deliberately deflationary policies of the Brüning government between 1930 and 1932 were not only rational, but without alternative. Additional evidence supporting the view that fear of inflation lingered throughout the 1920s and early 1930 comes from the maturity profile of bond issues and bank deposits. Issues of long-term debt were rare and carried high rates of interest. Also, in contrast to the period before 1914, most deposits were held at short notice (Balderston 1991, 1993).

Historians have spent considerable time and effort unearthing comments that attest to fear of inflation during the early 1930s (Borchardt 1991, 1985). Yet fearing price increases in a context of rapidly falling prices implies that contemporaries were unable to grasp the nature of deflation.³ At its peak, during the spring and summer of 1932, prices of industrial goods were falling at an (annualized) rate of more than 15 %. The index of highly flexible prices, compiled by the Institute for Business Cycle Research, was falling at a rate of approximately 40 % during the summer of 1931. Once the price level had begun to weaken in 1928, prices continued to fall until 1932. Even by the last quarter of 1935, prices of industrial products had only regained their Spring 1931 level.⁴ There is some indirect evidence that the nature of deflations was not very clear to the wider public. Borchardt has shown how the term “deflation” only came to be used with any frequency in the popular press after 1931 (Borchardt 1985: 238). The 1928 edition of the popular Brockhaus encyclopedia defines deflation as a set of policy measures to reverse the price increases during an earlier inflationary episode. There seems to be little appreciation of the fact that deflationary pressures might arise as a result of economic shocks (Brockhaus 1929: 463, vol. 4).

Yet interpretations on the basis of this and other contemporary comments appear inconclusive – fear of inflation was clearly witnessed by some, but it is difficult to ascertain how wide-spread or deep it was. Critics have argued that fear of inflation was hardly genuine and common, and was simply instrumentalized by certain politicians. Fear of inflation in the early 1930s would have been patently irrational given the very considerable downward momen-

³Holtfrerich (1990: 69) also suggests that ‘inflation’ was simply a term used for any kind of expansionary monetary or fiscal policy.

⁴Using the price series for industrial finished goods (‘industrielle Fertigwaren’), Institut für Konjunkturforschung 1935: 104.

tum of prices in all sectors of the German economy, and detailed evaluations of contemporary press comments appear to yield contradictory results. Consequently, critics of the dominant view have argued that energetic political leadership could easily have overcome any lingering residual fears connected with the experience of hyperinflation. For example, while the danger of inflation was talked up by interested parties, 21,000 proposals to combat the slump were sent to the Reichsbank and the Berlin business school, the majority of which suggested going off gold and adopting expansionary policies (Holtfrerich 1990: 70).

In order to establish that fear of inflation condemned any kind of government intervention to failure, it has to be demonstrated that economic agents at the time would indeed expected rapid price increases – despite strong deflationary pressure – if new policies such as credit expansion had been adopted. This paper seeks to measure expectations of future price increases in Germany using data from the bond, forex and commodity markets. We begin by placing the decline in prices in Germany during the Great Depression in its historical context. Information from the bond market as well as the time-series properties of price changes are then used to extract a measure of inflationary expectations. We find strong evidence of concern about inflation. Further corroborating evidence comes from yield spreads, as well as the forex and commodity futures market. The conclusion discusses implications for the political and economic history of the Weimar Republic.

2 Methodology and Findings

How unusual were the early 1930s in the context of German economic history? A decline in the overall price level was not outside recent experience. Prices of industrial goods fell by almost 20 % in 1925-26, and the general deflation of the early 1890s and 1880s is unlikely to have faded completely from public memory (table 1). Once a deflation was underway, it normally persisted for 2 to 5 years. While a full appreciation of the underlying processes may have been lacking, deflations were not unusual events by the standards of Germany's economic history.

Table 1 here

What is unusual about the years 1929-32 compared to earlier episodes is the magnitude of the deflation. The consumer price index fell by 22.5 %, and the price of investment goods was reduced by an average of 48.3 %.⁵ NSP shrank by a cumulative 19.2%, whereas in four out of six previous deflations since the 1850s, it had continued to grow.

Did fear of inflation constitute a binding constraint for German policy-makers in the early 1930s? In the absence of survey data or unambiguous testimony in historical sources, a number of methods can be used to shed light on this question (Frenkel 1977, Cecchetti 1992, 1988, Hamilton 1992, 1987). Stated in its strong form, the hypothesis that inflationary expectations restricted “room for manoeuvre” suggests that economic agents anticipated price increases in the foreseeable future. In its weak form, it implies that, conditional on a change in policy, rapid price increases would have been expected. We use data from futures markets in foreign exchange and commodities interest rate spreads, the term-structure of interest rates as well as a rational-expectations model pioneered by Mishkin (1981) to examine the weak and the strong formulation of this hypothesis.

2.1 The Time-Series Properties of the Data

Augmented Dickey-Fuller and Phillips-Perron tests do not allow us to reject the hypothesis that unit roots are present in the two price series used – the consumer price index and the price of industrial product (‘industrielle Fertigwaren’).⁶ However, they are known to have low power against the alternative of a stationary process with a large autoregressive component (Schwert 1989). Cecchetti (1992: 146) suggests a good a priori reason for modelling price series in general as containing a unit root – and inflation as stationary. Changes in the price level will be determined by changes in the monetary base, the volume of goods, and the ratio of money demand to income. If any one of these variables happens to be $I(1)$, which is likely, then the series of price changes will only be stationary if the cointegrating vector is $(1, -1, -1)$, which is doubtful at best.

The basic time-series properties of price changes can thus be exploited using ARMA modelling. We can determine for how long price movements

⁵Hoffmann 1965: 601, table 148. The figure for investment goods refers to the years 1929-33, as Hoffmann gives no figures for 1931 and 1932.

⁶Institut für Konjunkturforschung 1935: 104, 107.

normally persisted, given that a deflation or a rise in prices had already started.⁷ Table 2 examines the performance of ARMA models with up to two AR and/or MA components, using two alternative price indices.

Table 2 here

For both the consumer price index and the price index of industrial finished products, ARMA(2,0) specifications prove superior.⁸ The size of the AR component allows us to judge over what horizon a deflation could have reasonably been expected to persist, once it had started. For the CPI, the AR-component is 0.95, suggesting that a deflation of 10 % (annualized) would have allowed contemporaries to predict deflation of 8.7 % in three months' time. For finished goods, the value is higher, suggesting a forecast of 9.4 %.⁹ Figures 1 and 2 show expected and actual inflation of the two price indices:

Figure 1 here

Figure 2 here

The findings from the ARIMA models suggest that a deflation, once it had started, could reasonably be expected to persist for a significant amount of time. Given the time-series properties of the data, and the fact that there was dramatic deflationary momentum in the economy, fear of inflation during the early 1930s appears to be strikingly irrational. Note, however, that there are periods when actual price changes were outside the 95 % error bands of our models. In the second half of 1932, and in early 1933, prices fell (increased) more rapidly than could have been predicted on the basis of past patterns.

Did Germans view the events of the early 1930s through the looking glass of the great inflation? It may be instructive to ask how long the direction of price change remained constant during those tumultuous years. Before

⁷We use the price index for manufactured goods ('industrielle Fertigwaren') from Institut für Konjunkturforschung 1935: 104.

⁸In the case of the CPI, the Akaike(1974) and Schwarz (1978) information criterion do not provide consistent evidence, favouring either the ARMA(2,0) or ARMA(2,1) specification. None of our conclusions is affected if the MA component is added.

⁹Even if we model the time series as I(1), the degree of predictability remains high. With an ARIMA (1,1,0) model, the AR-component implies continued deflation of 5.9 percent for the prices of finished products.

the final descent into hyperinflation, prices did not increase continuously. Before June 1921, there had been two periods of rapid price increases and two deflationary episodes, each lasting approximately four months (February-May 1920 and September 1920-January 1921 saw inflation, June-August 1920 and February-May 1921 deflation; cf. Bresciani-Turroni 1937: 444). This experience may well have been more relevant for contemporary Germans than the estimates derived from ARMA modelling, which suggested a much greater persistence of price movements – our ARMA models only use data from the post-inflation period. If deflation had turned to inflation so rapidly some ten years earlier, then an alternative approach may be more likely to capture expectations formation during the early 1930s.

2.2 Evidence from the Bond Market

2.2.1 A Rational Expectations Approach

A potentially richer way of modelling inflationary expectations was first introduced by Mishkin, who uses a rational expectations approach to infer inflationary expectations from bond prices. Mishkin (1981) takes the Fisher hypothesis as a starting point - the interest rate on a bond will be equal to the sum of the ex ante expected rate of inflation and the real return:¹⁰

$$i_t \equiv rr_t + \pi_t^e \quad (1)$$

where i_t is the nominal interest rate earned by holding a bond until time t , rr_t is the expected real return to holding the bond, and π_t^e is the inflation rate anticipated by agents over the interval $t - 1$ to t .

Since anticipated and actual rates of inflation can diverge, the interest earned by investors ex post may be higher or lower than the one expected at $t - 1$. The realized return on a bond held from $t - 1$ to t is

$$eprr_t \equiv i_t - \pi_t \equiv rr_t + \pi_t^e - \pi_t \quad (2)$$

[$eprr_t$ is the realized real return, π_t is actual inflation between $t - 1$ and t]

The mismatch between actual and expected inflation is $(\pi_t - \pi_t^e)$. Economic agents will attempt to forecast actual inflation given the information

¹⁰All rates are continuously compounded.

that they have available at time $t - 1$. Under the assumption of rational expectations, they will not consistently and continuously misjudge actual inflation. Hence, the mean expected difference between actual and anticipated inflation, conditional on the information set Ω at time $t - 1$, should be zero:

$$E(\pi_t - \pi_t^e \mid \Omega_{t-1}) = 0 \quad (3)$$

Forecast errors of rational economic agents - as captured by bond prices - should be uncorrelated with information available at $t - 1$. The information available to later historians X_t is a subset of the full wealth of information Ω_t available to agents at the time. If X_t has predictive power for real interest rates, we have

$$rr_t = \beta X_t + u_t \quad (4)$$

where u_t is the error term. Combining equations (2) and (4) yields

$$eppr_t = \beta X_t + u_t - (\pi_t - \pi_t^e) = \beta X_t + u_t - \varepsilon_t \quad (5)$$

Both ε_t and u_t will be orthogonal to the information set X_t ; we can therefore estimate equation (5).

Before we can apply the Mishkin approach to Weimar Germany, we need to establish that the Fisher equation holds. Given that the null of non-stationarity for both interest rates (proxied by monthly interest rates used later) and inflation rates (measured by the price index of industrial output) cannot be rejected (using both ADF and Phillips-Perron tests), the Fisher equation in its weak form requires that interest and inflation rates share a common stochastic trend.¹¹ The Johansen maximum likelihood procedure (trended case, no trend in the data generating process), allows us to reject the null hypothesis of no cointegrating vector against the alternative of one or more vectors (test statistic 21.4 vs. a 95% threshold level of 17.95, sample 1926/1-1930/12).¹² Thus we find that interest rates and prices cointegrate –

¹¹The bond data for 6% issues is from Institut für Konjunkturforschung 1936: 119. Gaps in the series were interpolated linearly. We use the price index for industrial finished products; results are unaffected if the CPI is used instead.

¹²We cannot reject the null of one vector against the alternative of two or more vectors at the 95 percent level. These results were generated using a maximum lag of 6 months in the VAR. Results are robust to reductions in the maximum lag down to a minimum of 2 months.

the residuals of a regression of interest rates on price changes appear to be $I(0)$ (the Augmented Dickey-Fuller test is significant at the 99% level; $ADF = -3.04^{**}$). Note that most of the tests for non-stationarity reported here refer to sample periods that are shorter than is customary. Recent research strongly suggests that the use of high-frequency samples reduces this problem – there are significant increases in the power of ADF tests with higher sampling frequency (Choi and Chung 1995, Hooker 1993). Nonetheless, our results should be treated cautiously.

Along with other authors (Evans and Lewis 1995, Mishkin 1992, Gagnon 1996), we find that the coefficient on the inflation variable is less than unity (the midpoint estimate is 0.74).¹³ Note, however, that the coefficient is not significantly different from one – a χ^2 test yields a statistic of 1.25, which is insufficient to reject the restriction at customary levels. Tax effects are probably responsible for finding coefficients less than unity (Summers 1983). Note also that our estimate of the coefficient on the inflation variable is smaller (yet not statistically significantly so) than coefficients found in the case of three high-inflation countries in the Third World (Argentina 1976-87, Brazil 1971-84, and Mexico 1979-1991; cf. Phylaktis and Blake 1993: 595, table 2).

We follow Cecchetti’s (1992, 1988) approach to the implementation of the Mishkin method.¹⁴ Included in the OLS regression are the nominal interest rate, as well as the money supply, output, and prices. The actual specification of a variable x is $\Delta x_n = (x_t/x_{t-n})$ and n indicates the lag length.¹⁵ Instead of using the first, thirteenth and twenty-fifth lag, as Cecchetti (1992: 149) does, we implement Hendry’s (1993) general-to-specific modeling approach, estimating a full set of a maximum of 13 lags, and then testing down.¹⁶

If we were to use the fitted values from an OLS regression as the expected real interest rate level, this would imply that economic agents “knew” the

¹³Crowder and Hoffmann (1996) find evidence of a unit coefficient in the US.

¹⁴As Cecchetti (1992: 148; cf. also Mishkin 1992, appendix 2) points out, the only other necessary condition is that the real interest rate is stationary. For the period preceding the forecasts, 1926-1930, we can reject the null of non-stationarity at the 90 percent level using an ADF(3) test.

¹⁵Similar to Cecchetti (1992: 149), we do not chose this transformation for the nominal interest variable.

¹⁶Using up to 25 lags is unfortunately impossible, given the number of observations in our dataset.

correct relationship between interest rates and all other variables for the entire sampling period. This is clearly unrealistic. We therefore use recursive least squares (RLS), generating rolling 1-month ahead forecasts of the real interest rate to infer ex ante rates – i.e. the initial model is estimated for 1926/8 to 1930/1, and on the basis of this estimate, a forecast for 1930/2 is calculated. In the next round, the sample period for initial estimation is expanded to 1926/8 - 1930/2, and on the basis of the new equation, a forecast for 1930/3 is generated. Agents are therefore expected to only “know” the data that is available to them up to the point in time when they make their “forecast”; despite using the rational expectations framework, it is clearly possible for forecasts to be “widely off the mark.” Estimation results for the initial periods are:

Table 3 here

The two specifications in table 3 use different dependent variables – either the real return on public bonds, or the real monthly interest rate from the interbank market.¹⁷ Differences in the sample period used are due to the maximum lag of a dependent variable that was included in the models, as well as constraints on data availability. In both equations, no significant coefficient on output could be found, and the variable was consequently excluded from the regression equations. Both models pass a number of tests. In particular, the heteroscedasticity-consistent standard errors are almost identical with the common standard errors. The residuals of our regressions are normally distributed, and there is no evidence of ARCH. Reset-tests give no evidence of model misspecification. We ultimately favour the model based on public bonds because the normality of the residuals is more firmly established. Also, there is another reason for preferring the public bond data. As the banking sector faced a liquidity crunch in the summer of 1931, the fundamental assumption underlying the Mishkin model – i.e. that the real interest rate is constant – begins to be questionable. In the case of interbank rates, it is clear that liquidity is at a premium during the summer of 1931. Bond yields, however, are largely unaffected by short-term liquidity needs

¹⁷Institut für Konjunkturforschung 1936, p. 112. Note that our main findings do not depend on the interpolated values during the second half of 1931, as innovations were already large and significant before markets were closed temporarily.

and show little change during the banking crisis.¹⁸

Recall that we are not only attempting to measure inflationary expectations. The purpose of the exercise is to gauge the room for ‘manoeuvre’ during the crisis. Hence, we are ultimately interested in the level of expected inflation conditional on a change in policy that would have attempted to slow the economic collapse. This is not directly observable. As an alternative, we can examine periods when such a new course of action was regarded as more likely — such as Britain leaving the gold standard, the introduction of currency controls, and electoral successes of the Nazi party. If our estimates of expected inflation increase during these periods (and diverge significantly from actual price changes), then it is possible to argue that a new policy might have triggered rapid increases in inflationary expectations.

Figure 3 gives the implied inflation rate from our preferred model specification (1) with monthly updating of the information set Ω_{t-1} , where $\pi_t^e = i_t - \widehat{eprr}_t$:

Figure 3 here

From the summer of 1931 onwards, expectations diverge significantly from actual inflation. At a time when prices were falling at about 15 % (annualized), the Mishkin model suggests that (i) expectations of as much as 10 % inflation p.a. would have been compatible with basic rationality during some months in 1931/1932, and (ii) after a long period when price reductions were anticipated more firmly by the month, the trajectory of inflationary expectations was turning upwards. Germans were indeed jittery about a resurgence of inflation. As soon as exogenous policy events such as the British decision to abandon the gold standard increase the likelihood of the German government adopting a more active policy, inflationary expectations increase.¹⁹

In terms of the Mishkin model, the expectation of a more moderate deflation is caused by a rise in nominal interest rates. As interest rates increased rapidly following the banking crisis and Britain’s decision to abandon the

¹⁸The issue of possible changes in liquidity preference is dealt with in more detail below. I thank Peter Temin for insisting that I examine this point in more detail.

¹⁹Note that, for an important part of this period, we had to interpolate the data on public bond yields. Stock exchanges were closed in the fall of 1931 and early 1932. However, since the disturbances are clearly visible long after the interpolation period, it is evident that our results are not driven by this. Also, forecasts from a model using only monthly interest rates – which are available without interruption – give broadly similar results.

gold standard, the path of actual and expected inflation diverges.²⁰ Inflationary expectations appear highly sensitive to changes in the likelihood of a more expansionist policy. Such “long memory” is not unusual by the standards even of today’s OECD countries. Gagnon (1996: 9, table 3) examines the impact of past inflation on ten-year bond prices. He provides clear statistical evidence that expectations about future inflation are influenced to a much greater extent by the experience of inflation over the ten preceding years, rather than shorter (and more recent) periods. Surely, the traumatic effects of the hyperinflation should have lingered in public memory longer than the mild bout of price increases experienced by most OECD countries in the 1970s.

The timing of the upward turn thus reinforces contemporary observations about the events preceding the banking crisis and Britain’s departure from gold. During a conference held by the Friedrich List society in September 1931, the events of the summer were still fresh on the participants’ minds. When exploring opportunities for monetary expansion, one participant commented that the declining reserves of the Reichsbank in June and July had spurred fear of inflation and aggravated the run on deposits.²¹ As the financial adviser at the British Embassy in Berlin put it: “The reasons against Germany’s departure from the gold standard are sufficiently well known... The fear of inflation is such that a fall in the quotation of the mark as expressed in dollars would immediately lead to panic...”.²² After the banking crisis, during the few days when the stock market opened, there was also a buying frenzy – driven, as the staff at the Frankfurter Zeitung’s business supplement “Die Wirtschaftskurve” observed, by investors who were trying to buy inflation-proof assets (Bauer 1931: 246).

Figure 3 compares the actual with expected inflation. An alternative measure of policy constraints is the accuracy of this forecast. Nervousness amongst investors caused declining quality of the inflation prediction, as figure 4 shows. The standard error of the forecast is divided by the average level of predicted inflation to derive the coefficient of variation. Uncertainty begins to rise dramatically after the banking crisis. The increase continues unabated until the Lausanne conference, which resolves the reparations issue.

²⁰On the banking crisis, cf. Balderston 1993.

²¹Reg.Rat a.D. Dr. Stern, cit. acc. to Borchardt and Schötz 1991: 144.

²²Cit. acc. to Borchardt 1985: 242.

2.2.2 Yield Spreads

It could be argued that the conditions of the German bond market following the banking crisis were highly unusual, and that the increase in yields did not reflect a fear of increased inflation in the future. Rather, it measures a change in liquidity premia, differences in default risk, movements in the real rate of interest, or time-varying risk premia. We can resolve the issue of liquidity risk by examining the spread of mortgage bonds (Pfandbriefe) and rye bonds over public bonds. Not all bonds will be affected equally by changes in liquidity premia. Pfandbriefe, for example, are notoriously illiquid because of small issue size and limited free float. The same is not true of public bonds, which were predominantly issued in large tranches by the Reich or individual Länder. Since the possibility of an internal default of the Reich was very small even in 1931, and Pfandbriefe had a history of zero default since their inception, the spread between the two will largely reflect differences in two factors, i.e. liquidity premia and the ‘gold clause’.²³

The bond market was devastated by the effects of the hyperinflation. A strong and stable demand for bonds disappeared together with the German *rentier* (Balderston 1993). All issuers found it difficult to tap the market for longer maturities or for larger issues. These facts alone indirectly suggest that strong fear of resurgent inflation was never far from the surface. This view is reinforced by the fact that a very large number of bonds – virtually all except issues by the state – had ‘gold clauses’, which guaranteed the value of coupon and principal payments in the case of another departure from the gold standard. The vast majority of bonds issued during the Weimar period thus contained a hedge against inflation, albeit an imperfect and indirect one – gold clauses could always be abrogated by parliament.

During the period 1919-23, bonds denominated in sugar, rye, coal, gold and potassium had been issued. By the late 1920s, most of these bonds had been redeemed. Rye bonds, however, continued to be traded (Wolfgang 1931: 131-2). They also make an ideal benchmark against which inflationary expectations can be judged – the stabilization of the Mark in 1923/24 was carried out using rye to back the currency. Bonds denominated in rye were therefore regarded as the ultimate hedge against inflation.

We can use the difference in the yields of these instruments to examine

²³ An internal default was never considered a possibility, even by the most pessimistic observers. In contrast, an external default was always likely once the crisis deepened.

inflationary expectations. Bonds with a ‘gold clause’ can be thought of as containing a conditional put option on repayment in gold. Thus, any increase in inflation should make these instruments relatively more valuable than bonds without the option – even if the devaluation has not yet occurred, we can think of the rise in ex ante inflation as increasing the probability that the value of the underlying will be below the strike value of the option. While prices are rising, the yield of the gold-backed bonds should be lower than that of the instrument which merely guarantees nominal repayment.²⁴ If rye prices are flat, then the yield spread between Mark and rye-denominated bonds will *ceteris paribus* be an indicator of anticipated inflation.

Figure 5 here

There are thus two factors working in opposite directions - after July 1931, the change in liquidity needs ought to have increased the spread of Pfandbriefe and rye bonds over Reichsanleihen (or diminished a negative spread), whereas increasing fear of inflation should have caused a rise in the difference. Figure 5 shows that the differential widens dramatically, with the more liquid Reichsanleihen carrying higher yields to maturity. Hence the (positive) spread of Reichsanleihen over Pfandbriefe is a lower bound on the change in inflationary expectations, as this is the net spread, i.e. after liquidity effects have presumably tightened the spread from the level it would have reached if Pfandbriefe had been equally liquid.²⁵ Rye bonds show a broadly similar pattern during the crucial period 1931/32. In July 1931, the yield spread of public bonds over gold bonds was 0.75%, the spread over rye bonds 0.82%. By September 1931, when the trading floors were reopened for a brief period, the differential had widened to 0.83% and 1.98%, respectively.²⁶ In April 1932, when continuous trading resumed, the spread jumped to 2.75% and 3.49%, after which it began to decline gradually. The

²⁴Note that the rise in French interest rates after 1931 is also driven by expectations of devaluation (Hautcoeur and Sicsic 1998: 18).

²⁵Note that, because the data is currently only available in aggregate form, it is not possible to match maturities perfectly. However, since the number bonds from which the index is derived is large, it is unlikely that dramatic changes in sample composition over short periods of time determined the results.

²⁶Note that the price of Goldpfandbriefe and of rye bonds did not remain constant – the value of the data is not undermined by non-trading. Data on rye bonds is from Statistisches Reichsamt (various years).

evidence from yield spreads between assets that guarantee nominal and real returns is therefore consistent with our finding that fear of inflation cannot be ruled out given the other evidence from the bond market, and that it was strongest in the second half of 1931 and the first half of 1932.

2.2.3 The Term Structure of Interest Rates

The term structure of interest rates is known to contain information about future changes in inflation (Mishkin 1990b, c).²⁷ A standard way to examine the extent to which changes in inflation between periods m and n can be predicted from the slope of the term structure is to estimate:

$$\pi_t^m - \pi_t^n = \alpha_{m,n} + \beta_{m,n} [i_t^m - i_t^n] + \eta_t^{m,n} \quad (6)$$

where π denotes the rate of inflation, i refers to the interest rate, α is the intercept, and η is the residual. $\alpha_{m,n}$ will reflect the difference between ex ante real rates of return between the two periods (Mishkin 1990c: 78-81). As information on the exact maturity of long-term bonds is unavailable, the analysis has to be adapted to the data constraints. For imperial and interwar Germany, we can use the long-term bond yields as compiled by the Bundesbank (1976: 278). The private discount rate is also available for pre-war and interwar period. The results of applying equation 6 are summarized in table 4.

Table 4 here

For both sample periods used in table 4, the slope of the term structure has predictive power. It is significant at the 6 % level. Both models pass a number of tests. They are free from autocorrelation, show no evidence of ARCH or heteroscedasticity, and Ramsey's reset test (up to the second power) does not suggest any misspecification.. We conclude that the difference between bond yields and the private discount rates forecasts changes in inflation. If our earlier argument is true, and Germans were afraid of inflation during the Great Depression, then this should be reflected in a particularly steep yield curve. The long-term mean of the difference between bond yields and the private discount rate is 0.97. In 1931, it jumps to 3.45%

²⁷The abundant literature on the topic cannot be reviewed in this paper. Classic papers include Fama (1990) and Campbell and Shiller (1987).

(from 0.22% in 1930), and to 3.32% in 1932. Based on model (1) in table 4, this implies increases in inflation by 2.52% and 5.3 % p.a. Information from the yield curve therefore reinforces our earlier finding that Germans expected accelerating price increases in 1931/32.

2.3 Futures Prices

Further corroborating evidence comes from the price of futures contracts for foreign exchange and agricultural commodities. Let $S_{j,t}$ be the spot rate of good j at time t , and $F_{j,t}$ the price of a one-period ahead forward contract. With investors neutral to risk and efficient markets,

$$F_{j,t} = E_t [S_{j,t+1}] \quad (7)$$

where E_t denotes expectations.²⁸ Inflationary expectations can then be measured as

$$\pi_t^e = \frac{12}{T} (f_{j,t} - s_{j,t+1}) \quad (8)$$

where lower case letters denote natural logarithms, and T is the number of months to settlement (Hamilton 1992).

We can use this method for both forward Reichsmarks and the price of two agricultural commodities, wheat and rye.²⁹ A discount on forward Marks implies that agents expect the exchange rate to depreciate – if expectations are rational in the sense of Muth (1960). During the years 1919-23, a decline in the Mark's external value was often viewed as synonymous with an increase in the rate of inflation. Since Frenkel's seminal (1977) contribution, inflationary expectations during the German hyperinflation have routinely been modelled using forward rates (Webb 1986, 1989). For the period from February 1921 to August 1923, Frenkel (1977: 655) demonstrated that β in a regression $S_t = \alpha + \beta F_{t-1}$ is not significantly different from unity. Germans during the early 1930s would have immediately associated any fall in the

²⁸We are abstracting from cost-of-carry.

²⁹A sceptical view – at a very general level – can be found in Mishkin (1990a). The results in our own work, as well as in the literature (Hamilton 1992) suggest that the problems he identifies are less severe than might be supposed.

external value of the Mark with an imminent rise in inflation.³⁰

After the banking crisis, and immediately before Britain announced that it is going to leave the gold standard, three-month forward Reichsmarks traded at a discount of more than 1.6%, implying an annual depreciation of the exchange rate of 6.8%.³¹ During the autumn of 1931, when the markets expected the Reichsmark to follow Sterling's devaluation, the forward discount widened to as much as 75% annualized (Einzig 1937: 294) - a level not seen since the darkest days of the hyperinflation, in April 1923, when three month forward Marks stood at an (annualized) discount of 65% (cf. figure 6).³² Given discounts of this order of magnitude, is reasonable to suppose that such differences are likely to be dominated by expectations of exchange rate and price changes (Frenkel 1977: 654).³³

Figure 6 here

Data on wheat futures also indicate that agents expected price increases, conditional on a major economic policy change.³⁴ During 1931 and 1932, the future price of rye and wheat as quoted on the Berlin exchange was almost always above the spot price.³⁵ Instead of comparing futures and spot prices, which may diverge for a number of reasons such as storage cost etc.,

³⁰In the case of the 1926 stabilization of the Franc Poincaré, there is debate if there is granger-causality running from the exchange rate to (wpi) inflation or vice versa (Sicsic 1992; Eichengreen 1992b). In the German case, we do not need to subscribe to a theory of imported price inflation. In a country where, at the height of the hyperinflation, prices had been changed daily even at the retail level based on the current dollar/mark exchange rate (Eichengreen 1992a: 135) any sudden fall in the gold value of the mark would lead to a rapid rise in expected inflation and the velocity of money.

³¹Most other currencies show rising premia against Sterling, especially in August and September. Cf. Einzig (1937: 470-71).

³²Cf. Einzig (1937: 450-470) for the market rates on forward Reichsmarks. Note that there are no observations for August 1931 - the dotted line marks the interpolation from July to September. My figures for the hyperinflation differ slightly from those in Webb (1986: 776-77) since he used one-month forward rates.

³³The bank rate differential vis-a-vis Britain was +5.5% in July and August of 1931; the difference in call money rates varied between +3.87% in November and +4.3% in June. Given the rate differential, forward Reichsmarks should have traded at a premium.

³⁴Data on rye futures are less useful. While the spot price of wheat has a correlation coefficient of 0.51 with the price index used above, the figure for rye is 0.14 (1930/10-1932/11).

³⁵The data on futures prices are from Statistisches Reichsamt (various years).

we follow the literature (Hamilton 1992) in comparing futures prices with different settlement dates. The actual change in spot prices between October and December 1931 was -2.78% (annualized). In the first week of August, when the December contract began to trade, the expected price change for the futures contract between October and December is +0.05% (annualized). After the suspension of the gold standard by the Bank of England, in the last week of August, this figure had risen to 8.5% p.a. Also, the rate of price increases was expected to accelerate rapidly. For most of August, the October future was almost always trading below the September contract, implying that prices were expected to fall over the next month. At horizons of up to three months, however, there was (unwarranted) fear of inflation at precisely those times when a change in policy became more likely.

3 Implications for the Political and Economic History of Weimar Germany

Even if we strongly stack the odds against such a finding by using a rational-expectations framework – fear of inflation during the Great Depression in Germany was not irrational, given the extent of political and economic turmoil. Evidence from the futures markets for forex and wheat strengthens this finding. We may therefore conclude that memories of the hyperinflation severely curtailed Weimar politicians’ room for manoeuvre. The nature of the policy constraint faced by the German government can be described more precisely. High *ex ante* interest rates aggravated the slump in the German economy (Voth 1995). These were not the result of high nominal interest rates, but of the strong deflationary pressure. To appreciate how strongly the zero interest rate constraint (Black 1997) restricted the room for manoeuvre, consider the implications of applying a standard monetary policy rule.³⁶ How low would interest rates have needed to be had the Reichsbank followed a Taylor rule, for example? Rates would then be targeted according to

$$r = \pi + gy + h(\pi - \pi^*) + r^f \quad (9)$$

where r is the central bank’s short-term interest rate, y is the deviation

³⁶A model beyond the familiar IS-LM framework can be found in Krugman (1998).

of real output from its trend, π is the inflation rate in percent, r^f is the equilibrium real interest rate, and g and h are policy parameters (Taylor 1998: 8). Taylor (1993) suggests g and h of 0.5 (rule 1). Brayton et al. (1997) have suggest setting $g = 1$ (rule 2). Given the massive deflation and the considerable output gap, rule 1 implies a nominal interest rate of -29 %. Following rule 2 would have suggested a rate of -38 %.³⁷ Since central banks are faced with a zero interest rate constraint, most of the relaxation in monetary policy had to come through a less deflationary outlook. Figure 7 documents the extent to which changes in anticipated deflation reduced ex ante interest rates between 1932 and 1934.

Figure 7 here

The decisive question therefore is if inflationary expectations could be influenced by policy measures. Could a more countercyclical Reichsbank policy have reduced the severity of the slump? This would constitute a close parallel to recent results for the United States, showing the extent to which the recovery was driven by changes in monetary policy (Romer 1992, Romer and Romer 1994). We can take this question further by examining the relationship between the measure of inflationary expectations that we extracted from the bond market and a number of policy variables. We estimate a VAR with 3 lags for two periods, one until the outbreak of the German banking crisis in 1931/6, the other for full sample. Figures 8 and 9 show the results. What emerges is the breakdown of previously established relationships as a result of the run on the banks. For the period up until the summer of 1931, we find the expected effects. An increase in the discount rate lowers expected inflation rapidly, with the maximum effect coming through after 3 to 4 months. Increases in the money supply increase expected inflation. However, the effect of the Reich's budget balance is counterintuitive. Deficit reductions appear to reduce expected inflation.³⁸

³⁷Net social product (Hoffmann 1965: 828) in 1932 was 19.3 percent below its 1929 level, and the prices of finished products were falling at an average annual rate of 13.4 percent. Following Taylor (1998), we assume $\pi^* = 2\%$ and $r^f = 2\%$. By using the 1929 output level (already below the 1928 peak), we assume no growth in productive capacity. Consequently, the interest rates derived are upper bounds.

³⁸This may be the result of both expected inflation and the budget being influenced by output; with a surging economy, both the Reich's budget and expected inflation would increase.

After the banking crisis, these relationships no longer hold. The first conspicuous difference is the increased persistence of the expectations variable – shocks barely die out at all. Any increase in expected inflation is almost permanent, unless a countervailing shock occurs. This is why the Brüning government found itself between a rock and a hard place – explosive changes in expected inflation threatened from the one side, while actual deflation accelerated. There is little to support the view that the gradual relaxation of the Reichsbank rate from December 1931 was important in lowering *ex ante* interest rates (Balderston 1993: 148, table 5.9). The Reichsbank was reacting to the beginning panic in 1931 by increasing interest rates for brief periods. Increases in the discount rate now increase expected inflation, in itself a vote of no-confidence in the stability of the macroeconomic regime.³⁹ This cautions against the suggestion in the literature that a more aggressive use of this instrument could have averted the final dip in 1932. The Reich's budget position and the monetary base are also insignificant. Thus, plans to extend the use of Rentenmarks in an effort to boost the money supply would have had little effect after the summer of 1931 (cf. Voth 1993). This argument does not excuse the deliberate austerity measures taken by the Brüning government in 1930 and 1931 (cf. Feinstein, Temin and Toniolo 1997, Temin 1990), but it cautions against the optimism inherent in many Keynesian policy suggestions.

The fact that federal deficits do not significantly impact inflationary expectations can either be interpreted to mean that contemporary anxieties on this count – such as evidenced by the reaction to the WTB-Plan – were overblown,⁴⁰ or that the increasing manipulation of the public books after 1932 (including measures such as the infamous Mefo-bills etc.) does not allow us to capture the true extent of the stimulus.⁴¹

A closer look at the timing of the turning points in the expectations series (figure 3) and of the uncertainty estimate (figure 4) suggests that there

³⁹Note, however, that the impulse response is not statistically significant from zero. To establish confidence intervals, 100 Monte Carlo simulations were run.

⁴⁰Named after its authors (Woytinsky, Tarnow, Baade), the WTB-Plan of December 1931 proposed extra spending on public works in an effort to combat unemployment. Cf. Feinstein, Temin and Toniolo 1997: 121.

⁴¹There is also no evidence that the budget balance granger-causes inflationary expectations. To test the sensitivity of this result, I interpolated the revised figures in Ritschl (1997: table A. 4). The results were unchanged.

were two main discontinuities – the reparations settlement at the Lausanne conference in the summer of 1932, and the regime shift in 1933. It is only from January 1933 onwards, after the Nazis had seized power, that deflationary expectations fall sharply. The lower discount rates introduced by the Reichsbank in late 1931 leave no discernible impact on the ex ante rates taken from the Mishkin model. The attempts under Chancellor Papen to revive the economy had not undermined the belief that future price declines were only too likely. The mild recovery of 1932 would therefore probably have petered out rather quickly, given that ex ante real interest rates were still extremely high (Temin 1990: 101, Feinstein, Temin and Toniolo 1997: 123-4). Our findings thus reinforce Temin’s argument that the new regime brought about a massive change in expectations: “The immediate recovery was the result of changed expectations when the Nazis took power. It was the result of anticipated as well as actual government activities. ... Hitler had been criticizing the deflationary policies of his predecessors for years ...”⁴² Our results also highlight a main mechanism through which changed expectations had an impact on the rate of recovery – by mitigating anticipated deflation, ex ante real rates were sharply reduced, thus boosting investment and growth.⁴³

Could a recovery have been ushered in without a “truly ... new (and horrible) regime” (Temin)? Foreman-Peck et al. (1996: 240-41) is the most recent attempt to model alternative policies.⁴⁴ Their conclusion is that a mix of enlightened monetary and fiscal policy could have averted most of the output fall during the Great Depression. Yet could such a policy have been pursued? The change in the parameters in the VAR estimated above has to be interpreted with care. Yet given the overall level of uncertainty, it is hard to see how a more interventionist policy could have been reconciled with the widespread fear of inflation. A second issue that has been hotly debated is the possible timing of a policy change, and the possibility to

⁴²Temin 1990: 103. Note, however, that this is the very period when actual deflation is less than predicted by the ARMA models (figure 1 and 2). An alternative interpretation would be that the fiscal and monetary stimulus of 1932 was beginning to work, and that, having been surprised a few times, agents in the bond market responded by revising expectations of future price changes upwards.

⁴³For the effect of deflation on industrial output in Germany, cf. Bittlingmayer 1998, table 3. Cf. also Voth 1994.

⁴⁴Cf. also Borchardt and Ritschl 1992

float the Reichsmark. Our results on the timing of changes in inflationary expectations strongly suggest that Britain's leaving the gold standard in the summer of 1931 was not the opportunity for Germany to take a similar leap. This is the very period when we find a strong divergence of expectations and reality. Uncertainty – as measured by the coefficient of variation of the inflation forecast – becomes substantial. The banking crisis, combined with news of Britain leaving gold (and the discussions in the German press whether to follow the British example or not) coincided with a degree of uncertainty that would have made any move on the part of the German government a very audacious act. It is also in this sense – by undermining the Brüning government's ability to combat the slump – that “Hitler is the foster-child of the inflation” (Robbins 1937: 5). The policy mix that Germany required could hardly have been provided by other parties. Just as in the case of four hyperinflations and during the U.S. recovery from the depression, a credible regime shift was required (Sargent 1986, Temin and Wigmore 1990). Nazi proclamations made it plain that they intended to combat unemployment and recession, using a wide array of counter-cyclical measures (Barkai 1990: 47-8). These could only be implemented if the fear of runaway inflation could be restrained. Public trust in an authoritarian regime that portrayed itself as equally committed to fighting unemployment and inflation was necessary to escape the German policy dilemma.

Evidence that further price declines were predictable as early as 1930 (with a relatively low level of uncertainty at the time) suggests that the continuation of the downturn in the economy should not have come as a surprise. If policy intervention held any promise of success, it would have had to come before the summer of 1931, when extraordinary economic and political conditions left large parts of the public jittery about inflation.⁴⁵ Borchardt (1991: 147-9) argued that policy intervention would have come too late since the truly extraordinary nature of the slump only became apparent in the second half of 1931. The first plans for deficit spending, for example, were being discussed from May 1931 onwards (the so-called Brauns memorandum). The vast majority of pump-priming plans were put forward in the second half of 1931 and early 1932. Our findings suggest an even stronger constraint for

⁴⁵Implementation of major policy initiatives before 1931 was complicated by the fact that the depression's unusual severity only became apparent at this late stage. Cf. Borchardt 1991: 146.

policy initiatives – the same events that demonstrated the unusual nature of the crisis also restricted room for manoeuvre as the public grew more concerned about the risk of renewed inflation.

During Germany’s Great Depression – with the notable exception of the second half of 1931 and early 1932 – deflation was highly predictable and should have surprised few. This finding is relevant to the debate whether monetary forces or autonomous declines in investment were crucial in causing the depression (Temin 1971, Temin 1976, Eichengreen 1992a). Since Germany experienced an unusually early onset of the depression (on some measures, the downturn already began in 1928), our estimates provide little evidence on the factors causing the start of the crisis.⁴⁶ During the early phase when it deepened, however, deflation was largely anticipated. This implies that *ex ante* real interest rates were also high, which is one of the key points on which monetarists and the autonomous-declines school differ. *Ex ante* real interest rates were at least 10 % between 1930 and 1933, reaching a peak of almost 17 % in mid-1931. Our findings thus reinforce the monetarist view, in so far as it holds that the crisis deepened because of monetary forces. This is not to discard a third alternative altogether – the debt-deflation hypothesis may be relevant during certain sub-periods. In 1931/32, for example, we find evidence that the extent of the deflation must have surprised some agents, thus potentially aggravating the difficulties of the financial system (Bernanke and Gertler 1989, 1990). While the deflation accelerated, fear of inflation is likely from the summer of 1931 onwards.

In his lectures on “Lessons from the Great Depression”, Peter Temin remarked that ‘[m]odern theories of the economy have brought expectations onto the stage as a lead actor, unlike their earlier position as extra or understudy. Our historical accounts need to follow suit’ (Temin 1990: 104). This paper has attempted to raise the curtain a little further. The results from using the Mishkin approach clearly suggest that, during the summer of 1931, evidence of investors’ nervousness left a trace in interest rates. Fear of potential inflation is likely to be the main culprit, as the bond market systematically underestimated the extent of the deflation. Note that, by using a rational expectations framework, we stacked the odds *against* such a finding – if our methodology contains any inherent bias, it is in favor of the deflation

⁴⁶Extending the forecast periods backwards to 1928 would only leave 2 years with a total of 24 observations for initial estimates.

being fully anticipated. This result receives further support from the spread of government bonds over gold-backed mortgage bonds and rye bonds, from the term structure of interest rates, and from the futures market for foreign exchange and agricultural commodities. Not surprisingly, by December 1931, the German economist Wilhelm Lautenbach used a public lecture in Berlin to argue against what he saw as rampant “inflation hysteria” (Borchardt 1985: 237).

References

- [1] Akaike, H. (1974), ‘A New Look at Statistical Model Identification’, *IEEE Transactions on Automatic Control*, AC-19, pp. 716-23.
- [2] Balderston, Theodore (1991), ‘German Banking Between the Wars: The Crisis of the Credit Banks’, *Business History Review* 65, 554-605.
- [3] — (1993), *The Origins and Course of the German Economic Crisis*, Haude & Spener: Berlin.
- [4] Barkai, Avraham (1990), *Nazi Economics. Ideology, Theory and Policy*, New Haven: Yale University Press.
- [5] Bauer, Lothar (1931), ‘Die Börsen’, *Die Wirtschaftskurve* 10/III, 246-51.
- [6] Bernanke, Ben and Mark Gertler (1990), ‘Financial Fragility and Economic Performance’, *Quarterly Journal of Economics* 105, pp. 87-114.
- [7] — (1989), ‘Agency Costs, Net Worth, and Business Fluctuations’, *American Economic Review* 79, pp. 14-31.
- [8] Bittlingmayer, George (1998, forthcoming), ‘Output, Stock Volatility and Political Uncertainty in a Natural Experiment: Germany, 1880-1940’, *Journal of Finance*.
- [9] Black, Fischer (1997), ‘Interest Rates as Options’, *Journal of Finance* 50, pp. 1371-76.
- [10] Bombach, Gottfried (1976), ‘Einleitung’, in Gottfried Bombach, ed., *Der Keynesianismus II: Die beschäftigungspolitische Diskussion vor Keynes in Deutschland. Dokumente und Kommentare*, Berlin: Springer.

- [11] Borchardt, Knut (1991), *Perspectives on Modern German Economic History and Policy*, Cambridge: Cambridge University Press.
- [12] — (1985), ‘Das Gewicht der Inflationsangst in den wirtschaftspolitischen Entscheidungsprozessen während der Weltwirtschaftskrise’, in: Gerald D. Feldman, ed., *Die Nachwirkungen der Inflation auf die deutsche Geschichte*, Munich: Oldenbourg.
- [13] — and Hans-Otto Schötz (1991), eds., *Wirtschaftspolitik in der Krise. Die (Geheim-) Konferenz der Friedrich-List-Gesellschaft im September 1931 über Möglichkeiten und Folgen einer Kreditausweitung*, Baden-Baden: Nomos.
- [14] — and Albrecht Ritschl (1992), ‘Could Brüning Have Done It? A Keynesian Model of Interwar Germany, 1925-1938’, *European Economic Review* 36, pp. 695-701.
- [15] Brayton, Flint, Andrew Levin, Ralph Tryon, and John Williams (1997), ‘The Evolution of Macro Models at the Federal Reserve Board’, *Carnegie-Rochester Conference Series on Public Policy*, forthcoming.
- [16] Brockhaus Enzyklopädie (1929), Vol. 4, Artikel ‘Deflation’, Brockhaus Verlag: Leipzig.
- [17] Bresciani-Turroni, Costantino (1937), *The Economics of Inflation. A Study of Currency Depreciation in Post-War Germany*, London.
- [18] Campbell, John and Robert Shiller (1987), ‘Cointegration and Tests of Present Value Models’, *Journal of Political Economy* 95, pp. 1062-1088.
- [19] Cecchetti, Steven (1992), ‘Prices During the Great Depression: Was the Deflation of 1930-1932 Really Unanticipated?’, *American Economic Review* 82.
- [20] — (1988), ‘Deflation and the Great Depression’, unpublished manuscript, University of Ohio, March.
- [21] Choi, In and Bhum Chung (1995), ‘Sampling Frequency and the Power of Tests for a Unit Root: A Simulation Study’, *Economic Letters* 49, pp. 131-36.

- [22] Crowder, William and Dennis Hoffman (1996), 'The Long-Run Relationship between Nominal Interest Rates and Inflation: The Fisher Equation Revisited', *Journal of Money, Credit and Banking* 28, pp. 102-118.
- [23] Deutsche Bundesbank (1976), *Deutsches Geld- und Bankwesen in Zahlen 1876-1975*, Frankfurt am Main: Knapp.
- [24] Dominguez, Kathryn, Ray Fair and Matthew Shapiro (1988), 'Forecasting the Depression: Harvard versus Yale', *American Economic Review* 78, pp. 595-612.
- [25] Eichengreen, Barry (1992a), *Golden Fetters. The Gold Standard and the Great Depression*, Oxford: Oxford University Press.
- [26] — (1992b), 'Comment: More Speculation about Destabilizing Speculation', *Explorations in Economic History* 29, pp. 93-8.
- [27] — and Jeffrey Sachs (1985), 'Exchange Rates and Economic Recovery in the 1930s', *Journal of Economic History* 45, pp. 925-946.
- [28] Einzig, Paul (1937), *The Theory of Forward Exchange*, London: Macmillan.
- [29] Evans, Martin and Karen Lewis (1995), 'Do Expected Shifts in Inflation Affect Estimates of the Long-Run Fisher Relation?', *Journal of Finance* 50, pp. 225-53.
- [30] Fama, Eugene (1990), 'Term Structure Forecasts of Interest Rates, Inflation and Real Returns', *Journal of Monetary Economics* 25, pp. 59-76.
- [31] Ferderer, J. Peter and David A. Zalewski (1994), 'Uncertainty as a Propagating Force in the Great Depression', *Journal of Economic History* 54, pp. 825-849.
- [32] Feinstein, Charles H., Peter Temin and Gianni Toniolo (1997), *The European Economy Between the Wars*, Oxford: Oxford University Press.
- [33] Foreman-Peck, James, Andrew Hughes Hallet and Yue Ma (1996), 'Optimum International Policies for the World Depression 1929-1933', *Economies et Sociétés* 22, pp. 219-42.

- [34] Frenkel, Jakob A. (1977), 'The Forward Exchange Rate, Expectations, and the Demand for Money: The German Hyperinflation', *American Economic Review* 67, pp. 653-671.
- [35] Gagnon, Joseph (1996), 'Long Memory in Inflation Expectations: Evidence from International Financial Markets', *Board of Governors of the Federal Reserve System. International Finance Discussion Papers* 538.
- [36] Gielen, Gregor (1994), *Können Aktienkurse noch steigen?* Wiesbaden: Gabler.
- [37] Hamilton, James D. (1987), 'Monetary Factors in the Great Depression', *Journal of Monetary Economics*, 19, pp. 145-169.
- [38] — (1992), 'Was the Deflation During the Great Depression Anticipated? Evidence from the Commodity Futures Market', *American Economic Review* 82, pp. 157-177.
- [39] Hautcoeur, Pierre-Cyrille and Pierre Sicsic (1998), 'Threat of a Capital Levy, Expected Devaluation and Interest Rates in the France During the Interwar Period', *Banque de France - Notes d'études et de recherche* 50.
- [40] Hendry, David F. (1993), *Econometrics. Alchemy or Science? Essays in Econometric Methodology*, Oxford: Blackwell.
- [41] Hoffmann, Walther G. (1965), *Das Wachstum der deutschen Wirtschaft seit der Mitte des 19. Jahrhunderts*, Berlin/Heidelberg: Springer.
- [42] Holtfrerich, Carl-Ludwig (1990), 'Economic Policy Options and the End of the Weimar Republic', in: Ian Kershaw, ed., *Weimar: Why Did German Democracy Fail?*, New York: St. Martins.
- [43] Hooker, Mark (1992), 'Testing for Cointegration: Power versus Frequency of Observation', *Economic Letters* 41, pp. 359-62.
- [44] Institut für Konjunkturforschung (1935), *Konjunkturstatistisches Handbuch*, Hamburg: Hanseatische Verlagsanstalt.
- [45] James, Harold (1986), *The German Slump*, Oxford: Oxford University Press.

- [46] Kroll, Gerhard (1959), *Von der Weltwirtschaftskrise zur Staatskonjunktur*, Berlin: Dunker & Humblot.
- [47] Krugman, Paul (1998), 'Japan's Trap', unpublished manuscript, Massachusetts Institute of Technology.
- [48] Mishkin, Frederic (1981), 'The Real Interest Rate: An Empirical Investigation', *Carnegie-Rochester Conference Series on Public Policy* 15, pp. 151-200.
- [49] — (1990a), 'Can Futures Market Data Be Used to Understand the Behavior of Real Interest Rates?', *Journal of Finance*, pp. 245-57.
- [50] — (1990b), 'The Information in the Longer Maturity Term Structure about Future Inflation', *Quarterly Journal of Economics* 105, pp. 815-28.
- [51] — (1990c), 'What Does the Term Structure Tell Us About Future Inflation?', *Journal of Monetary Economics* 25 (1990), pp. 77-95.
- [52] — (1992), 'Is the Fisher Effect for Real? A Reexamination of the Relationship between Inflation and Interest Rates', *Journal of Monetary Economics* 30, pp. 195-215.
- [53] Muth, J. (1960), 'Optimal Properties of Exponentially Weighted Forecasts', *Journal of the American Statistical Association* 55, pp. 299-306.
- [54] Phylaktis, Kate and David Blake (1993), 'The Fisher Hypothesis: Evidence from Three High Inflation Economies', *Weltwirtschaftliches Archiv* 29, pp. 591-99.
- [55] Ritschl, Albrecht (1997), *Deutschlands Krise und Konjunktur 1924-1934*. unpublished manuscript, Economics Department, Munich University.
- [56] Robbins, Lionel (1937), 'Foreword', in: Costantino Bresciani-Turroni, *The Economics of Inflation. A Study of Currency Depreciation in Post-War Germany*, London.
- [57] Romer, Christina (1992), 'What Ended the Great Depression?', *Journal of Economic History* 52, pp. 757-84.

- [58] Romer, Christina and David Romer (1994), 'What Ends Recessions?', *NBER Macroeconomics Annual*, pp. 13-57.
- [59] Sargent, Thomas (1986), 'The End of Four Big Inflations', in: Thomas Sargent, ed., *Rational Expectations and Inflation*, New York: Harper and Row, pp. 40-109.
- [60] Schwert, G. William (1989), 'Tests for Unit Roots: A Monte Carlo Investigation', *Journal of Business and Economic Statistics* 7.
- [61] Schwarz, Gideon (1978), 'Estimating the Dimension of a Model', *Annals of Mathematical Statistics* 6, pp. 461-4.
- [62] Sicsic, Pierre, 'Was the Franc Poincaré Deliberately Undervalued?', *Explorations in Economic History* 29, pp. 69-92.
- [63] Statistisches Reichsamt (various years), *Wirtschaft und Statistik*, Berlin.
- [64] Summers, Lawrence (1983), 'The Non-Adjustment of Nominal Interest Rates: A Study of the Fisher Effect', in: James Tobin, ed., *Symposium in Memory of Arthur Okun*, Washington: Brookings Institute.
- [65] Taylor, John B. (1998), 'An Historical Analysis of Monetary Policy Rules', unpublished manuscript, Economics Department, Stanford University.
- [66] — (1993), 'Discretion Versus Policy Rules in Practice', *Carnegie-Rochester Conference Series in Public Policy* 39, pp. 195-214.
- [67] Temin, Peter (1976), *Did Monetary Forces Cause the Great Depression?*, New York: Norton.
- [68] — (1990), *Lessons from the Great Depression*, Cambridge, MA: MIT Press.
- [69] — (1971), 'The Beginning of the Great Depression in Germany', *Economic History Review* 24, pp. 240-248.
- [70] — and Barrie Wigmore (1990), 'The End of One Big Deflation', *Explorations in Economic History* 27, pp. 483-502.

- [71] Voth, Hans-Joachim (1993), 'Wages, Investment and the Fate of the Weimar Republic: A Long-Term Perspective', *German History* 11, pp. 265-292.
- [72] — (1994), 'Zinsen, Investitionen und das Ende der Großen Depression in Deutschland', *Zeitschrift für Wirtschafts- und Sozialwissenschaften* 114, pp. 267-81.
- [73] — (1995), 'Did High Wages or High Interest Rates Bring Down the Weimar Republic?', *Journal of Economic History* 55 (4), pp. 801-21.
- [74] Webb, Steven (1989), *Hyperinflation and Stabilization in Weimar Germany*, Oxford: Oxford University Press.
- [75] — (1986), 'Fiscal News and Inflationary Expectations in Germany after World War I', *Journal of Economic History* 46, pp. 769-794.
- [76] Wolfgang, Ernst (1931), *Die Kursbildung am Rentenmarkt*, Stuttgart: Poeschel.