Economica (2001) **68**, 317–333

Wars and Markets: How Bond Values Reflect the Second World War

By BRUNO S. FREY and MARCEL KUCHER

University of Zurich

Final version received 27 June 2000.

Historical events are reflected in asset prices. Based on a unique data-set, we analyse government bond prices of Germany and Austria traded on the Swiss bourse during the Second World War. Some war events generally considered crucial are clearly reflected in government bond prices: this holds, in particular, for the official outbreak of the war and the loss and gain of national sovereignty. Other events to which historians attach great importance are not reflected in bond prices, most prominently Germany's capitulation in 1945. The analysis of financial markets provides a fruitful method for evaluating the importance contemporaries attached to historical events.

INTRODUCTION

Political events are reflected in asset prices. A good example would be the impact of the United Nations peacekeeping policy on exchange rates: while the missions in Lebanon resulted in a long-lasting positive effect on the exchange rate, no systematic changes induced by the UN sanctions could be identified in the South African exchange rates (Sobel 1998). As for wars, important events during the US Civil War have also been shown to systematically affect the exchange rate of greenbacks relative to the gold dollar (Willard *et al.* 1996).

This paper empirically analyses the relationship between financial markets and history for particular assets and for a particular period. We are interested in knowing how far major events of the Second World War are reflected on capital markets, and to what extent fluctuations of capital market values can be related to major events in that war. We concentrate on the two main actors on the side of the Axes, Germany and Austria. While in the eyes of most historians the former was mainly responsible for the outbreak of the Second World War, the latter was annexed by Germany in 1938; from then on the two countries formed Grossdeutschland, and in that capacity together became a main actor in the war.

Bond values can be hypothesized to reflect war events. In particular, traders would have been interested in knowing the likelihood of, say, a German defeat in the war, with a concomitant loss of interest payments and the capital sum at maturity. Hence we predict a fall in the bond prices should any war event negatively affect that probability, *ceteris paribus*. For Austria the situation was somewhat different. Though the Germans formally acknowledged the Austrian public debt when they annexed the country, at the same time they applied tight German foreign currency regulation to Austrian bonds (Schwab 1948). We therefore predict that the Austrian government bonds, *ceteris paribus*, experienced a fall in value with an extension of Nazi rule and a rise when its end became more likely with the end of the war.

For both Germany and Austria, we find systematic effects of major war events on asset prices. The outbreak of the Second World War on 1 September,

1939 (Germany's attack on Poland) is reflected in a major downturn of the bond values of Germany and Austria. Traders on the stock market were thus pessimistic about the success of the Nazi war machine from the very beginning. German bond prices also fell drastically when the United States entered the war in December 1941. In Austria bond prices exhibited a downward break when Germany annexed the country (13 March 1938). Another major war event was the capitulation of the German sixth Army at Stalingrad on 2 February 1943. Traditional historians give great weight to this event, often characterizing it as *the* turning point of the war (see e.g. Cartier 1978). However, the bond market foresaw the disaster much earlier: the data show a significant negative structural break in November 1942, when the Russian army undertook a large counter-offensive against the Germans and encircled the sixth Army at Stalingrad. The analysis of the asset market thus suggests that November 1942 is a more appropriate turning point of the war in the East.

As a *complementary* method for assessing the particular evaluations of events happening at a given moment of time, analysing data from financial markets has at least three advantages.

1. In analysing financial markets, we direct our attention towards the actual behaviour of thousands of people directly and indirectly engaged in stock markets (compared with the mere intentions, ideas or comments of the writers of historical documents). This greatly reduces the incentives to behave strategically.
2. People who are active on financial markets bear a high monetary risk. This gives them a strong incentive to gather all the relevant information.
3. Financial markets usually exhibit a high predictive power. This results from the activities of so-called marginal traders. This type of trader decides on a relatively unbiased basis and collects the important information carefully. In the extreme case, only one such trader could drive the market price to the underlying equilibrium price. (See the literature on the marginal trader and the Hayek Hypothesis, respectively, e.g. Smith 1982, or Forsythe *et al.* 1992.)

The remainder of this paper is organized as follows. Section I investigates the relationship between financial markets and historical events. A description and overview of the data are given in Section II and the following section presents the econometric methods used. Section IV discusses the break-points identified as well as the corresponding changes in government bond values for Germany and Austria. Section V analyses break-points in the *difference* between the German and the Austrian bond indices in order to formally test the hypothesis that the two kinds of bonds were 'politically' merged. The final section draws conclusions.

I. Financial Markets and History

Financial markets reflect the actual and expected future development of the assets in question, in particular the probability that they are serviced, paid back (in the case of bonds), and remain tradable (for instance, that no currency restrictions prohibit the repatriation of the funds invested). Financial markets are therefore not *per se* related to the fate of a nation or a population. A nation may disappear, but its financial assets may survive. Normally, however, there is

a strong correlation between the fate of a population and/or nation with the values of traded assets. In most cases, when a nation is destroyed its public debt is neither serviced any longer nor paid back at maturity, a fact that the financial markets reflect by a drop in value to zero (if there is no hope that the debt will ever be honoured). Similarly, if the population of a country is negatively affected (say by natural catastrophes or a war), the respective government may be unable to service its public debt, so that the population's fate is again reflected in the financial market.

Financial markets do not act by themselves; rather, they reflect the evaluation of historical events as well as the expectations of a particular group of persons, the *traders*. They are far from representative of the population. Nevertheless, they have strong monetary incentives to take into account the judgments of other traders in the market. A mistaken forecast, for example, directly affects their own income and wealth.

The traders deal only partly for themselves but mostly for investors, i.e. a much wider group of people. They comprise not only private capital owners but also persons acting for institutional investors such as firms and pension funds. In most cases it is unknown who the investors are; in principle, the final actors may be situated anywhere in the world. Movements on financial markets are therefore driven not only by expectations of the people directly engaged in trading, but also by actors less directly affected.

One problem that may arise by analysing financial markets is that a historical fact may have been predicted in advance by the people active on the financial markets, in which case a break should be visible *before* the event or be completely absent, depending on the speed of adjustment. Either way, no break will be visible at the date of the event itself. An example is both the outbreak and the end of a war, which in many cases is foreseen much in advance. There exists suggestive evidence however that financial markets tend to overreact to the arrival of news (see e.g. DeBondt and Thaler 1985). The overreaction hypothesis implies that, although many investors have predicted an event way in advance and financial markets have adjusted accordingly, a break in the price series can still be identified.

Historians deal with past economic and political events in a quite different way. They carefully collect and select facts and interpret them in the light of their general knowledge of the field and the particular circumstances obtaining (see e.g. Carr 1961; Handlin *et al.* 1954, or Marwick 1970, who gives extensive references to the literature). Such interpretation is necessarily *ex post facto*, i.e. after the consequent development is known. This knowledge may bias the evaluation of the events, and may lead to 'facts' being overlooked or overemphasized as the case may be. This problem is most obvious in the case of wars. Once the outcome is known—say, a crashing defeat of the country—it is difficult to analyse objectively why the decision-makers of the country engaged in the war at all. Simply to refer to a misjudgment is unsatisfactory, because it would have to be explained why such error was possible. In order to evaluate the historical situation existing at a given moment of time, historians have to take care not to impute to the then decision-makers information that was revealed only by subsequent developments.

The analysis of financial markets is certainly no substitute for the traditional inquiries undertaken by historians. But as a *complementary* method,

it has the advantage of being quantitative: i.e. it is in the tradition of the new economic history or cliometrics (see e.g. Goldin 1995; North 1977; and, critically, Davis 1968).

II. The Asset Market

During the Second World War, and often also before, all governments directly or indirectly intervened in economic markets, including stock markets. In Germany, in particular, many foreign currency restrictions with a strong influence on capital markets were either introduced or tightened up soon after the Nazi takeover, i.e. in 1933.[1] The only relevant market on which government bonds of the countries considered were freely traded was the Swiss stock exchange. For reasons of neutrality, the Swiss government controlled neither price movements nor the extent of trading, and there were almost no restrictions for foreign investors. Trading was stopped only during May and June 1940, when it was unclear whether the German forces would outflank the Maginot Line in the North, i.e. by invading Belgium and the Netherlands, or in the South (i.e. by marching through Switzerland).

Many countries issued government bonds in Switzerland during the time-span between the two world wars. In our analysis we are considering only obligations of the *national* governments. As already mentioned, we concentrate on the two main players on the side of the Axes, Germany and Austria. Converted into today's Swiss francs, the value at issue of the 31 German government bonds equalled roughly 3 billion Swiss francs,[2] while Austria borrowed about 590 million Swiss francs. Our analysis considers a weighted index of the values of all government bonds issued in Switzerland after 1922 for each of the two countries.

It is important to note that the bonds of both countries were issued and traded in Swiss francs. Bond-holders were therefore protected against debased repayments. However, changes in exchange rates could in theory alter the probability that bonds would be serviced by changing the cost to the respective government of servicing the debt. However, since exchange rates of the German mark as well as of most other currencies were fixed against the Swiss franc during the war (the sole exception was the US dollar), the latter effect probably was not of much importance to the governments.

No information is available on who traded at the Swiss stock exchange during the Second World War. But as mentioned before, even if we knew who the actual traders were, it would remain unclear whose money they invested and therefore who their *clients* were. Given the high degree of openness of the Swiss financial market, it seems likely that investors from all over Europe used this 'safe haven'.

There is, however, limited information available concerning the *extent of trading* in government bonds on the Swiss stock exchange. Unfortunately, the Swiss National Bank did not keep any records regarding the turnover in stocks or bonds. Turnover was, however, taxed by the Swiss government, and the resulting tax information can be used to estimate the extent of trading. Schwab (1948) carried out such an estimate and came up with the following results. The extent of trading in foreign government bonds in Switzerland fell from about 18 billion of today's Swiss francs in 1937 to about 3.5 billion in 1943, and rose again to

about 7 billion in 1946. German government bonds each accounted for roughly 30% of the annual turnover, whereas the respective share of Austria stood at 7%.

The Second World War 'officially' started with the German invasion of Poland on 1 September 1939, and ended in the West with the unconditional capitulation of the German forces in Reims on 7 May and in Berlin on 9 May 1945. In many respects, however, the war started earlier, e.g. with the occupation of the Rheinland by Germany in March 1936, or the invasion of Sudetenland and thereafter of the remainder of the Czechoslovak Republic in March 1939. It could even be argued that the Second World War was a direct consequence of the Nazi takeover in January 1933. In order to be able to analyse whether it makes sense to look at this period as a form of war preceding the official war dates, we include monthly data extending from December 1933 to December 1948. Owing to lack of data, we cannot go back any further even though it would be interesting to analyse the effects of the Nazi takeover. The data were collected from the *Monatsberichte der Schweizerischen Nationalbank* (monthly publication of the Swiss National Bank), January 1934–January 1949.[3]

Bond prices are affected by war events, which cause investors to believe that the respective government might default on the coupons or the capital sum at maturity, as well as on the time value of money. Hence any conditions that affect the interest rate in money markets should also affect bond prices. In our econometric work, therefore, we controlled for general market movements by introducing an index of all government bonds traded in Zurich as an explanatory variable (for details, see Section III below). Figure 1 shows the monthly index of German and Austrian government bonds traded on the Swiss stock exchange, as well as the market index. Roughly 50% of the market index

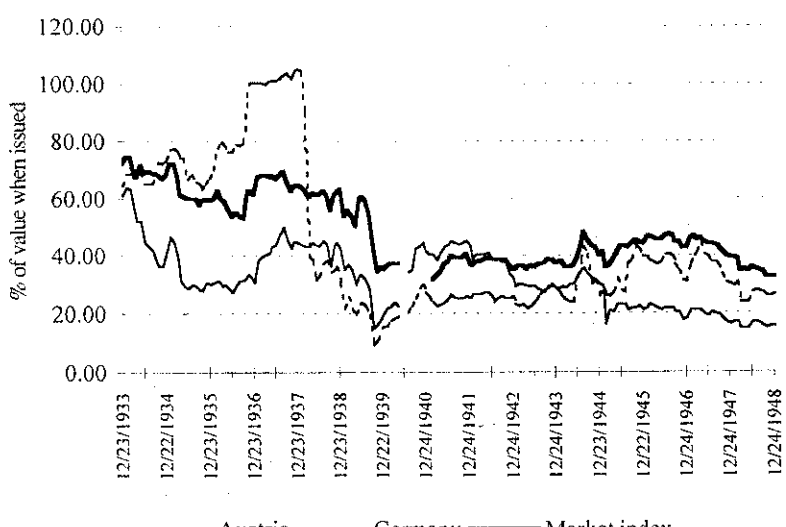

FIGURE 1. Index of the German and Austrian Government Bonds traded in Switzerland.
Source: Monthly Publication of the Swiss National Bank (SNB) 1933–1948.

consists of foreign government bonds, of which Germany and Austria hold a share of about 30% and 7%, respectively.

In the long run, there is a strong downturn in the German government bonds, which was especially marked between 1933 and 1936. This is rather surprising, as the rise of Hitler to power has often been attributed to the 'capitalists' who considered him a stronghold against communism (see e.g. Bracher 1964). The capital market offers quite a different evaluation. The bond values strongly recovered in 1937/38 but fell drastically from the middle of 1938 to the end of 1939 when war broke out. There was again a rise in the value of German government bonds after the successful *Blitzkrieg* in the beginning of 1940. But it did not last long: from the second half of 1941 on, there was a permanent fall in German bond values, indicating that the stock market soon predicted that the Nazis would lose the war, the debt would no longer be serviced, and the capital would be lost.

In contrast to Germany, the index for Austria shows a marked increase in value between 1933 and 1937. There was a huge drop with the *Anschluss* (annexation) by Germany in 1938, and the index remained significantly below the German index until 1943. Starting in mid-1944, the Austrian government bonds recovered slightly and outperformed the German index until the end of the sample period.

The evaluation of German and Austrian bond values thus differed significantly, which is an interesting fact in itself because after 1938 the two countries formally merged into one, Grossdeutschland.

III. Econometric Techniques of Analysis

The econometric method used is aimed at searching the series of German and Austrian government bond prices for structural breaks. In contrast to an event study, the starting point is *not* a list of dates with the data then telling which ones matter: rather, the method used here allows the data to speak for themselves, without *a priori* specification of the dates.

The sequential test procedure we follow is based on Banerjee *et al.* (1992).[4] The basic idea behind the procedure used is to estimate conditional random walks within small time windows and then test for differences in the means of the bond prices between these time windows. In order to find all possible turning points, a four-step procedure is applied. Steps 1–3 are used to isolate 36-month windows within which a structural break is most likely. The last step then tests for structural breaks within these windows. Applying only the last step of the procedure to the data would yield inappropriate results, since it was developed under the assumption that there is only one break-point in the series. If there were a second shift, which reversed the first, a 'normal' regression with dummies for possible breaks might very well miss both shifts. To address the problem, we look for mean shifts in rather short 'time-windows' only and use steps 1–3 to determine which periods to look at.

Step 1 Using data from a 36-month window starting December 1933, the first step implies estimating the regression

$$(1) \qquad \ln p_t = \beta_0 + \beta_1 \ln p_{t-1} + \beta_2 \ln \bar{p}_{t-1} + \varepsilon_t$$

for each of the two countries, where p_t stands for the index-value of all government bonds of the country considered on date t, $\bar{p}_t$ is the index of all government bonds traded in Zurich (which we use as a measure of the market performance as a whole), β are the parameters to be estimated and ε_t is a white-noise error term. A Wald test associated with the hypothesis that there was a shift in the mean at the midpoint of the window is then calculated. The idea behind step 1 is to estimate a random walk and then check for changes in the constant, which is the procedure followed in recent stock market studies. It implies that bond prices follow an exponential Brownian motion (an overview can be found in Duffie 1996[5]). The inclusion of a measure of market performance as a right-hand variable allows us to estimate the random walk, *ceteris paribus*. It is supposed to correct for factors that influence the value of all bonds traded (like changing real interest rates, inflation, etc.).

Step 2 The regression is estimated again in a second step, this time using a 36-month window that begins one month later, i.e. in January 1934. Step 2 is then repeated over and over, each time moving the window by one month, until the entire period has been covered. The *F*-statistics from all the Wald tests can be seen in the following section. By searching for peaks in the series of *F*-statistics, the first two steps identify the dates when the null hypothesis of no structural breaks is most strongly questioned.

Step 3 The third stage of the econometric procedure consists in selecting particular 36-month windows on the basis of the *F*-statistics computed in steps 1 and 2. Windows associated with an *F*-statistic exceeding five are considered as dates where structural breaks are most likely.

Step 4 In the last stage, we test for statistically significant structural breaks within each of the windows isolated in step 3. We do this by estimating a series of the following equations, which in comparison with equation (1) have been extended by a dummy variable as suggested by Perron (1989):

$$(2) \qquad \ln p_t = \beta_0 + \beta_1 \ln p_{t-1} + \beta_2 \ln \bar{p}_{t-1} + \gamma_s D_{st} + \varepsilon_t, \qquad \text{with } s = 6, \ldots, 42.$$

where $D_{st} = 1$ if date t is on or after date s and zero otherwise. The parameter γ_s measures a change in the conditional mean (i.e. a shift in the mean price index, *ceteris paribus*) that occurs at date s. Since all the prices are in logs, γ_s can be interpreted as the percentage change in the conditional mean. We estimate equation (2) repeatedly, each time moving s by one month. For each resulting equation, we test whether γ_s is different from zero using a conventional *F*-test. The date associated with the highest *F*-statistic is then designated as the date when the most important mean shift took place within each window. Since sequential break tests cannot identify breaks around the beginning or end of a sample, we add six observations at the beginning and at the end of the windows examined in this last step. So for the first equation estimated in step 4, s is set at date six of the new window (which equalled date one in the original window).

Three further points warrant comment. First, since the bond price series contain a unit root, test statistics based on regression residuals will have a non-

standard distribution. For step 4, we therefore generate Monte Carlo critical values for the Wald test under the null hypothesis of no structural breaks. Critical values for the *F*-tests of no breaks were approximated with 5000 Monte Carlo simulations of the equation $\ln p_t = c + \ln p_{t-1} + \varepsilon_t$, with $c = 0.1$ and s.e.$(\varepsilon_t) = 0.1$ (the rationale behind the parametric choices is that these are the average parameters resulting from equation (1)[6]). The resulting 90%, 95% and 99% critical values are 3.14, 4.32 and 8.00, respectively.

Second, we also tried to test for variations in the bond index of a specific country *relative* to the index of all government bonds traded in Zurich. That is, we rewrote equation (1) as $\ln p_t - \ln p_t = \beta_0 + \beta_1 \ln p_{t-1} + \beta_2 \ln p_{t-1} + \varepsilon_t$. Such a specification would seem to be more in line with the excess return literature frequently used in finance studies (see, e.g. Campbell *et al.* 1997). We did however find the same break-points as we did with the procedure first suggested, and the size of the effects did not change dramatically (none were reversed). Since we believe that the coefficients of the specification presented in (1) are more easily accessible, we will in the following present results from this first specification only.

Finally, in order formally to test the hypothesis that German and Austrian bonds 'politically' merged after the *Anschluss*, we analyse the differences in price movements between German and Austrian government bonds in a way similar to that suggested above. Details are presented in Section V below.

We do of course fully appreciate that the capital market is influenced simultaneously by a great many factors. The econometric method suggested here allows us to control only for some of them. Nevertheless, the results of our analysis are encouraging.

IV. Results

Germany

Steps 1–3 of our econometric analysis identified six possible break-points for Germany (as shown in Figure 2 showing the *F*-statistics). Table 1 gives a survey of the resulting break-points and the corresponding percentage changes in the conditional mean price index.

German government bonds experienced a strong upward surge beginning in the summer and autumn of 1936. In July/August of that year the conditional average index rose by more than 7%. This can be attributed to the Olympic Games in Berlin, which took place in August 1936 and which made the Nazi regime look peaceful to many; thus, the French delegation, for example, used the fascist salute upon entering the stadium at the opening ceremony. The market was bullish until January 1937, when this feature was particularly marked.

In mid-March 1938 the Nazis invaded the remaining parts of the Czechoslovak Republic (after the Sudetenland was handed over to them at the Munich Conference on 29 September 1938). According to many historians (e.g. Weinberg 1994), this heralded the beginning of the Second World War. The government bond markets support this interpretation of history. The value of German government bonds fell by no less than 17% compared with the average market values. The actors thus lost even more confidence in the

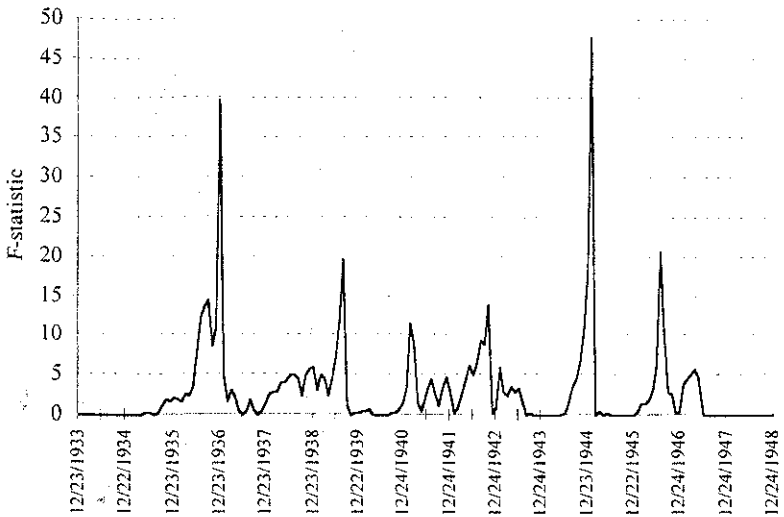

FIGURE 2. *F*-tests for structural breaks in the index of government prices, Germany 1933–1948.

TABLE 1
STRUCTURAL BREAK-POINTS AND CORRESPONDING EVENTS FOR GERMANY

Date	% change in German bond index[a]	Major events
July 1936	+7.9%**	Olympic Games in Berlin (30 July–16 Aug.)
March 1939	−17%**	Invasion of Czech Republic (15–16 March)
Sept. 1939	−38.7%**	Outbreak of war (1 Sept.)
Dec. 1941	−4.7%**	Pearl Harbor; war entry of USA (7–11 Dec.)
Nov. 1942	−6.5%**	Russian offensive at Stalingrad (Nov.–Feb.)
Feb. 1945	−34.0%**	Yalta conference (4–11 Feb.)

[a]% change in the conditional mean (i.e. the parameter γ_i from equation (2)); * and ** indicate statistical significance on the 95% and 99% confidence level, respectively.

German government's capacity to service and pay back its bonds (which had already been seriously hampered before). The invasion of the Czechoslovak Republic was the first time Hitler annexed territory beyond 'German' lands, and this was taken as an indication that he would not stop there, and that it was likely that a major war would be started. However, a degree of uncertainty remained; some actors on capital markets must have thought that the annexation of the Czechoslovak Republic would satisfy Hitler's demands. Accordingly, the value of German government bonds dropped only half as much, compared with when the war 'officially' broke out in September 1939.

The Second World War began on 1 September 1939 when German troops invaded Poland, but the stock market was already interpreting the systematic

sabre-rattling by the Nazi government in a strongly negative way at the end of 1938, when the average index fell by around 16%. The actual start of the war sent it down by 39%. This can be taken to indicate that the capital market was extremely pessimistic about the prospects of a German victory. In any case, the prospect of servicing and repayment of the German government bonds was considered to have fallen dramatically with the advent of the war.

As already noted, the Swiss stock exchange was closed in May/June 1940 so that the effects of the German *Blitzkrieg* victories are not reflected as econometrically estimated break-points in our analysis. But Figure 1 shows clearly that the average level of the German government bond values rose back to a level similar to that before the war. It is, however, worth noting that it did not rise above that level; this may be taken to indicate that after the *Blitzkrieg* peace was considered a likely prospect, with 'normal' prewar conditions expected to resume.

The fourth structural break is identified in December 1941, but the decline of average bond prices is rather small (around 5%). This reflects a major war event which was unpredictable, namely the Japanese attack on Pearl Harbor (7 December) and the consequent war declarations of the United States (and the United Kingdom) on Japan, and of Germany (and Italy) on the United States (8 and 11 December, respectively).

Yet another significant drop in German bond values (again by about 5%) occurred in November 1942. In that month the Soviet army started a large counter-offensive against the German sixth Army and parts of the fourth Panzer Army. More than 300,000 German troops were encircled at Stalingrad. The capital market considered the launching of the offensive to be more significant than the capitulation by Field Marshal Friedrich Paulus three months later (2 February 1943), when no robust break-point can be identified. The traders thus predicted the actual defeat when its first signs were visible, and not when it occurred.

The last break-point indicated by the data took place towards the end of the war. Average bond prices fell by 34% in February 1945 when the Allied forces took the Ruhr and reached the Rhine and the Soviets invaded East Prussia. It seems that the capitulation of all German troops in Rheims and Berlin (7 and 9 May 1945) had already been foreseen by the capital market when the Allied forces entered the heartland of the Reich.

Austria

The econometric analysis of the Austrian government bonds identifies five dates for possible structural breaks, of which three proved to be statistically significant in the fourth step of the econometric procedure. (See Figure 3 for the *F*-tests and Table 2 for a survey of the results.)

On 13 March 1938, Hitler declared the *Anschluss* of Austria with Germany to form Grossdeutschland. The prices for Austrian government bonds fell by no less than 46% in that month. A significant drop is visible as of the beginning of the year, when the Nazi government prepared for that event. It is noteworthy that the traders on the Swiss stock exchange did not consider the seemingly enthusiastic support of the *Anschluss* in Austria during the invasion of the German troops to be relevant for their interests. The same holds for the

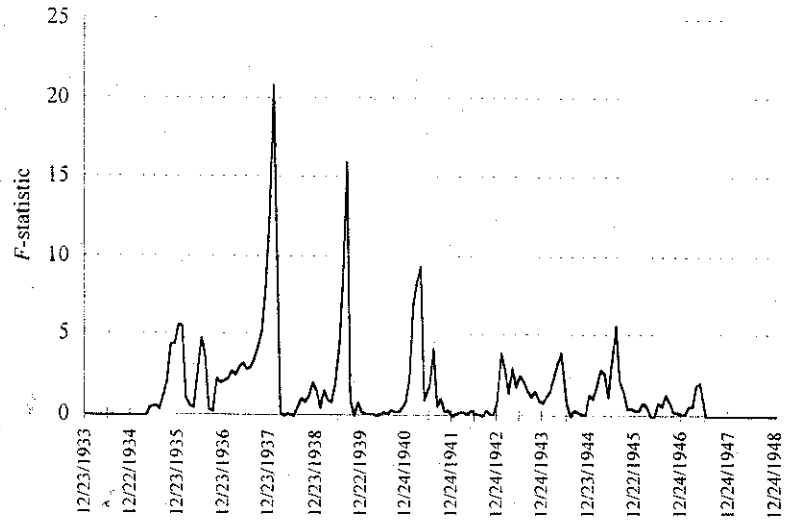

FIGURE 3. *F*-tests for structural breaks in the index of government prices, Austria, 1933–1948.

TABLE 2

STRUCTURAL BREAK-POINTS AND CORRESPONDING EVENTS FOR AUSTRIA[a]

Date	% change in Austrian bond index	Major events
March 1938	−45.7%**	Annexation of Austria
Sept. 1939	−46.2%**	Outbreak of war
Aug. 1945	+11.5%*	Potsdam Conference

[a] See Table 1 notes.

unanimous support (more than 99% of the votes) of the *Anschluss* in a plebiscite undertaken on 10 April of the same year.[7]

In tandem with Germany, the outbreak of the war strongly depressed average Austrian government bond values (again, minus 46% in September 1939).

The capitulation of the German forces (May 1945) does not appear in the data for Austria. One reason for this might be that the future of Austria was taken to be uncertain and traders could not predict clearly how it would affect that part of the Reich which, after all, was annexed by the Germans. This uncertainty was mitigated in August of the same year when the Potsdam Conference (15 July–2 August) settled crucial relevant issues for Austria. At the conference the Western Allies agreed that the newly formed Austrian government, which so far had limited executive power in the Russian sector only, would be recognized as the sole legitimized government in the whole of former Austria. Russia also agreed to conduct fair parliamentary elections in its sector. This vastly increased the probability that Austria would re-emerge as

a Western oriented, sovereign nation, which was reflected in an increase in average bond prices of 12%.

V. Did the German–Austrian Unification Affect Financial Markets?

One historically interesting question is whether the financial markets believed that Germany and Austria were politically merged for ever. Had they been fully integrated, the two bond indices should have followed the same data-generating process. This would imply that both government bond time-series would feature the same break-points. As we saw in the preceding section, this does not seem to be the case. In this section we will formally test the hypothesis by applying the same econometric technique to the differences between the German and the Austrian bond index. Formally, we rewrite equation (1) as follows:

$$(1') \qquad (\ln p_t^G - \ln p_t^A) = \beta_0 + \beta_1(\ln p_{t-1}^G - \ln p_{t-1}^A) + \beta_2 \ln \bar{p}_t + \varepsilon_t,$$

where p_t^G and p_t^A now stand for the index-value of all German and Austrian government bonds respectively on date t. The index of all government bonds traded in Zurich, $\bar{p}_t$, still corrects for the market performance as a whole, the β are the parameters to be estimated and ε_t is a white-noise error term. All other steps of the econometric procedure have been adapted analogously.

A lasting political merger between Austria and Germany should reduce the difference between the prices of the government bonds of the two nations to zero if investors were to consider it unlikely that the government of Grossdeutschland would for one reason or another decide to service only one of the former national bonds. On the other hand, changes in the differences suggest that investors expected changing probability estimates of the two countries honouring their debts. While there may be all sorts of reasons why the default probabilities of the two government bonds may increasingly differ in the course of time, the most straightforward explanation seems to be that Austria and Germany would become independent countries again.

Thus, any events that diminish the probability of Austria re-emerging as an independent state may be hypothesized to bring the Austrian bond prices closer to the German ones and therefore to reduce the difference between the two bond indices. This would result in a negative sign of the coefficient of the dummy variable measuring a break. Alternatively, events that increase the probability of Austria becoming independent again should by the same process enlarge the difference between the two bond indices and therefore show up with a positive sign. Events that do not change this probability should not show up as structural breaks.

Steps 1–3 of our econometric analysis identify six possible break-points (as exhibited in Figure 4 showing the *F*-statistics), four of which turn out to be significant on the last stage. The results from the econometric comparison can be found in Table 3. As expected, events that do not change the probability of Austria losing or regaining national sovereignty do not appear as structural breaks. This is true for a number of events, e.g. the outbreak of war or the US declaration of war on Germany. There are, however, several events that

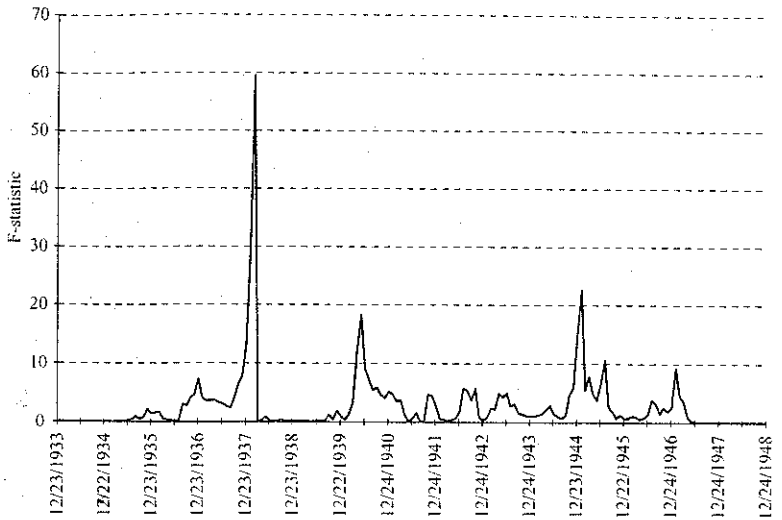

FIGURE 4. *F*-tests for structural breaks in the difference of the German and Austrian government price indices, 1933–1948.

TABLE 3

STRUCTURAL BREAK-POINTS AND CORRESPONDING EVENTS FOR DIFFERENCES BETWEEN GERMANY AND AUSTRIA[a]

Date (1)	Major historical event (2)	% change in difference of bond indices (3)
March 1938	Annexation of Austria	−75.9%***
May 1940	German invasion of Belgium, France and Holland	−7.5%***
February 1945	Yalta Conference	+30.8%***
August 1945	Potsdam Conference	+29.3%***

[a]Column (2) is the percentage change in the conditional mean of the difference between the German and the Austrian government bond index. *** indicates statistical significance on the 99% confidence level.

changed this probability. The most prominent such event is the *Anschluss* in 1938. In comparison with the German index, the annexation lowered the index of Austrian government bonds by as much as 76%. In 1940 the rapid German victories in the West also made it more likely that Austria would remain part of the German Reich for a long time.

On the other hand, the Yalta Conference made it clear that the Allied forces would accept only an unconditional surrender of Germany. Although Austria was at that time still an integral part of the German Reich, this had a very negative effect on Germany only, and almost no effect on Austrian government bonds. Thus, capital markets considered it likely that Austria

would re-emerge as a sovereign nation and hence would not be negatively affected by the Allied decisions (as can be seen by the 30% *gain* of the Austrian index over the German). The re-emergence of Austria as a sovereign nation became a fact at the Potsdam Conference. This had a positive effect on Austria but none on Germany. Hence on the capital markets a 30% gain of the Austrian over the German index resulted. These results support the view that, though Austria was officially part of 'Grossdeutschland', investors from the very beginning had had their doubts about how lasting this 'political' merger would be.

The evidence presented in the preceding two sections suggests that two main factors are responsible for movements on capital markets: (1) events that change the probability of a defeat or victory of a country are reflected in statistically significant structural break-points; and (2) the likely loss or gain of national sovereignty results in structural break-points.

VI. The Postwar Fate of Bond Prices

Readers might wonder what happened to the bond prices after the war. Was the markets' assessment that Germany and Austria would not pay for a considerable time-span correct, as is suggested by the very low value of bond prices at the end of the war?

Table 4 depicts the value of the government bonds for the two countries. The most obvious feature is that the countries' bond prices developed very differently. While Austrian bond prices reached par as early as late 1952, it was not until 1956 that German government bonds did so.

Common to Germany and Austria is the fact that their postwar governments did acknowledge all of the foreign debt and that eventually both resumed servicing it.[8] However, the two countries differed considerably when it comes to the date they resumed servicing their foreign debt. There is a large amount of literature on when and why governments repudiate debts.[9] Several models ask under which conditions regimes decide to repudiate debt run up either by earlier regimes or in the service of aims for which they do not think their people should pay (like fighting against the Nazis). In the light of these

Table 4

Values of Government Bonds of Four European Countries Traded in Switzerland after the Second World War

	% of value at issue	
Date	Germany	Austria
December 1945	21.18	39.99
December 1947	16.72	30.40
December 1949	39.50	49.03
December 1951	48.15	64.09
December 1953	89.89	102.95
December 1955	99.84	108.54

Source: *Monatsberichte* of the Swiss National Bank (SNB), 1948–56.

models, it seems quite clear that those countries that rely most heavily on new foreign credits try to resume payments as soon as possible. For the two countries considered here, Austria relied much more on foreign credits than did (Western) Germany.

Austria's stronger dependence on foreign credits is strongly related to the fact that the densely inhabited eastern part of Austria came under Russian control after the war. This had two effects. On the one hand, the Russian army dismantled almost all production facilities that were not destroyed during the war and took them back to the Russian mainland. On the other hand, it remained unclear under what conditions the Russians would eventually withdraw and whether they would ever grant Austria independence as a Western country. This made the United States reluctant to grant financial aid to Austria, and since the new Austrian government could not hope for financial help from Russia, it saw itself confronted with the necessity to borrow from the capital market. In order to increase its financial credibility, therefore, Austria resumed interest payments soon after the United States stopped their financial aid in 1950 and its government bonds reached par in late 1952.

The situation was somewhat different for Germany. Upon its establishment, Western Germany took over all foreign obligations of the Nazi government to the Western countries. Also, Western Germany was under Western occupation only and received substantial US foreign aid. The German government therefore was under less pressure to borrow on the capital market. For this reason, it was totally unclear whether Germany would ever repay its (foreign) debt until the currency reform in 1948. As a consequence, the price of the German government bonds fell to an all time low of roughly 15% of par. It was only in 1953 that, under British and Swiss pressure, Germany signed the London as well as the Swiss treaty under which it began to service English and Swiss foreign debt in August 1953. Full servicing of all foreign debts was resumed in the third quarter of 1954.[10] One year later, in the last quarter of 1955, the German government bonds traded in Switzerland reached par again.

VII. Conclusions

Looking at asset prices traded on bond markets 'provides a useful way for studying how people in the past responded to various events ...' (Willard *et al.* 1996, p. 1017). This represents a new way of interpreting the importance that thousands of people directly and indirectly engaged in stock exchanges attributed to various war events. Such an approach in no way substitutes for an historical analysis, but it complements it in a useful way. It thus constitutes a further step in the direction of a quantitatively oriented history undertaken by economists.

We find that some events connected with the Second World War, and generally taken to be of first-rate importance, are clearly reflected in government bond prices. This holds in particular for the beginning and the end of the war. For both Germany and Austria, the outbreak strongly depressed asset values. Traders thus considered the war to be a very negative event for the two countries responsible for it. The end of the war was considered negative for Germany but positive for Austria.

Two further events deserve to be singled out. The Olympic Games of 1936 was not only a propaganda scoop but also positively affected the evaluation of the Nazi government among stock exchange traders. On the other hand, the annexation of Austria by Germany in 1938—which seemed as if it was overwhelmingly and passionately welcomed by the Austrian population—negatively affected the evaluation of Austrian government bonds. Even more surprisingly, the Austrian government bonds fell well below the evaluation of the German bonds, even though Germany and Austria formally merged into one country and Germany acknowledged all Austrian debt. Moreover, we have presented evidence that, at least from 1943 on, Austria was no longer considered an integral part of Grossdeutschland by the bond markets.

The analysis undertaken here suggests that bond market traders were quite successful in their evaluation of the future course of political and military events. The Second World War was from the very beginning considered to be a losing enterprise for Germany and a deadly threat to German public foreign debt—quite in contrast to the gains in land, resources and power that the Nazi leaders promised their subjects. It also shows that asset markets are able to foresee particular events, such as the defeat of the German forces at Stalingrad, weeks if not months before they actually occurred. This is not too bad a record, which may be of considerable use for the interpretation of history.

ACKNOWLEDGMENTS

We are grateful to Gary S. Becker, Knut Borchardt, Robert Chirinko, Werner De Bondt, Reiner Eichenberger, Lars Feld, Lorenz Coette, Timothy Guinnane, Jakob de Haan, Gebhard Kirchgaessner, Felix Oberholzer-Gee, Jan Osterloh, Juerg de Spindler, Peter Stolz and Isabelle Vautravers for their helpful comments.

NOTES

1. Many capital restrictions in Germany had already been introduced during the banking crises in September 1931 and were only tightened up by the Nazis. There were, however, some additional restrictions, such as those concerning the transfers of interest payments that were introduced by the Nazis.
2. All amounts indicated in this paragraph are in 1999 Swiss francs. For the conversion of Second World War prices into 1999 Swiss francs, we only took inflation into account. Since the Swiss CPI is nowadays about 6.9 times higher than during the war, values at issue were multiplied by 6.9 in order to get 1999 Swiss francs. So, for example, the actual value for the 31 German government bonds at time of issue was only roughly 460 million wartime Swiss francs. However, some researchers (like Jost 1998) point out that not only inflation but also the development over time of national income should be taken into account when converting wartime prices. This, of course, would yield considerably higher values in 1999 Swiss francs.
3. The data can be found in tables 14 (1934–38 and 1941–46), 18 (1939), 17 (1940) and 12 (1947–49).
4. A similar procedure is applied by Sobel (1998), and by Willard *et al.* (1996) in their analysis of the Greenback market.
5. In fact, we did also run a regression with autoregressive processes of up to sixth order, but did not find any different results.
6. Note that Banerjee *et al.* (1992) applied a similar test procedure. However, while their test statistic is $\tilde{F}_T^{\max} \equiv \max_k \tilde{F}_T(k)$, we fixed k in the middle of the windows and used $\tilde{F}_T(k)$ instead.
7. Approximately 4,453,000 of the 4,484,000 electorate voted 'yes', only 11,924 voted 'no' and 5776 spoilt their papers (Henschy 1989).
8. However, neither of the two countries offered investors compensation for the forgone interest payments during the war.
9. For a good survey on how debts were repudiated in the 1930s, see Eichengreen and Portes (1986).
10. See, e.g. *Die Wirtschaftslage*, 1953–54.

REFERENCES

BANERJEE, A., LUMSDAINE, R. L. and STOCK, J. H. (1992). Recursive and sequential tests of the unit root and trend break hypotheses: theory and international evidence. *Journal of Business and Economic Statistics*, **10**, 271–87.

BRACHER, K. D. (1964). *Die Auflösung der Weimarer Republik: Eine Studie zum Problem des Machtzerfalls in der Demokratie*, 4th edn. Villingen: Ring.

CAMPBELL, J. Y., LO, A. W. and MACKINLAY, C. A. (1997). *The Econometrics of Financial Markets*. Princeton, NJ: Princeton University Press.

CARR, E. H. (1961). *What is History?* London: Macmillan.

CARTIER, R. (1978). *La seconde guerre mondiale*. Paris: Larousse.

DAVIS, L. (1968). And it will never be literature: The New Economic History: a critique. *Explorations in Economic History*, **6**, 75–92.

DEBONDT, W. and THALER, R. (1985). Does the stock market overreact? *Journal of Finance*, **40**, 793–805.

DUFFIE, D. (1996). *Dynamic Asset Pricing Theory*. Princeton, NJ: Princeton University Press.

EICHENGREEN, B. and PORTES, R. (1986). Debt and default in the 1930s: causes and consequences. *European Economic Review*, **30**, 599–640.

FORSYTHE, R., NELSON, F., NEUMANN, G. R. and WRIGHT, J. (1992). Anatomy of an experimental political stock market. *American Economic Review*, **82**, 1142–61.

GOLDIN, C. (1995). Cliometrics and the Nobel. *Journal of Economic Perspectives*, **9**, 191–208.

HANDLIN, O. *et al.* (1954). *The Harvard Guide to American History*. Cambridge, Mass.: Harvard University Press.

HENSCHY, R. (1989). *Freedom at Midnight. Austria 1938–55: A Story of the Traumatic Years of Occupation*. Worcester: Billings & Son.

JOST, H. U. (1998). *Politik und Wirtschaft im Krieg: die Schweiz, 1938–1948*. Zürich: Chronos.

MARWICK, A. (1970). *The Nature of History*. London: Macmillan.

NORTH, D. C. (1977). The New Economic History after twenty years. *American Behavioral Scientist*, **21**, 187–200.

PERRON, P. (1989). The Great Crash, the oil price shock and the unit root hypothesis. *Econometrica*, **57**, 1361–1401.

SCHWAB, H. (1948). *Der Schweizerische Effektenmarkt 1936–1946*. PhD dissertation, University of Zurich.

SMITH, V. L. (1982). Markets as economizers of information: experimental examination of the 'Hayek Hypothesis'. *Economic Inquiry*, **20**, 165–79.

SOBEL, R. S. (1998). Exchange rate evidence on the effectiveness of United Nations policy. *Public Choice*, **95**, 1–25.

WEINBERG, G. L. (1994). *A World at Arms: A Global History of World War II*. Cambridge: Cambridge University Press.

WILLARD, K. L., GUINNANE, T. W. and ROSIN, H. S. (1996). Turning points in the Civil War: views from the greenback market. *American Economic Review*, **86**, 1001–18.