American Economic Review 2024, 114(1): 134–168
https://doi.org/10.1257/aer.20221479

The Ends of 27 Big Depressions[†]

By Martin Ellison, Sang Seok Lee, and Kevin Hjortshøj O'Rourke*

How did countries recover from the Great Depression? In this paper, we explore the argument that leaving the gold standard helped by boosting inflationary expectations, lowering real interest rates, and stimulating interest-sensitive expenditures. We do so for a sample of 27 countries, using modern nowcasting methods and a new dataset containing more than 230,000 monthly and quarterly observations for over 1,500 variables. In those cases where the departure from gold happened on well-defined dates, inflationary expectations clearly rose in the wake of departure. Instrumental variable, difference-in-difference, and synthetic matching techniques suggest that the relationship is causal. (*JEL* E31, E32, E42, E43, F30, N10, N20)

What does it take to end a big depression? Maybe history can provide us with guidance. In this paper we study the end of the Great Depression in 27 countries. Many authors, notably Eichengreen and Sachs (1985), have suggested that leaving the gold standard was a prerequisite for recovery. How true was this in general?[1] And if going off gold and recovery were linked to each other, then what was the mechanism? Monetary loosening, in the form of lower nominal interest rates? Beggar thy neighbor currency devaluations (Bouscasse 2023)? Fiscal expansion, as intellectual straitjackets were jettisoned along with the peg to gold? Or did going off gold matter in some other way?

*Ellison: University of Oxford (email: martin.ellison@economics.ox.ac.uk); Lee: Bilkent University (email: sang.lee@bilkent.edu.tr); O'Rourke: NYU Abu Dhabi (email: ko37@nyu.edu). Emi Nakamura was the coeditor for this article. O'Rourke acknowledges the financial support of the ERC, under the European Union's Seventh Framework Programme (FP7/2007–2013), ERC grant agreement 249546, as well as the support of the NYU Abu Dhabi Faculty of Social Science. We are grateful to the following for helpful comments: Ben Bernanke, Stephen Broadberry, Eric Chaney, Barry Eichengreen, Benjamin Elsner, Rui Esteves, Giovanni Federico, Refet Gürkaynak, George Hall, Jean Imbs, Harold James, Raša Karapandža, Morgan Kelly, Dennis Novy, Angela Redish, Gary Richardson, Catherine Schenk, Nathan Sussman, Alan Taylor, Gianni Toniolo, Hans-Joachim Voth, and seminar participants at Bilkent University, CEPR Economic History Symposium, ESSIM, European Macro History Online Seminar, Federal Reserve Bank of Chicago, SECHI, Turku School of Economics, University College Dublin, University of Bonn, University of Oxford, and Northwestern University. Gianni died recently and we dedicate this article to his memory. Three referees, as well the coeditor, made numerous suggestions that improved the paper immensely, and we thank them all most sincerely. Special appreciation goes to Alan Fernihough and Ritva Ellison for their assistance in preparing the data, and to Jonathan Lee and Jerome Sajan Varghese for their excellent research assistance. The usual disclaimer applies.

[†]Go to https://doi.org/10.1257/aer.20221479 to visit the article page for additional materials and author disclosure statements.

[1]Campa (1990) extended the Eichengreen and Sachs argument from Europe (which was their focus), to Latin America, and found that their argument held there as well. See also Bernanke and Carey (1996) and Obstfeld and Taylor (2004).

The title of this paper is of course a tribute to Thomas Sargent's celebrated article on the end of four central European hyperinflations in the aftermath of World War I. Just as Sargent (1982) argued that changing expectations was central to halting hyperinflation, we argue that changing expectations was central to stopping the Great Depression. And just as he argued that going back on gold, or pegging to the dollar, was essential to replacing expectations of continuing hyperinflation with expectations of stable prices, we argue that leaving gold was essential to replacing expectations of continuing deflation with expectations of stable or increasing prices. The result was a collapse in real interest rates, a rebound in interest-rate-sensitive expenditure, and economic recovery. In both cases it took a regime shift to change expectations. As Sargent stressed, a simple change in policies would not have sufficed. Our paper offers a historical bookend to his argument: the monetary institution that allowed individual countries to escape hyperinflation in the 1920s had to be abandoned in the 1930s so that the world could escape the Depression.

We are not the first people to argue that going off gold mattered because it signaled to economic agents that the policy regime had shifted and that the era of deflation was over (Romer 2014). This paper is, however, the most comprehensive study to date on the topic, breaking new ground not only in its country coverage but also in the methods used. Fisher (1935) was an early advocate, in a contribution that was often overlooked before being revived by Dimand (2003). Read in conjunction with his better-known debt-deflation theory of the Great Depression (Fisher 1933), the piece suggests that Fisher saw price dynamics as central to both the start and end of the Great Depression. Temin and Wigmore (1990) made the case for the United States in a paper which cites Sargent in theoretical support of their argument, and whose title also mirrors his. Temin reprised the argument in his Lionel Robbins Lectures (Temin 1991), and Romer (1992) took it one step further by estimating US real interest rates using the single equation methods of Mishkin (1981) and quarterly data. In her account, an autonomous inflow of gold from Europe shifted US price expectations in an inflationary direction and enabled the economy to recover. More recently, Eggertsson (2008) embedded the argument within a theoretically well-specified dynamic stochastic general equilibrium model, while Jalil and Rua (2016) and Binder (2016) provided empirical support using narrative evidence. Similar arguments have also been made for Japan and the United Kingdom (Shibamoto and Shizume 2014; Chouliarakis and Gwiazdowski 2016).

We focus on the links between going off gold, inflation expectations, real interest rates, and economic recovery, extending the argument along two dimensions. First, we provide empirical evidence for 27 countries, many more than other work has analyzed. Second, we estimate inflation expectations using state-of-the-art dynamic factor models that take all the real-time data available into account, rather than relying on single equation techniques. With a greatly expanded dataset and a valid econometric technique, we compare the separate contributions of the nominal interest rate and inflation expectations to changes in ex ante real interest rates, economic recovery, and the ends of 27 big depressions. Causality is addressed using instrumental variables (IV), difference-in-difference (DiD), and synthetic control methods.

Dynamic factor models are ideal for our purpose, keeping track of expectations in real time by updating model forecasts whenever there is news in the latest releases

of a large number of economic indicators. Developed to assist decision-making in modern central banks, the method for extracting inflation expectations mirrors that employed to produce the New York Fed Staff Forecast. We use 778 variables to estimate our dynamic factor models, taken from a newly assembled database of over 1,500 cleaned and cross-validated series for 35 countries, which are in turn based on more than 6,800 original "raw" series. All data are being made available to other researchers via the internet.

There is an extensive literature on historical inflationary expectations (Binder 2016) to which this paper contributes. This includes several papers on the Great Depression, although most of those focused on the question of whether or not the deflation of the downturn was expected, rather than on the role of expectations during the recovery (Dominguez, Fair and Shapiro 1988; Hamilton 1992; Cecchetti 1992; Evans and Wachtel 1993; Klug, Landon-Lane and White 2005; Romer and Romer 2013; Binder 2016; Saleuddin and Coffman 2018). There is also a large literature on the role of monetary policy during the Great Depression and subsequent recovery in the United States, notably Friedman and Schwartz (1963), but including more recent model-based contributions such as Christiano, Motto and Rostagno (2003). The contribution of Eichengreen and Sachs (1985), in whose steps we follow, was to analyze monetary policy in the United States (and elsewhere) in an international context, viewing the Depression as a global phenomenon linked to widespread adherence to the gold standard. Choudhri and Kochin (1980) identify the effect of selected European countries being on gold using the experience of Spain, a country that never was. As indicated at the outset, leaving gold could have facilitated recovery in a variety of ways. For example, Hausman, Rhode, and Wieland (2019) show that leaving the gold standard led to economic recovery in the United States by boosting farm prices, incomes, and expenditure. Inflation could thus have had a direct impact on economic activity in an environment where highly indebted farmers had a relatively high marginal propensity to consume. Jacobson, Leeper, and Preston (2023) argue that leaving gold converted what had been real US government debt to nominal debt, making possible a policy of unbacked fiscal expansion that made an important contribution to US recovery. Our expectations mechanism provides another, complementary, channel through which leaving the gold standard could have facilitated recovery, and we show that it was at work in many countries.

The papers which are closest to us in spirit are Dorval and Smith (2015), Hamilton et al. (2016), Albers (2018), and Daniel and Steege (2020). Dorval and Smith calculate expected and unexpected inflation in over 20 countries during the interwar period. They use univariate methods, and their interest is in the relationship between inflation and output growth. Hamilton et al. (2016) estimate ex ante real interest rates for 15 countries between 1858 and 2014. They use annual data and single equation methods, and do not have our focus on the Depression. Albers independently collected data from the same interwar data sources that we use. He extracted about 1,150 time series from the sources, and used these to derive monthly economic activity indices for 28 countries. We have collected and cross-validated in excess of 1,500 time series for 35 countries, based on an even larger dataset; more importantly, we use these to trace the links between going off gold, inflationary expectations, real interest rates,

and economic recovery. Like us, Daniel and Steege (2020) use a dynamic factor model to calculate expected inflation in Germany. They conclude that the German recovery was not due to an increase in inflationary expectations (see also Voth 1999). The New York Fed model that we use is a more recent variant of this class of models; more importantly we look at the experiences of 27 countries, not just Germany.

In Section I we introduce the data and document our sources. Section II explains the methodology used to estimate real-time inflation expectations and ex ante real interest rates. The estimates are compared with other evidence on inflation expectations in Section III. Section IV discusses the surprisingly tricky issue of when to date countries' departure from gold. Sections V, VI and VII explore the relationship between going off gold, inflation expectations, and economic recovery. Section VIII uses IV, DiD, and synthetic matching techniques to argue that these relationships are causal. Section IX concludes.

I. Data

The principal data sources for our study are the *International Abstract of Economic Statistics* (Tinbergen 1934; Derksen 1938) and the *Statistisches Handbuch Der Weltwirtschaft* (1936, 1937). The former were compiled by the International Conference of Economic Services and the International Statistical Institute, based on information provided by national statistical institutions and economic research institutes; Jan Tinbergen edited the first volume. The latter was published by the German Statistiches Reichsamt, and relied on data gathered from national statistical offices, the League of Nations, central banks, periodicals, and other sources. These publications provide detailed and comprehensive information on a large number of economic indicators in many countries, at monthly and quarterly frequencies from January 1919 to December 1936. The indicators include a wide range of economic and financial data, such as prices and quantities at both the aggregate and the industry level, volumes and values of aggregate and disaggregated international trade, prices and quantities in financial markets, and measures of labour market conditions. Albers (2018) discusses the quality of the data in his own work on the Great Depression, concluding that the compendia provide a reliable and invaluable source for interwar macroeconomic time series. He also notes that contemporaries praised the *Handbuch* for its coverage and accuracy (Mitić 1936).

We began by digitizing 2,115 monthly and quarterly series from the *International Abstract* (204,330 observations), and 4,673 series from the *Statistisches Handbuch* (282,776 observations). We then constructed a cleaned and cross-checked database based on these raw data. When the same series appeared in both sources we combined them into a single variable, checking for consistency and making any necessary adjustments (for example, because of differing base years). When a variable could not be harmonized, it was dropped from the analysis. We then cross-validated the surviving series, using the NBER Macrohistory database, the *Federal Reserve Bulletin* (FRB), and the International Statistical Yearbooks of the League of

Nations.[2] We ended up with a database containing 1,573 series and 233,040 observations covering 35 countries.

The paucity of data for Brazil, Chile, Greece, Latvia, Norway, Romania, and Yugoslavia precluded their inclusion in this study. We also omitted Spain from the analysis because it did not join the gold standard after World War I (Choudhri and Kochin 1980), although the Spanish data are included in the online database for completeness. This left us with 27 countries: Argentina, Australia, Austria, Belgium, British India, Bulgaria, Canada, Czechoslovakia, Denmark, Dutch East Indies, Estonia, Finland, France, Germany, Hungary, Italy, Japan, Lithuania, the Netherlands, New Zealand, Peru, Poland, South Africa, Sweden, Switzerland, the United Kingdom, and the United States. Variables are not used in estimation if they display large instability or do not appear to help reduce forecast errors. For example, the gold stock in British India is not utilized because it became much more volatile after September 1931, while there is little gain in including all 18 subcategories of the Wholesale Price Index for Germany. This leaves us with 778 series that capture the major data categories in each country. They are available online, along with the original raw data and the cleaned 35-country database.[3]

Given our paper's emphasis on the role of ex ante real interest rates, we draw particular attention to our preferred measures of the nominal interest rate, inflation, and aggregate output. For the nominal interest rate, we follow Romer (1992) in using three to six month market interest rates wherever possible, with the central bank discount rate acting as a proxy for countries where market rates are unavailable. For inflation, we focus on the 12-month change in the wholesale price index as this is the most commonly available measure across our sample of countries.[4] For Bulgaria and South Africa where a consistent monthly wholesale price index is unavailable, we select 12-month changes in a cost of living index. Aggregate output is measured by the index of total production or its variant whenever feasible; otherwise it is proxied by the quantity of a key product or commodity produced. A summary of the preferred measures for each country is in online Appendix A.

Camacho, Lovcha, and Perez Quiros (2015) argue that it is better to seasonally adjust each data series before estimating a factor model, and we follow their approach. Most of the output data we use are already seasonally adjusted, and there is unlikely to be significant seasonal variation in nominal interest rates, but price series in our data sources are generally not adjusted for seasonality. To circumvent the problem, we use 12-month changes in price levels and apply statistical tests to check that the resulting series are free of residual seasonality. We also confirm that there is no seasonal variation in our estimates of the real interest rate.[5]

[2] https://www.nber.org/research/data/nber-macrohistory-database, Federal Reserve Board (1919 and subsequent years), League of Nations (1926 and subsequent years).

[3] The data are available at https://cepr.org/node/402920.

[4] Our decision to focus on wholesale prices may not be innocuous. However, if the Fisher (1933) debt deflation theory is correct then what matters is the price index relevant for the most indebted agents. Jordà, Schularik and Taylor (2016) calculate that the average share of mortgages in total bank lending across 17 advanced economies in 1929 was only about 30 percent. With the much larger non-mortgage lending being dominated by firms, expectations of wholesale price inflation are likely to have been central to economic recovery.

[5] For example, we test for seasonality by applying the X-13ARIMA-SEATS procedure to our 12-month change measures of inflation. The procedure is employed as standard by the US Census Bureau and subsumes practically all known methods of seasonal adjustment. It finds no evidence of residual seasonal variation in our inflation or real interest rate measures.

II. Methodology

The ex ante real interest rate is defined by the Fisher equation as the difference between the current nominal interest rate and the expected rate of inflation over the next 12 months. To keep track of the real interest rate, we therefore need an estimate of forward-looking inflation expectations that is updated in real time as new macroeconomic data are released. Fortunately for us, the real-time estimation of inflation expectations is a core input to decision-making in modern monetary policy-making. Central banks worldwide have therefore developed sophisticated nowcasting and forecasting techniques that we can apply retrospectively to our data. In essence, our estimate of the real interest rate is that which a modern central bank would have made had they been exposed to the flow of information released from January 1919 to December 1936.

We adopt the nowcasting methodology of Bańbura et al. (2010) and Bańbura and Modugno (2014) that is used to construct the New York Fed Staff Nowcast.[6] The version we employ is documented in Bok et al. (2018). The method builds on the machinery of dynamic factor models, which view movements in observed data as driven by a limited number of latent factors. This conceptual reduction allows us to analyze our large and complex dataset in a statistically consistent and tractable manner. In particular, we can account for the impact of new data releases on forward-looking real-time inflation expectations, which is crucial for tracking movements in the ex ante real interest rate. The method is conveniently able to handle data with different sample lengths, publication delays, reporting frequencies, and missing observations. Historical data are replete with such problems, so adopting the nowcasting methodology improves upon earlier historical studies based on more traditional factor models (e.g., Ritschl, Sarferaz, and Uebele 2016; and Albers 2018).

In our dynamic factor model, the large set of variables observed for each country is related to a small number of country-specific latent factors and idiosyncratic components. The number of variables to be explained ranges from a minimum of 11 in Lithuania to a maximum of 49 in Canada. These are related to r dynamic factors. To be precise, observations $y_{i,t}^{j}$ of variable i in country j and period t are explained by country-specific latent factors $f_{1,t}^{j}, \ldots, f_{r,t}^{j}$ and an idiosyncratic component $e_{i,t}^{j}$:

$$y_{i,t}^{j} = \mu_{i}^{j} + \sum_{k=1}^{r} \lambda_{i,k}^{j} f_{k,t}^{j} + e_{i,t}^{j} \quad \text{for} \quad i = 1, \ldots, n. \tag{1}$$

The observed variables are related to the dynamic factors through the estimated factor loadings, $\lambda_{i,1}^{j}, \ldots, \lambda_{i,r}^{j}$, with the idiosyncratic component capturing sources of variation unrelated to the factors. The latent factors and the idiosyncratic components are assumed to follow autoregressive processes:

$$f_{k,t}^{j} = \alpha_{k}^{j} f_{k,t-1}^{j} + u_{k,t}^{j} \quad \text{for} \quad k = 1, \ldots, r, \tag{2}$$

$$e_{i,t}^{j} = \rho_{i}^{j} e_{i,t-1}^{j} + \varepsilon_{i,t}^{j} \quad \text{for} \quad i = 1, \ldots, n, \tag{3}$$

[6] The New York Fed Staff Nowcast is at https://www.newyorkfed.org/research/policy/nowcast.

where the variance-covariance matrices of the innovations are set as diagonal to facilitate estimation, as common in the literature (Bok et al. 2018).

Equations (1)–(3) form a state space model in which (1) is the measurement equation and (2) and (3) are state transition equations. The system is estimated using the Kalman filter and maximum-likelihood methods, and forecasts for key variables are constructed from forecasts of the latent factors and idiosyncratic components by applying the appropriate factor loadings. Of special interest is expected inflation over the coming 12 months, which requires a forecast at time t of $y^{j}_{1,t+12}$ if the first observable variable in country j is the 12-month change in prices:

$$E_t y^{j}_{1,t+12} = \hat{\mu}^{j}_{1} + \sum_{k=1}^{r} \hat{\lambda}^{j}_{1,k}\left(\hat{\alpha}^{j}_{k}\right)^{12} \hat{f}^{j}_{k,t} + \left(\hat{\rho}^{j}_{1}\right)^{12} \hat{e}^{j}_{1,t}. \tag{4}$$

A dynamic factor model is estimated separately for each country. We adopt the four latent factor structure of the New York Fed Staff Nowcast model, which features a single factor that loads on all variables and three additional factors that load on real, financial, and labour market variables, respectively. For countries that lack consistent labour market data for the whole sample period, we omit the labour factor and estimate a model with only three latent factors. Data are transformed where necessary and checked for stationarity using the augmented Dickey-Fuller (ADF) and Phillips-Perron tests. For those variables with missing values where standard tests cannot be applied, we find stationarity-inducing transformations by evaluating the series graphically. Our results are robust to suitable alternative specifications with different numbers of dynamic factors or lags in the autoregressive process; the specification of the model estimated for each country is provided in online Appendix B.

Our focus on the real-time updating of inflation expectations means that we need to identify what data were available when and control for the dates at which new information is released. The principal data sources are not helpful in this respect, but the *Federal Reserve Bulletin* is published monthly and so allows us to check the data in real time and see the delay with which each variable is reported in many of our countries. We use evidence from bulletins published between January 1919 and December 1936 to estimate the release date for each type of variable. For example, the May 1926 edition reports wholesale price indices from 24 out of our 27 countries. Of those, 18 relate to prices in March 1928 and two to prices in April 1928. The information was cabled to the Fed from various foreign statistical offices, suggesting widespread availability of price data with a two-month delay. Broadly speaking, prices, sales, logistics/transportation, and financial quantities are released with a delay of two months; production, labour, and international trade with a delay of three months. Financial prices are observed immediately. We apply the same structure to all countries, on the understanding that alternative assumptions regarding release delays may affect the precise timing of monthly forecast revisions but are unlikely to fundamentally change the evolution of 12-month change forecasts one or more years ahead. The assumption that financial prices are observed without delay is in any case uncontroversial.

The dynamic factor models are initially estimated using data from the period before the Great Depression. For all but Denmark, the Dutch East Indies, Finland, New Zealand, and Belgium, we start estimation with data from January 1919 to

January 1928, one year before the Great Depression began in the United States.[7] After the initial period, the models are reestimated semiannually each January and July using expanding windows that incorporate the latest observations. This ensures that we are always making appropriate pseudo out-of-sample forecasts for the period after the start of the Great Depression.[8] Full details of the data used to estimate each country's model are in online Appendix B. As we will see below, the results are consistent with the established narrative about how big depressions ended in well-studied countries. This serves as a proof of concept for our empirical approach, validating our application of the same method to the analysis of the many countries in our sample whose interwar economic experiences have been relatively less studied.

Forecasts from the dynamic factor model depend on the latent factors whose estimates evolve as new information becomes available. Updates to the forecasts are driven by changes in these estimates, which in turn depend on the amount of news in each new data release and the importance of that news to the variables of interest that are being forecast. The dynamic factor model methodology calculates these automatically, and allows us to track how forecasts are updated as new information is released.

III. Other Evidence on Inflation Expectations

The estimates of expected inflation produced by our dynamic factor models are the optimal forecasts of agents who use a dynamic factor structure to interpret the real-time data flows we have collated. This raises questions about the appropriateness of our exercise. Did agents at the time have access to our real-time dataset and did they behave as if they used a dynamic factor model to interpret the data and form inflation expectations? If we see now that some data predicted inflation, was that understood at the time?[9] If expectations had been surveyed, then we could straightforwardly assess our approach by showing that our estimates of expected inflation were consistent with those in the surveys. Unfortunately, systematic surveys of inflation expectations are not available until much later.

Figure 1 presents estimates of expected inflation in Germany and the United States taken from Voth (1999) and Binder (2016) respectively, alongside those produced by our dynamic factor model. The comovement for Germany is high, which is not surprising given that Voth's estimate is from a statistical model that shares many of its inputs with ours. More thought provoking is the US comparison to

[7] Data for Denmark, the Dutch East Indies, Finland, and New Zealand are only available from January 1925 and are incomplete in the early part of the sample, so initial estimation is extended to include data up to January 1929. For Belgium, some early observations are similarly missing, and initial estimation is with data up to July 1928.

[8] The use of expanding windows may help to allay the theoretical concern that our expectations are based on models initially estimated for the pre-Great Depression period, and that rational agents should not base their inflation forecasts on the same relationships once countries had left gold. Note that there might be potentially offsetting biases involved here. On the one hand, agents in countries leaving gold late might have had a better understanding than they would have had in the 1920s that leaving gold would raise inflation, based on the experiences of early leavers. On the other hand, a one-time devaluation-induced jump in prices might have a smaller impact on expected inflation than a same-sized move occurring for other reasons.

[9] For example, Barsky and DeLong (1991) show that the amount of gold mined before 1914 predicted inflation but did not affect inflation expectations. Their explanation stresses the difficulties of interpreting the data and forming expectations, rather than a lack of access to real-time information.

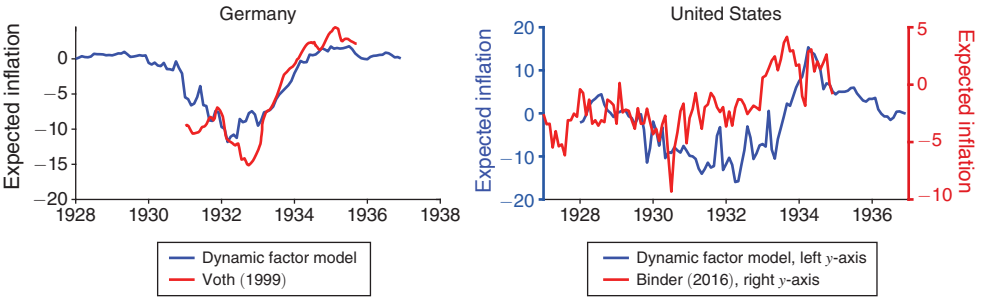

Figure 1. Expected Inflation from the Dynamic Factor Models (Blue Lines, Left y-axes) and Two Estimates from the Existing Literature

Binder (2016), who followed Jalil and Rua (2016) in constructing a monthly index of inflation expectations based on the frequency with which the words "inflation" and "deflation" appeared in the *New York Times*. Her measure tracks ours until the middle of 1930 but recovers quickly thereafter, whereas we estimate that agents continued to expect deflation well into 1933. Both series show US inflation expectations rising from 1933 to 1935.

Financial market data offer an alternative source of independent evidence, in particular from commodity futures markets that operated in the United States, United Kingdom, France, Germany, and Japan during the period. Futures markets are forward looking, so the spreads between futures contract prices and the spot price are potentially informative about agents' inflation expectations. Prices in commodity futures markets are set by traders making actual financial transactions, so by definition reflect the information and beliefs held by some agents at the time.[10]

We begin with futures and spot prices quoted on the New York Cotton Exchange, which we transcribed from *Barron's* and cross-checked with the *New York Times* and the *Washington Post*. The data are monthly from June 1921 to December 1936, each observation taken as close to the beginning of the month as possible. Spreads for the sample period are plotted in Figure 2, based on futures contracts for raw cotton expiring 3, 6, and 9 months ahead. There were negative spreads in 1928 and early 1929, with futures prices below the spot price. Afterward, the spread turned positive with futures priced above the spot price. This remained the case until late 1934, when spreads once again became negative.

Interpretation of the evidence in Figure 2 is contentious. Hamilton (1987) argues that futures prices predict future spot prices, so that traders expect cotton prices to fall when spreads are negative, and to rise when they are positive. If raw cotton is representative of the goods in the wholesale price index, then on this interpretation expectations regarding the general price level were deflationary in 1928 and early 1929, prior to onset of the Great Depression; they became inflationary during the Great Depression; and they were once again deflationary from late 1934, after it had

[10] Modern approaches extract a measure of market-based expectations from the spread between the yields on nominal and index-linked bonds. The first index-linked government bonds to be issued at scale were in the United Kingdom in 1981, far beyond our time horizon. An interesting counterexample is Austria, which issued gold, silver, and paper bonds in a way that allowed Mitchener and Weidenmier (2010) to recover a market-based measure of inflation expectations, but only until April 1911, before the start of our sample.

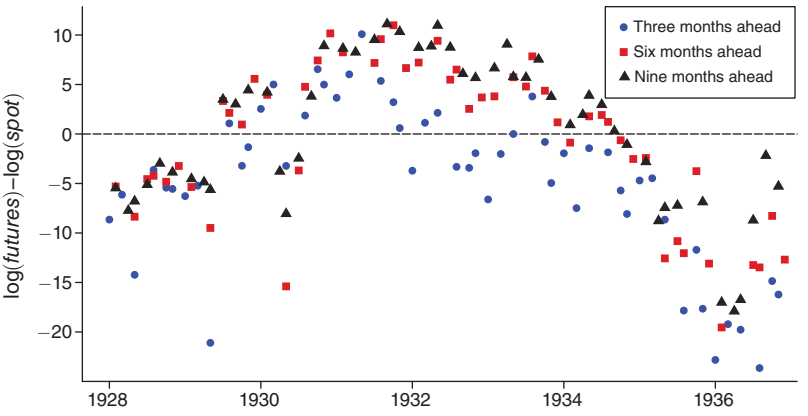

FIGURE 2. SPREADS BETWEEN FUTURES AND SPOT PRICES ON THE NEW YORK COTTON EXCHANGE

ended. One possible objection to this argument is that raw cotton may not have been representative of goods in the wholesale price index. A more fundamental objection is that even if it was, the data in Figure 2 can be interpreted in more than one way. Saleuddin and Coffman (2018) argue that positive spreads during the Great Depression were consistent with expectations of deflation, and negative spreads before and after with expectations of inflation. The more the general price level was expected to fall the more commodities ended up in storage, paying higher storage costs and providing lower convenience yields. By the theory of Working (1949), this should have led to futures prices rising relative to spot.[11] The evidence in Figure 2 is consistent with our dynamic factor model estimates if the data are interpreted in this way. The fall and subsequent recovery in US inflation expectations in Figure 1 occurred against a backdrop of similar dynamics in spreads, which storage theory associates with a progressive deterioration in the general price level expectations of cotton futures markets traders, followed by an improvement.

IV. Dating Departures from the Gold Standard

To explore whether or not leaving the gold standard helped boost inflationary expectations, we need to know when countries left the gold standard. But what exactly does that mean? Full adherence to the gold standard involved a domestic monetary rule (maintaining the convertibility of local currency into gold at a fixed

[11] That storage costs matter was vividly apparent on April 20, 2020 when the price of West Texas Intermediate crude turned negative for the first time in its history. As the COVID-19 pandemic hit demand, producers did not immediately halt oil production and storage facilities quickly started to fill up. At the margin, over-supply had to be stored in floating oil tankers, which was so expensive that producers were prepared to pay traders to take oil off their hands. The net convenience yield went deep into negative territory as front-end May 2020 futures closed at −$37.63 (the closest thing to a spot price in this market) and May 2021 futures closed at $63.38. Another reason why futures prices rose relative to spot prices during the Great Depression may be risk aversion on the part of traders. If uncertainty rose in the Depression and traders were not risk neutral, then they would have demanded a higher risk premium for holding futures contracts, driving up futures prices and widening the spread between futures and the spot price. A full analysis of these arguments is presented in online Appendix C, alongside results for other US commodities and four other countries for which we collected commodity futures data.

price); no exchange controls (so that, in particular, gold could flow freely into and out of the country); and (as an automatic consequence of the previous two commitments) a fixed exchange rate vis-à-vis other countries on the gold standard. By implication, leaving the gold standard could involve an official suspension of convertibility; the imposition of exchange controls or restrictions on international gold shipments; or depreciation or devaluation against either gold or other currencies on gold. The League of Nations (1937) published data on all three dimensions of the phenomenon which have been widely reproduced: Table 1 gives the League's data for countries we are interested in. It also gives five sets of judgments regarding exactly when each country should be regarded as having left the gold standard: the authors in question being Brown (1940), who relied on the September 1933 issue of the Bank of Nova Scotia's Monthly Review; Kemmerer's (1954) testimony to the US Senate; Officer's (2008) widely cited encyclopedia article on the gold standard; Obstfeld and Taylor (2003); and Wolf (2008).

For our purpose, the key issue is: what constituted a regime change sufficient that it would change inflationary expectations? De jure suspension, or de facto devaluation, seem more obvious candidates than exchange controls; countries could and often did impose exchange controls while maintaining the link between the money supply and gold reserves. Indeed, one motive for imposing exchange controls was precisely to prevent gold outflows that threatened to destroy this link. It is not surprising, therefore, that Mitchener and Wandschneider (2015, p. 189) find that "countries imposing exchange controls did not actively pursue expansionary monetary policy after abandoning gold. An examination of discount rate policy of exchange-control countries suggests that, while they did not follow France and continue to raise rates after imposing controls, they also did not pursue a discount rate strategy similar to the United States, a country which floated and then aggressively pursued expansionary monetary policy."

Similarly, in discussing Germany's decision to impose foreign exchange controls in July 1931, Knut Borchardt (1984, p. 475) writes, "If one regards the guarantee of convertibility for capital transactions as an essential feature of the gold standard, then Germany left the gold standard in July 1931. On the other hand, for contemporaries we have to notice that only leaving the parity against gold seemed to be the real breaking of the rules of the gold standard. At least this is the way our sources regard it. Till long after July 1931, and thus after the introduction of the "Devisenbewirtschaftung," the question was asked, whether Germany would or should leave the gold standard. This could only mean leaving the parity in favor of floating." Efforts to reduce wages and prices in an attempt to regain competitiveness continued in Germany after the imposition of exchange controls (Brown 1940; Eichengreen and Temin 2000). For this reason, we privilege suspension or devaluation when timing the departure of countries from the gold standard.

Our task is straightforward when countries left the gold standard without imposing exchange controls, or when they imposed exchange controls at the same time, or after, devaluation or suspension. This is the case for Belgium, British India, Denmark, the Dutch East Indies, Finland, France, Japan, the Netherlands, Peru, Sweden, Switzerland, and the United Kingdom. For each of these 12 countries there is one unambiguous date of departure. Canada devalued in September 1931 and officially suspended the following month: the *Economist* commented that the latter

TABLE 1—DATES OF PRINCIPAL MEASURES AFFECTING ADHERENCE TO GOLD STANDARD

	League of Nations (1937)				Brown	Kemmerer	Officer	OT	Wolf	Our coding		
Country	Official suspension of gold	Exchange control	Depreciation or devaluation in relation to gold	Introduction of a new gold parity	Departure from gold					Group	Departure from gold	Exchange control
Argentina	Dec-29	Oct-31	Nov-29		Nov-29	1929	1929	Dec-29		C	Dec-29 & Nov-33	
Australia	Dec-29		Mar-30		Mar-30	1929	1930	Jan-30		C	Jan-31 & Sep-31	
Austria	Apr-33	Oct-31	Sep-31 & Apr-34	Apr-34	Oct-31	1931	1931	Oct-31	Sep-31	C	Oct-31 & Apr-33	
Belgium	Mar-35	Mar-35 & Apr-35	Mar-35	Mar-35		1935	1935	Mar-35		A	Mar-35	
British India	Sep-31		Sep-31		Sep-31	1931	1931	Sep-31		A	Sep-31	
Bulgaria		1918				1931	1931			D	N/A	Oct-31
Canada	Oct-31		Sep-31		Sep-31	1931	1931	Jul-31		A	Sep-31	
Czechoslovakia		Oct-31	Feb-34 & Oct-36	Feb-34 & Oct-36		1931	1931		Sep-31	C	Feb-34 & Oct-36	
Denmark	Sep-31	Nov-31	Sep-31		Sep-31	1931	1931	Sep-31		A	Sep-31	
Dutch East Indies	Sep-36		Sep-36			1936	1936			A	Sep-36	
Estonia	Jun-33	Nov-31	Jun-33			1931	1931			B	Jun-33	
Finland	Oct-31		Oct-31		Oct-31	1931	1931	Oct-31		A	Oct-31	
France			Sep-36	Oct-36		1936	1936	Sep-36	Sep-36	A	Sep-36	
Germany		Jul-31				1931	1931	Jul-31	Jul-31	D	N/A	Jul-31
Hungary		Jul-31				1931	1931	Aug-31	Jul-31	D	N/A	Jul-31
Italy		May-34	Mar-34 & Oct-36	Oct-36		1934	1934	Dec-34	May-34	C	Jul-35 & Oct-36	
Japan	Dec-31	Jul-32	Dec-31		Dec-31	1931	1931	Dec-31		A	Dec-31	
Lithuania		Oct-35								D	N/A	Oct-35
Netherlands	Sep-36		Sep-36			1936	1936			A	Sep-36	
New Zealand	Sep-31		Apr-30		Apr-30	1931	1930	Apr-30		A	Sep-31	
Peru	May-32		May-32		May-32	1932	1932			A	May-32	
Poland		Apr-36				1936	1936		Apr-36	B	Oct-36	
South Africa	Dec-32		Jan-33		Jan-33	1931	1933	Jan-33		A	Dec-32	
Sweden	Sep-31		Sep-31		Sep-31	1931	1931	Sep-31	Sep-31	A	Sep-31	
Switzerland			Sep-36	Sep-36		1936	1936			A	Sep-36	
United Kingdom	Sep-31		Sep-31		Sep-31	1931	1931			A	Sep-31	
United States	Apr-33	Mar-33 & Nov-34	Apr-33	Jan-34	Apr-33	1933	1933	Apr-33		B	Apr-33	

Sources: League of Nations (1937); Brown (1940); Kemmerer (1954); Officer (2008); Obstfeld and Taylor (2003); Wolf (2008). For our coding, see text.

decision was "simply the conferring of legal recognition to a previous *fait accompli.*"[12] South Africa was forced to suspend convertibility in December 1932, and the following month the pound reached parity with sterling (Drummond 1981). In both cases we take the earlier of the two months as the date of departure. The New Zealand experience was more complicated, but online Appendix E argues that its real departure from gold was unambiguously September 1931, when the United Kingdom left. We refer to these 15 countries, for which there is one unambiguous departure date, as Group A.

In eight of our countries, the abandonment of the gold standard took place in stages. A second group of countries (Group B) first imposed exchange controls and then unambiguously suspended convertibility, devalued, or depreciated. Given our prioritization of devaluation or suspension over exchange controls, Estonia is taken to leave in June 1933 rather than November 1931 and Poland is taken to leave in October 1936, when it devalued, rather than in April when it imposed exchange controls (Bernanke and James 1991; Wolf 2007). In March 1933 the newly elected President Roosevelt imposed restrictions on foreign exchange transactions and gold exports, but it was only the following month that the dollar was devalued and, in the eyes of most commentators, taken off gold (Eichengreen 1992; League of Nations 1937).

Group C consists of countries where the timing of devaluation or suspension is ambiguous, or where a country left the gold standard more than once. Argentina is a good example of the latter. The Argentinian paper peso depreciated relative to gold in November 1929, but at the time this was not perceived as a break with the gold standard. On December 14 the *Economist* was still describing the country's exchange rate system as being based on gold.[13] Three days later, however, the Casa de Conversión, which was responsible for converting paper currency into gold and vice versa, was unexpectedly closed. We follow other scholars in dating Argentina's original departure to December 1929 (see for example, Smith 1934; Brown 1940; Eichengreen 1992). However, in December 1931 Argentina pegged its currency to the US dollar and French franc, both of which were tied to gold. This, in turn, eventually led to a second suspension of the gold standard, in November 1933 (when the currency was devalued and a bill was introduced in parliament that would lead to the creation of a new central bank and a fiat money system: Brown 1940; Gerchunoff and Machinea 2015). Table 1 lists two dates for Argentina: December 1929 and November 1933. The table also lists two possible departure dates for the four other countries in Group C (Australia, Austria, Czechoslovakia, and Italy); interested readers are referred to online Appendix E for a full discussion of each case.

The four remaining sample countries imposed exchange controls without ever formally abandoning the gold standard or devaluing (Group D). Germany and Hungary both introduced exchange controls in July 1931, but the official parities remained unchanged throughout our period (League of Nations 1937). In Bulgaria, the government dismissed the possibility of going off gold, but was forced to impose exchange controls: in October 1931 the Bulgarian National Bank was given a monopoly on all foreign exchange transactions (Tooze and Ivanov 2011).

[12] "Canada and Gold." *Economist*, 24 October 1931.
[13] "Finance and Banking." Argentine Supplement. *Economist*, 14 December 1929.

Similarly, Lithuania imposed exchange controls in October 1935 while maintaining the link with gold (League of Nations 1937).

In summary, there are four categories of countries. First, there are 15 countries that suspended the gold standard and/or devalued, unambiguously, at a clearly defined date, and did so either without, or before, or at the same time as imposing capital controls (Group A). These are Belgium, British India, Canada, Denmark, the Dutch East Indies, Finland, France, Japan, the Netherlands, New Zealand, Peru, South Africa, Sweden, Switzerland, and the United Kingdom. Second, there are three countries that first imposed exchange controls, and then broke the link with gold at clearly defined dates: Estonia, Poland, and the United States (Group B). Third, there are five countries (Argentina, Australia, Austria, Czechoslovakia, and Italy) that clearly left the gold standard, but where the timing of the departure is ambiguous (Group C). And finally, there are four countries that imposed exchange controls but maintained the formal link with gold (Bulgaria, Germany, Hungary, and Lithuania) (Group D). In the following section we look at movements in inflation expectations and real interest rates in each of these four groups.

V. Results by Country Group

This section traces the evolution of expected inflation and ex ante real interest rates before and after countries left the gold standard. Figure 3 plots expected inflation (the dashed red lines, on the right axes) and real interest rates (the solid blue lines, on the left axes) for each of the countries in Group A: these all left the gold standard on clearly defined dates.[14] The date of departure from the gold standard is indicated in each case by a green vertical dotted line. While it is more difficult to see for countries that left the gold standard in 1936 (i.e., the Dutch East Indies, France, the Netherlands, and Switzerland), which is when our data end, it seems clear that leaving the gold standard was followed by an almost ubiquitous increase in expected inflation and a decline in real interest rates. Indeed, in many countries (Belgium, British India, Canada, Denmark, New Zealand, Peru, Switzerland, and the United Kingdom) expected inflation had actually been flat or declining, and real interest rates flat or rising, prior to departure, so leaving gold coincided with a turning point in expectations. In the United Kingdom, inflationary expectations increased following the departure from gold; October 1931 was clearly a turning point for UK real interest rates. Leaving gold was less obviously a turning point for inflationary expectations in the Dutch East Indies, Finland, France, Japan, the Netherlands, and Sweden, since they had already been on an upward trajectory, but a priori that does not invalidate our argument since other forces may have been at work in those countries raising inflationary expectations.[15]

Figure 4 gives the results for those countries that first imposed exchange controls and later devalued (Group B). Once again, suspension or devaluation is indicated by the vertical green dotted lines, while exchange controls are indicated by the black

[14] Only the expected inflation rate is available for Canada because we do not have suitable nominal interest rate data.

[15] Alternatively, agents may have anticipated that the gold standard was going to be abandoned and adjusted their expectations of inflation accordingly. We find it striking that in 8 of our 15 Group A countries leaving gold coincided with a turning point in expectations, suggesting that in many cases it was unanticipated.

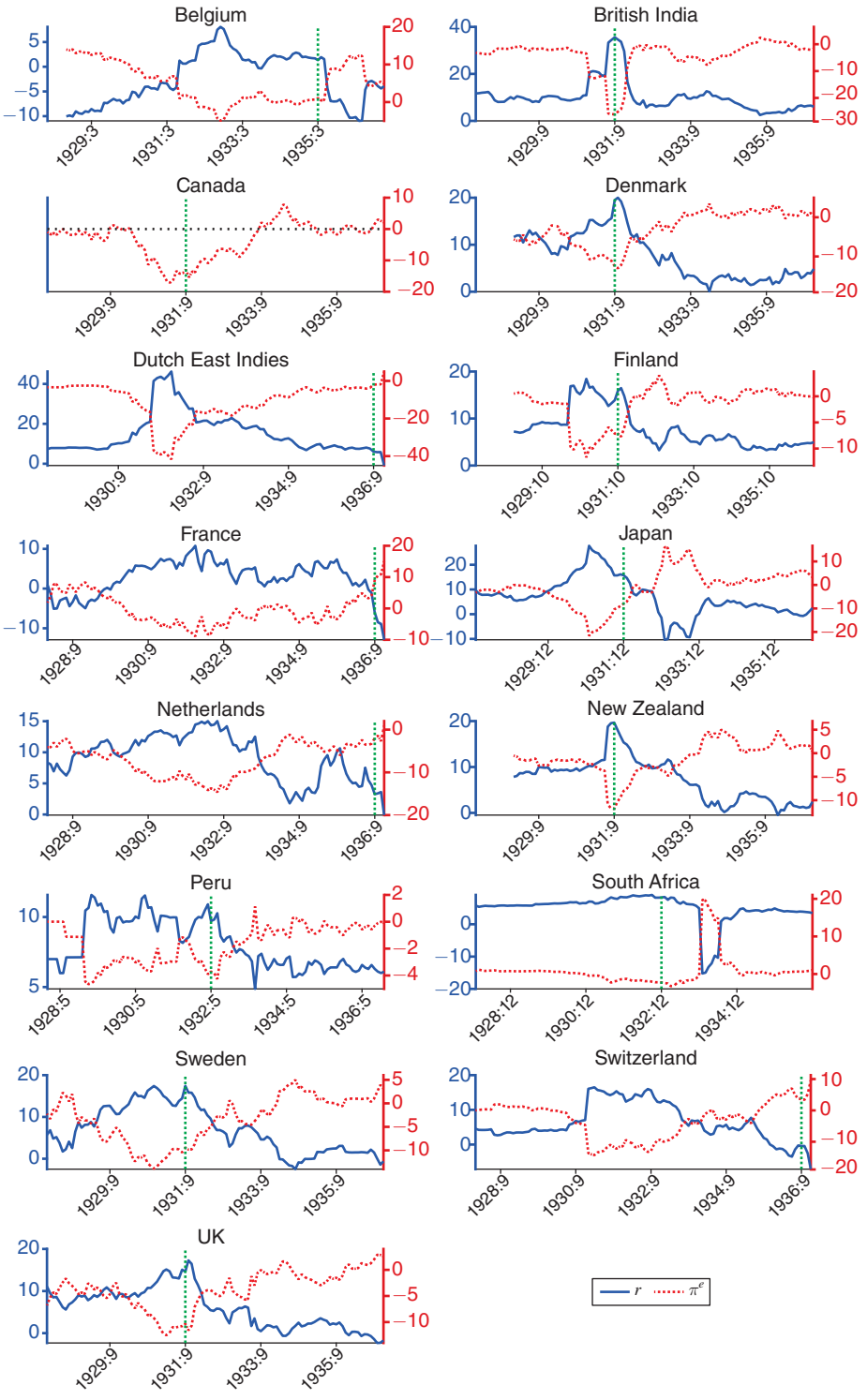

FIGURE 3. REAL INTEREST RATES (SOLID BLUE) AND EXPECTED INFLATION (DASHED RED), GROUP A

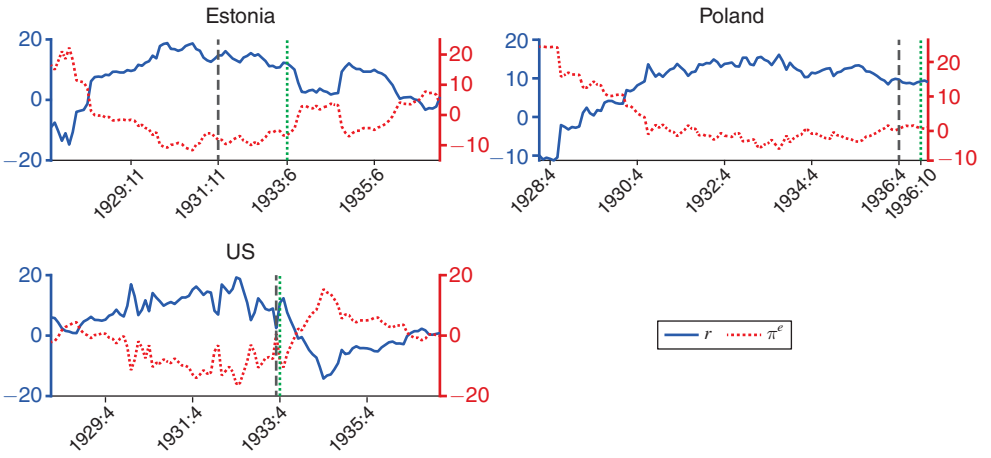

FIGURE 4. REAL INTEREST RATES (SOLID BLUE) AND EXPECTED INFLATION (DASHED RED), GROUP B

dashed lines. In the US case it is difficult to disentangle the two events since they occurred in successive months. Consistent with the argument of Temin and Wigmore (1990) inflationary expectations clearly rose, and real interest rates fell, following this policy shift. Yield curve evidence confirms this finding (see online Appendix F). Capital controls did not interrupt declines in real interest rates, and rises in inflationary expectations, underway in all three countries, but there is no evidence of the systematic reversal of expectations evident in Figure 3. There seems to have been a dramatic shift in expectations in Estonia following that country's departure from gold in 1933, but in Poland inflationary expectations were already rising prior to their final abandonment of the gold standard. Perhaps the signal provided by suspension or devaluation was muted in countries that were already withdrawing from international financial markets.

Figure 5 considers those countries where the timing of departure is genuinely ambiguous (Group C).[16] Once again, capital controls are indicated by black dashed lines, and candidate dates are indicated by green dotted lines. Other dates mentioned in the text, or online Appendix E, are plotted in cyan and magenta dash-dotted lines. In Argentina, the 1929 departure had no impact on expectations; the imposition of exchange controls in October 1931, and the second departure in November 1933, clearly did. In Australia, both the devaluation of January 1931, and sterling's departure from gold in September 1931, were followed by a rise in inflationary expectations and a decline in the real interest rate, but it was the former date that marked the real turning point, rather than the latter as in the case of New Zealand. In the Austrian case, there was a major reversal of expectations after March 1931, six months before our first candidate departure date, and a second, smaller reversal in April 1933. Given that our data end in 1936, it is hard to see whether October 1936 was a real turning point in Czechoslovakia, but in any event inflationary expectations rose after that date (and

[16] It would clearly be circular to use our data on expectations to infer when the countries concerned "really" left gold, which is why we omit these countries from the analysis of Section 7. Nevertheless the data themselves remain, we hope, informative.

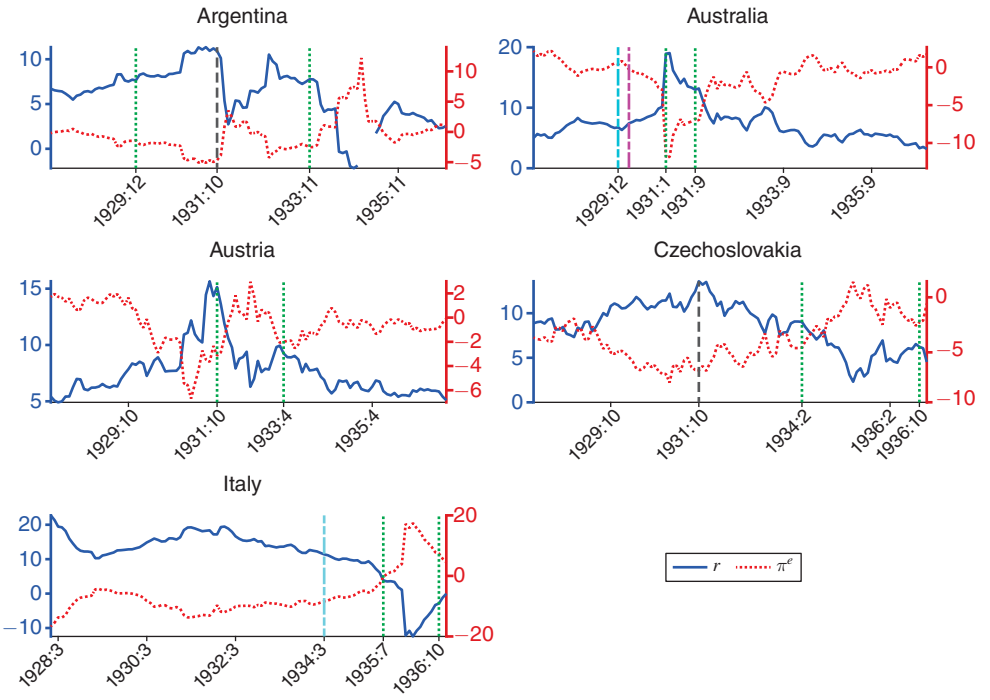

FIGURE 5. REAL INTEREST RATES (SOLID BLUE) AND EXPECTED INFLATION (DASHED RED), GROUP C

continued to rise in February 1934). In July 1935, the 40 percent reserve requirement regarding paper money was abolished in Italy, allowing the government to monetize a greater portion of its budget deficits. Our results suggest that inflationary expectations rose sharply shortly thereafter, consistent with the argument that this marked an important turning point in Italy (online Appendix E).

Finally, Figure 6 plots inflationary expectations and real interest rates for the four countries in Group D. Recall that these imposed exchange controls on well-defined dates (indicated by black vertical dashed lines) but never formally suspended the link with gold. In Germany, real interest rates declined before and after July 1931; the Lausanne conference of July 1932, which led to the suspension of German reparations to its European creditors, and the accession of Hitler to power in January 1933 (indicated by the cyan vertical dashed line) seem to have been more important in permanently shifting expectations. This is unsurprising. Reparations had overshadowed the German economy for years, while Eichengreen and Temin (2000, p. 205) comment, "whatever else might be said about it, no one could mistake the rhetoric of the Nazis for the rhetoric of the gold standard." In 1932, the Commercial Counsellor of the British Embassy in Berlin described the Nazis' program as "consisting chiefly of departure from the gold standard and ejection of all Jews." According to Borchardt (1984, p. 497), sticking to gold was "understood as a kind of bulwark against Hitler." In Bulgaria and Hungary, inflationary expectations had already been on an upward trajectory, and real interest rates on a downward trajectory, prior to the imposition of exchange controls. In Lithuania, inflationary expectations rose, and real interest rates fell, following the imposition of capital controls in October 1935: only here is

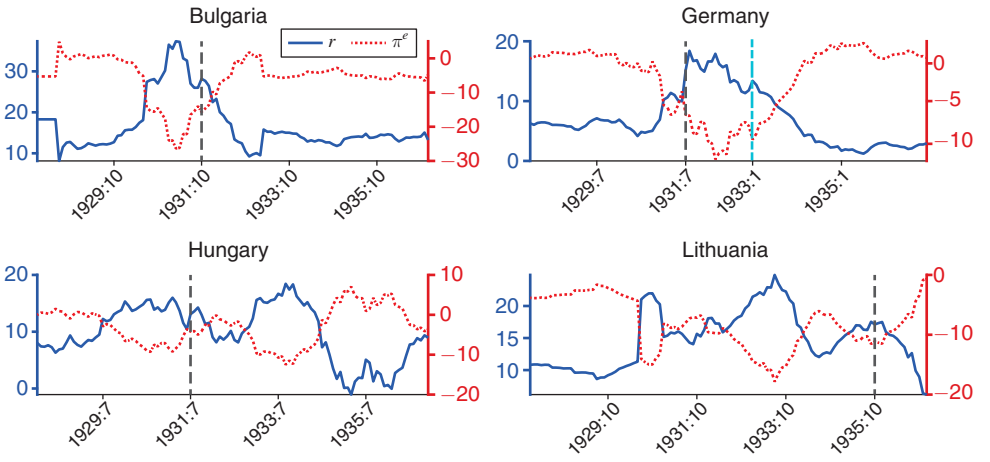

FIGURE 6. REAL INTEREST RATES (SOLID BLUE) AND EXPECTED INFLATION (DASHED RED), GROUP D

there evidence of a turning point in expectations. Overall, it is unclear that imposing exchange controls had the same consistently positive impact on inflationary expectations that seems to have been associated with devaluation or suspension.

VI. Expected Inflation in Three Countries

This section asks why our estimates of expected inflation and ex ante real interest rates behave as they do in three countries (the United Kingdom, United States, and Germany) after they left the gold standard. The estimates evolve over time as new data are released and the date of the 12-month change being forecast moves forward. To manage this complexity, we follow the practice of the New York Fed Staff Forecast by fixing the date of the 12-month change being forecast and asking how data released before then contribute to that forecast being revised. The dynamic factor model methodology is especially suited to our task, as it allows us to explain in detail which data series are responsible for each and every revision to forecasts and expectations. For the specific cases we are interested in, it turns out that revisions to the inflation forecast are the dominant factor for expectations of the real interest rate. The remainder of this section therefore reports on the behavior of expected inflation, with further results in online Appendix G.

To obtain our decomposition we use a more general version of equation (4):

$$E_t y^j_{1,t^*} = \hat{\mu}^j_1 + \sum_{k=1}^{r} \hat{\lambda}^j_{1,k} \left(\hat{\alpha}^j_k\right)^{(t^*-t)} \hat{f}^j_{k,t} + \left(\hat{\rho}^j_1\right)^{(t^*-t)} \hat{e}^j_{1,t}. \tag{5}$$

Here $E_t y^j_{1,t^*}$ is the estimate, at time t, of the inflation forecast in the 12 months to time t^* (in equation (4) t^* was set equal to $t + 12$). Consider the forecast of UK inflation in the 12 months to the end of September 1932, one year after the United Kingdom left gold. The factor model generates a forecast of inflation for this period when it is first estimated with pre-Great Depression data: in December 1928 the forecast was −5.0 percent. The forecast is then revised each month to take account of any information in new data releases, giving us a time series of real-time forecasts for UK inflation in the 12 months to September 1932 that runs from December 1928

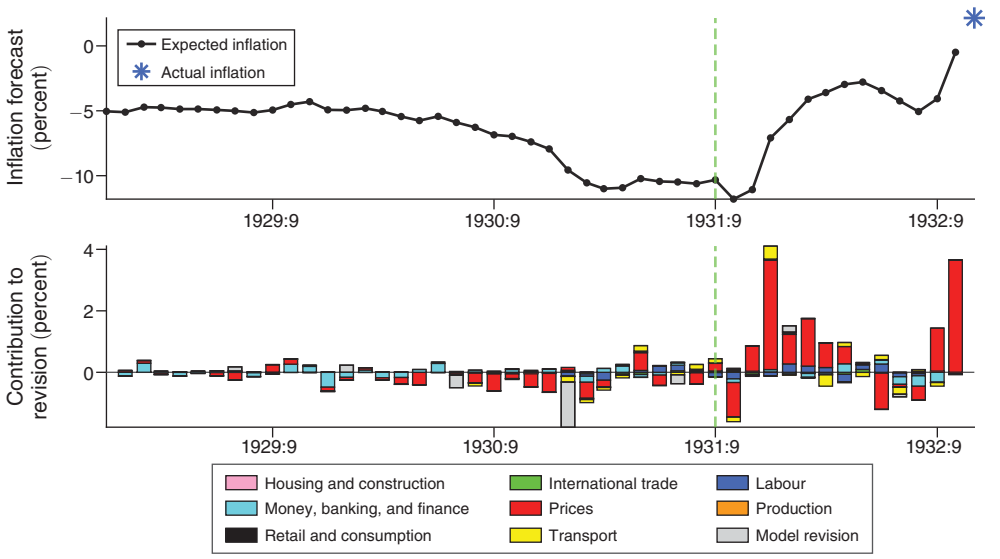

FIGURE 7. REAL-TIME FORECASTS OF UK INFLATION IN THE 12 MONTHS TO SEPTEMBER 1932

to November 1932, when the final inflation data were released. By looking at which data series contain the new information that leads to forecasts being revised, we can identify exactly what causes our estimates of expected inflation to move after countries left the gold standard.

The real-time forecasts for UK inflation to September 1932 are in the upper panel of Figure 7, with the stacked bars in the lower panel decomposing each month's forecast revision (in a format that mimics the New York Fed Staff Forecast). Starting from the initial forecast of −5.0 percent in December 1928, things are stable until early 1930 when the forecast begins a steady decline to −10.7 percent in August 1931, the month before the United Kingdom left the gold standard. The accelerated decline in January 1931 is due to the semiannual reestimation of the model that month. Nothing much then happens to the forecast until December 1931, when data released after a two-month delay show the wholesale price index had stopped falling in October 1931, and railways had enjoyed a recovery in receipts for all goods and the weight of general merchandise transported. The upward revision in the forecast is undermined slightly by negative news on unemployment, released after a three-month delay. The forecast continues on an upwards trajectory in the coming months on further positive news in new data releases (some from financial market indicators available without delay), eventually settling on the final value of 2.1 percent marked by the star in the upper panel.

The corresponding real-time forecasts of US inflation are in Figure 8. The forecast is always for the 12 months to the end of April 1934, one year after the United States left the gold standard. There are three temporary peaks, and evidence of a trend break after leaving gold. The first peak begins in October 1931, when the Fed raised interest rates in response to the United Kingdom's departure from the gold standard. In our dynamic factor model, the rise in expected inflation is driven by the dynamics of the banker's acceptance rate for New York and the rates on

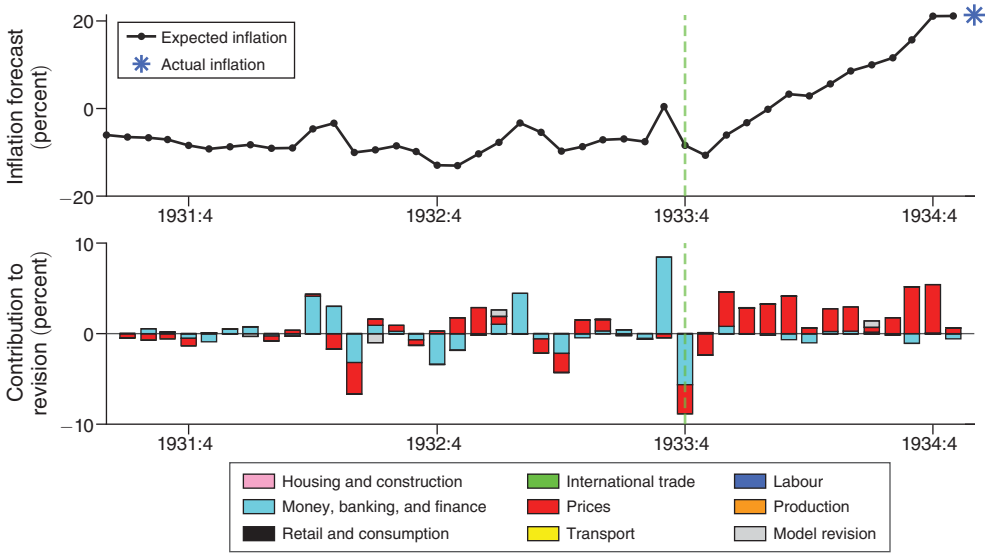

FIGURE 8. REAL-TIME FORECASTS OF US INFLATION IN THE 12 MONTHS TO APRIL 1934

prime commercial paper and customer loans. The second peak coincides with stock markets recovering from the depths of the Great Depression, with almost all of the dynamic factor model's upwards forecast revision for August 1932 coming from booming industrial and railroad stocks. The third peak comes just before the United States left gold in April 1933. This is the month that Roosevelt declared a bank holiday, which restored interest rates and boosted stock prices after a month-long run on banks. The dynamic factor model associates these developments with an improvement in inflation expectations. Although the initial recovery is short-lived, the trend is now upwards as successive releases of the wholesale price index come in higher than expected.

Our dynamic factor models forecast every variable in each country's dataset at every point in time, which means we can produce around 50,000 more decomposition figures. For countries where inflation expectations rose after leaving the gold standard, a common theme in their recovery is the contribution of financial variables and price indices. Rather than discuss more of these, we finish this section with a decomposition for Germany in Figure 9. The forecast is inflation in the 12 months to January 1934, one year after Hitler's accession to power. Most noticeable are the large revisions that accompany the semiannual reestimation of the model in January and July of each year, which point to structural changes in Germany. As expected from the discussion in Section V, there is only a small uptick in inflation expectations associated with the German banking crisis of June 1931 and very little movement when exchange controls were imposed in July 1931. The downwards revision of the forecast in March 1932 is in part due to the collectively bargained hourly wage rate for 1932 falling. Finally, the recovery in expectations that starts in March 1933 is associated with a boom in urban construction activity and the turning point in wholesale prices.

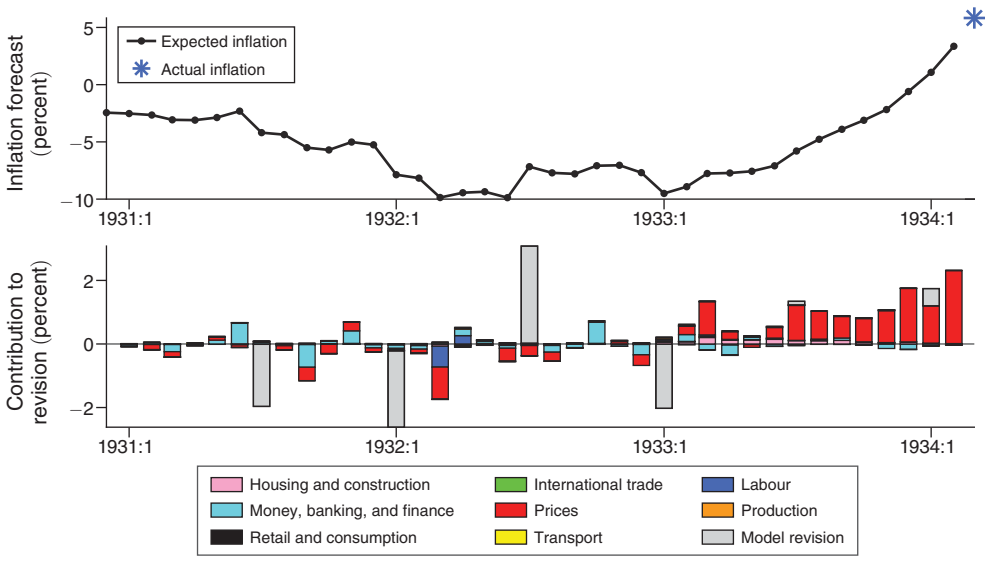

Figure 9. Real-Time Forecasts of Germany Inflation in the 12 Months to January 1934

VII. Cross-Country Comparisons

We now turn to a more systematic investigation of the links between departure from the gold standard, real interest rates, and economic recovery. The aim in this section is to make cross-country comparisons that are as clean as possible, so we take a conservative approach and only compare those countries that belong to our Groups A and B, i.e., countries that unambiguously left the gold standard on a single clearly defined date or that first imposed exchange controls and then devalued on clearly defined dates. Our focus is on countries for which we have data for at least 12 months after they left the gold standard, meaning that the event studies in this section are based on the experiences of 12 countries.[17]

We start in Table 2 with changes in real interest rates on and after leaving the gold standard. The reference point is the average real interest rate in the three months prior to departure; so for example for Belgium, which left the gold standard during March 1935, the changes are relative to the average real interest rate between the end of December 1934 and the end of February 1935. The table shows that the real interest rate in Belgium fell by 0.4 percentage points between then and the end of March 1935, by 6.1 percentage points within a quarter, by 8.8 percentage points within 6 months, and by 11.9 percentage points within 1 year. In some countries there was a rise in the real interest rate on departure, but one quarter out it had fallen in all but two countries and by two quarters it had fallen in all. It is striking that the countries that experienced the largest initial rises were those that left the gold standard right

[17] We do not have monthly nominal interest rate data for Canada, which means that for this country we can discuss inflation expectations, prices and output, but not the real interest rate. British India is omitted because of the huge swing in the estimate of expected inflation that occurs around the time of leaving the gold standard. Although including it reinforces our results, we consider it prudent to treat British India as an outlier.

Table 2—Change in Real Interest Rate on and after Leaving the Gold Standard

Country	Departure from gold standard	Change in real interest rate on or after			
		Departure	One quarter	Two quarters	One year
Belgium	Mar-35	−0.4	−6.1	−8.8	−11.9
Denmark	Sep-31	4.4	2.3	−3.5	−7.3
Estonia	Jun-33	0.8	−5.5	−8.2	−9.5
Finland	Oct-31	2.6	−0.9	−5.9	−8.6
Japan	Dec-31	−0.1	−7.4	−5.9	−17.2
New Zealand	Sep-31	3.0	−1.3	−4.3	−6.9
Peru	May-32	−0.7	−1.8	−1.8	−3.2
South Africa	Dec-32	−0.2	−0.2	−2.2	−3.6
Sweden	Sep-31	3.8	1.0	−1.8	−7.1
United Kingdom	Sep-31	0.9	−0.8	−6.9	−8.5
United States	Apr-33	3.7	−2.0	−7.3	−21.0
Average excl. US		1.4	−2.1	−4.9	−8.4

at the start, in September or October 1931.[18] Outside the United States, the average decline in real interest rates one year after leaving gold was 8.4 percentage points.

A simple test of the change in the real interest rate n months after our countries left gold shows a significant rise on departure and after one month but a significant fall after 3 months all the way out to 12 months, where statistical significance is evaluated at the 1 percent level. Corresponding nonparametric tests of how many of the countries saw the real rate fall after n months confirm a statistically significant effect; it is highly unlikely that all 11 countries would see falls from 4 months on if rising or falling rates were independently equally likely. These tests are potentially sensitive to the presence of aggregate trends or shocks, so we also perform placebo tests in which we randomly permute the dates at which countries leave gold and see what we would have concluded about real interest rates had we thought that countries left on those dates. Our analysis rejects the null hypothesis that when countries left gold is statistically independent from their outcomes for real interest rates. Details of all tests are in online Appendix H, but the results should only be seen as indicative until we address causality in Section VIII.

The stacked bar plots in Figure 10 decompose the changes in the real interest rate in Table 2 into a part due to rising expectations of inflation and a part due to falling nominal interest rates. The gray bars show the contribution from changes in expected inflation, positive for a fall and negative for a rise. The black bars indicate the contribution from changes in the nominal interest rate, positive for a rise and negative for a fall. The reference point for changes is again the average value in the three months prior to leaving gold.

The gray bars dominate the black bars in Figure 10, especially at longer horizons. The evidence is thus overwhelmingly in favor of falling real rates being driven by

[18] Figure 10 shows that in Denmark, Finland, Sweden, and the United Kingdom, real interest rates initially rose largely or entirely because of higher nominal rates; in New Zealand they rose because of rising expectations of deflation. Eichengreen (1992) notes that the early devaluers were reluctant to engage in expansionary open-market operations despite the fact that they had quit gold: sterling area money supplies remained essentially unchanged during 1932. In order to "release their golden fetters, it was necessary for policy-makers to abandon not only the gold standard's institutions but also the gold standard's ethos" Eichengreen (1992, pp. 292–3).

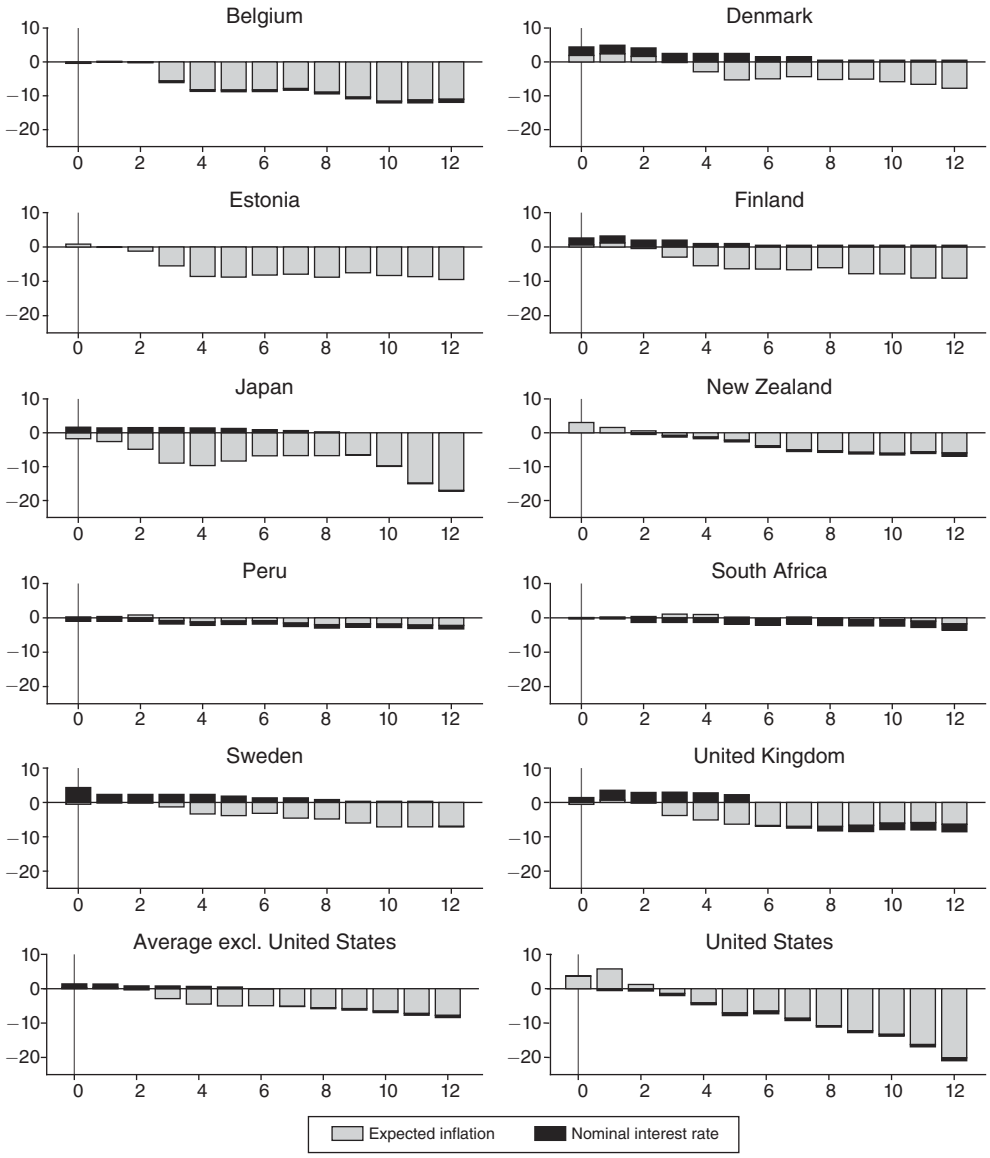

Figure 10. Decomposition of Change in Real Interest Rate *n* Months after Leaving Gold Standard (Gray Bars Change in Expected Inflation, Black Bars Change in Nominal Interest Rate)

rising expectations of inflation, rather than declining nominal rates. Nominal interest rates did not change much after countries left the gold standard, and even rose for a few months in Denmark, Finland, Japan, Sweden, and the United Kingdom.[19] By contrast, expectations of inflation soon increased everywhere, and by enough that

[19] The temporary rise in nominal rates in these countries is a consequence of steep nominal rate increases that occurred shortly before leaving the gold standard. It took some time for nominal rates to fall after departure, so at a monthly frequency we record an increase in the nominal interest rate. See the individual country plots in online Appendix D for more details.

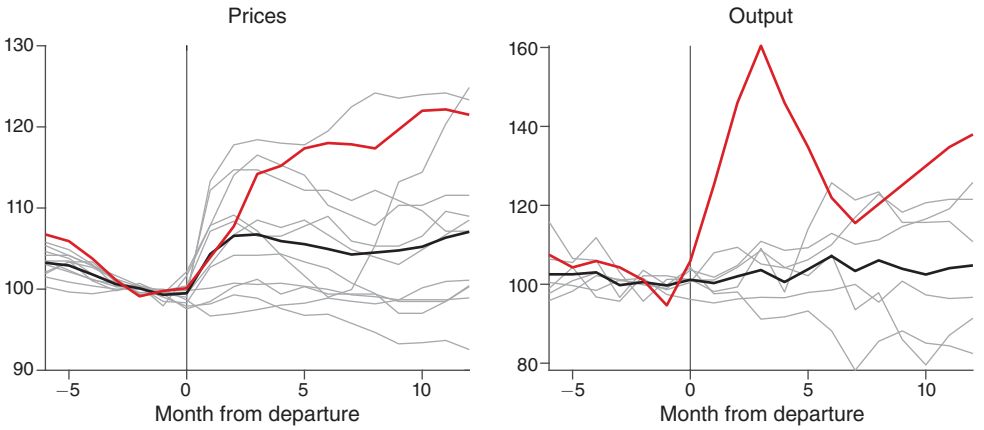

Figure 11. Prices and Output after Leaving the Gold Standard (Red Line US, Black Line Average Excluding US)

after two quarters the sum of the stacked bars is always negative: the real interest rate fell in every country shortly after leaving the gold standard. There is only one country for which the real interest rate fell more because of falling nominal rates than because of rising inflationary expectations: South Africa. Of the average 8.4 percentage point decline in the real interest rate outside the United States one year after leaving gold, 7.8 percentage points were due to rising inflation expectations.

A fall in the real interest rate is a likely prerequisite for economic recovery, but to really see whether leaving gold was instrumental in the ends of big recessions we need to know what happened to prices and output. Figure 11 plots the data we have for the 12 countries in our event study. We center each country's month of departure on zero, and normalize to 100 the indices for prices and output in the three months prior to departure. Prices are the wholesale price index for all but South Africa, for which it is a total cost of living index. Output is total industrial production or production of coal, although it is only available for 7 of our countries. We cannot include Peru and New Zealand because we have no suitable output data, and the data we have for Denmark (pig slaughtering for export), Estonia (shale gas), and Finland (production of export industries) are unfortunately too narrow.

Prices were on a downward trajectory in every country before they left the gold standard, with a panel regression of the change in the index before or after leaving gold showing significantly higher prices 4, 5, and 6 months prior to departure. Prices stabilized rapidly for most countries on leaving the gold standard and were on average significantly higher already one month later. Nonparametric tests of the number of countries where prices rose after leaving gold also support a significant effect, with only Canada, South Africa, and Sweden yet to see prices rising after one month. The pattern of falling prices before leaving and rising prices after is particular to the actual dates when countries left the gold standard. Placebo tests based on randomly perturbed dates support the actual dates being important for the turnaround in a country's prices. Some of this is driven by price dynamics in the United States (in red), which are stronger than those experienced in the other countries (averaged in black). That the United States was special among recovering countries is also argued by Romer (1993), but even setting aside the United States, we find

that leaving the gold standard ended the declines in prices in all countries and started the upward trend in many (online Appendix H).

For some countries that left gold on clearly defined dates, departure is accompanied by both a one-time jump in the domestic price level and an apparent change in its trend. Although far from ubiquitous, the former likely reflects the effect of currency devaluations on the wholesale price index via the prices of imported goods. These pass-through effects are observed in Belgium, Estonia, Finland, and Peru, and to a lesser extent in Denmark, Japan, the United Kingdom, and the United States (see online Appendix D). There is no evidence of a jump in the wholesale price index in New Zealand, South Africa, Sweden, or Canada. The experience in countries that did not leave the gold standard on clearly defined dates is similarly mixed, with domestic prices not jumping in many countries.[20]

The limited number of countries for which monthly output data are available makes it challenging to draw firm conclusions regarding the recovery of the real economy. There is a lot of volatility and heterogeneity, but the average trend is a mild decline before leaving the gold standard followed by a gradual pickup afterward. The laggards are the United Kingdom, where the recovery took a long time to get going, and Canada, where industrial production continued its downward trend throughout the year after they left gold. The exceptionalism of the United States is again apparent. No other country had such a huge rebound in industrial production, a result that cautions against extrapolating from the United States' experience.

VIII. Causality

The previous sections concluded that leaving the gold standard was accompanied by an increase in expected inflation, a reduction in the real interest rate, and a recovery in real activity. While indicative, the results so far do not identify the causal effect of leaving, a shortcoming shared by much of the existing literature on the interwar gold standard. In this section we address causality via three different but complementary approaches: IV, DiD, and the synthetic control matching methods of Abadie and Gardeazabal (2003) and Abadie, Diamond, and Hainmueller (2010).

A. *Instrumental Variables*

The first step in giving our correlations a causal interpretation is to discuss possible endogeneity, reverse causality, and simultaneity biases. It is not obvious that these concerns are all that large in our case. It is straightforward to think of mechanisms through which leaving the gold standard would cause a fall in the real interest rate, but harder to imagine why falling real rates would cause a country to leave gold. If anything, countries went on gold to anchor inflation expectations, and since a drop in real rates predicts economic recovery, it would be more likely to strengthen than to weaken a country's commitment to gold. Furthermore, Bernanke and James (1991) argue that the countries leaving gold in 1931 had similar macroeconomic

[20] If agents know that there are strong pass-through effects then inflation expectations may react differently to domestic price developments when a country leaves gold. Since the dynamic factor models are regularly reestimated and updated, this is unlikely to create a persistent bias in our results.

fundamentals to those that did not, while Bernanke (1995) sees decisions about leaving gold as not being driven by prevailing macroeconomic conditions. Instead, the dominant view (e.g., Eichengreen 1992; Wandschneider 2008) is that decisions were strongly affected by political factors and philosophical/economic beliefs. If so, endogeneity is not a major issue.

The idea that allegiance to the gold standard in the 1930s was influenced by philosophical and economic beliefs led Eichengreen and Sachs (1985) and Eichengreen and Irwin (2010) to propose that a country's experiences in the 1920s could be a valid instrument in an IV regression. For example, a country that experienced high inflation in the 1920s and witnessed the stabilizing disinflationary effect of going back onto gold (e.g., the 1926 Poincaré stabilization in France) would have been more reluctant to abandon the gold standard. While a country's experience in the 1920s may have had a direct influence on the probability of leaving the gold standard, it should have had no direct effect on what happened to the real interest rate after leaving: the conditions needed for an instrument to be valid.

We thus estimate IV regressions for a sample of 11 European countries (Austria, Belgium, Czechoslovakia, Denmark, France, Hungary, Italy, the Netherlands, Poland, Sweden, and the United Kingdom) for which we have sufficient data from the period in the 1920s before they returned to gold. The specification is

$$(6)\quad \left(i_{j,1935} - \pi^{e}_{j,1935}\right) - \left(i_{j,1930} - \pi^{e}_{j,1930}\right) = c_0 + c_1\left(\frac{GoldPrice_{j,1935}}{GoldPrice_{j,1930}}\right) + \epsilon_j,$$

where the dependent variable is the change in the average real interest rate in country j between 1930 and 1935, and the independent variable is the average gold price of country j's currency in 1935 relative to that in 1930. As instruments in the IV regressions, we use the change in average inflation between the year before a country returned to gold and the year afterwards, and the change in output in the year after a country returned to gold.[21] The idea is that countries which saw larger disinflation/deflation and improvements in output after returning to gold in the 1920s would have been more reluctant to abandon gold in the 1930s.

The results are shown in Table 3. The 2SLS and GMM IV estimates indicate that devaluations 'caused' lower real interest rates in the sample countries, with the similarity of the OLS and IV estimates reinforcing claims that endogeneity is unlikely to be a major issue.[22] The first stage of the 2SLS regression rejects the joint exclusion restriction test on the instruments, and the individual coefficients on the average change in inflation and output in the first stage are significant and of the expected sign, consistent with our conjecture that these are valid instruments.[23] A coefficient of the order of 0.2 on the relative gold price of a currency implies that a 30 percent

[21] The dates on which countries returned to gold are taken from Bernanke and James (1991). The first was Sweden in April 1924, while the last was Italy which completed its return to gold in December 1927.

[22] The Hausman test suggests that the OLS estimates are consistent against 2SLS, providing no evidence that endogeneity is an issue. The Sargan test for 2SLS does not reject the null that all instruments are valid, although it is unlikely that there is conditional homoskedasticity in our cross-country panel. Finally, the J-test does not reject the null that the GMM model is valid. Test statistics and associated p-values are in the online replication files.

[23] The coefficients on the average change in inflation and output in the first stage of the 2SLS regression are −0.98 and 0.97, respectively, with heteroskedasticity-robust standard errors 0.23 and 0.13. The R^2 is 0.72, and the F-statistic is 40.04.

Table 3—Instrumental Variables Regressions

	OLS	2SLS	GMM
Constant	−19.71	−18.78	−20.21
	(4.73)	(5.09)	(4.83)
$\frac{GoldPrice_{j,1935}}{GoldPrice_{j,1930}}$	0.18	0.17	0.20
	(0.06)	(0.07)	(0.07)
R^2	0.399	0.397	
Observations	11	11	11

Notes: Dependent variable is change in real interest rate, 1930 to 1935. Heteroscedasticity-robust standard errors (HC1) in parentheses.

depreciation on leaving the gold standard (which is close to the average fall in the gold value of currencies that had left by 1935) lowered the ex ante real interest rate by $0.2 \times 30 = 6$, i.e., 600 basis points. This is consistent with Table 2. Our results come with caveats: the sample size is small, the parameter estimates are only significant at the 5 percent level, and one can think of reasons why the instruments might be correlated with other relevant policy actions, given that the dependent variable in the regression (the change in the real interest rate) is not defined narrowly around departures from gold.

B. *Difference-in-Differences*

The apparent exogeneity of early leavers' decisions to come off gold suggests a DiD regression comparing the experiences of early and later leavers. The treatment is leaving gold early, and the control group is all countries that left later. The treated group consists of all those countries that unambiguously left the gold standard early, between September and December 1931 (British India, Denmark, Finland, Japan, New Zealand, Sweden, and the United Kingdom);[24] the control group is countries that unambiguously left after March 1933 (Belgium, Czechoslovakia, Dutch East Indies, Estonia, France, Italy, the Netherlands, Poland, Switzerland, and the United States). Our decision to impose December 1931 as the cut-off for early departure gives a reasonably balanced specification, with seven countries in the treatment group and ten in the control group, offering what is likely to be the cleanest possible identification. We consider average real interest rates in two periods p, the first before September 1931 and the second after December 1931. The DiD specification is

$$(7) \qquad \left(i_{j,p} - \pi^e_{j,p}\right) = c_0 + c_1 I_j^{EarlyLeaver} + c_2 I_p^{AfterDec1931} + c_3 I_j^{EarlyLeaver} \times I_p^{AfterDec1931} + \epsilon_{j,p},$$

[24] The only early-leaving country not in our treatment group is Australia, because its departure from the gold standard is not unambiguously dated as occurring between September and December 1931. Adding it as a country that left gold in September 1931 (one of its candidate departure dates) has only minimal impact on our DiD estimation results.

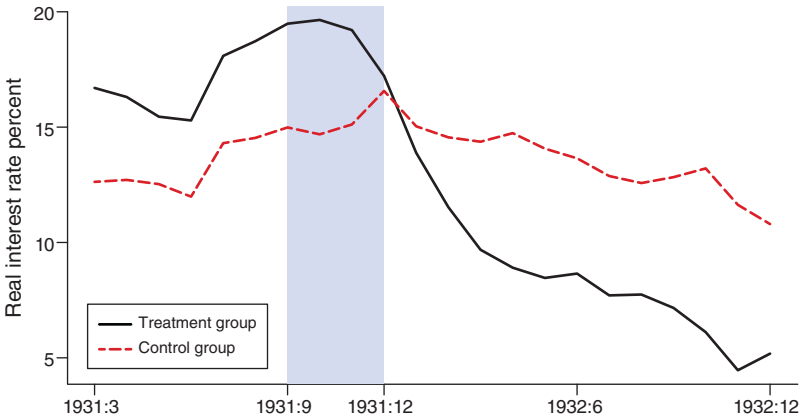

FIGURE 12. AVERAGE REAL INTEREST RATES IN TREATMENT (EARLY LEAVERS) AND CONTROL GROUPS

where the dependent variable of the regression is the average real interest rate in country j and period p. The first independent variable is an indicator, $I_j^{EarlyLeaver}$, that takes the value one for countries in the treatment group and zero for countries in the control group; the second indicator, $I_p^{AfterDec1931}$, is one for observations of the dependent variable (average real interest rate) after December 1931 and zero for observations before September 1931. The interaction term $I_j^{EarlyLeaver} \times I_p^{AfterDec1931}$ is therefore the DiD treatment effect of a country leaving the gold standard early. It captures how much more real interest rates changed after December 1931 in the treatment group relative to the control group. We report two sets of results, depending on the window over which real interest rates are averaged before and after leaving. In each case we consider the average real interest rate before September 1931 and after December 1931, but in the first case we average over a 6-month window and in the second over a 12-month window.

For DiD to work well, the treatment and control groups should have parallel trends prior to going off gold. This is arguably reasonable in our case, given the Bernanke and James (1991) assertion that macroeconomic conditions in countries leaving gold in 1931 were not materially different from those in countries that still remained. Figure 12 confirms that the treatment and control groups in our dataset had parallel real interest rate trends before September 1931.[25] The assumption of parallel trends is relaxed in Section VIIIC when we explicitly construct synthetic control units that satisfy parallel trends. In an ideal world, we would also estimate a staggered DiD specification (Callaway and Sant'Anna 2021) to differentiate between the experiences of early, late and even later leavers. Unfortunately, the departures of leavers between 1932 and 1935 are spread out, making the effective sample size too small to infer staggered effects reliably.

[25] Trends in inflation and the gold value of currency were also close to parallel before the first country left the gold standard. Although these trends have no impact on the DiD estimates, they are presented for completeness in online Appendix I.1.

Table 4—Difference-in-Differences Regressions

	6-month window	12-month window
Constant	13.12	11.84
	(2.50)	(2.11)
$I_j^{EarlyLeaver}$	3.64	3.95
	(3.05)	(2.49)
$I_p^{AfterDec1931}$	1.29	1.52
	(0.96)	(1.15)
$I_j^{EarlyLeaver} \times I_p^{AfterDec1931}$	−7.86	−9.02
	(2.09)	(2.00)
R^2	0.12	0.22
Observations	34	34

Notes: Dependent variable is real interest rate, before and after early leavers left gold. Robust standard errors clustered by country in parentheses.

The DiD regression results are in Table 4. There are 34 observations in each regression because we measure the average real interest rate in all 17 countries, both before September 1931 and after December 1931. The second column shows that the average real interest rate in control group countries was 13.12 percent in the 6 months before September 1931. By contrast, the average in early-leaving countries over the same period was $13.12 + 3.64 = 16.76$ percent, higher although not significantly so in such a small sample. In the 6 months after December 1931, the average real interest rate in control group countries rose to $13.12 + 1.29 = 14.41$ percent, while in the early-leavers it fell to $13.12 + 3.64 + 1.29 - 7.86 = 10.19$ percent. The results show that leaving gold had a statistically significant effect, lowering real interest rates by at least 7.86 percentage points, consistent with the findings from the IV regressions in Table 3.

C. *Five Synthetic Control Matching Counterfactuals*

The synthetic control matching method begins as the DiD regression by dividing countries into two groups, those in the treatment group that left the gold standard early and those in a control group that did not. However, rather than comparing averages between groups, each country in the treatment group is matched to a synthetic counterpart, constructed by taking a suitably weighted average of the pool of countries in the control group. The weights are chosen so that economic conditions in the synthetic counterpart reflect those in the treatment country in the period *before* it is treated. The behavior of a country's synthetic counterpart in the period *after* treatment acts as our counterfactual.[26]

In our case, the treatment group is all the countries that unambiguously left the gold standard between September and December 1931 (British India, Denmark, Finland, Japan, New Zealand, Sweden, and the United Kingdom), and the control

[26] The method is similar in spirit to Choudhri and Kochin (1980), whose comparative study of European countries during the Great Depression uses Spain as a control because it did not join the gold standard after World War I. The synthetic control matching method is more general because it allows all untreated countries to act as potential controls; see Abadie (2021).

group is those countries that were still unambiguously on the gold standard in March 1933 (Belgium, Czechoslovakia, Dutch East Indies, France, Italy, Netherlands, Poland, Switzerland, and the United States). The treatment group is thus the same as in the previous section, while the control group is as before except that we drop Estonia for which data on prewar economic conditions are incomplete. The economic conditions in the treated countries that the synthetic counterparts are constructed to reproduce are population size, GDP per capita in 1930, and the behavior of either the ex ante real interest rate or inflation on specific dates before the country left the gold standard.[27] Minimizing the quadratic distance from these variables defines the weights with which control countries are combined to produce the synthetic counterparts.

Following the notation in Abadie and Gardeazabal (2003), weights $\mathbf{W}^* = \left(w_1^*, \ldots, w_J^*\right)'$ solve the constrained optimization problem:

$$\mathbf{W}^* = \arg\min_{\mathbf{W}} \left(\mathbf{X}_1 - \mathbf{X}_0\mathbf{W}\right)' \mathbf{V} \left(\mathbf{X}_1 - \mathbf{X}_0\mathbf{W}\right), \tag{8}$$

such that $w_j^* \geq 0, \forall j$ and $\sum w_j^* = 1$. $\mathbf{X}_1$ is a $K \times 1$ vector of economic conditions in the treated country before leaving the gold standard, to be matched by a weighted average of the columns in $\mathbf{X}_0$, a $K \times J$ matrix of corresponding economic conditions in J control countries. $\mathbf{V}$ is a diagonal matrix that reflects the relative importance of matching economic conditions when making predictions for the outcome variable, which in our case is either the ex ante real interest rate or inflation. It is optimized to give weights $\mathbf{W}^*(\mathbf{V})$ and a synthetic counterpart that predicts the outcome variable as well as possible before the country leaves gold.[28] Given $\mathbf{W}^*(\mathbf{V})$ and the outcome variable $\mathbf{Y}_0$ in control countries before and after the treated country leaves the gold standard, the counterfactual evolution of the synthetic counterpart is $\mathbf{Y}_1^* = \mathbf{Y}_0\mathbf{W}^*(\mathbf{V})$, to be compared to the actual pre- and postdeparture outcome variable in the treated country, $\mathbf{Y}_1$.

The decision to restrict our analysis to countries that left the gold standard before December 1931 or after March 1933 facilitates a clean dichotomy between the treatment and control groups. It puts clear blue water between the departure dates of early and late leavers, and is designed to minimize the likelihood that our estimates are contaminated by anticipatory effects that might occur if the early departure of treatment group countries raised expectations of control group countries also leaving the gold standard. We see no evidence of such effects in our control group countries, which all maintained a strong commitment to the gold standard until at least early 1933. In any event any anticipatory effect would likely bias our estimates downwards, in the same way as would spillover or general equilibrium effects, by understating the impact that leaving had on the treatment countries relative to their synthetic counterparts.

The method produces synthetic counterparts for Denmark, Finland, New Zealand, Sweden, and the United Kingdom that match population and GDP per

[27] Data on population size and GDP per capita are taken from the Maddison Project Database at the Groningen Growth and Development Center: https://www.rug.nl/ggdc/historicaldevelopment/maddison/. We obtain almost identical results using the Broadberry and Klein (2012) estimates of population size and GDP per capita that account for changes in national boundaries in Europe.

[28] See online Appendix I.2 for additional information, including on how $\mathbf{V}$ is optimized.

Table 5—Weights Used in Synthetic Counterparts for Real Interest Rates

	Denmark	Finland	New Zealand	Sweden	UK
Belgium			0.05		
Czechoslovakia			0.71		
Dutch East Indies	0.12		0.24		0.06
Italy	0.03	0.40		0.46	
Netherlands	0.85	0.20		0.54	0.72
Poland		0.40			
Switzerland					0.22

capita in 1930, and have small root mean square errors (RMSE) when fitting the country's real interest rate or inflation before leaving gold. The R^2 coefficients of determination between actual and synthetic counterparts before departure are in the range $0.64 - 0.98$, indicating that synthetic counterparts track actual predeparture outcomes in each country (online Appendix Tables I.2–I.6). The good fit in the predeparture period could be by construction, since it may just be the mechanical result of picking the synthetic control weights. To address this concern, we therefore reran the synthetic control analysis but pretending that the treatment happened six months or one year before it actually did. The results from this "backdating" exercise, presented in online Appendix I.7, show as hoped that the synthetic and actual series continue to track each other until the "actual" intervention, which also verifies that our estimates are not overly influenced by observations in the periods immediately preceding a country's departure from the gold standard. For other countries in the treatment group, there is no weighted average of control group countries that comes close to reproducing the economic conditions that prevailed before leaving gold. Table 5 presents the weights assigned to control group countries when constructing the synthetic counterparts for real interest rates in our five countries. Reading the second column, we see that Denmark's synthetic counterpart is a weighted average of the Dutch East Indies, Italy, and the Netherlands. The weight on all other control group countries is negligible.

The results are in Figure 13. In each case the solid blue line indicates the country of interest and the dashed red line its synthetic counterpart. Our success in constructing appropriate synthetic counterparts is apparent in the proximity of the blue and red lines in the period before leaving the gold standard, which is marked as before with a green vertical dotted line. The closeness of the solid blue and red dashed lines is by design: we relinquished other countries in the treatment group precisely because we were unable to construct synthetic counterparts that matched the behavior of real interest rates before leaving. Our counterfactuals begin after the green vertical line marking when the countries left the gold standard. These tell a consistent story about what would have happened to real interest rates and inflation if the five countries had not left the gold standard when they did. Real interest rates would have remained elevated for at least 12 months and inflation would have picked up by less than it did. Leaving the gold standard caused a fall in real interest rates and a turnaround in inflation in these countries.

In Denmark, Finland, Sweden, and the United Kingdom there is a short-lived rise in the real interest rate on leaving gold, as policymakers used nominal rates to

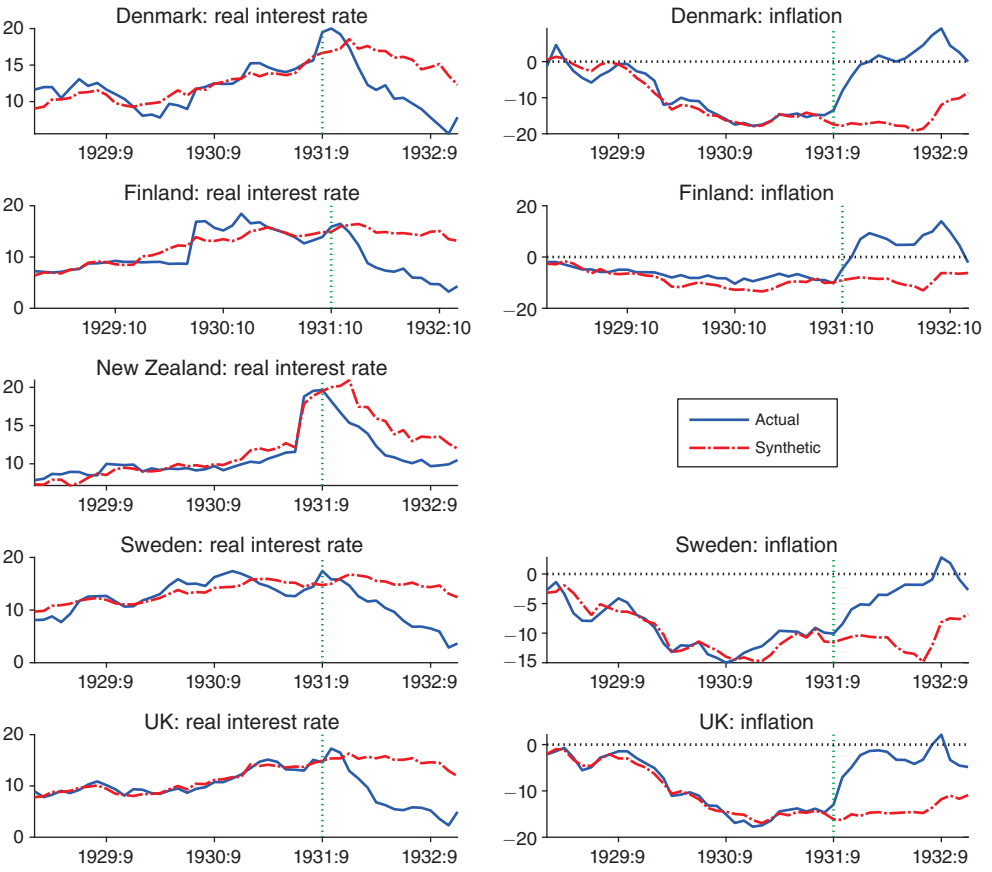

FIGURE 13. ACTUAL AND COUNTERFACTUAL (SYNTHETIC) REAL INTEREST RATES AND INFLATION IN FIVE EARLY LEAVERS

first defend their currencies and then adapt to the new regime. The exception is New Zealand, which maintained a constant nominal rate on leaving gold. The jump in the real rate for New Zealand in July 1931 occurs before it left gold, as its estimated model is updated and forecast dynamics catch up with rapidly falling prices. If the model is updated more than semiannually, then the jump is smoothed across several months, but the narrative on leaving stays the same.

IX. Conclusions

Fifteen of our twenty-seven countries unambiguously left the gold standard on clearly defined dates. Our results confirm that in all fifteen leaving gold was associated with an increase in inflationary expectations and a decline in real interest rates. In eight of the fifteen leaving gold was associated with a turning point in expectations, a vindication of our argument. Although the timing is less clear, leaving gold seems to have had similar effects in several other countries, including Argentina, Australia, Austria, Estonia, Italy, and the United States—the country about which the argument was first made.

Abandoning the institution that had helped to stabilize inflationary expectations in the 1920s was, thus, an important precursor to recovery in many countries in the 1930s. But leaving the gold standard was not the only thing that countries did during this period, and inflationary expectations may have increased for different reasons as well. In Germany, for example, the suspension of reparations and Hitler's ascension to power seem to have been the crucial watersheds. We hope that future research will deal more comprehensively with the causes and consequences of such shifts in expectations during the 1930s.

REFERENCES

Abadie, Alberto. 2021. "Using Synthetic Controls: Feasibility, Data Requirements, and Methodological Aspects." *Journal of Economic Literature* 59 (2): 391–425.

Abadie, Alberto, Alexis Diamond, and Jens Hainmueller. 2010. "Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Control Program." *Journal of the American Statistical Association* 105 (490): 493–505.

Abadie, Alberto, and Javier Gardeazabal. 2003. "The Economic Costs of Conflict: A Case Study of the Basque Country." *American Economic Review* 93 (1): 113–32.

Albers, Thilo Nils Hendrik. 2018. "The Prelude and Global Impact of the Great Depression: Evidence from a New Macroeconomic Dataset." *Explorations in Economic History* 70 (C): 150–63.

Barsky, Robert B., and J. Bradford DeLong. 1991. "Forecasting Pre-World War I Inflation: The Fisher Effect and the Gold Standard." *Quarterly Journal of Economics* 106 (3): 815–36.

Banbura, Marta, and Michele Modugno. 2014. "Maximum Likelihood Estimation of Factor Models on Datasets with Arbitrary Pattern of Missing Data." *Journal of Applied Econometrics* 29 (1): 133–60.

Banbura, Martha, Domenico Giannone, and Lucrezia Reichlin. 2010. "Nowcasting." European Central Bank Working Paper 1275.

Bernanke, Ben S. 1995. "The Macroeconomics of the Great Depression: A Comparative Approach." *Journal of Money, Credit and Banking* 27 (1): 1–28.

Bernanke, Ben S., and Kevin Carey. 1996. "Nominal Wage Stickiness and Aggregate Supply in the Great Depression." *Quarterly Journal of Economics* 111 (3): 853–83.

Bernanke, Ben S., and Harold James. 1991. "The Gold Standard, Deflation, and Financial Crises in the Great Depression: An International Comparison," in *Financial Markets and Financial Crises*, edited by R.G. Hubbard, 33-68. Chicago: University of Chicago Press.

Binder, Carola Conces. 2016. "Estimation of Historical Inflation Expectations." *Explorations in Economic History* 61 (C): 1–31.

Bok, Brandyn, Daniele Caratelli, Domenico Giannone, Argia M. Sbordone, and Andrea Tambalotti. 2018. "Macroeconomic Nowcasting and Forecasting with Big Data." *Annual Review of Economics* 10 (1): 615–43.

Borchardt, Knut. 1984. "Could and Should Germany Have Followed Great Britain in Leaving the Gold Standard?" *Journal of European Economic History* 13 (1): 471–97.

Bouscasse, Paul. 2023. "Canst Thou Beggar Thy Neighbour? Evidence from the 1930s." Unpublished.

Broadberry, Stephen, and Alexander Klein. 2012. "Aggregate and Per Capita GDP in Europe, 1870-2000: Continental, Regional and National Data with Changing Boundaries." *Scandinavian Economic History Review* 60 (1): 79–107.

Brown, William Adams Jr. 1940. *The International Gold Standard Reinterpreted, 1914-1934.* New York: Cambridge, MA: National Bureau of Economic Research.

Callaway, Brantly, and Pedro H. C. Sant'Anna. 2021. "Difference-in-Differences with Multiple Time Periods." *Journal of Econometrics* 225 (2): 200–30.

Camacho, Maximo, Yuliya Lovcha, and Gabriel Perez Quiros. 2015. "Can We Use Seasonally Adjusted Variables in Dynamic Factor Models?" *Studies in Nonlinear Dynamics & Econometrics* 19 (3): 377–91.

Campa, Jose Manuel. 1990. "Exchange Rates and Economic Recovery in the 1930s: An Extension to Latin America." *Journal of Economic History* 50 (3): 677–82.

Cecchetti, Stephen G. 1992. "Prices during the Great Depression: Was the Deflation of 1930-1932 Really Unanticipated?" *American Economic Review* 82 (1): 141–56.

Choudhri, Ehsan U., and Levis A. Kochin. 1980. "The Exchange Rate and the International Transmission of Business Cycle Disturbances: Some Evidence from the Great Depression." *Journal of Money, Credit and Banking* 12 (4): 565–74.

Chouliarakis, George, and Tadeusz Gwiazdowski. 2016. "Regime Change and Recovery in 1930s Britain." Unpublished.

Christiano, Lawrence, Roberto Motto, and Massimo Rostagno. 2003. "The Great Depression and the Friedman-Schwartz Hypothesis." *Journal of Money, Credit and Banking* 35 (6): 1119–97.

Daniel, Volker, and Lucas Ter Steege. 2020. "Inflation Expectations and the Recovery from the Great Depression in Germany." *Explorations in Economic History* 75.

Derksen, J. B. D. 1938. *International Abstract of Economic Statistics, 1931-1936.* The Hague: Permanent Office of the International Statistical Institute.

Dimand, Robert W. 2003. "Irving Fisher on the International Transmission of Booms and Depressions through Monetary Standards." *Journal of Money, Credit and Banking* 35 (1): 49–59.

Dominguez, Kathryn M., Ray C. Fair, and Matthew D. Shapiro. 1988. "Forecasting the Depression: Harvard versus Yale." *American Economic Review* 78 (4): 595–612.

Dorval, Bill, and Gregor W. Smith. 2015. "Interwar Inflation, Unexpected Inflation, and Output Growth." *Journal of Money, Credit and Banking* 47 (8): 1599–1615.

Drummond, Ian M. 1981. *The Floating Pound and the Sterling Area.* Cambridge: Cambridge University Press.

Eggertsson, Gauti B. 2008. "Great Expectations and the End of the Depression." *American Economic Review* 98 (4): 1476–1516.

Ellison, Martin, Sang Seok Lee, and Kevin Hjortshøj O'Rourke. 2024. "Replication Data for: The Ends of 27 Big Depressions." American Economic Association [Publisher], Inter-University Consortiun for Political and Social Research [Distributor]. https://doi.org/10.3886/E191743V1.

Eichengreen, Barry. 1992. *Golden Fetters: The Gold Standard and the Great Depression, 1919-1939.* New York: Oxford University Press.

Eichengreen, Barry, and Douglas Irwin. 2010. "The Slide to Protectionism in the Great Depression: Who Succumbed and Why?" *Journal of Economic History* 70 (4): 871–97.

Eichengreen, Barry, and Jeffrey Sachs. 1985. "Exchange Rates and Economic Recovery in the 1930s." *Journal of Economic History* 45 (4): 925–46.

Eichengreen, Barry, and Peter Temin. 2000. "The Gold Standard and the Great Depression." *Contemporary European History* 9 (2): 183–207.

Evans, Martin, and Paul Wachtel. 1993. "Were Price Changes During the Great Depression Anticipated? Evidence from Nominal Interest Rates." *Journal of Monetary Economics* 32 (1): 3–34.

Federal Reserve Board. 1919 and subsequent years. "Federal Reserve Bulletin (May)." Board of Governors of the Federal Reserve System.

Fisher, Irving. 1933. "The Debt-Deflation Theory of Great Depressions." *Econometrica* 1 (4): 337–57.

Fisher, Irving. 1935. "Are Booms and Depressions Transmitted Internationally Through Monetary Standards?" *Bulletin de l'Institut International de Statistique* 28: 1–29.

Friedman, Milton, and Anna J. Schwartz. 1963. *A Monetary History of the United States, 1867-1960.* Cambridge, MA: National Bureau of Economic Research.

Gerchunoff, Pablo, and José Luis Machinea. 2015. "Going through the Labyrinth: The Political Economy of Argentina's Abandonment of the Gold Standard (1929-1933)." *CEPAL Review* 117: 103–20.

Hamilton, James D. 1987. "Monetary Factors in the Great Depression." *Journal of Monetary Economics* 19 (2): 145–69.

Hamilton, James D. 1992. "Was the Deflation during the Great Depression Anticipated? Evidence from the Commodity Futures Market." *American Economic Review* 82 (1): 157–78.

Hamilton, James D., Ethan S. Harris, Jan Hatzius, and Kenneth D. West. 2016. "The Equilibrium Real Funds Rate: Past, Present, and Future." *IMF Economic Review* 64 (4): 660–707.

Hausman, Joshua K., Paul W. Rhode, and Johannes F. Wieland. 2019. "Recovery from the Great Depression: The Farm Channel in Spring 1933." *American Economic Review* 109 (2): 427–72.

Jacobson, Margaret M., Eric M. Leeper, and Bruce Preston. 2023. "Recovery of 1933." Board of Governors of the Federal Reserve System, Finance and Economics Discussion Paper 2023-032.

Jalil, Andrew J., and Gisela Rua. 2016. "Inflation Expectations and Recovery in Spring 1933." *Explorations in Economic History* 62 (C): 26–50.

Jordà, Òscar, Moritz Schularik, and Alan M. Taylor. 2016. "The Great Mortgaging: Housing Finance, Crises and Business Cycles." *Economic Policy* 85: 107–40.

Kemmerer, Donald L. 1954. *Statement*. Washington D.C.: Government Printing Office.

Klug, Adam, John S. Landon-Lane, and Eugene N. White. 2005. "How Could Everyone Have Been So Wrong? Forecasting the Great Depression with the Railroads." *Explorations in Economic History* 42 (1): 27–55.

League of Nations.1926 and subsequent years. *International Statistical Yearbook*. Economic and Financial Section.

League of Nations. 1937. *World Economic Survey, Sixth Year, 1936/37*. Geneva: League of Nations.

Mishkin, Frederic S. 1981. "The Real Interest Rate: An Empirical Investigation." *Carnegie-Rochester Conference Series on Public Policy* 15 (1): 151–200.
Mitchener, Kris James, and Kirsten Wandschneider. 2015. "Capital Controls and Recovery from the Financial Crisis of the 1930s." *Journal of International Economics* 95 (2): 188–201.
Mitchener, Kris James, and Marc D. Weidenmier. 2010. "Searching for Irving Fisher." NBER Working Paper 15670.
Mitić, M. 1936. "Statistisches Handbuch der Weltwirtschaft (Book Review)." *Zeitschrift für Nationalökonomie* 7 (4): 569–570.
Obstfeld, Maurice, and Alan M. Taylor. 2003. "Sovereign Risk, Credibility and the Gold Standard: 1870–1913 versus 1925–31." *Economic Journal* 113 (487): 241–75.
Obstfeld, Maurice, and Alan M. Taylor. 2004. *Global Capital Markets: Integration, Crisis, and Growth.* Cambridge: Cambridge University Press.
Officer, Lawrence H. 2008. "Gold Standard." In *EH.Net Encyclopedia*, ed. Whaples. R. Economic History Association. https://eh.net/encyclopedia/gold-standard/.
Ritschl, Albrecht, Samad Sarferaz, and Martin Uebele. 2016. "The U.S. Business Cycle, 1867-2006: A Dynamic Factor Approach." *Review of Economics and Statistics* 98 (1): 159–72.
Romer, Christina D. 1992. "What Ended the Great Depression?" *Journal of Economic History* 52 (4): 757–84.
Romer, Christina D. 1993. "The Nation in Depression." *Journal of Economic Perspectives* 7 (2): 19–39.
Romer, Christina D. 2014. "It Takes a Regime Shift: Recent Developments in Japanese Monetary Policy through the Lens of the Great Depression." *NBER Macroeconomics Annual* 28 (1): 383–400.
Romer, Christina D., and David H. Romer. 2013. "The Missing Transmission Mechanism in the Monetary Explanation of the Great Depression." *American Economic Review* 103 (3): 66–72.
Saleuddin, Rasheed, and D'Maris Coffman. 2018. "Can Inflation Expectations Be Measured Using Commodity Futures Prices?" *Structural Change and Economic Dynamics* 45 (C): 37–48.
Sargent, Thomas J. 1982. "The Ends of Four Big Inflations." In *Inflation: Causes and Effects*, edited by R.E. Hall, 41–98. Chicago: University of Chicago Press.
Shibamoto, Masahiko, and Masato Shizume. 2014. "Exchange Rate Adjustment, Monetary Policy and Fiscal Stimulus in Japan's Escape from the Great Depression." *Explorations in Economic History* 53 (C): 1–18.
Smith, Lawrence. 1934. "The Suspension of the Gold Standard in Raw Material Exporting Countries." *American Economic Review* 24 (3): 430–49.
Statistisches Reichsamt. 1936. *Statistisches Handbuch der Weltwirtschaft.* Berlin: Verlag für Sozialpolitik, Wirtschaft und Statistik.
Statistisches Reichsamt. 1937. *Statistisches Handbuch der Weltwirtschaft.* Berlin: Verlag für Sozialpolitik, Wirtschaft und Statistik.
Temin, Peter. 1991. *Lessons from the Great Depression.* Cambridge, Massachusetts: MIT Press.
Temin, Peter, and Barrie A. Wigmore. 1990. "The End of One Big Deflation." *Explorations in Economic History* 27 (4): 483–502.
Tinbergen, Jan. 1934. *International Abstract of Economic Statistics, 1919-1930.* London: International Conference of Economic Services.
Tooze, Adam, and Martin Ivanov. 2011. "Disciplining the 'Black Sheep of the Balkans': Financial Supervision and Sovereignty in Bulgaria, 1902-38." *Economic History Review* 64 (1): 30–51.
Voth, Hans-Joachim. 1999. "Inflationary Expectations and Uncertainty during the Great Depression in Germany." Unpublished.
Wandschneider, Kirsten. 2008. "The Stability of the Interwar Gold Exchange Standard: Did Politics Matter?" *Journal of Economic History* 68 (1): 151–81.
Wolf, Nikolaus. 2007. "Should I Stay or Should I Go? Understanding Poland's Adherence to Gold, 1928-1936." *Historical Social Research / Historische Sozialforschung* 32 (4): 351–68.
Wolf, Nikolaus. 2008. "Scylla and Charybdis. Explaining Europe's Exit from Gold, January 1928–December 1936." *Explorations in Economic History* 45 (4): 383–401.
Working, Holbrook. 1949. "The Theory of Price of Storage." *American Economic Review* 39 (6): 1254–62.