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Around the World with Irving Fisher

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Abstract

This paper aims to show why Irving Fisher's own data on interest rates and inflation in New York, London, Paris, Berlin, Calcutta, and Tokyo from 1825 to 1927 suggested to him that nominal interest rates adjusted neither quickly nor fully to changes in inflation, not even in the long run. In Fisher's data, interest rates have more persistence than inflation and change less than inflation over time. The Fisher effect is a misnomer unless it is taken to refer to what Fisher actually found and what his data show: a persistent negative effect of increased inflation on real interest rates.

JEL-Code: E310, E430.

Keywords: Fisher effect, inflation, interest rates.

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1. Introduction

Ricardian equivalence, as you know, refers to the idea that government budget deficits do not matter because taxpayers are indifferent between debt-financed and tax-financed government expenditure: they realize that current debt needs to be serviced through future taxation and plan their saving accordingly. However, the attribution of this proposition to David Ricardo is unfair to him because, even if he exposited the logic behind it, he found the proposition unconvincing. To quote from Ricardo (1817, 254): "… it must not be inferred that I consider the system of borrowing as the best calculated to defray the extraordinary expenses of the State. It is a system which tends to make us less thrifty – to blind us to our real situation."

This short paper is intended to demonstrate anew that Ricardo is not alone, for Irving Fisher has suffered a similar treatment by his followers. The Fisher effect – through which nominal interest rates react to changes in inflation point by point so as to leave real interest rates unchanged, at least in the long run – is a comparable misnomer because, as will be shown here, Fisher's (1930) own data on interest rates and inflation that he collected from six financial centers around the world suggest that nominal interest rates do not come close to mirroring the movements in inflation, even in the long run. Fisher (1930, 413) recorded "a great unsteadiness in real interest when compared with money interest." Yet, many writers continue to attribute to Fisher the idea that real interest rates are immune to changes in inflation and to suggest that Fisher thought it somehow natural for real interest rates, like private consumption in the Ricardian case, to be so immune. For example, Okun (1981, 208) states incorrectly: "As Fisher saw it, an extra 1 percentage point of expected inflation raises the nominal expected rate of return on real capital assets by 1 percentage point and induces a parallel increase of 1 percentage point in bond and bill yields to keep expected returns in balance." For another example, Feldstein and Eckstein (1970, 366) write: "The data thus confirm the two basic Fisherian hypotheses: (1) in the long run, the real rate of interest is (approximately) unaffected by the rate of inflation, but (2) in the short run, the real rate of interest falls as the rate of inflation increases."[1]

In fact, Fisher thought no such thing. On the contrary, as Tobin (1987) and Dimand (1999), among others, point out, both Fisher's theory of interest and his reading of the historical record suggested to him that real interest rates varied inversely with inflation, and that the adjustment of nominal interest rates to changes in inflation took a very long time (Fisher, 1896). In Fisher's (1930, 43) words: "… when prices are rising, the rate of interest tends to be

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[1] Feldstein and Eckstein (1970) used quarterly U.S. data for 1954-1969.

high but not so high as it should be to compensate for the rise; and when prices are falling, the rate of interest tends to be low, but not so low as it should be to compensate for the fall."[2] To stress the point, we revisit Fisher's (1930) data.

2. Fisher's Data from Six Cities: A Time Series Approach

In an Appendix to his *Theory of Interest* (1930, 520-5), Fisher tabulates nominal interest rates as well as wholesale commodity price indices in six financial centers: New York, London, Paris, Berlin, Calcutta, and Tokyo, for a period spanning up to a hundred years from 1825 to 1927.[3] During this period, for decades on end, prices in New York, London, and Berlin rose by merely a fraction of a percentage point per year while prices actually fell on average in Paris. Meanwhile, prices in Calcutta and Tokyo increased by 2.1 per cent and 3.9 per cent per year on average (Figure 1). Fisher's informal analysis of the data confirmed his view that nominal interest rates tended to adjust only partially and slowly to changes in inflation, but he squeezed less juice out of the data than he might have.

We start by studying correlations across Fisher's data after removing trends and cycles from each time series y_t with an AR(2) model, either by estimating

(1)
$$y_t = \alpha + \beta t + \phi_1 y_{t-1} + \phi_2 y_{t-2} + \varepsilon_t$$

or

(2)
$$\Delta y_t = \alpha^* + \phi_1^* \Delta y_{t-1} + \phi_2^* \Delta y_{t-2} + \epsilon_t$$

We interpret the estimated residuals ε_t and ϵ_t as the prewhitened versions of the original time series, and use them to study the magnitude and duration (i.e., cycle length) of the innovations in each series as well as their lead-lag structures and correlations across countries.

Table 1 suggests cycles of about three to four years (Model 2) or more (Model 1), except Model 1 does not suggest cyclical behavior of interest rates or inflation in New York or of inflation in Tokyo. With the possible exception of the interest rate series in New York and Tokyo, the ADF test results for unit roots do not suggest that detrending the series with Model 2 is better than using Model 1 (the 0.05 critical value is -2.9 throughout). Both New York and Tokyo exhibit extreme values near the end of the sample as does London (Figure 1). Because several of the series are quite short (about 40-50 years in New York, Paris, Berlin, and

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[2] Fisher (1930, 494) describes the relationship between interest rates and inflation also thus: "When the price level falls, the rate of interest *nominally* falls slightly, but *really* rises greatly and when the price level rises, the rate of interest *nominally* rises slightly, but *really* falls greatly." Here Fisher means the rate of change of the price level even if he says only "price level." Fisher (1907, 270) made a clear distinction between the two: "Falling prices are as different from low prices as a waterfall is from sea level."

[3] The sample periods vary from place to place, see Table 3.

Tokyo), the cycle lengths shown in Table 1 cannot be very precisely estimated.

Table 1. Cycle Length of Interest Rates and Inflation Rates 1825-1927
and Unit Root Tests

	AR(2) model (1) (Years)		AR(2) model (2) (Years)		Augmented Dickey-Fuller unit root test (Intercept, lag = 2)	
	Nominal interest rate	Inflation rate	Nominal interest rate	Inflation rate	Nominal interest rate	Inflation rate
New York	Long	Long	3.3	3.1	-2.37	-3.46
London	17.7	8.1	3.5	3.1	-4.05	-4.98
Paris	8.1	4.2	3.9	3.2	-3.95	-3.45
Berlin	9.4	5.4	3.4	3.2	-3.39	-4.51
Calcutta	12.3	4.9	2.8	3.5	-5.12	-4.38
Tokyo	8.1	Long	4.1	Long	-2.54	-3.58

Source: Authors' computations based on Fisher's data.

Note: Cycle lengths in the first four columns are measured in years. The critical value for the ADF test in the last two columns is -2.9 throughout.

The cycle lengths shown in Table 1 are rather similar. Merging the series into an unbalanced panel offers a way of estimating a common dynamic structure for all six cities combined by detrending the data for each city by $\mu_i + \beta_i t$:

$$(3) \quad y_{i,t} - (\mu_i + \beta_i t) = \varphi_1 \{y_{i,t-1} - [\mu_i + \beta_i(t-1)]\} + \varphi_2 \{y_{i,t-2} - [\mu_i + \beta_i(t-2)]\} + e_t$$

Estimation of equation (3) suggests a cycle of 5.9 years for inflation and 16.7 years for nominal interest rates with asymptotic standard errors of 0.11 years for inflation and 29 years for interest rates. The cyclical tendency is clear for inflation, but vague for interest rates. This suggests that the dynamics of inflation and interest rates are quite different in Fisher's data with a possible cycle in interest rates that is much longer than the inflation cycle. If a common shock sets both series in upward motion, inflation will start to descend while nominal interest rates keep rising albeit modestly, reaffirming Fisher's view of the lack of sensitivity of nominal interest rates to inflation.

Table 2 shows the simultaneous correlations among Fisher's annual interest-rate series prewhitened by Model 1 (Model 2 gives similar results not shown). For New York, Fisher reports short 60-90 day commercial paper rates for 1866-1922 and long 4-6 month rates for 1890-1927; we report the former. For London, Paris, and Berlin, he reports market rates and

bank rates (the London bank rate is the discount rate of the Bank of England); we report the market rates. For Calcutta and Tokyo, he reports bank rates and market rates, respectively. The shaded part of Table 2 suggests the pull of gravity: the contemporaneous correlations among interest rates within Europe and across the Atlantic are higher than those between Europe or the United States and Asia. The correlations among the European countries range from 0.66 to 0.76 compared with 0.13 between Calcutta and Tokyo. The correlations across the Atlantic range from 0.38 to 0.68. The correlations between Europe and Asia range from negative to 0.38 whereas across the Pacific, they are robustly negative. The pattern is clear: from 1825 to 1927, financial market integration was inversely related to the distance between the financial centers.

Table 2. Cross-country Correlations of Prewhitened Interest Rates 1825-1927

	New York	London	Paris	Berlin	Calcutta	Tokyo
New York	1.00	0.43	0.68	0.38	-0.15	-0.32
London		1.00	0.76	0.75	0.35	-0.16
Paris			1.00	0.66	-0.20	-0.21
Berlin				1.00	0.38	-0.07
Calcutta					1.00	0.13
Tokyo						1.00

Source: Authors' computations based on Fisher's data.

Similarly, Table 3 shows the simultaneous correlation between domestic and foreign inflation – a sign of product market integration – to vary inversely with distance. Foreign trade was free. On the whole, inflation shocks are more closely correlated across countries than interest-rate shocks. No country is seen to lead neither inflation nor interest rates. Rather, the shocks are virtually simultaneous year by year.

Table 3. Cross-country Correlations of Prewhitened Inflation Rates 1825-1927

	New York	London	Paris	Berlin	Calcutta	Tokyo
New York	1.00	0.79	0.50	0.50	0.19	0.60
London		1.00	0.71	0.71	0.33	0.57
Paris			1.00	0.52	0.17	0.18
Berlin				1.00	0.06	0.22
Calcutta					1.00	0.53
Tokyo						1.00

Source: Authors' computations based on Fisher's data.

Table 4 shows that in the three European cities as well as Calcutta an increase in the inflation rate by one standard deviation is accompanied by an increase in the nominal interest rate equal to 0.3 or 0.4 times one standard deviation of the nominal interest rate. In London, for example, the standard deviations of inflation and the nominal interest rate are 8.53 per cent and 1.25 per cent, respectively. Therefore, based on Model 1, an increase in the inflation rate in London by one per cent per year goes along with an increase in the nominal interest rate by 0.04 (i.e., 0.30×1.25/8.53) per cent per year.

Table 4. Correlations of Prewhitened Inflation and Interest Rates 1825-1927

	New York	London	Paris	Berlin	Calcutta	Tokyo
Model 1	0.12	0.30*	0.41*	0.28*	0.33*	-0.11
	(0.19)	(0.001)	(0.004)	(0.02)	(0.004)	(0.25)
Model 2	0.06	0.22*	0.31*	0.25*	0.36*	-0.18
	(0.33)	(0.01)	(0.02)	(0.04)	(0.002)	(0.14)

Source: Authors' computations based on Fisher's data.

Note: p-values are shown within parentheses. An asterisk denotes statistical significance at the 0.05 level in a one-tailed test.

To trace the reaction of nominal interest rates to inflation over time, we estimated a vector-autoregressive model (VAR with lag = 2 and a trend) for each of Fisher's series (not shown). The impulse response functions thus obtained for London suggest that the initial (i.e., concurrent) correlation of 0.30 shown in Table 4 rises to 0.55 in the following year, and then gradually declines to zero in six years (Figure 2, upper panel). A higher nominal interest rate is followed by less inflation, a correlation that peters out after five years (Figure 2, lower panel). Further, Figure 2 confirms that inflation is more volatile than nominal interest rates. Increased inflation makes nominal interest rates edge upward, an effect that persists even after inflation reverses course.

Because the time series are of uneven length and short except for London, we also estimated a VAR model with country-specific trends and common dynamic AR(2) parameters. The resulting impulse response functions for all six cities combined are similar to those for London shown in Figure 2, and are more precisely estimated because the pooled sample is much larger than that for London alone. In either case, the impulse response pattern means that an increase in the inflation rate by one per cent is followed by a tiny increase in nominal interest rates in the first year, an effect that gradually declines to zero after six years. The pattern of interaction between nominal interest rates and inflation observed in Figure 2 suggests that both variables are influenced by other factors.

3. Back to Fisher: Regression Analysis

Unlike Wicksell (1936), Fisher (1930) imagined nominal interest rates i to adjust slowly to changes in the rate of inflation π. He formalized his idea by developing distributed lags that can be derived either from transactions-cost based models of gradual adjustment of interest rates to expected inflation or from models of instantaneous adjustment combined with adaptive expectations.[4] In either case, the dynamic relationship between i and π can be described by a lagged dependent variable:

(4) $i = a\pi + bi_{-1} + c + e$

The short-run effect of π on i is $a > 0$, the long-run effect is $a/(1-b) > a$ if $1 > b > 0$, the mean lag is $a/(1-b)^2$, c is a constant reflecting a risk premium plus the price of time, and e is white noise.

   For comparison with the correlations shown in Table 4, Table 5 shows OLS estimates of six such equations, one for each of Fisher's six cities.[5] With the possible exception of New York and Tokyo, the hypothesis that the interest-rate series have unit roots can be rejected everywhere in an Augmented Dickey-Fuller test, with an intercept and a two-period lag (Table 1). Like in Rose (1988), none of the six inflation series have unit roots either (not shown). Therefore, Mishkin's (1992) method of deducing a one-to-one long-run relationship between nominal interest rates and inflation from cointegration tests for a common trend in both series in some but not all industrial countries does not apply to Fisher's data. Without serially correlated errors in London, Paris, Berlin, Calcutta, and possibly also Tokyo and without unit roots, OLS estimates of the parameters in equation (1) can be expected to be consistent but biased. Further, the AR(2) cycles observed in the inflation series in Section 2 suggest that the OLS estimates must be taken with a grain of salt.

   Notice that current inflation has a significantly positive effect on interest rates in four of the six cities, all except New York and Tokyo.[6] Where statistically significant, however, the short-run effect of inflation on interest rates is small, ranging from 0.03 to 0.05. The lagged effect of last year's interest rate is significant throughout, ranging from 0.35 in Calcutta to 0.69 in Paris. Even so, the long-run effect of inflation on interest rates is significantly larger

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[4] Examples of transactions cost in financial markets include the cost of setting up complicated models to guide financial transactions and of hiring highly paid traders to conduct business.
[5] For the three cities for which Fisher presents a market rate as well as a bank rate, the market rate is used. The equations for the bank rates (not reported) are similar. For New York, Table 5 reports the short-rate equation; again, the long-rate one is qualitatively similar even if it extends over a period that is shorter by 19 years.
[6] Fisher's (1930, 532-3) quarterly data for New York 1890-1927 produce broadly similar results (not reported).

than zero only in London, Berlin, and Calcutta, and is well below one throughout, ranging from 0.05 in New York to 0.17 in Paris.

Table 5. Six Cities: Regression Results on Interest Rates 1825-1927

	Constant	Short-run effect	Long-run effect	Mean lag (years)	Adjusted R^2
New York 1867-1922	1.902 (0.698)	0.018 (0.020)	0.050 (0.064)	0.139 (0.214)	0.331
London 1825-1927	1.432 (0.303)	0.050* (0.012)	0.117* (0.041)	0.276* (0.140)	0.337
Paris 1873-1914	0.795 (0.298)	0.053* (0.018)	0.170 (0.097)	0.559 (0.499)	0.492
Berlin 1862-1912	1.969 (0.433)	0.034* (0.017)	0.058* (0.029)	0.098 (0.059)	0.232
Calcutta 1862-1926	3.71 (5.64)	0.036* (0.013)	0.055* (0.023)	0.085* (0.043)	0.185
Tokyo 1888-1926	3.497 (1.013)	-0.012 (-0.014)	-0.025 (0.027)	-0.054 (0.058)	0.327

Note: An asterisk denotes statistical significance at the 0.05 level. Standard errors are shown within parentheses. The standard errors of the estimates of the long-run effects and the mean lags are approximated by a Taylor expansion of $J_f^T(\hat{a},\hat{b})Cov(\hat{a},\hat{b})J_f(\hat{a},\hat{b})$ where for the long-run effect $J_f(a,b) = [1/(1-b), a/(1-b)^2]$ and for the mean lag $J_f(a,b) = [1/(1-b)^2, 2a/(1-b)^3]$.

Figure 1 presents Fisher's data on nominal interest rates and inflation, making the same point as Tables 4 and 5 by showing how real interest rates *r,* originally defined by Fisher (1896) as

$$(5) \quad r = \frac{1+i}{1+\pi} - 1$$

vary inversely with inflation in Fisher's six cities. If *i* adjusted fully and promptly to π, then *r* would be roughly constant and independent of π. But this is not what Figure 1 shows. On the contrary, all six panels of Figure 1 suggest with a striking consistency that nominal interest rates hardly budged anywhere when inflation changed.[7] This means that changes in inflation could have real effects by moving real interest rates about and thereby also investment, saving, asset portfolios, consumption, output, and employment.

In Fisher's time, as Figure 1 shows, while inflation did not hesitate to move into negative territory, nominal interest rates did not follow. In London, wholesale prices rose merely by 9 per cent from 1820 to 1927, not per year but for the period as a whole, while in New York they remained unchanged from 1867 to 1926 as they did in Berlin from 1866 to 1911; in

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[7] A similar pattern of real interest rates and inflation emerges from Fisher's quarterly data for New York 1890-1927.

Paris, wholesale prices fell by 18 per cent from 1872 to 1914 (Fisher, 1930, 520-3). In Fisher's data, deflation was nearly as common as inflation, reaffirming his inference that deflation makes both real interest rates and debt burdens rise, leading to distrust, distress selling, bankruptcies, bank runs, reduced output and trade, and unemployment (Fisher, 1896, 1933).[8] There can be no controversy about deflation making real interest rates rise when nominal interest rates refuse to go below zero as was the case throughout Fisher's data. It may have been natural in those days to expect nominal interest not to follow inflation because bouts of inflation were often followed by deflation since inflation expectations were well anchored by the gold standard, but Fisher did not make this observation. In Fisher's data, the average real interest rate as defined in equation (5) is positive everywhere over the sample period as a whole, ranging from 3.2 per cent per year in Paris to 6.1 per cent in New York.

While Fisher viewed real interest as a passive variable that varies inversely with inflation, Wicksell (1936) regarded real interest – i.e., natural interest adjusted for inflation – as the expected long-term return on new investments, arguing that an increase in the real rate of interest signaled higher profits, thus encouraging bank lending with increased inflation as a result. By suggesting an inverse relationship between inflation and real interest, Fisher's data seem to contradict this version of Wicksell's story. If, however, Wicksell's real interest is viewed as money interest adjusted for inflation, Wicksell's argument implies that an increase in money interest rates for given natural interest reduces inflation and increases real interest, a process that produces an inverse relationship between inflation and real interest consistent with Fisher's analysis and data.

4. More Recent Literature

Turning Fisher's analysis of the effects of inflation on interest rates on its head, yet without invoking Wicksell's theory, Fama (1975) postulated rational expectations

(6) $\pi_{t+1} = E(\pi_t) + \vartheta_t$

where π_{t+1} is the one-period-ahead inflation rate and the forecast error is orthogonal to information known at time t and where the current interest rate i_t mirrors expected inflation

(7) $E(\pi_t) = \alpha + \beta i_t + \theta_t$

if the real rate of interest is constant such that $\alpha = -\bar{r}$ and $\beta = 1$. Combining the two equations gives

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[8] For a historical survey of deflation, see Bordo and Filardo (2005).

(8) $\pi_{t+1} = \alpha + \beta i_t + \varepsilon_t$

If θ is orthogonal to i in equation (7) and ϑ is orthogonal to $E(\pi)$ in equation (6), then ε is also orthogonal to i in equation (8), making the estimate of β unbiased as well as consistent because the interest rate is measured at a point in time when inflation is not known.[9] Fama reports $\beta = 1$ in U.S. data from 1954-1971. His approach requires markets to be efficient with serially random forecast errors.

Table 6 shows that estimates of equation (8) with Fisher's data for each of the six cities listed in Tables 1-5 contradict Fama's finding, and can perhaps as well be interpreted as contradicting Wicksell's view that an increase in the natural real rate of interest increases inflation. Several other empirical studies have failed to find supportive evidence for the mislabeled Fisher effect, i.e., for full adjustment of nominal interest rates to inflation (Cooray, 2003). Gradual but ultimately full adjustment of nominal interest rates to inflation has been observed in the United States, the United Kingdom, and Canada in the first post-war decades, true, but not after 1980s and not in many other countries. Summers (1982) found no evidence for any significant impact of inflation expectations on nominal inflation rates in the short run or the long run in the United States during 1860-1940. He did find such an effect in the post-war period but solely due to the inclusion of the years 1965-1971; even so, the effect reported was smaller than one, meaning that changes in expected inflation do affect real interest rates. Further, decadal averages for real interest rates were highest in deflationary decades (1870-79, 1880-89, 1920-29, and 1930-39) and lowest when inflation was high (such as 1869-69, 1910-19, 1940-49,5 and 1970-79). Further, Summers (1982) found that nominal interest rates do not adjust fully to inflation even when all years when prices fell are removed, thus demonstrating that the zero floor below nominal interest rates was not the source of the weak correlation between nominal interest and inflation – that is, the strong inverse correlation between real interest and inflation.

Mishkin (1984) tested for full adjustment in seven OECD countries during 1967-1979,[10] and rejected the constancy of real interest rates in each case, which means that real interest rates in these countries decline with increased inflation. Mishkin (1992) reports cointegration between inflation and nominal interest rates in U.S. data, which he interprets as full adjustment of nominal interest rates to inflation in the long run, implying that the two series will move together along trend generating a high correlation. He rejects full adjustment in the

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[9] See Nelson and Schwert (1977) for a criticism of this approach.
10 Canada, France, West Germany, the Netherlands, Switzerland, the United Kingdom, and the United States.

short run when the two series are stationary, concluding that short-term fluctuations in interest rates reflect macroeconomic shocks while long-term movements may reflect changes in inflation expectations.

Table 6. Fama's Test in Fisher's Data 1825-1927

	Fama's α	Fama's β	Adjusted R^2
New York 1867-1922	16.83 (4.22)	-3.07 (0.75)	0.22
London 1825-1927	6.28 (2.42)	-1.69 (0.67)	0.05
Paris 1873-1914	4.12 (2.55	-1.71 (0.93)	0.05
Berlin 1862-1912	-3.54 (3.61)	1.20 (1.05)	0.01
Calcutta 1862-1926	4.88 (6.35)	-0.48 (1.08)	0.00
Tokyo 1888-1926	28.80 (11.32)	-3.44 (1.55)	0.09

Note: Standard errors are shown within parentheses.

In sum, the absence of full adjustment of nominal interest rates to inflation when inflation and interest rates are stationary is consistent with the absence of such a relationship in Fisher's data. Fisher found the contemporaneous correlation between inflation and nominal interest rates to be weak. When he related nominal interest rates to distributed lags of past inflation rates as a proxy for the market's expected rate of inflation, the effect remained quite weak. Fisher also proposed comparing the variance of real and nominal interest rates, suggesting that if the former was larger than the latter then interest rates did not respond fully to inflation (recall Figure 1). As we do, Summers (1982, 26) observes that "there is no sense in which his [Fisher's] results can be said to demonstrate the empirical validity of the theory that bears his name."

More recent empirical evidence, surveyed by Cooray (2003), mostly supports Fisher's findings. For example, Koustas and Serletis (1999) find no evidence of an effect of inflation on short-term interest rates. Fahmy and Kandil (2003) report a weak effect of inflation on short-term interest rates while trends in inflation and interest rates tend to coincide.

5. Discussion

In retrospect, it is remarkable that the name of one of the world's great economists came to be associated above all else with a view that he, after careful study, did not share. Fisher's (1930,

415) view was that "… men are unable or unwilling to adjust at all accurately or promptly the money interest rates to changed price levels. Negative real interest rates could scarcely occur if contracts were made in a composite commodity standard. The erratic behavior of real interest is evidently a trick played on the money market by the "money illusion" when contracts are made in unstable money." A few pages earlier, Fisher (1930, 400) had written: "Most people are subject to what may be called "the money illusion," and think instinctively of money as constant and incapable of appreciation or depreciation." Fisher understood that under certain circumstances, including perfect foresight, real interest rates might be immune to changes in inflation, at least over the long haul, but he rejected the premises needed to erect such a theory. His appeal to money illusion made him suspect, however, at a time when Keynesian economics was under siege on partly similar grounds, and triggered three reactions. Some rebelled against Fisher by applying econometric time series methods to more recent data, concluding in some cases that real interest rates were immune to inflation after all (e.g., Fama, 1975), but this approach met later with mixed success and, further, it left Fisher's own data unexplained. Others built models showing how money illusion was not necessary to explain how changes in the rate of inflation could move real interest rates and other real magnitudes (e.g., Mundell, 1963; Tobin, 1965), for the rate of inflation, all things considered, is a relative price. Endogenous growth theory, by making also real interest rates endogenous in the long run, makes a similar point. Others still argue that money illusion is real (Akerlof and Shiller, 2009, 41-50).

6. Conclusion

We have seen why Irving Fisher's data on interest rates and inflation in New York, London, Paris, Berlin, Calcutta, and Tokyo from 1825 to 1927 suggested to him that nominal interest rates adjusted neither quickly nor fully to changes in inflation, not even in the long run. Further, in Fisher's data the dynamics of nominal interest rates are quite different from those of inflation. Interest rates have more persistence than inflation and change less than inflation. While the evidence for each of the six cities *per se* is rather vague, the assumption of a common dynamic structure suggests inflation cycles of about six years but no significant cyclical behavior of interest rates. The failure of nominal interest rates to imitate the inflation cycles underlines the lack of sensitivity of nominal interest rates to inflation. The Fisher effect is a misnomer unless it is taken to refer to what Fisher actually found and what his data show: a persistent negative effect of increased inflation on real interest rates.

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Figure 1. Six Financial Centers: Nominal Interest Rates and Inflation 1825-1927
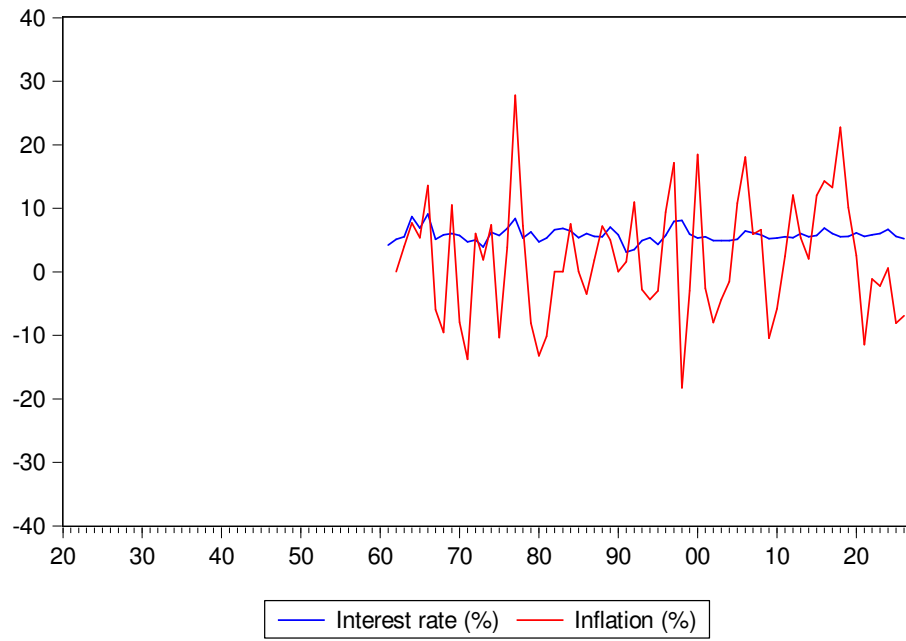
New York 1867-1922
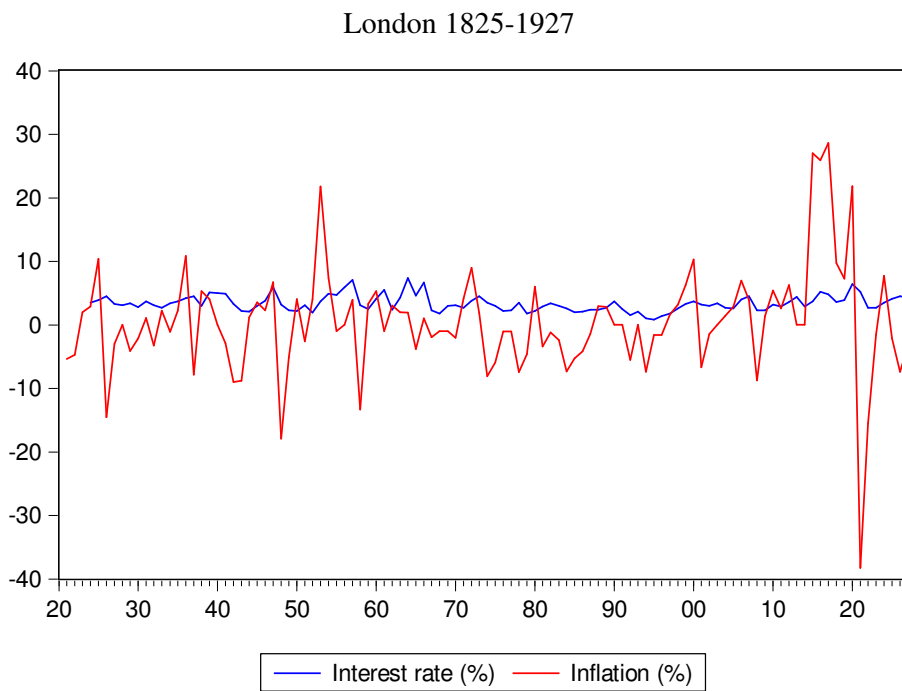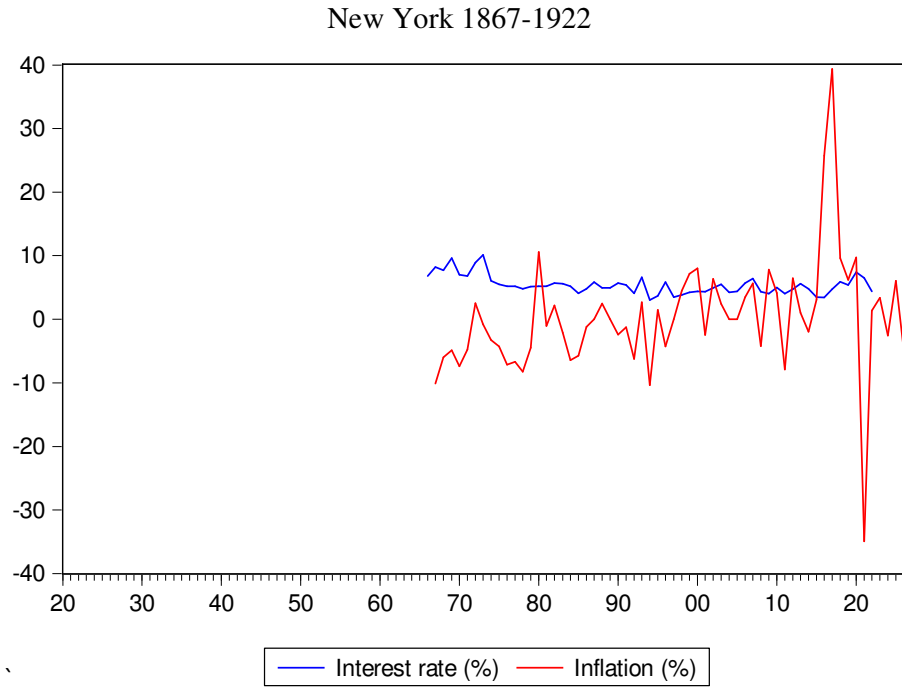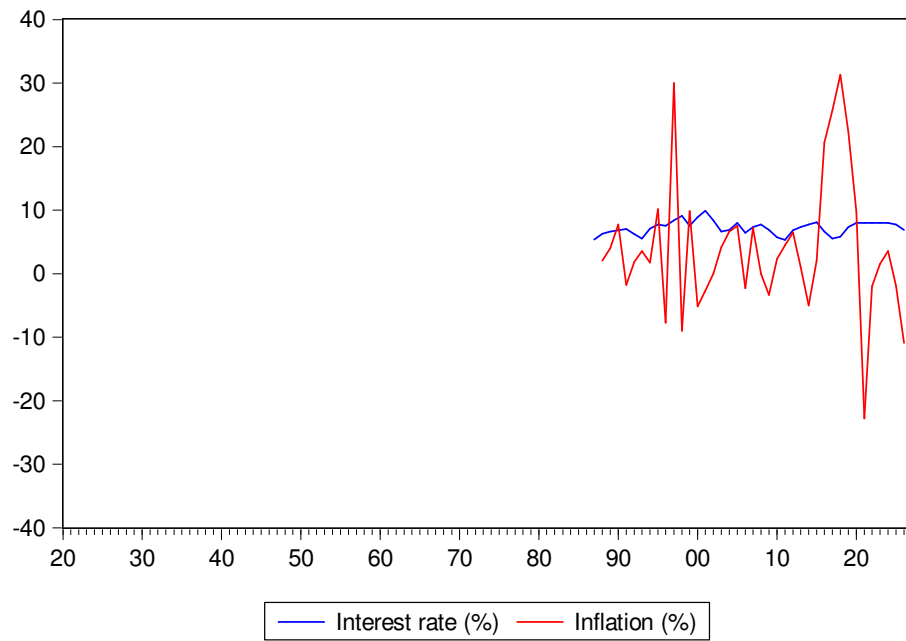

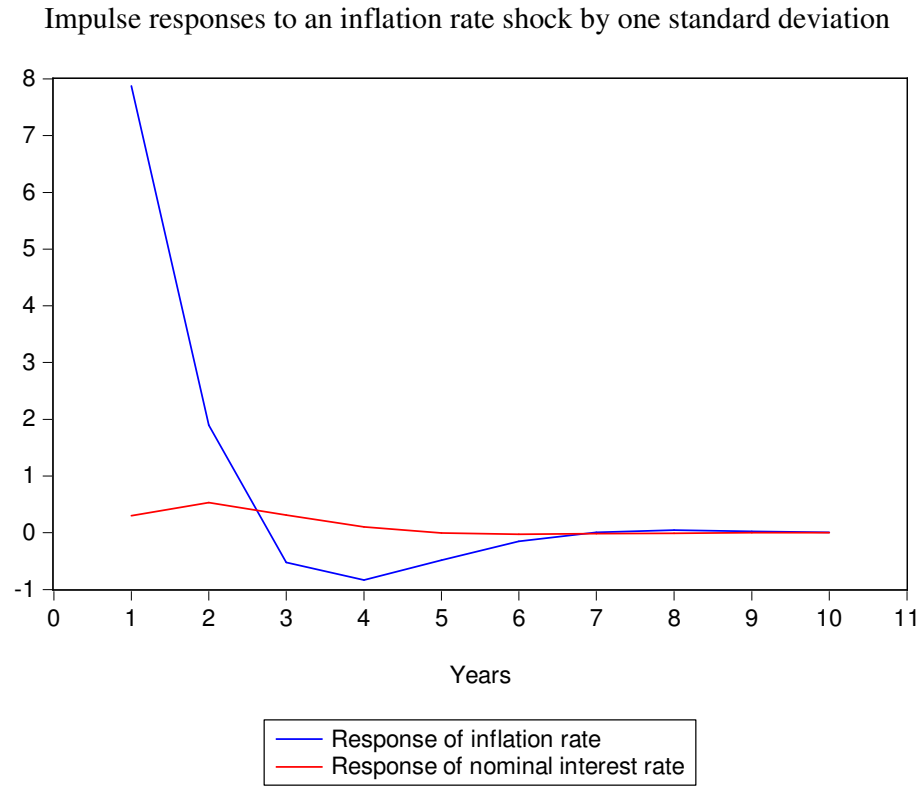London 1825-1927

Paris 1873-1914
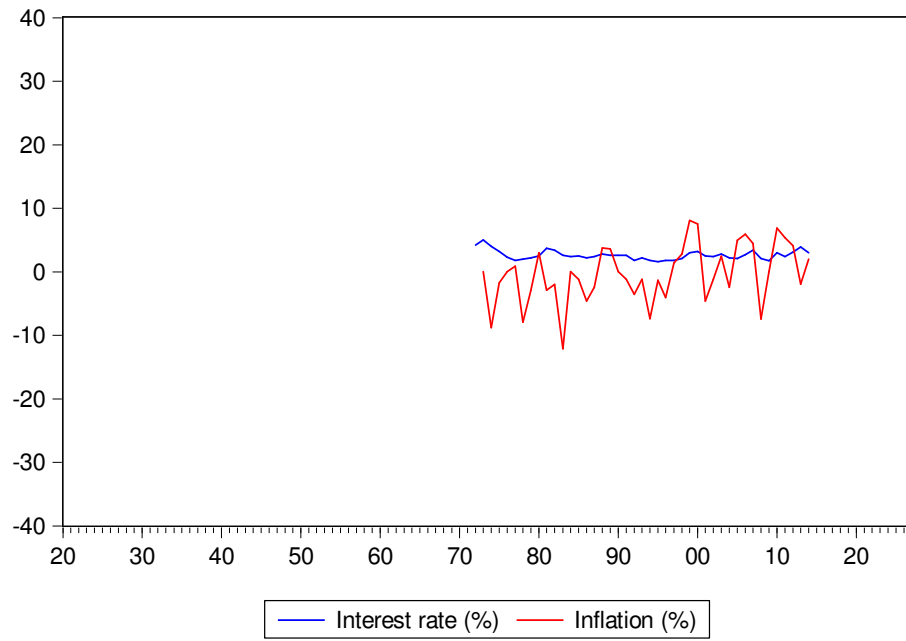
Berlin 1862-1912
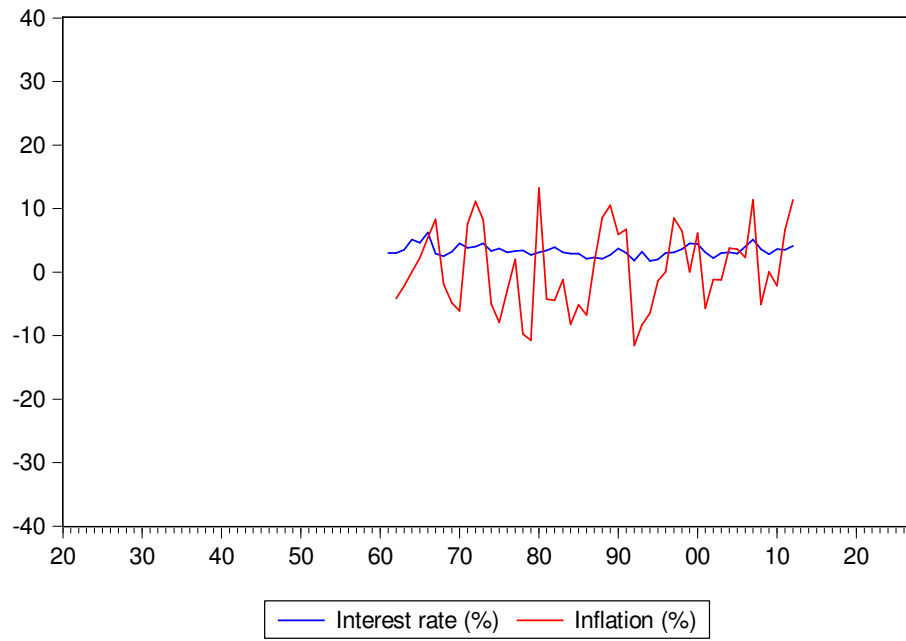
Calcutta 1862-1926

Tokyo 1888-1926

Source: Fisher (1930, 520-5).

Figure 2. London: Interaction of Nominal Interest Rates and Inflation 1825-1927

Impulse responses to an inflation rate shock by one standard deviation

Years

- Response of inflation rate
- Response of nominal interest rate

Impulse responses to a nominal interest rate shock by one standard deviation

Years

- Response of nominal interest rate
- Response of inflation rate
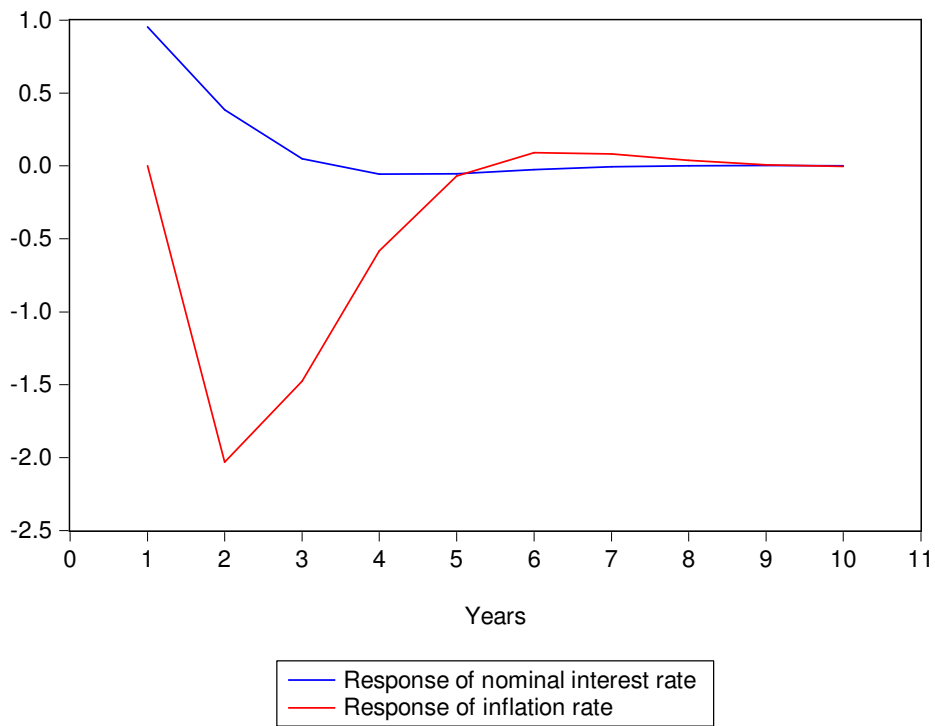
Source: Authors' computations.

Note: The vertical axes show the response of nominal interest rates and inflation measured in standard deviations to an increase in each of those variables by one standard deviation. The horizontal axes show the number of years following a shock in year 1.