CAPITAL MARKET INTEGRATION AND EXCHANGE-RATE REGIMES IN HISTORICAL PERSPECTIVE

James R. Lothian

ABSTRACT

This chapter uses very long time series of historical data to investigate the cross-country convergence of real and nominal short-term and long-term interest rates across exchange-rate regimes. Consistent with theory, the behavior of nominal interest rates varies considerably across regimes, while the behavior of real interest rates, in contrast, proves to be very nearly the same under the classical gold-standard, Bretton Woods and floating-rate regimes. The chapter goes on to discuss theoretical reasons for this neutrality and to present related qualitative evidence on the similarity of important capital-market institutions in the gold and floating-rate periods, and on the changes in such institutions that took place during the latter.

1. INTRODUCTION

On one view, international capital markets have become increasingly linked over the past two decades, both as a result of rapid financial and technological innovation, and because of the gradual erosion of governmental controls. On another reading, however, they have remained much less than fully integrated. The culprit, according to a prominent version of this story, is increased

Research in Banking and Finance, Volume 1, pages 139–173.

ISBN: 0-444-50587-3

financial volatility – particularly exchange-rate volatility, which, it is argued, has hampered capital flows and thus kept international markets apart.

The underlying motivation for this chapter is to examine these two quite contradictory characterizations. To do so I investigate the behavior of interest rates historically, focusing on the time paths and degrees of international convergence of both real long-term bond yields and real short-term 'money market' interest rates in a sample of panel data that at its longest spans the two-century period 1795–1994, and at its geographically broadest, the United States and nine other industrial countries.

For both short-term and long-term rates, I find approximately the same degree of convergence during the classical gold standard era, the Bretton Woods years and the current floating rate period. The question that I go on to consider is what forces might conceivably be responsible for these results. Are they consistent with other economic, and most importantly financial developments, over the long period that these data cover and hence a phenomenon of behavioral significance? Or alternatively, are they simply a statistical artifact? Relatedly, why does the move to floating exchange rates in the early, 1970s have so little visible effect?

Section 2 of this chapter outlines theoretical considerations and reviews some of the previous literature on international interest rate behavior. Section 3 describes the data used and details the empirical results. Section 4 contains a discussion of the institutional features of banking and international financial markets historically. Section 5 presents summary material and conclusions.

2. THEORETICAL CONSIDERATIONS

Consider the simplest model of an integrated world economy, one in which there are no transactions costs of any sort and no risk, and in which agents have perfect foresight and the law of one price holds continuously in all markets. In that instance, prices of identical goods in different countries will always be the same when they are expressed in the same currency units.

In bond markets, the result is cross-country equality between exchange-rate-adjusted nominal interest rates on securities with identical characteristics:

$$R_t = R_t^F - \hat{s}_t, \tag{1}$$

where R_t and R_t^F are the nominal interest rates on the domestic and foreign bonds, and $\hat{s}_t$ is the percentage change in the nominal exchange rate, the foreign currency price of a unit of the domestic currency.

Applied to goods markets, the result is equality of exchange-rate-adjusted price levels and hence inflation rates in the two countries, provided that the various goods receive the same weights in the two indexes:

$$\pi_t = \pi_t^F - \hat{s}_t, \tag{2}$$

where π_t and π_t^F are the two countries' inflation rates.

Equation (1) is, of course, uncovered interest parity (UIP); equation (2) is a variant of purchasing power parity (PPP). Combined, the two have direct implications for real interest rates: If both hold, real interest rates will be equal across countries. This will be true, moreover, regardless of the exchange-rate regime. To see this why, first consider the open-economy version of the Fisher equation:

$$R_t - R_t^F = (r_t - r_t^F) + (\pi_t - \pi_t^F), \tag{3}$$

where the r_ts are the two real yields, and where, given the assumption of perfect certainty, actual rates of inflation equal, and hence replace, anticipated rates, and the distinction between *ex post* and *ex ante* real rates does not therefore apply.

Now to take account of changes in the exchange rate, subtract $\hat{s}_t$ from both sides. The result after rearranging terms is:

$$r_t - r_t^F = [(R_t - R_t^F) - \hat{s}_t] + [\hat{s}_t - (\pi_t - \pi_t^F)]. \tag{4}$$

If UIP and PPP, or their analogues under fixed exchange rates, equality of nominal interest rates and equality of inflation rates, both hold, the right-hand side of (4) will be zero and r_t and r_t^F will be equal. The exchange-rate regime, moreover, will not matter. It will be neutral and of no consequence for the behavior of the real variables, the two real yields. The only difference between fixed and floating rates in this case is that $\hat{s}_t$ by definition is zero under fixed rates. The behavior of nominal yields, however, very likely will differ across regimes since countries generally have resorted to floating exchange rates in situations in which their policies toward inflation have differed substantially.[1]

In the absence of perfect foresight, distinctions between actual and anticipated rates of inflation and actual and anticipated rates of exchange-rate change, and hence between *ex ante* and *ex post* real yields, all become relevant. Equations (3) and (4) then have to be rewritten as:

$$(R_t - R_t^F) = (\rho_t - \rho_t^F) + \pi_t^* - \pi_t^{*F}, \tag{5}$$

and

$$\rho_t - \rho_t^F = [(R_t - R_t^F) - \hat{s}_t^*] + [\hat{s}_t^* - (\pi_t^* - \pi_t^{*F})], \tag{6}$$

where the π_t^*s are rates of inflation anticipated at time t to prevail over the lives of the bonds, $\hat{s}_t^*$ is the anticipated rate of change of the nominal exchange rate, similarly defined, and the ρ_ts are the *ex ante* real yields.

If UIP and PPP hold in the *ex ante* sense of equation (6), *ex ante* real interest rates in the two countries will be equal. Conversely if either or both are

violated, there will be a gap between the two *ex ante* real rates. For *ex post* real interest rates to be equal, one additional condition has to be met: inflation expectations in the two countries have to be exactly on the mark.

To see this, use the definitions of *ex ante* and *ex post* real interest rates given in (3) and (5) respectively to write an equation relating the difference in *ex post* real interest rates to the difference in the *ex ante* rates and to errors in inflation expectations:

$$r_t - r_t^F = (\rho_t - \rho_t^F) + \bar{\varepsilon}_t^{\pi}, \tag{7}$$

where $\bar{\varepsilon}_t^{\pi} \equiv (\pi_t^* - \pi_t^{*F}) - (\pi_t - \pi_t^F)$, the difference in the two inflation-prediction errors.

In the empirical work that follows, I use *ex post* measures of real interest rates throughout, but focus almost exclusively on the relationships in quinquennially averaged data. Under the usual assumptions of rational expectations, prediction errors will be mean zero, and therefore are likely to be reduced by this averaging.

One additional caveat with regard to this measure, however, needs to be made. Like other cross-country convergence measures, real interest differentials are subject to some ambiguity in interpretation. Fluctuations in real interest differentials, rather than signaling changes in the degree of financial integration could conceivably be simply a reflection of changes in domestic economic variables. The principal theoretical candidate here is changes in the degree of convergence of real consumption growth. It should be noted, however, that such changes are not devoid of implications for capital market behavior as the analysis of Mace (1991) makes clear. In a world of full consumption insurance, consumption growth rates will tend toward equality. This happens because of borrowing, borrowing that a well-functioning and highly integrated world capital market facilitates. Following this line of reasoning, a number of researchers, in fact, have used convergence of consumption growth as an indicator of capital market integration (e.g. Bayoumi & MacDonald, 1995).

I.A. Previous Evidence on International Financial Integration

Although agreement on the issue is not unanimous, a substantial body of evidence appears inconsistent with anything close to full financial integration and the complete equality of real interest rates that would be one of its hallmarks.[2] One piece of evidence is the strong positive cross-country correlation between investment and savings, first documented by Feldstein and Horioka (1980) and the subject of much subsequent research. A second comes from direct tests of real-interest rate equality based on an equation such as:

$$r_t = a + br_t^F + u_t. \tag{8}$$

In general, these tests have rejected the hypothesis that $(a\ b) = (0\ 1)$.[3]

A third type of evidence comes from indirect tests of real-interest equality based upon a variant of equation (6):

$$\rho_t - \rho_t^F = [R_t - R_t^F) - fd_t] + [fd_t - \hat{s}_t^*] + [\hat{s}_t^* - (\pi_t^* - \pi_t^{*F})], \tag{9}$$

in which the deviation from *ex ante* UIP is itself decomposed into two components. The first, the difference between the nominal-interest differential, and the forward premium fd_t, is the covered interest parity (CIP) relation, or in Frankel's (e.g. 1992) terminology the 'country premium'. The second, the difference between the forward premium and the anticipated change in the nominal exchange rate, Frankel lumps together with the anticipated change in the real exchange rate, under the heading of 'currency premia'.

Since the bulk of the evidence shows that covered interest parity holds for major currencies in recent decades, researchers have focused their attention on the second and third right-hand-side terms in equation (5), particularly the second.[4] For the current float, the period that has been most intensively investigated, the results have been largely negative: Using quarterly and monthly data and forecast horizons of one to twelve months ahead, researchers generally have found significant differentials between *fd* and $\hat{s}^*$.[5] These have been interpreted variously as risk premia, reflections of rational learning in the presence of regime changes, and irrational behavior on the part of traders.[6] Whatever the underlying reason for the differentials, they do translate, other things being equal, into differentials between real interest rates internationally.

A final body of evidence comes from examination of actual portfolios. These contain higher proportions of domestic securities than would be consistent with traditional models of portfolio choice. This finding of 'home bias' has been taken as prima facie evidence of inefficiency. (Tesar & Werner, 1995).

One possible explanation for such results centers around the effects of exchange-rate variability. According to this line of reasoning, the uncertainty generated by frequent and substantial changes in real exchange rates has adversely affected the functioning of capital markets. Although international arbitrage still takes place, it does so in the context of increased risk. This, it is argued, decreases the flow of capital from one country to the other and thus creates widened cross-country differentials between real yields.

As Mussa & Goldstein (1993) have pointed out, this argument, though widely voiced, has been more or less viewed as a truism and not developed rigorously. McKinnon (1990) is an exception. He compares nominal interest rate behavior under the classical gold standard and under the float, and concludes on the basis of this evidence that the openness of international

capital markets was a good deal less in the latter period. For this and other reasons, he has advocated reestablishment of fixed exchange rates.

How apt a description of capital-market behavior under floating exchange rates this is, and what, in any event it implies about the choice of an exchange-rate regime, is issues to be resolved. The underlying question in both instances has to do with the partial as opposed to the total effects of the regime, and hence ultimately with the degree to which exchange-rate regimes and the institutions affecting international capital markets, including the regulatory apparatus, is independent of the macroeconomic environment. Below I argue that the degree of independence is not high in either instance.

3. DATA AND OVERVIEW OF EMPIRICAL RESULTS

In the empirical analysis that follows I use annual data for long-term bond yields (either government or high-grade corporate) and for a variety of short-term, 'money-market' interest rates, for samples of ten countries and seven countries respectively. The ten-country sample is made up of Belgium, France, Germany, The Netherlands, Sweden, the United Kingdom, the United States, Canada, Italy, and Norway; the seven-country sample excludes the last three. The sample period varies according to data availability, but at its longest – long-term real rates for both the United Kingdom, and the United States – it spans the full two centuries from 1795 to, 1994.

As a proxy for the *ex ante* real interest rate I use the spreads between the nominal rates and the contemporaneous rates of inflation. The price-level data used to construct these estimates are for GNP (or GDP) deflators beginning in 1870 and linked to WPIs or CPIs, depending on data availability, before that date.[7] For the money market rates, the errors introduced by this procedure arguably are less of a problem than for the long-term bond yields. As stated above, in an effort to mitigate their effects, I use quinquennial averages of the data. None of the results reported below, however, depends crucially on averaging. In earlier versions of this paper I used the annual observations as my basic units of observation and obtained virtually the same results.

3.1. Overview of Real and Nominal Yield Behavior

Figures 1–4 and Tables 1 and 2 provide an overview of the data. Tables 1 and 2 provide summary figures showing the degree of cross-country divergence of both short-term and long-term real interest rates for various subperiods. The measure of such divergence used here, as also in the charts, is in all instances the cross-country standard deviation of the quinquennial average real rate.[8]

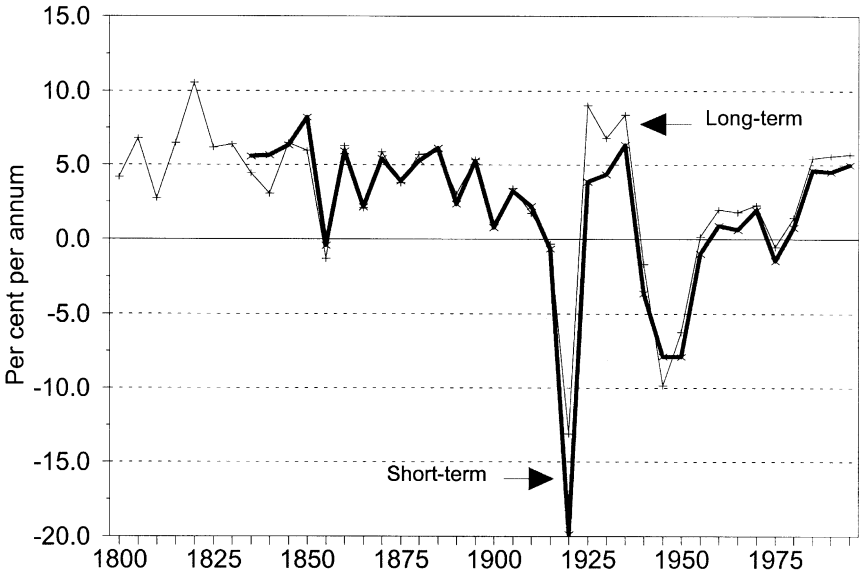

Fig. 1. Cross-Country Averages of Real Interest Rates.

These are given for various aggregations of countries chosen on the basis of data availability. Table 1 contains the figures for the full sample period; Table 2 is a comparison of such figures for the classical-gold-standard period (averages for 1875 through 1915 are used), the Bretton-Woods period (averages for, 1955 through 1970) and the current float (averages for 1975 through 1994). Included as overall summary measures in the table are 'world' composite figures, cross-country standard deviations for all of the countries with yearly data during that particular quinquennium.[9] Figure 1 plots the world means for both real rates; Figure 2 plots the corresponding cross-country standard deviations for the real rates. Figures 3 and 4 plot similar measures for nominal interest rates.

One item of interest in the charts is the difference between the behavior of real and nominal rates. The real rates appear highly variable both on a quinquennial basis and over the subperiods themselves. Over the entire sample period, however, they tend to stabilize. For nominal rates, very nearly the opposite is true. During episodes of high variability in real rates, the nominal rates generally are much more stable than the real, but over much longer periods we see the opposite. This contrast becomes especially apparent during the past four decades. Nominal rates drift up substantially during these years,

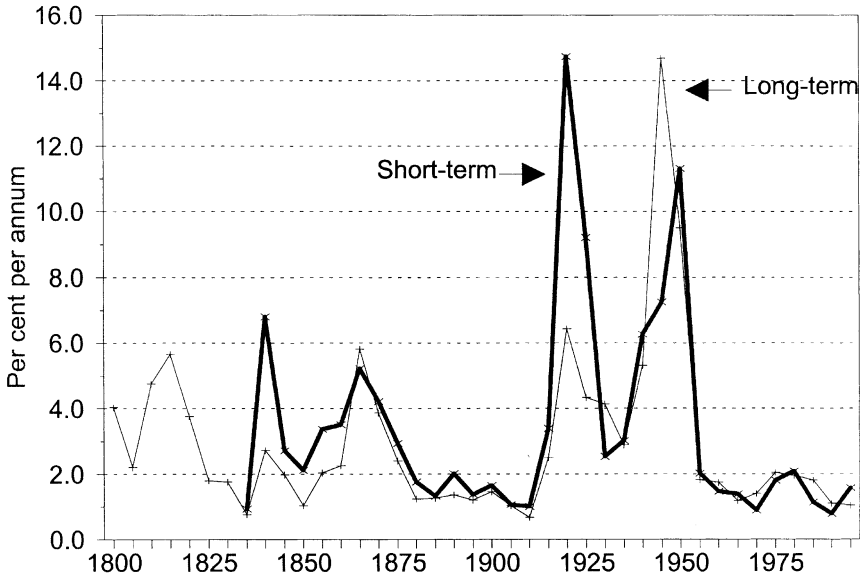

Fig. 2. Cross-Country Standard Deviations of Real Interest Rates.

starting in the later years of the Bretton Woods era and continuing for much of the current floating rate period. Real rates, despite their sizable fluctuations over the short and intermediate term, appear to have been much more nearly mean-reverting during these four decades, as well as over the past century and a quarter.[10]

Divergences in real rates among countries appear to follow declining trends in the nineteenth century and, to a lesser extent and rather intermittently, in the years since World War II also. The nineteenth century decline is consistent with the hypothesis that the world became more integrated under the gold standard of 1880–1914; the post-WWII decline, with the hypothesis of greater integration in recent years.

What stands out in particular in Table 1 and Fig. 2 is the similarity between real rate behavior under the gold standard, Bretton Woods and the float. This is highlighted further in Table 2 where the three are compared. In all three instances we see roughly the same, and by historical standards relatively low, degree of real-rate divergence. Contrary to the argument that increased risk has widened the gaps between real interest rates under the current float, we actually see some decrease in real interest rate divergence during this period. This is the

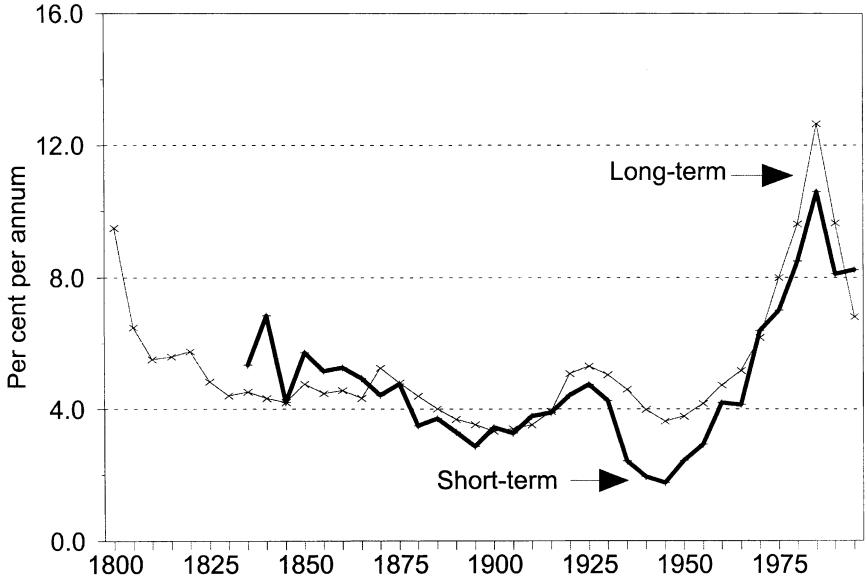

Fig. 3. Cross-Country Averages of Nominal Interest Rates.

case when we compare the figures for Bretton Woods and the float as a whole, and when we subdivide the two periods and compare the later, more stable subperiods within each. For both short-term and long-term real rates, divergences are less in the later subperiods for both Bretton Woods and the float than in the corresponding earlier subperiods, and also less in the later subperiod for the float than in the later subperiod for Bretton Woods. In most of the comparisons in Table 2, in fact, real-rate divergences are the lowest for these three periods, under the float, with the gold standard being a close second.

II.B. Test Results

Shown in Tables 3 and 4 are the results of ANOVA-type tests of differences in the degree of convergence across regimes of real short-term and real long-term rates respectively. Underlying these tests is a series of dummy variable regressions of the form:

$$SD_{it} = \gamma + \lambda_1 D1 + \lambda_2 D2 + \cdots + \lambda\beta_j Dj + \varepsilon_t, \tag{10}$$

where SD_{it} is the cross-country standard deviation of the *i*th variable, either the real short-term or real long-term interest rate for a specific country group, the

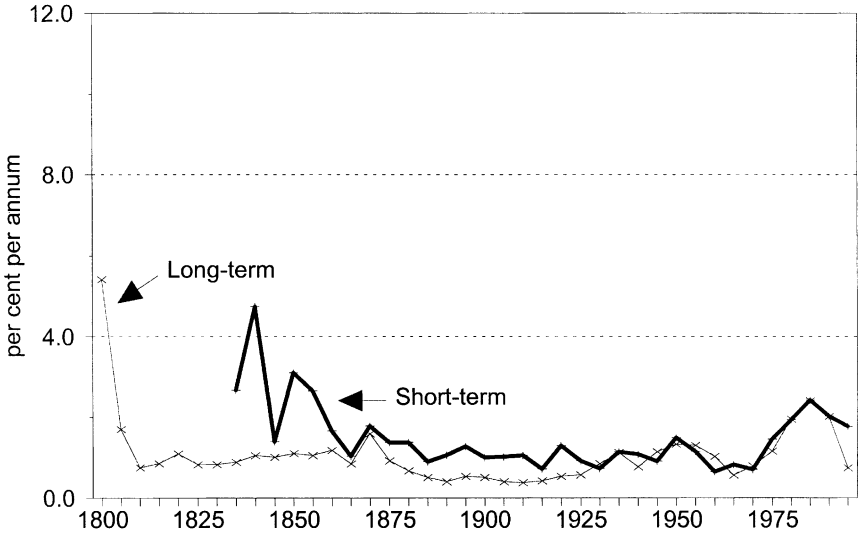

Fig. 4. Cross-Country Standard Deviations of Nominal Interest Rates.

Ds are dummy variables for periods, γ and the λs are coefficients to be estimated, and ε is the error term, assumed NID(0, σ^2). Four dummy variables were used in these regressions: DW2, a dummy for the World War I and World War II periods; DIW, a dummy for the inter-war period; D3R a dummy for gold, Bretton Woods and the current float combined; and DBW and DFL, dummies for the latter two periods individually. The constant term γ, therefore, applies to the period preceding the classical gold standard years.

The results of these regressions strongly confirm the impressions formed from the tabular and graphical evidence of largely similar behavior under gold, Bretton Woods and the current float and hence of no increase in divergence under the float. Differences among periods in the cross-country standard deviations of real rates are statistically significant in all instances as one might imagine from the evidence presented already, but differences among the gold, Bretton-Woods and floating-rate periods never are. We can see this in the lack of statistical significance of DBW and DFL, either jointly or individually, when entered along with D3R in the regression. The three periods in turn showed significantly less cross-country real-rate divergence than the other periods: D3R is always negative and statistically significant.

A qualification to these results needs to be made. One can quite plausibly argue that in the nineteenth century in general, and during the classical gold-

Table 1. Cross-country Standard Deviations of Real Interest Rates: Period Averages of Quinquennially Averaged Annual Data, 1795–1994

Period	Number of Countries in Average						Number of Countries in Average					
	3	4	5	6	7	All	3	4	5	9	10	All
	Short-Term Rates						Long-Term Rates					
Pre-Gold												
Pre–1880	4.03	3.74	4.08	3.58			3.54	3.15	2.91	2.55	2.41	2.93
1800–10							3.66					3.66
1815–30							3.21	3.24				3.24
1835–50	3.16	2.11				3.15	1.62	1.70	1.62			1.62
1855–75	4.73	4.07	4.08	3.58		3.85						
Classical Gold Standard												
1880–1915	1.80	1.72	1.76	1.73	1.82	1.70	1.50	1.51	1.42	1.35		1.34
Inter-war												
1925–1940	3.94	5.16	5.74	5.63	5.26	5.26	4.55					4.17
Bretton Woods												
1950–1970	1.30	1.66	3.91	3.68	3.42	3.42	4.14	3.82	3.70	3.30	3.13	3.13
1950	2.42	3.38	12.92	12.32	11.31	11.31	15.09	12.61	11.93	10.01	9.50	9.50
1955–70	1.02	1.24	1.66	1.52	1.44	1.44	1.40	1.63	1.64	1.62	1.53	1.53
Float												
1975–1994	1.66	1.68	1.57	1.54	1.48	1.48	1.12	1.25	1.22	1.50	1.44	1.44
1975–80	2.05	2.25	2.03	2.06	1.95	1.95	1.25	1.68	1.76	2.08	2.00	2.00
1985–94	1.41	1.30	1.26	1.19	1.17	1.17	1.03	0.96	0.86	1.11	1.07	1.07

Sources: See the data appendix.

Notes: The 10 countries for which long-term rates are available, listed in their order of inclusion, are: the U.K., the U.S., Germany, France, Belgium, Italy, Sweden, Canada, Norway and the Netherlands. The 7 countries for which short-term rates are available, again listed in their order of inclusion, are: the U.K., the U.S., Germany, Italy, Belgium, France, and Sweden. Data for France and Belgium for both the World War I and World War II years were missing. Data for the German hyperinflation years have been omitted in all calculations. The figures under 'All' do not necessarily equal the figures for the maximum number of countries for which some data are available during a subperiod, since the data for the latter are not always available for all quinquennia within the subperiod.

Table 2. Cross-Country Standard Deviations of Real Interest Rates: Gold, Bretton Woods and the Float Compared

Period	Number of Countries in Average					
	3	4	5	6	7	All
Short-Term Rates						
Classical Gold Standard						
1880–1915	1.80	1.72	1.76	1.73	1.82	1.70
1880–1910	1.50	1.50	1.43	1.45	1.03	1.46
Bretton Woods						
1950–1970	1.30	1.66	3.91	3.68	3.42	3.42
1960–1970	0.83	0.97	1.49	1.33	1.25	1.25
Floating Rates						
1975–1994	1.66	1.68	1.57	1.54	1.48	1.48
1985–1994	1.41	1.30	1.26	1.19	1.17	1.17
	3	4	5	9	10	All
Long-Term Rates						
Classical Gold Standard						
1880–1915	1.50	1.51	1.42	1.35	1.40	1.34
1880–1910	1.25	1.28	1.14	1.15	0.86	1.16
Bretton Woods						
1950–1970	4.14	3.82	3.70	3.30	3.13	3.13
1960–1970	1.67	1.79	1.66	1.52	1.44	1.44
Floating Rates						
1975–1994	1.12	1.25	1.22	1.50	1.44	1.44
1985–1994	1.03	0.96	0.86	1.11	1.07	1.07

Sources and notes: See Table 1.

standard period in particular, the actual rate of inflation will be a poor proxy for the anticipated rate. One is greater measurement error in the price data then. The other has to do with the properties of inflation under the gold standard regime. In the most basic theoretical model, non-zero inflation differentials are purely transitory aberrations under gold, largely unpredictable before the event and of little or no consequence afterwards. If that literally were the case, then the differential in nominal interest rates might provide a better measure of the cross-country divergence in *ex ante* real interest rates than the *ex post* differentials that I have used. By that criterion, one would rank the gold-standard period the most open of the three, leaving Bretton Woods and the float

as somewhat distant seconds. Whether that simple model provides a good characterization of behavior under gold can itself be questioned, however, since a country's adherence to gold was not always a foregone conclusion, and since

Table 3. Regressions with Dummy Variables for Periods: Cross-Country Standard Deviations of Short-term Real Interest Rates

Countries	NOBS	Const	DW2	D3R	DBW	DFL	R^2/SEE	F Ratio
3	33	5.008	–1.893	–3.212	–0.772	–0.330	0.232	
		0.896	2.533	1.485	2.052	1.910	3.351	
		5.008	–1.893	–3.491			0.228	0.072
		0.896	2.533	1.209			3.245	
4	28	4.309	–0.931	–2.586	–0.487	–0.148	0.441	
		0.518	1.718	0.777	1.003	0.934	1.638	
		4.309	–0.931	–2.744			0.435	0.118
		0.518	1.718	0.653			1.579	
5	26	4.912	8.004	–3.154	–0.102	–0.213	0.772	
		0.527	1.580	0.745	0.912	0.849	1.490	
		4.912	8.004	–3.240			0.771	0.032
		0.527	1.580	0.639			1.426	
6	24	4.948	7.370	–3.219	–0.205	–0.205	0.753	
		0.640	1.692	0.846	0.960	0.893	1.567	
		4.948	7.370	–3.327			0.752	0.036
		0.640	1.692	0.744			1.493	
7	17	5.258	6.056	–3.439	–0.379	–0.341	0.769	
		0.849	1.898	1.297	1.297	1.240	1.698	
		5.258	6.056	–3.707			0.767	0.051
		0.849	1.898	0.980			1.578	
All	33	4.831	4.453	–3.133	–0.257	–0.218	0.460	
		0.680	1.925	1.128	1.559	1.451	2.546	
		4.831	4.453	–3.257			0.460	0.018
		0.680	1.925	0.919			2.461	

Note: Const is the intercept in the regression; DW2 is a dummy for the two world wars; D3R is a dummy for the classical-gold-standard, Bretton-Woods and floating-rate periods combined period; and DBW and DFL are dummies for the latter two periods separately. Standard errors are beneath the coefficients in parentheses. The F ratio tests the hypothesis that the coefficients of DBW and DFL are both zero. The constant and the coefficients of DW2 and of D3R are almost always significantly different from zero at the .05 level or better; the coefficients of DBW and DFL never are, either separately or jointly.

the equilibrium real exchange rate might well have been anticipated to change in certain instances, as a result of factors like shifts in the terms of trade and differentials in trend productivity growth.[11]

Table 4. Regressions with Dummy Variables for Periods: Cross-Country Standard Deviations of Long-term Real Interest Rate

Countries	NOBS	Const	DW2	D3R	DBW	DFL	R/SEE	F Ratio
3	40	3.527	7.612	–2.028		–0.100	–0.382	0.530
		0.472	1.600	0.899	1.324	1.233	2.163	
		3.527	7.612	–2.164			0.528	0.049
		0.472	1.600	0.706			2.106	
4	36	3.812	6.458	–2.305	0.122	–0.259	0.441	
		0.615	1.896	1.087	1.553	1.446	2.536	
		3.812	6.458	–2.352			0.440	0.028
		0.615	1.896	0.870			2.460	
5	30	3.065	8.866	–1.650	0.229	–0.192	0.702	
		0.400	1.442	0.633	0.849	0.790	1.386	
		3.065	8.866	–1.653			0.700	0.102
		0.400	1.442	0.523			1.339	
9	22	3.850	6.158	–2.501	0.274	0.149	0.892	
		0.381	0.851	0.466	0.466	0.434	10.608	
		3.850	6.158	–2.392			0.890	0.183
		0.381	0.851	0.423			10.787	
10	16	4.114	5.382	–2.711	0.131	0.039	0.919	
		0.431	0.862	0.610	0.570	0.545	6.876	
		4.114	5.382	–2.652			0.919	0.030
		0.431	0.862	0.482			6.852	
All	40	3.331	8.758	–1.991	0.195	0.103	0.748	
		0.310	1.051	0.590	0.870	0.810	1.421	
		3.331	8.758	–1.915			0.748	0.026
		0.310	1.051	0.464			1.383	

Note: Const is the intercept in the regression; DW2 is a dummy for the two world wars; D3R is a dummy for the classical-gold-standard, Bretton-Woods and floating-rate periods combined period; and DBW and DFL are dummies for the latter two periods separately. Standard errors are beneath the coefficients in parentheses. The F ratio is to test the hypothesis that the coefficients of DBW and DFL are both zero. The constant and the coefficients of DW2 and of D3R are always significantly different from zero at the .05 level or better; the coefficients of DBW and DFL never are, either separately or jointly.

4. OTHER EVIDENCE ON CONVERGENCE

As in all empirical research, the question that arises is whether these findings make sense when viewed from the perspective of other information. Are they consistent with evidence from other sources, and with the predictions of theory? Alternatively could the results be spurious – an artifact of the statistical method used, or the result of errors in the data? This is the issue to which I now turn. First I present some additional, corroborative empirical evidence derived from data on gross foreign assets and on trade flows for a number of the countries in the sample. Then I go on to examine the institutions surrounding international capital markets over the sample period. Here I focus on three issues: the institutional features of international finance and international financial markets in the gold-standard era, the important developments in these markets and in international financial practices in the two most recent decades, and of the theory applicable to such developments. The object of this exercise is to examine the consistency of this qualitative evidence with the quantitative findings that we have just reviewed.

4.1.. Corroborative Empirical Evidence

One bit of evidence that the similarity across the three regimes is in fact a behavioral phenomenon and not simply a statistical aberration is provided by historical data on gross foreign assets that are available at various points in time since the latter portion of the nineteenth century for a subsample of the countries studied here. These data, which are presented in Table 5, show a time pattern that on the whole is consistent with the results reported above.[12] In the classical gold standard period, gross foreign assets of these countries, expressed both in, 1914 dollar amounts and as a fraction of GNP, grew continually, and by the start of World War I stood at well over 50% of the countries' combined GNP. During the inter-war years, the data show substantial declines on both bases, but after World War II that pattern is reversed. By, 1984, foreign assets had reached record amounts when expressed in, 1914 dollars, but given the substantial growth in real income in these years still remained well below their highs as a fraction of nominal GNP recorded in, 1914. With continued strong growth over the next eight years, that too has changed, and by, 1992, the last year for which data were available, the figure stood at roughly 40% of GNP.

A second type of corroborative evidence comes from trade data. Grassman (1980) presented decadal average data for the period 1875 to 1885 for the United Kingdom, Italy, Denmark, Norway and Sweden for the ratio of exports

Table 5. Gross Foreign Assets, 1885–1994, Selected Years

	1885	1900	1914	1938	1960	1970	1975	1984	1992
Foreign Assets in billions of U.S. dollars									
United Kingdom	7.8	12.1	19.5	22.9	26.4	38.2	59.4	211.6	597.2
United States	0.4	0.7	3.5	11.7	63.6	137.9	256.2	814.2	2145.5
Germany	1.9	4.8	6.7	0.7	1.2	19.1	61.1	135.8	773.8
Canada	0.1	0.2	1.3	5.9	10.6	16.5	45.1	137.6	
France	3.3	5.2	8.8	3.9					
Netherlands	1.0	1.1	1.2	4.8					
Six-Country Totals:									
a. Foreign assets	14.4	24.0	39.9	45.3					
b. Nominal GNP	25.9	41.4	72.0	163.8					
c. Ratio (a/b)	55.7	57.9	55.4	27.7					
Four-Country Totals:									
a. Foreign assets	10.1	17.7	29.9	36.6	97.1	205.8	393.2	1206.7	3654.1
b. Nominal GNP	21.9	36.4	52.3	152.9	677.2	1355.5	2315.2	5028.7	9191.3
c. Ratio (a/b)	46.2	48.6	57.1	23.9	14.3	15.2	17.0	24.0	39.8
Foreign Assets in billions of 1914 U.S. dollars									
United Kingdom	9.6	15.3	19.5	15.8	7.6	8.3	9.4	18.8	41.8
United States	0.5	0.9	3.5	8.1	18.3	29.9	40.4	72.3	150.0
Germany	2.3	6.1	6.7	0.5	0.3	4.1	9.6	12.1	54.1
Canada	n	0.1	0.2	0.9	1.7	2.3	2.6	4.0	9.6
France	4.1	6.6	8.8	2.7	0.0				
Netherlands	1.2	1.4	1.2	3.3					
Totals									
Six-Countries	17.7	30.4	39.9	31.3	27.9				
Four-Countries	12.4	22.4	29.9	25.3	27.9	44.6	62.0	107.2	255.5

Sources: See text.

plus imports to GNP. Using this as a measure of openness of trade, he concluded that these economies "had roughly the same degree of openness [then] as a century ago."

I updated the data for Grassman's five countries through 1994 and compiled data for five additional countries in my sample beginning with the decade starting in 1955.[13] His series with my updates and my series for nine countries are plotted in Fig. 5. Like the foreign asset data, these data show a high degree of openness under gold, substantial declines in the inter-war and World War II

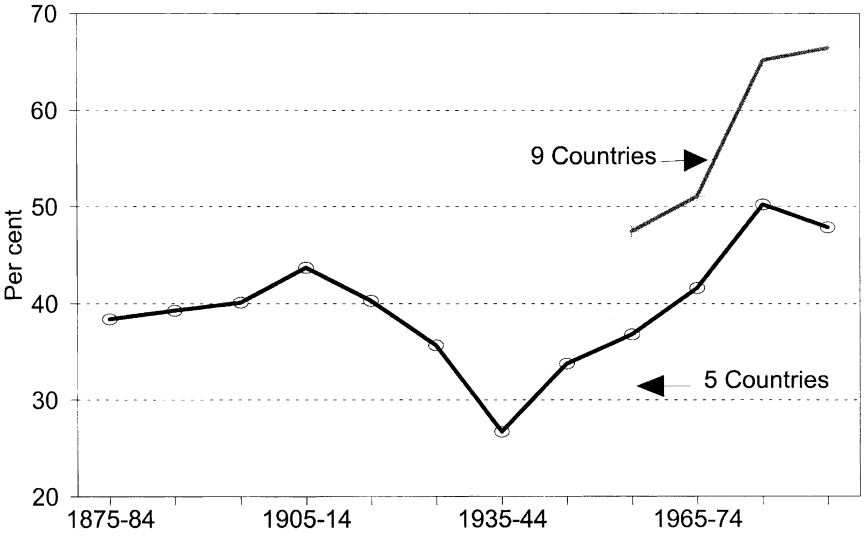

Fig. 5. Sum of Imports and Exports as a Ratio to Real GNP, Decadal Averages.

periods and increases thereafter. In recent decades moreover they point to even greater openness than under gold.

A third body of outside evidence comes from several recent studies of economic and financial integration that use multi-country time series similar to those used here. These include the study of real wage behavior among countries by Williamson (1995), and the studies of capital market integration by Bordo, Eichengreen & Kim (1998), Jackson & Lothian (1993), Obstfeld & Taylor (1997) and Taylor (1996) as well as the book now in manuscript form of Obstfeld and Taylor. In broad outline at least, all of these studies report results similar to mine. The last is particularly supportive since Obstfeld and Taylor, citing an earlier version of this paper, use the same measure as I do here, but apply it to a somewhat different data set.[14]

4.2. International Finance in the Gold-Standard Era

It is clear both from studies of the period and from qualitative evidence from a variety of sources – practitioner-oriented textbooks, the contemporary financial press and other contemporary accounts – that the capital markets and the foreign exchange market during the classical gold standard years shared

many important features of markets today: Capital markets were international in their focus; cross-country arbitrage activities were common; and commercial banking in all of the major countries was, or soon became, internationalized.

This situation is succinctly summarized by Cameron in his introduction to a volume containing a series of case studies of the period (Cameron, p. 3). "[In] the generation or so before World War I," he writes, ". . . international investment reached dimensions previously unknown and the banking systems of the world achieved a degree of internationalization also without precedent."

Foreign financing of domestic investment was common both in the United States and Europe during the classical gold standard years and indeed throughout much of the 19th century (Myers, p. 58 ff.). London merchant banks, often acting in concert with their counterparts abroad, regularly served as underwriters for foreign government and corporate bond issues (Cameron, 1991, pp. 14–16). It also appears to have been fairly common for securities to be issued simultaneously in more than one country, or to be foreign-currency denominated, practices that have only started to resurface within the past decade. Shorter term financing, too, had a strong international dimension. Commercial bills were the major vehicles for borrowing short-term funds. These often were drawn on a British bank and could be, and frequently were, discounted on Lombard Street, the London money market (Myers. p. 68 ff.). In describing the role of Lombard Street during the classical gold-standard period, *Bankers Magazine* stated that it was "no longer a purely English or even British institution; it belongs to all nations" (Cottrell, 1991).

Securities trading was also carried on globally. U.S. railroad bonds are the major example. At the time they were widely traded on the *London Stock Exchange* and also in the major continental financial centers like Paris and Amsterdam (Michie, 1987; Wilkins, 1991; Davis & Cull, 1994).[15] It is clear, moreover, from contemporary textbook treatments and other practitioner-oriented discussions of banking and foreign exchange during the period that trading of this sort was by no means an exception. This literature provides considerable detail on the instruments used in, and the specifics of, international arbitrage trades in the money and bond markets and in the foreign exchange market.[16] Indeed, in reading these descriptions one is struck by the strong parallel to practices in world financial markets currently.[17] One possible difference, however, has to do with the depth of the two markets. Lance Davis in commenting on an earlier version of his paper and Bordo, Eichengreen & Kim (1998) in their work on the question of financial integration have argued that the range of securities traded internationally was narrower during the classical gold standard era than today.

A further subject of debate is the extent to which such trading was effective as an arbitrage device. Spalding in *The London Money Market* (1938, p. 106), viewed interest arbitrage as leading to full equality of (nominal) interest rates internationally. Viner (1937, p. 403), in contrast, described it as limited "as an equilibrating factor . . . by the imperfect international mobility of funds." Morgenstern (1959), in an extensive empirical analysis of monthly data on interest rates, gold prices and exchange rates, reached conclusions that were consistent with Viner's. Officer in two much later studies (1985, 1986), however, that given reasonable estimates of transactions costs most of the apparent failures of gold arbitrage observed by Morgenstern and a good deal of the apparent failures of interest-rate arbitrage were explainable without resort either to risk or to market inefficiency.

Communications clearly were much less developed during the gold-standard era than now, computers of course being unknown, but contemporary commentators used many of the same phrases that we are accustomed to hearing in connection with the flow of information in our own markets. Thus in describing the situation at the start of this century Irving Fisher (1907) wrote:

> Foresight is clearer and more prevalent today than ever before. Multitudes of trade journals and investors' reviews have their chief reason for existence in supplying data on which to base prediction. Every chance for gain is eagerly watched for. An active and keen speculation is constantly going on which, so far as it does not consist of fictitious and gambling transactions performs a well-known and provident function for society.

As Garbade & Silber (1978) later demonstrated, these information flows were of measurable importance. The introduction of the telegraph, their results showed, led to an increase in efficiency of the domestic U.S. financial markets while the laying of the trans-Atlantic cable had an even greater quantitative effect on efficiency internationally.[18]

On the continent, the principal players in both the capital markets and the foreign exchange market throughout the classical gold standard period were the commercial banks (Cameron, 1991; Cottrell, 1991). In the United Kingdom and the United States, in contrast, investment banking institutions private banks in the United States and merchant banks in the United Kingdom – were predominant. One of the reasons that U.S. commercial banks came relatively late to the scene was the prohibition of international branching that existed under the National Banking Act. When that prohibition was removed following the passage of the Federal Reserve Act in, 1913 the situation changed and the U.S. money-center banks began to establish branches.[19]

4.3. Institutional Change and the Current Float

During the past two decades the institutions surrounding international capital markets have come back full circle, and then some. The catalogue of important changes that have occurred during these years includes: the re-internationalization of commercial and investment banking, the opening of new financial markets, the development of new financial techniques and the re-emergence of a number of older techniques that had lain dormant, the widespread integration of computer technology into both domestic and international finance, and the erosion of capital controls and of other regulatory impediments to market efficiency. All to varying degrees have had an impact on international financial markets and practices.

In corporate finance there has been both a return to financing practices prevalent in the early part of this century, with the resurrection of practice such as internationally syndication of bank loans, global bond issuance, and foreign-currency-denominated bond financing, and by the development of a wide variety of new products geared toward risk-management.[20] At the same time, trading has expanded greatly in both the international capital markets and the foreign exchange market.

What has facilitated these activities are the new markets that have come into being over the past several decades: the offshore 'Euro' markets, the Euro money market, the Euro bond market, and the more recently developed Euro equity and commercial paper markets, and the variety of markets in what are now collectively termed 'financial derivatives'. Taken as a group, the Euro markets have provided investors with greater access to instruments denominated in foreign currencies, borrowers with greater opportunities to issue such instruments, and in the case of the Euro money market, a major new source of funding for banks. Because these markets have been relatively free from regulatory and other governmental constraints, they have increased the flow of market information and reduced the costs associated with regulation. Included under the heading of derivative markets are the organized markets in financial options and futures, the interest-rate and foreign exchange swaps markets, and the other related over-the-counter markets in products tailored by commercial and investment banks to their corporate clients. These markets have allowed investors and borrowers to reduce their exposure to interest-rate and exchange-rate risk, and have otherwise aided the arbitrage process.[21]

One of the important factors contributing to these developments in international banking and financial markets is the technological change that has occurred in both the communications and computational realms. The computational gains brought about by widespread computerization have made

trading and financial investment strategies possible today that two decades or so ago would have been extremely costly, if not impossible, to effect. Indeed, what is now known as 'financial engineering' was largely non-existent then. From the standpoint of the low frequency data analyzed in this paper, the communications changes are probably of lesser importance, the truly great reductions in the barriers to the transmission international financial information having come much earlier with the laying of the trans-Atlantic cable and the subsequent introduction of international telephone communication. Nevertheless, better modern telephone communication and direct computer links that provide close to real-time price information doubtless have reduced transaction costs further and thus strengthened the links among markets.

A second important institutional change has been in the regulations surrounding the capital and foreign exchange markets. In most industrialized countries, capital controls have now after close to five decades finally been removed, domestic capital markets have been made more accessible to foreign firms, and other harmful restrictions have been either removed or relaxed.

Some idea of the extent of these changes and how they have been distributed over time can be had from Fig. 6. Shown there are five-year totals derived from

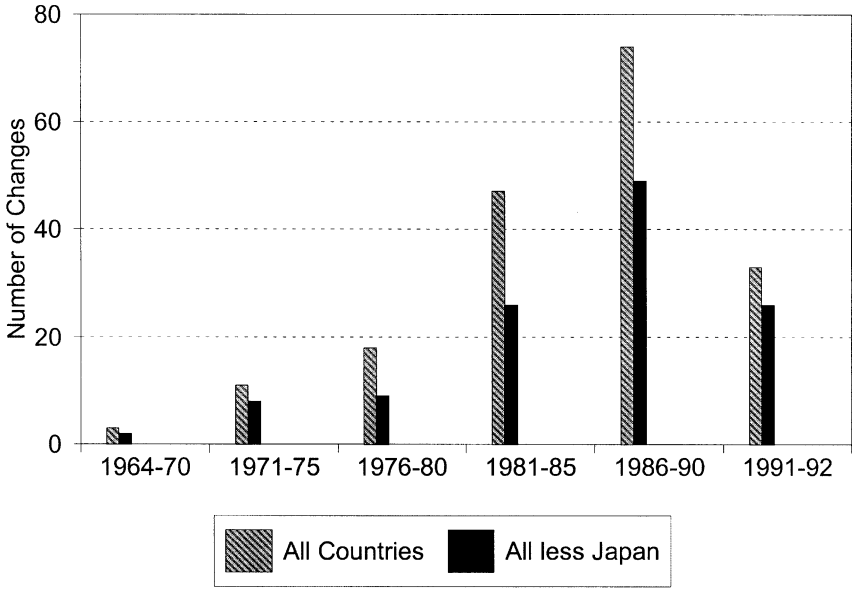

Fig. 6. Liberalization of Financial Regulations in Seven Major Countries.

the list of major regulatory changes over the years, 1964 to, 1992 in Mussa & Goldstein's (1993) survey article on international capital-market integration. These data are plotted both for the full seven countries in the Mussa & Goldstein list (all with the exception of Japan included in my sample) and for those seven countries less Japan. What emerges is a pattern of changes that is consistent both with the narrowing of real-interest differentials observed in the tables and the pattern of increase in gross foreign assets.

4.4. Changes in Institutions and the Exchange-Rate Regime

A major factor driving many of these developments was the change that took place in the macroeconomic environment, principally as a result of the shift in U.S. and various other countries' monetary policies toward greater expansiveness in the, 1970s. Arguably it was the forces that these inflationary policies set in motion that were responsible for much that has gone on in financial markets, during the past several decades, including a good deal of the changes that have occurred in the area of financial regulation, and indeed the change in the exchange-rate regime itself.

In this regard, consider the following quote from an article that Walter Wriston, the former chairman of Citibank, wrote in the early 1980s and that was subsequently reprinted in Wriston (1986, p.133):

> Today except in a very few instances, national borders are no longer defensible against the invasion of knowledge, ideas, or financial data. The Eurocurrency markets are a perfect example. No one designed them, no one authorized them, and no one controlled them. They were fathered by controls, raised by technology, and today are refugees, if you will, from national attempts to allocate credit and capital, for reasons that have little to do with finance or economics.

The endogenous nature of this institutional change has several important implications. On the one hand, it helps explain why the move to floating rates had so little noticeable negative impact on markets. On the other, it suggests that much of the debate surrounding exchange-rate regimes has been misplaced. Asking the question of how much more integrated financial markets would have been had exchange rates remained fixed, involves the wrong thought experiment, since the very forces that led to the float in large measure led to the other institutional changes that strengthened the links among markets.

First, consider the move to floating exchange rates itself. When there are substantial differences among countries in domestic monetary policy goals, exchange-rate flexibility will have to increase.[22] The institutional structure of capital markets, including the regulatory structure affecting such markets,

might also be expected to evolve under such conditions. Because the divergences in monetary policies that lead countries to adopt floating exchange rates are likely to be accompanied by substantial volatility in monetary growth, the volatility of interest rates, inflation rates, and by definition nominal exchange rates also is likely to be greater. Taken by itself, this increased volatility would impair the functioning of international financial markets. Information costs would be increased relative to those in a world of fixed exchange rates and stable monetary policies. In that sense, the argument made by McKinnon and others is correct.[23] But it is only part of the story. The problem is that such developments cannot simply be viewed in isolation. Along the lines of Telser (1981) and Telser & Higinbotham (1977), one would expect this increased risk to generate feedback effects on capital-market institutions. Consider, for example, organized futures markets, which are the focus of those two studies. The development and operation of such markets is costly. These costs, however, are (largely) independent of the state of the spot market in the particular good. The benefits are not. They are an increasing function of the risk inherent in spot-market price changes. As the volatility of spot prices increases, the (opportunity) cost of not having a futures market in the good also increases. The establishment of an organized futures market, therefore, hinges on whether on the margin the benefits – the reduction in these opportunity costs – exceed the costs of establishing and operating the market. Certainly, this is one way to explain the development of the host of forward-looking markets that has taken place over the past twenty-five years. As the cost of not hedging exposure in foreign exchange markets, money markets and other financial markets has risen, new instruments and new markets, have come into being.[24]

At the same time, one could argue that similar forces have been operable in the regulatory realm, and that the erosion of interest rate ceilings, capital controls and other restrictions on markets has certainly been hastened, though very likely not totally engendered by, such forces. Again the reasoning is similar: the costs, the welfare loss inherent in regulation, in general would increase with volatility, while the benefits to those in society who had experienced gains from the regulations in the form of income transfers of one sort or another would not. In instances in which prices are controlled, the Regulation Q ceilings on time-deposit interest rates in the United States being a prime example, the case is perhaps clearest. In the low inflation environment of the early 1960s, these ceilings made little difference. When inflation accelerated and they became binding, commercial banks reacted. The development of CDs and expansion of the Euro money market was the immediate result; legislation removing the ceilings was the ultimate result.

5. CONCLUSIONS

I reach two conclusions on the basis of these findings. One has to do with the liberalization of markets, particularly capital markets. Perhaps not surprisingly, international integration appears greatest in the periods in which markets have been the most nearly free of impediments – the classical gold standard being the exemplar. The other concerns differences in behavior across floating and fixed exchange rate regimes. Contrary to the argument that increased risk associated with floating exchange rates has adversely affected financial markets, we actually see some decrease in the cross-country divergence in real interest rates between the floating-rate period and the Bretton-Woods period, and no systematic difference between periods of floating and of fixed exchange rates otherwise.

That the volatility of nominal and real exchange rates under the float does not appear to have mattered, I have argued is the result of the substantial changes in institutions that have occurred over the past two decades, changes that were at least to some extent and perhaps in large part a response to this greater volatility. Not only have financial markets become subject to fewer restrictions, they also have evolved in other ways. A host of new instruments, markets, and corporate finance tools have been developed. These have made it possible for market participants to cope better with exchange-rate and interest-rate risk, and thus appear to have offset much of the direct negative effect of increased exchange-rate volatility might otherwise have had. The end result has been to make financial markets more nearly global in scope, a situation in many ways akin to that which prevailed during the heyday of the gold standard and rather briefly in the early inter-war years.

NOTES

1. See Darby & Lothian (1989) for empirical analyses of the difference in inflation rates between the two regimes, and Savvides (1990) for a more general analysis of the factors affecting the choice of an exchange-rate regime.
2. See in addition the review of this literature in Mussa & Goldstein (1993).
3. These studies include Cumby & Mishkin (1986), Mark (1985) and Mishkin (1984b). Later studies, however, have reported somewhat more favorable evidence. Goodwin & Grennes (1994), for example, present evidence consistent with international real-interest equality, given transactions costs. Johnson (1992) finds no difference across regimes in the links between Canadian and U.S. interest rates. Goldberg, Lothian & Okunev (1998) find mean reversion of major-country real-interest differentials after allowance for one time shifts in the series.
4. With regard to PPP, the literature earlier on in the floating rate period appeared to be less than comforting, with real exchange rates widely described as following random

walks and subject to erratic behavior. More recent studies have told a different story. Studies using long historical time series (e.g. Lothian & Taylor, 1996) almost universally show exchange rates to be mean reverting, while a number of studies for the float alone are now beginning to show the same thing (see Frankel & Rose, 1995; Jorion & Sweeney, 1996; Lothian, 1995; and Oh, 1996). Perhaps, more important, the issue of interest here is the behavior of the first difference of the (log) real exchange rate rather than the rate itself. No study that I know of has concluded that the log real exchange is I(2) and hence that it's first difference is non-stationary. Correspondingly several recent studies that have used first differenced data demonstrate long-term convergence of nominal exchange rate growth and inflation differentials, and therefore of real exchange growth rates to zero (e.g. Lothian, 1998).

5. Frankel (1992, p. 200) in reviewing the evidence describes these currency premia as "substantial and variable" and "responsible for approximately the entirety of [the] real interest differentials vis-à-vis the United States." In addition, see Engel (1996), and Hodrick (1987) for overviews of this literature.

6. The risk premium explanation has been most prevalent. Frankel & Froot (1987 and, 1990) present evidence of irrationality on the part of traders. Evans and Lewis (forthcoming), however, show that this latter explanation and rational learning in the face of change in the inflation regime are observationally equivalent. More recently, Lothian & Simaan (1998) show that despite the often substantial departures from UIP over the shorter run, the relation holds rather well over longer periods.

7. A detailed description of series and sources is presented in the Data Appendix. Note that for Belgium, the WPI is used for the full sample period and for the Netherlands the CPI is used.

8. A question that has been raised is whether these measures can be viewed as indicators of capital-market integration, given the sizable intra-country differences in interest rates that existed in some instances (e.g. among mortgage rates in the various regions of the United States in the nineteenth century). For interest rates in organized markets, however, particularly after the introduction of the telegraph, such intra-country differences were small. Hence, at the very least, the cross-country standard deviations used in this paper will provide an indication of the degree to which such markets are integrated internationally.

9. Given the different starting dates for the individual country series and the lack of data for several countries during and immediately after the two World Wars, the composite figures are not temporally homogeneous. In comparing their movements with the more nearly homogeneous series for the various (fixed) country groups, however, I detected no substantial differences among the series.

10. The Fisher effect, as Fisher himself pointed out (1907), thus operated in a highly imperfect fashion. Consistent with Friedman & Schwartz's (1982, Chapter 10) analysis of the United Kingdom and the United States, the Fisher effect only becomes visible in the data some time in the, 1960s, as agents presumably caught on to the shift in the inflation regime that was then underway.

11. The obvious alternative would be to model the inflation processes in the various countries. Given the different monetary and exchange rate regimes prevailing over these two centuries, however, those processes would be subject to a perhaps considerable number of changes in each instance. While techniques for extracting measures of anticipated inflation in the presence of such shifts exist (see, e.g. Evans & Wachtel, 1993; Evans & Lewis, 1995), I know of no successful application to data such as these.

In any event, the complexities of the models would make interpretation of any empirical results extremely difficult.

12. The sources of the foreign asset data were Woodruff (1967, p. 150, Table IV/I) prior to, 1960 and Dunning & Cantwell (1987) from, 1960 to, 1984. Data for GNP for that period came from the data set used in Bordo (1993). I updated the foreign asset data by interpolating the stock of portfolio- related assets from the stock of direct foreign assets, which in turn was taken from publications of the United Nations. I updated the GNP data from the *International Financial Statistics* on CD ROM.

13. Germany was omitted here due to incomplete trade figures, and Denmark was not included in my sample. The source for new data was the *International Financial Statistics* on CD ROM.

14. See von Furstenberg (1998) for a review of some of this literature.

15. The prevalence of this practice was such that Irving Fisher (1907) in testing what has later been termed the 'Fisher open equation' was able to get around the problem of heterogeneous securities that has plagued much modern research on international capital markets by examining the price of both rupee-denominated and gold-denominated Indian government bonds traded in London. For a similar more recent study see Neal (1985).

16. See, for example, Deutsch's *Arbitrage*, 3rd ed., 1933, as well as the earlier editions of that work, the first of which was published in 1904.

17. In the same vein, see Michie's (1991, p. 72) account of the advent of after-hours trading on the London Exchange, the motivation for which was the desire of traders in London for a greater overlap with the American market. Michie's description of this episode is completely reminiscent of the similar developments in U.S. markets in the 1980s: the move to 24-hour trading of foreign exchange, the earlier opening hours of bond- and money-market trading floors in New York in order to correspond better with British trading hours, and the start of U.S. Treasury bond trading in London and Tokyo.

18. It is interesting to note that, as in our own era, technological change in the financial realm did not meet with universal approval. After cataloguing a variety of causes of the panic of 1857, a writer in *Hunt's Merchant Magazine* solemnly intoned: "Fifthly, the more immediate cause of the panic is the operation of the electro telegraph." Compare that with the indictment of 'program trading' in the aftermath of the October, 1987 stock-market crash – the evils of speculation according on one interpretation, the curious longevity of crank notions in economics on another.

19. For a case study. see Cleveland & Huertas (1985), *Citibank 1812–1970*. National City Bank, the largest U.S. commercial bank in the late nineteenth century and the forerunner of Citibank, N.A. only began to trade foreign exchange in 1897, four years after the Bank of New York, the first New York bank to do so. By, 1912, however, National City had established correspondent relationships with 132 foreign banks to facilitate foreign exchange trading and trade financing. By, 1917, after the acquisition two years earlier of a majority interest in the International Banking Corporation, a Connecticut chartered bank with an extensive branch network in Asia, National City had offices in 35 foreign countries.

20. Darby (1986), Goldberg & Johnson (1986), Heinkel & Levy (1992) present analyses of various aspects of international banking during this period. See Gardner & Molyneux (1990) and Swary & Topf (1992) for figures on and discussions of the growth of international banking in major industrial countries.

21. See Brown (1989), Eckl, et al. (1990) and Abken (1991) for discussions of some of these issues and Popper (1993) for an analysis of the efficiency of the currency swaps market and its effect on the international market in longer term bonds.

22. See Edison & Melvin (1990) and Savvides (1991) for discussions of the factors affecting the choice of exchange-rate regimes. For a comparison of experience under Bretton Woods and floating exchange rates se Darby & Lothian (1989).

23. The association of welfare losses with uncertainty resulting from increased price variability is of course more general. The work of Hayek (1945), is the classic source on this issue. It has also figured prominently in the work of Arnold Harberger, Larry Sjaastad and their students on inflation behavior in Latin America, as well as in Friedman's Nobel Lecture (1977).

24. Einzig (1962) makes exactly his point in discussing the periods in history in which there was an active forward market in foreign exchange.

ACKNOWLEDGMENTS

I would lik to thank George Benston, Victor M. Borun, Lance Davis, Mark Flannery, David Gordon, Iftekhar Hasan, Kees Koedijk, Clemens Kool, Maurice Levi, Richard Marston, Cornelia McCarthy, Alan Meltzer, Hugh Rockoff, Larry Sjaastad, Frederick Sturm, Paul Wachtel, Myles Wallace, Robert Wharton and participants in seminars at the Atlanta Finance Forum, Clemson University, Fordham University, University College Cork, the University of Chicago, the University of Limburg and in the Cliometric sessions of the 1996 ASSA Meetings for their comments on earlier versions of this chapter. I would also like to thank Michael Field, Marybeth Holland, John Kneebone, Deborah Lightfoot and James R. Lothian, III who provided research assistance at various points in the course of this work. The usual caveat, of course, applies.

REFERENCES

Bayoumi, T., & MacDonald, R. (1995). Consumption, Income and International Market Integration. *International Monetary Fund Staff Papers, 42* (September), 552–576.

Bordo, M. D., Eichengreen, B., & Kim, J. (1998). Was There Really an Earlier Period of International Financial Integration Comparable to Today? *NBER Working Paper No. W6738, 9* (September).

Bordo, M. D. (1993). The Bretton Woods International Monetary System: An Historical Overview. In: M. D. Bordo & B. Eichengreen, (Eds), *A Retrospective on the Bretton Woods System*. Chicago: University of Chicago Press for the NBER.

Brown, B. (1989). *The Economics of the Swap Market*. London: Routledge.

Cameron, R. (1991). Introduction. In: R. Cameron & V. I. Bovykin, (Eds), *International Banking, 1870–1914*. Oxford and New York: Oxford University Press.

Cleveland, H. van B., & Huertas, T. F. (1985). *Citibank 1812–1970*. Cambridge, MA: Harvard University Press.

Collins, M. (1991). *Banks and Industrial Finance in Britain, 1800–1930*. London: Macmillan.
Cottrell, P. L. (1991). Great Britain. In: R. Cameron & V. I. Bovykin (Eds), *International Banking, 1870–1914*, Oxford and New York: Oxford University Press.
Cumby, R. E., & Mishkin, F. S. (1986). The International Linkage of Real Interest Rates: The European–U.S. Connection. *Journal of International Money and Finance, 5* (March), 5–23.
Darby, M. R. (1986) The Internationalization of American Banking and Finance: Structure Risk and World Interest Rates. *Journal of International Money and Finance, 5* (December), 430–428.
Darby, M. R., & Lothian, J. R. (1983). Conclusions. In: M. R. Darby, J. R. Lothian et al. (Eds), *The International Transmission of Inflation*. Chicago: University of Chicago Press for the NBER, 1983.
Darby, M. R., & Lothian, J. R. (1989). International Transmission Afloat. In: M. D. Bordo (Ed.), *Money, History and International Finance: Essays in Honor of Anna J. Schwartz*. Chicago: University of Chicago Press for the NBER.
Davis, L. E., & Cull, R. J. (1994). *International Capital Markets and American Economic Growth, 1820–1914*. Cambridge: Cambridge University Press.
Deutsch, H. (1933). *Arbitrage in Bullion, Coin Bills, Stocks, Shares, and Options*. 3rd ed. (revised by Otto Weber). London: Sir Isaac Pitman & Sons, Ltd.
Dewey, D. R., & Shugrue, M. J. (1922). *Banking and Credit*. New York: Ronald Press.
Eckl S., Robinson, J. N., & Thomas, D. C. (1990). *Financial Engineering: A Handbook of Derivative Products*, Oxford: Basil Blackwell.
Edison, H., & Melvin, M. T. (1990). The Determinants and Implications of the Choice of an Exchange Rate System. In: W. S. Haraf & T. D. Willett (Eds), *Monetary Policy for a Volatile Global Economy.* Washington: American Enterprise Institute.
Einzig, P. (1937). *The Theory of Forward Exchange*. London: Macmillan.
Einzig, P. (1962). *The History of Foreign Exchange*. New York: St. Martin's Press.
Engel, C. (1996). The forward discount anomaly and the risk premium: A survey of recent evidence. *Journal of Empirical Finance, 3* (June), 123–192.
Evans, M. D. D., & Lewis, K. K. (1995) Do Expected Shifts in Inflation Affect Estimates of the Long-Run Fisher Relation? *Journal of Finance, 50* (March), 225–253.
Evans, M. D. D., & Lewis, K. K. (1995) Do Long-Term Swings in the Dollar Affect Estimates of the Risk Premia. *Review of Financial Studies, 8* (Autumn), 709–742.
Evans, M. D. D., & Wachtel, P. (1993). Inflation Regimes and the Sources of Inflation Uncertainty. *Journal of Money, Credit and Banking, 25* (August, Part II), 475–511.
Feldstein, M., & Horioka, C. (1980). Domestic Savings and International Capital Flows. *Economic Journal, 90* (June), 314–329.
Fisher, I. (1907). *The Rate of Interest*. New York: Garland Publishing [reprinted with a new introduction by Donald Dewey, 1962].
Frankel, J. A. (1992). Measuring International Capital Mobility: A Review. *American Economic Review, 82* (May), 197–202.
Frankel, J., & Froot, K. A. (1987). Using Survey Data to Test Standard Propositions Regarding Exchange Rate Expectations. *American Economic Review, 77* (March), 133–153.
Frankel, J. A., & Froot, K. A. (1990) Chartists, Fundamentalists and the Demand for Dollars. In: A. Courakis & M. P. Taylor (Eds), *Private Behaviour and Government Policy in Interdependent Economies*. Oxford: Oxford University Press.

Frankel, J. A., & Rose, A. K. (1996) A Panel Project on Purchasing Power Parity: Mean Reversion within and between Countries', *Journal of International Economics, 40* (February), 209–224

Friedman, M. (1977). Nobel Lecture: Inflation and Unemployment. *Journal of Political Economy, 85* (June), 451–472.

Friedman, M., & Schwartz, A. J. (1982). *Monetary Trends in the United States and the United Kingdom*. Chicago: University of Chicago Press for the NBER.

Garbade, K. D., & Silber, W. L. (1978). Communication and the Performance of Financial Markets: 1840–1975. *Journal of Finance, 33* (June), 819–832.

Gardner, E. P. M., & Molyneux, P. (1990). *Changes in Western European Banking*, London: Routledge.

Goldberg, L., & Johnson, D. (1990). The Determinants of U.S. Banking Activity Abroad. *Journal of International Money and Finance, 9* (June), 123–137.

Goldberg, L., Lothian, J. R., & Okunev, J. (1998). Has International Financial Integration Increased? unpublished paper, Fordham University.

Goodwin, B. K., & Grennes, T. J. (1994). Real Interest Rate Equalization and the Integration of International Financial Markets. *Journal of International Money and Finance 12* (February), 107–124.

Grassman, S. (1980). Long-Term Trends in Openness of National Economies. *Oxford Economic Papers, 32* (March), 123–133.

Hayek, F. A. (1945) The Use of Knowledge in Society. *American Economic Review, 35* (September), 519–530 [reprinted in his Individualism and the Economic Order, University of Chicago Press, 1948].

Heinkel, R. L., & Levi, M. D. (1992) The Structure of International Banking. *Journal of International Money and Finance, 11* (June), 251–272.

Hodrick, R. J. (1987). *The Empirical Evidence on the Efficiency of Forward and Future Foreign Exchange Markets*. New York: Harwood Academic Publishers.

International Monetary Fund, International Financial Statistics, various issues.

Jackson, P. S., & Lothian, J. R. (1993). The Behavior of Bond Yields Across Exchange-Rate Regimes and the Integration of Capital Markets. *Greek Economic Review, 15* (December), 1–28.

Johnson, D. R. (1992). International Interest Rate Linkages and the Exchange Rate Regime. *Journal of International Money and Finance, 11* (August), 340–365.

Jorion, P., & Sweeney, R. J. (1996) Mean Reversion in Real Exchange Rates. *Journal of International Money and Finance, 15* (August), 535–550.

Kimbrough, K. (1983). The Information Content of the Exchange Rate and the Stability of Real Output under Alternative Exchange-Rate Regimes. *Journal of International Money and Finance, 2* (April), 27–38.

Lothian, J. R. (1985). Equilibrium Relationships between Money and Other Economic Variables. *American Economic Review, 75* (September), 828–835.

Lothian, J. R. (1997). Multi-Country Evidence on the Behavior of Purchasing Power Parity under the Current Float. *Journal of International Money and Finance, 16* (February), 19–36.

Lothian, J. R., & Yusif, S. (1998). International Financial Relations under the Current Float: Evidence from Panel Data. *Open Economies Review, 9* (October), 293–314.

Lothian, J. R., & Taylor, M. P. (1996). Real Exchange Rate Behavior: The Recent Float from the Perspective of the Past Two Centuries. *Journal of Political Economy, 104* (June), 488–509.

Mace, B. (1991). Full Insurance in the Presence of Aggregate Uncertainty. *Journal of Political Economy, 99* (October), 928–56.

Mark, N. C. (1985). Some Evidence on the International Inequality of Real Interest Rates. *Journal of International Money and Finance, 4* (June), 189–208.

Marston, R. C. (1994). *International Financial Integration: A Study of Interest Differentials Between the Major Countries*. Cambridge: Cambridge University Press.

McKinnon, R. I. (1990). Interest Rate Volatility and Exchange Risk: New Rules for a Common Monetary Standard. *Contemporary Policy Issues, 7* (April), 1–17.

Michie, R. C. (1987). *The London and New York Stock Exchanges, 1850–1914*. London: Allen and Unwin.

Mishkin, F. S. (1984). The Real Interest Rate: A Multi-Country Empirical Study. *Canadian Journal of Economics, 17* (May), 283–311.

Mishkin, F. S. (1984). Are Real Interest Rates Equal Across Countries?: An Empirical Investigation of International Parity Conditions. *Journal of Finance, 39* (December), 1345–1357.

Morgenstern, O. (1959). *International Financial Transaction and Business Cycles*. Princeton: Princeton University Press for the NBER.

Mussa, M., & Goldstein, M. (1993). The Integration of World Capital Markets. In: *Changing Capital Markets: Implications for Monetary Policy.* Kansas City, MO: Federal Reserve Bank of Kansas City, 1993.

Myers, M. (1931). *The New York Money Market*. New York: Columbia University Press.

Neal, L. (1985). Integration of International Capital Markets: Quantitative Evidence from the Eighteenth to the Twentieth Centuries. *Journal of Economic History, 45* (June), 219–26.

Obstfeld, M., & Taylor, A. M. (1998). The Great Depression as a Watershed: International Capital Mobility over the Long Run. In: M. D. Bordo, C. D. Goldin, & E. N. White (Eds), *The Defining Moment: The Great Depression and the American Economy in the Twentieth Century.* Chicago: University of Chicago Press for the NBER.

Oh, K.-Y. (1996). Purchasing Power Parity and Unit Root Tests Using Panel Data. *Journal of International Money and Finance, 15* (June), 405–418.

Popper, H. (1993). Long-term Covered Interest Rate Parity: Evidence from Currency Swaps *Journal of International Money and Finance,12* (August), 438–448.

Savvides, A. (1990). Real Exchange Rate Variability and the Choice of Exchange Rate Regime. *Journal of International Money and Finance, 9* (December), 440–454.

Spalding, W. F. (1938). *The London Money Market*, 6th ed., London: Sir Isaac Pitman and Sons.

Taylor, A. (1996) International Capital Mobility in History: Savings and Investment. *NBER Working Paper 5743* (April) .

Telser, L. G. (1981). Why There Are Organized Futures Markets. *Journal of Law and Economics, 24* (April), 1–22.

Telser, L. G., & Higinbotham, H. N. (1977). Organized Futures Markets: Costs and Benefits. *Journal of Political Economy, 85* (October), 969–1000.

Tesar, L. L., & Werner, I. M. (1995) Home Bias and High Turnover. *Journal of International Money and Finance, 14* (August), 467–492.

Viner, J. (1975). *Studies in the Theory of International Trade*. Clifton, NJ: Augustus M. Kelley [a reprint of the 1937 edition].

von Furstenberg, G. M. (1998) From Worldwide Capital Mobility to International Financial Integration. *Open Economies Review, 9* (January), 53–84.

Wilkins, M. L. (1991). Foreign Banks and Foreign Investment in the United States. In: R. Cameron & V. I. Bovykin (Eds), *International Banking, 1870–1914*. Oxford and New York: Oxford University Press.
Wriston, W. (1986). *Risk and Other Four-Letter Words*. New York: Harper and Row.

DATA APPENDIX

DATA SOURCES

Board of Governors of the Federal Reserve System, *Federal Reserve Bulletin*, various issues.
Bordo, Michael D. (1993). The Bretton Woods International Monetary System: An Historical Overview. In Michael D. Bordo and Barry Eichengreen, eds. *A Retrospective on the Bretton Woods System*. Chicago: University of Chicago Press for the NBER, 1993 [and associated data diskettes].
Bordo, Michael D. & Jonung, Lars. (1987) *The Long-Run Behaviour of the Velocity of Circulation, The International Evidence*. New York: Cambridge University Press [and associated data diskettes].
Fratianni, Michele and Spinelli, Franco. (1984). Italy in the Gold Standard Period. In Michael Bordo and Anna J. Schwartz, eds. *A Retrospective on the Classical Gold Standard*. Chicago: University of Chicago Press for the NBER.
Friedman, Milton & Schwartz, Anna J. (1982). *Monetary Trends in the United States and the United Kingdom*. Chicago: University of Chicago Press for the NBER.
Homer, Sydney. (1977). *A History of Interest Rates*, 2nd ed. New Brunswick, NJ: Rutgers University Press.
International Monetary Fund, *International Financial Statistics*, various issues, and companion CD ROM.
Jastram, Roy W. (1977). *The Golden Constant*, New York: John Wiley and Sons.
Mitchell, B. R. (1988). *British Historical Statistics*. Cambridge: Cambridge University Press.
Mitchell, B. R. (1975). *European Historical Statistics, 1750–1970*. New York: Columbia University Press.
Warren, George F. & Pearson, Frank A. (1935). *Gold and Prices*. New York: John Wiley and Sons.

DATA DESCRIPTION

United Kingdom

Short-term interest rate. 1831–1844, Overend-Guerney average annual rate for first-class 3-month bills from Mitchell (1988), table entitled 'Financial Institutions 15. The Market Rate of Discount – 1824–1980'; 1845–1869, average annual rate for 3-month bank bills from the same source; 1870–1986, average annual rate for 3-month bank bills from Bordo and Jonung (1987) and Bordo (1993); 1987–1994, average annual money market rate from *International Financial Statistics* (*IFS*).

Long-term bond yields. 1791–1869, average annual yields on 3% consols for from Mitchell, table entitled 'Financial Institutions 13. Yield on Consols'; 1870–1975, average annual yields on 3% consols from Bordo and Jonung (1987); 1976–1994, average annual government bond yield from *IFS*.
Price index. 1791–1869, wholesale price index from Jastram, (1977), Table 2 1870–1994 GNP deflators from Bordo and Jonung (1987) and Bordo (1993) through, 1989 and from *IFS* thereafter. I linked these separate subseries in each instance by multiplying the later series by the ratio of the earlier to the later series in the overlap year. I then re-based the resultant linked series to, 1914 = 100. I followed an analogous procedure where necessary in constructing the other countries' price indexes.

United States

Short-term interest rates. 1831–1899, average annual commercial paper rate from Homer (1977), Table 44; 1900–1975, average annual prime 60–90 day commercial paper rate from Homer (1977), Table 51; 1976–1994, average annual prime 60–90 day commercial paper rate from various issues of the *Federal Reserve Bulletin*.

Long-term bonds yields. 1798–1899, average annual New England municipal bond yields; prior to 1857, Massachusetts 5s and Boston 5s from Homer (1977), Table 38, with values for 1825 and 1827 interpolated as the averages for the 1824 and 1826 and 1826 and 1828, respectively; 1857–1899, Macaulay's 'average of New England Municipals, as reported in the same table. 1899–1994, average annual high grade corporate bond yields; 1900–1975, from Table 4.8, Friedman and Schwartz (1982); 1976–1994, average annual high grade corporate bond yields from various issues of the *Federal Reserve Bulletin*.

Price index. 1791–1800, wholesale price index from Warren and Pearson (1935), Table 1, with a missing observation for 1792 interpolated as the arithmetic average of the 1791 and 1793 observations; 1800–1869, wholesale price index from Jastram (1977), Table 7; 1870–1994 GNP deflators from Bordo and Jonung (1987) and Bordo (1993) through, 1989 and from *IFS* thereafter.

Germany

Short-term interest rates: 1857–1899, average annual open market discount rate in Berlin from Homer (1977), Table 33; 1900–1944, average annual open market rate of discount from Homer (1977), Table 67, with observations for, 1923 and, 1924 missing; 1950–1994,average annual money market rate from *IFS*.

Long-term bond yields. 1815–1843, average annual yield on Prussian State 4s, from Table 32; 1844–52, missing yields on Prussian 4s for these years were interpolated from changes in yields on Bavarian $3\frac{1}{2}$s multiplied by the ratio of the total change in Prussian 4s between 1842 and 1853 divided by the total change in the Bavarian $3\frac{1}{2}$s; 1853–1867, average annual yield on Prussian State 4s, from Table 32; 1868 and 1869 average annual yield on Bavarian $3\frac{1}{2}$s; 1870–1900, average annual computed average bond yield, Table 32; 1901–1959, average annual yield on high-grade bonds, Table 66, with figures missing for, 1922, 1923 and, 1944–1947; 1948–1994,from *IFS*.

Price index. 1815–1949, wholesale price index from *European Historical Statistics* (*EHS*), Table I1; 1950–1994, GNP deflator from *IFS*.

France

Short-term interest rates. 1863–1899, average annual open-market discount rate from Homer (1977), Table 27; 1900–1913, average annual open-market discount rate from Homer (1977) Table 61,; 1925–1938, average annual private discount rate from Homer, Table 61; 1949–1994, average annual money market rate from *IFS*.

Long-term bond yields. 1800–1825, average annual yield on 5% French government rentes minus 67 basis points, the difference between the yield on the 5% rentes and the yield on 3% rentes in 1826), from Table 25; 1826–1899, average annual yield on 3% rentes, from Table 25; 1900–1948, average annual yield on 3% perpetual rentes, Table 60; 1949–1994, average annual government bond yield from *IFS*.

Price index. 1802–1949, wholesale price index from *EHS*, Table I1; 1949–1994, GNP deflator from *IFS*.

Belgium

Short-term interest rates. 1857–1899, average annual free-market rate of discount from Homer (1977), Table 31; 1900–1940, average annual free-market rate of discount from Homer (1977), Table 65, with missing observations for, 1915–1918; 1948–1994, average annual money market rate from *IFS*.

Long-term bond yields. 1831–1900, average annual yields on $2\frac{1}{2}$ rentes, Table 30; 1901–1975, average annual yields on 3% rentes, Table 64; 1976–1992, average annual government bond yields from *IFS*.

Price index. 1832–1975, wholesale price index from *EHS*, Table I1, observations missing for, 1914–1919 and, 1941–1945; 1976–1994, wholesale price index from *IFS*.

Italy

Long-term bond yields. 1861–1879, average annual government bond yield from, Fratianni and Spinelli (1984); 1880–1965, average annual government bond yield from Bordo (1993); 1966–1994, average annual government bond yield from *IFS*.

Price index. 1861–1869, GNP deflator from Fratianni and Spinelli (1984); 1880–1994, GNP deflator from Bordo (1993) through, 1989 and from *IFS* thereafter.

Sweden

Short-term interest rates. 1857–1899, average annual discount rates charged by Bank of Sweden from Homer (1977), Table 35; 1900–1962, average annual discount rates charged by Bank of Sweden from Homer (1977), Table 69; 1963–1994, average annual money market rate from *IFS*.

Long-term bond yields. 1870–1985, effective average return on government long-term bond debt from Bordo and Jonung (1987); 1986–1994, average annual government bond yield from *IFS*.

Price index. 1830–1869, cost-of-living index from *EHS*, Table I2; 1870–1994 GNP deflators from Bordo and Jonung (1987) and Bordo (1993) through, 1989 and from *IFS* thereafter.

Canada

Long-term bond yields. 1870–1965, average annual Canadian government bond yield from Bordo and Jonung (1987) and as described there; with missing values for, 1914–1918 interpolated by them; 1966–1994, average annual government bond yield from *IFS*.

Price index. 1870–1994 GNP deflators from Bordo and Jonung (1987) and Bordo (1993) through, 1989 and from *IFS* thereafter.

Norway

Long-term bond yields. 1870–1986, average annual government bond yield from Bordo and Jonung (1987); 1987–1994, average annual government bond yield from *IFS*.

Price index. 1870–1994 GNP deflator from Bordo and Jonung (1987) and Bordo (1993) through 1989 and from *IFS* thereafter.

Netherlands

Short-term interest rates. 1900–1941, average annual market rate of discount in Amsterdam from Homer (1977), Table 63; 1946–1994, average annual money market rate from *IFS*.

Long-term bond yields. 1900–1961, average annual yield on $2\frac{1}{2}$ perpetual government bonds from Homer (1977), Table 62; 1962–1994, average annual government bond yield from *IFS*. The first series was linked to the second by multiplying by the ratio of the one to the other in, 1961.

Price index. 1900–1975, cost-of-living index from *EHS*, Table I2; 1976–1994, consumer price index from *IFS*.