EMERGING MARKET SPREADS: THEN VERSUS NOW*

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We analyze yield spreads on sovereign bonds issued by emerging markets, using modern data from the 1990s and newly-collected historical data on bonds traded in London during 1870–1913, a previous era of global capital market integration. We show that spreads today co-move across emerging markets to a significantly higher degree than they did in the historical sample. Moreover, sharp changes in spreads in the 1990s tend to be mostly related to global events, whereas they were primarily related to country-specific events in 1870–1913. Although we find that fundamentals co-move somewhat more strongly today than they did in the past, we conjecture that today's investors pay less attention to country-specific events than their predecessors did.

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I. INTRODUCTION

The frequency and virulence of financial crises that affected emerging markets in the second half of the 1990s have led to calls for reform of the current international financial architecture. Many observers have also wondered whether globalization in international financial markets, perhaps owing to informational and technological advances, has gone too far. The 1990s were characterized by large and volatile private international capital flows toward emerging market countries and, for the first time after several decades, large amounts of sovereign bonds were issued by emerging market countries and actively traded on secondary markets. This paper seeks to shed light on today's international financial environment by comparing it with that of 1870–1913, a previous golden age for emerging market bonds and international capital flows toward "emerging markets." Our focus is on sovereign bond yield spreads and on comparing the nature of financial crises and the degree of financial integration in emerging markets, "then" (1870–1913) versus "now" (1992–2000).

There is a growing consensus that global economic integration reached a peak in the late nineteenth and early twentieth century, collapsed with the world wars and the intervening great depression, and gradually increased again after the collapse of the Bretton Woods system to attain levels similar to pre-1914 only in the 1990s [e.g., Sachs and Warner, 1995]. O'Rourke and Williamson [1998] show that capital outflows from Britain to contemporary developing economies were extremely high, and barriers to movement of capital (and labor) were virtually absent. Bordo, Eichengreen, and Kim [1998] describe the period between 1870 and World War I as an era of global finance in which large amounts of foreign securities were actively traded in England. Obstfeld and Taylor [1998] argue that only in the 1990s did financial integration return to the levels experienced in the era of the classical gold standard.

Our main contribution is to analyze a new hand-collected data set consisting of monthly observations of secondary market yields on sovereign bonds denominated in British pounds and traded in London during 1870–1913, issued by the "emerging markets" of the day. Our historical sample includes sixteen contemporary emerging markets around the world, covering virtually all of the borrowing developing countries for which data are available. We compare the characteristics of those data with a number of similar present-day data sets on emerging market sovereign bonds, all denominated in U.S. dollars with spreads computed vis-à-vis yields on U.S. government long-term bonds—just as spreads are computed vis-à-vis British consols for the historical data. This enables us to examine whether the crises and volatility that characterize today's international financial system are necessary evils that accompany large-scale international capital flows, or result from institutional features of the 1990s.

In particular, we address the following issues:

- To what extent do spreads on emerging market bonds tend to move together in the two periods?

- How frequent are "sharp changes" in spreads in the two periods? What proportion of such sharp changes takes place in several countries at the same time? What types of events (political, economic, etc.) trigger sharp changes? To what extent are these events country-specific as opposed to global?

Using a variety of statistical techniques, we establish the following facts:

- Co-movement of spreads of different countries is far higher among today's emerging markets, and investing in several emerging markets provides smaller diversification benefits than it did in the past.

- Sharp changes (defined in a number of ways) in emerging market spreads take place more often in modern times. Moreover, crises (positive sharp changes) today typically affect many countries at the same time, whereas global crises were virtually non-existent in the historical sample.

- In the historical data, most of the events causing sharp changes in spreads were local, country-specific (mostly political) events taking place in the country whose spreads are being considered. By contrast, today's crises are almost solely global and can seldom be related to events having a direct impact on the country whose spreads are being considered.

Although we do not provide a conclusive proof, we suspect that two factors play an important role in accounting for the higher co-movement of spreads today. First, we find evidence of higher co-movement of fundamental economic factors. Second, investors today seem to pay less attention to developments in the country whose spreads are being considered, perhaps owing to institutional changes in the way international investment in emerging markets is organized (e.g. individual investors "then" versus investment funds "now").

It might be argued that the comparison between the early period of globalization with the 1990s is unfair on the grounds that the 1990s have been "special" in some sense, perhaps because we all tend to remember more recent crises better. However, we feel that the 1990s are indeed representative of the "today" that we are interested in, for three reasons. First, it is events in the 1990s that have generated calls for reform of the international financial architecture. Second, the 1990s are the first time since World War I to see the return of large private capital flows toward emerging markets in the form of bonds; under this strict definition of "emerging markets," there were no emerging markets between World War I and the 1990s. Third, it has been argued by Bordo and Eichengreen [2000] that currency and banking crises have *not* occurred more frequently in the 1990s than in the 1980s or 1970s.[1]

The present paper is related to other studies of international capital flows in the late nineteenth and early twentieth century [e.g., Bordo and Eichengreen, 2000; Clemens and Williamson, 2000; and Obstfeld and Taylor, 2001]. Our paper is the first to analyze co-movement in emerging market sovereign spreads for that period. Our attempt to document sharp changes in the risk premium of a large number of countries

[1] Accordingly, in considering crises during the past 120 years, Bordo and Eichengreen [2000] analyze the entire post-Bretton Woods era as one period. They show that the frequency of banking and currency crises of the period since 1973 has been about double that of the Bretton Woods era and the classical gold standard period, and is matched only by that of the 1920s and 1930s. Aziz, Caramazza, and Salgado [2000] show that currency crises were as frequent in the 1970s and 1980s as in the 1990s.

and to relate them to a broad range of historical events is also novel.[2] The present study is also somewhat related to the literature on "contagion" and the crises of the 1990s in Latin America, Asia, and Russia. Our main contribution of relevance to this literature is the historical perspective through which we attempt to shed some light on the relative importance of fundamentals and investor behavior in asset price fluctuations.[3]

The remainder of the paper is organized as follows. Section II describes the data sets used for this study and our empirical approach. Section III reports the main findings on emerging market spreads. Section IV presents additional robustness tests. Section V reports evidence on co-movement of economic fundamentals and further discusses and interprets the results. Section VI concludes.

II. Institutional Setting and Data Description

A. The Market for Emerging Market Debt: Then and Now

The London market for foreign government bonds between 1870 and World War I was highly developed and active. The total market value of government bonds traded in London was £3 billion in 1875 and £4 billion in 1905, of which £0.6 billion in 1875 and over £1.2 billion in 1905 (or 55 percent of Britain's GDP in 1875 and 66 percent of Britain's GDP in 1905) issued by emerging markets in our sample. Such sovereign bonds represented the main vehicle of emerging market borrowing at the time. Trade in many foreign bonds was very liquid, with price movements reported daily on *The Times* and analyzed in depth in *The Economist*. Political events in borrowing countries were reported in minute detail and seem to have been viewed by investors as key information in evaluating credit worthiness [Ferguson, 2001].

Whether or not the degree of globalization in this period exceeds today's depends on the measures used[4], yet it is clear that the outflow of capital financing emerging market sovereign debt relative to Britain's GDP "then" far exceeds the comparable figure relative to US GDP today. Similarly, relative to Britain's GDP, credit to the large borrowers of the time (e.g., Argentina or Russia) was far more important than today's debt of Russia or Indonesia to American investors.[5]

B. Historical Data on Spreads (1870–1913)

Our data set consists of monthly observations on sovereign bond yields for 1870–1913. The data were collected by hand from *The Times* of London and *The Economist's Investor's Monthly Manual*, and have never been analyzed before. The

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[2] Sussman and Yafeh [2000] analyze the Japanese risk premium during this period.

[3] Among the large number of studies on "contagion" and its sources, Glick and Rose [1999] focus on trade relations, whereas Kaminsky and Reinhart [2000], and Kaminsky, Lyons, and Schmukler [2000] emphasize the behavior of investment funds.

[4] See Bordo, Eichengreen, and Kim [1998], Ferguson [2001], and Obstfeld and Taylor [2001].

[5] The ratio of Argentina's debt to Britain's GDP in 1905 was orders of magnitude larger than the ratio of Russia's debt to U.S. GDP in 1998.

data are available daily, but only end-of-the-month observations were collected, owing to resource constraints. All bond coupons were payable in pounds in London. For each emerging market, spreads are computed as the absolute (percentage point) difference between the yields on bonds issued by the emerging market and the yields on British consols. Further detail on the bonds is provided in the Appendix.

The sixteen historical "emerging markets" in our sample are Argentina, Brazil, Canada, Chile, China, Egypt, Hungary, Greece, Japan, Mexico, Portugal, Queensland, Russia, Sweden, Turkey, and Uruguay.[6] These are virtually all the major borrowers on the London market that—following a distinction made in the financial press of the time—were not able to issue debt in London in their own currencies, and for which data are available. These countries would certainly be considered "emerging markets"—using modern parlance—today as well, in light of their low per capita income (relative to Britain), distance from the industrial core of Europe, large net borrowing and absence of developed domestic capital markets.[7]

We also define a "high-quality-data" sub-sample of historical emerging markets, which excludes four countries (Greece, Mexico, Turkey, and Uruguay) from the above list because at times they suspended interest payments (making the yield calculation inaccurate), or displayed implausibly high yields. The use of this sub-sample and a variety of other sub-samples allows us to show that our results are not driven by a few countries with extreme observations.

C. Modern Data on Spreads (1992–2000)

Our baseline data set on emerging market spreads on sovereign bonds denominated in U.S. dollars is drawn from J.P. Morgan and consists of the EMBI (Emerging Markets Bond Index) and EMBI+ bond yield spreads (vis-à-vis yields on U.S. long-term government bonds). EMBI and EMBI+ spreads are the most closely watched indicators of emerging market spreads by market participants, and have been widely used by researchers in previous work. These spreads are available at a daily frequency and—being secondary market spreads—at all times, including times of crisis. By contrast, primary market yields are observed with erratic frequency and are often not available in times of crisis (arguably, the most interesting times), when many countries are just unable to launch new issues.

The choice of sample period in modern times is constrained by the absence (since World War I) of a significant active secondary market for emerging market bonds prior to the introduction of Brady bonds in the early 1990s. Before the 1990s,

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[6] Our historical sample does not include the United States among emerging markets for several reasons. First, wealth per capita was the same in the United States and Britain by the turn of the century. Second, the United States became a net lender around that time. Third, U.S. domestic capital markets were highly developed and commonly used by the U.S. government. Finally, the United States borrowed in dollars, not pounds as contemporary emerging markets did. Our sample includes Queensland, which was an independent British colony starting in 1859 (it became one of the states forming the federation of Australia in 1901). In addition to Queensland, Canada and Egypt (after 1882) were also closely tied to Britain. More detailed data on the debt amounts issued by the various historical emerging markets are reported in Mauro, Sussman, and Yafeh [2000].

[7] Our definition is close in spirit to the one used by Bordo and Eichengreen [2000].

most foreign borrowing by emerging market countries took the form of bank loans. It was only following the payments difficulties experienced by a number of emerging market countries (beginning with Mexico) that bank loans were repackaged as Brady bonds and secondary market trading began on a large scale.

To obtain a reasonable number of countries, we analyze the period November 1994 through May 2000; this gives us daily (or end-of-the-month) EMBI spreads for the following eight emerging markets: Argentina, Brazil, Bulgaria, Mexico, Nigeria, the Philippines, Poland, and Venezuela. To obtain a larger sample (14 countries—Ecuador, Korea,[8] Morocco, Panama, Peru, and Russia in addition to those listed above) we also analyze daily data on EMBI+ spreads April 30, 1998 through May 31, 2000.

EMBI spreads are a weighted average of the spreads on a variety of Brady bonds issued by the country being considered.[9] Almost all bonds have a long maturity. Although the EMBI+ spreads include a number of non-Brady issues (both sovereign and corporate bonds), it still consists mainly of Brady bonds, reflecting their relative importance in overall market capitalization and trading activity. One important characteristic that distinguishes the historical and modern samples is that all countries issuing Brady bonds have previously defaulted on (or restructured) loans from foreign commercial banks, whereas only some countries in the "emerging markets then" group had defaulted prior to 1870. Conversely, some of the historical emerging market countries defaulted on the bonds we are considering during 1870-1913, whereas no country defaulted on (or restructured) Brady bonds, with the exception of Ecuador in the aftermath of its late 1999 crisis. Even though these characteristics may complicate the comparison with the historical sample, we feel the EMBI and EMBI+ indices are best for our purposes. This is because Brady bonds constitute the bulk of emerging market sovereign debt traded today: according to data provided by the Emerging Markets Traders Association [1999], Brady bonds accounted for more than half of all the transactions in emerging market debt instruments in the 1990s. Moreover, Brady bonds were by far the most commonly issued and traded form of *sovereign* debt, especially in the early and mid 1990s with a volume of transactions over 20 times the volume of trade in non-Brady sovereign debt in the mid-1990s. Brady bonds therefore tend to constitute the bulk of any portfolio of emerging market sovereign debt in the 1990s.

Nevertheless, we also examine an alternative modern data set consisting of the daily yields on one liquid sovereign Eurobond (non-Brady bond) per country.[10] The countries in this sample of emerging markets include some that never went through a Brady deal (Colombia, Indonesia, Korea, Russia, South Africa, Thailand, and Turkey) and some that did (Argentina, Brazil, Mexico, the Philippines, and Venezuela). The data are drawn from Bloomberg and refer to September 16, 1997 through May 31, 2000. A disadvantage of this alternative data set is its reliance on only one bond per

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[8] Korea never restructured, nor defaulted on, its debt.

[9] The Brady market started with the first restructuring of Mexico's defaulted sovereign loans into Brady bonds in 1990. The stock of outstanding dollar-denominated Brady bonds reached its peak of $156 billion in March 1997 and has been declining following a series of buybacks and exchanges for uncollateralized bonds and Eurobonds [International Monetary Fund, 1997, p. 75].

[10] Details on the bonds are provided in the Appendix.

country, which is dictated by the fact that very few emerging markets have more than one Eurobond with sufficient liquidity. However, this alternative data set allows us to explore the robustness of our main results not only to using non-Brady bonds, but also to considering countries that did not have Brady deals. The results are indeed very similar to those obtained with our baseline EMBI/EMBI+ data set.[11]

D. Data on Exports in Common Currency

The data on exports in common currency used in Section V are drawn from the following sources. For the historical sample, the data on exports in local currency are drawn from Mitchell [1998] and the data on exchange rates vis-à-vis the British pound are drawn from Schneider, Schwarzer, and Zellfelder [1991]. There are nine countries in our historical spreads sample for which we have annual data on exports in common currency in 1870–1913: Australia, Brazil, Canada, China, Egypt, Japan, Portugal, Russia and Sweden. Further detail on the data sources is provided in the Appendix.

III. EMERGING MARKET SPREADS, THEN AND NOW

A. A First Look at the Data

Simple inspection of the spreads over 1870–1913 and 1992–2000 (Figures I and II) reveals the following:

- The spreads are substantially higher (in basis points) in modern times than in historical times.

- There is a great deal more common variation across countries in modern times than in historical times. Around the time of the Mexican crisis (December 1994) and the Russian crisis (August 1998) spreads rise in near-unison in most emerging markets. By contrast, in historical times, fluctuations in the spreads seem to display a higher degree of country specificity.

- The period 1870–1913 saw times of turbulence and sharp changes in spreads, but also tranquil times. By contrast, during 1992–2000 there seems to have been some volatility in most countries for much of the time.

In absolute terms, spreads are higher today than in the historical sample. The cross-country mean of the period average spread is above 800 basis points in the modern sample, compared with less than 400 basis points in the historical sample, and only about 200 basis points considering the high-quality-data sample (Table I).[12] This comparison might be influenced by the fact that British yields in the historical sample

[11] This is consistent with the high correlation between the EMBI yield and the eurobond yield for the countries for which both are available: 0.97 for Argentina, 0.82 for Brazil, 0.92 for Mexico, 0.92 for the Philippines, and 0.98 for Venezuela.

[12] With the exception of the country-specific findings in Table V, all of the historical statistics reported in Tables I through IV are calculated for the period starting in May 1877, when spread series for all countries in the sample become available.

TABLE I

Spreads in basis points - Sample Statistics

	Mean	Minimum	Maximum	Standard deviation	Coefficient of variation	Mean / Britain mean
Historical Sample (1877:5 - 1913:12)						
Argentina	309	137	764	131	0.42	1.06
Brazil	245	125	653	84	0.34	0.85
Canada	88	17	122	19	0.22	0.30
Chile	245	125	603	83	0.34	0.84
China	310	151	584	109	0.35	1.07
Egypt	137	59	568	73	0.53	0.47
Greece	877	241	3857	699	0.80	3.02
Hungary	181	91	723	95	0.52	0.62
Japan	288	146	447	82	0.28	0.99
Mexico	720	254	3819	800	1.11	2.48
Portugal	447	125	1491	361	0.81	1.54
Queensland	104	46	149	17	0.16	0.36
Russia	177	64	384	80	0.45	0.61
Sweden	93	41	183	32	0.35	0.32
Turkey	1030	-8	8107	1782	1.73	3.55
Uruguay	650	126	3016	548	0.84	2.24
Cross sectional mean						
All emerging markets	369	109	1592	312	0.58	1.27
High quality data	219	94	556	97	0.40	0.75
British bond yields (in percent)	2.90	2.42	3.48	0.21	0.07	1.00
Modern Sample (1994:11-2000:5)						Mean/US mean
Argentina	811	329	1631	309	0.38	1.28
Brazil	835	362	1589	313	0.37	1.32
Bulgaria	1077	463	2154	430	0.40	1.70
Mexico	740	336	1637	300	0.40	1.17
Nigeria	1430	545	2588	603	0.42	2.26
Philippines	392	161	893	191	0.49	0.62
Poland	309	145	861	173	0.56	0.49
Venezuela	1117	264	3161	608	0.54	1.76
Cross sectional mean						
All emerging markets	839	326	1814	366	0.45	1.32
United States bond yields (in percent)	6.34	4.98	7.99	0.68	0.11	1.00

Data Sources: *The Economist's Investor's Monthly Manual* and J.P. Morgan website. The "high quality data" set of countries excludes Greece, Mexico, Turkey and Uruguay.

were much lower than U.S. yields in the 1990s (on average, 2.9 percent, compared with 6.3 percent, respectively)—an issue we return to below. The standard deviation of the spreads is typically higher in the modern sample than in the historical sample. However, the cross-sectional average of the coefficient of variation (the standard deviation divided by the mean) is roughly the same in the modern sample as it is in the historical sample. The next sections confirm these informal observations using a variety of techniques and robustness tests.

B. Empirical Approach

We use a variety of approaches to compare the characteristics of our data sets then versus now. Although each of the methods we use may be prone to certain econometric shortcomings, obtaining similar findings when using different techniques provides greater confidence in our results.

We measure the co-movement of sovereign bonds issued by emerging markets using a variety of techniques: correlation coefficients; principal components analysis;[13] "betas" between returns on each country's bonds and on a portfolio consisting of all emerging market bonds; a simplified version of concordance analysis; and a latent factor model with a GARCH element in the factors.

We then turn to sharp changes in spreads in both periods. Defining sharp changes (i) *relative* to existing spreads, (ii) exceeding an *absolute* threshold, or (iii) exceeding two *standard deviations*, we compute the proportion of such changes that affect more than one country at a time. Finally, we analyze major *long-lasting* changes in spreads: we search each spread series for "structural breaks" [Perron, 1989], without using any prior information about history; having identified the dates when such breaks occurred, we consult history books and contemporary news articles, and record any important events taking place around the dates of the breaks. To search for breaks, we repeatedly estimate the following equation

$$(1) \qquad \log(\text{Spread})_t = \beta_0 + \beta_1 \log(\text{Spread})_{t-1} + \beta_2 \Delta l\log(\text{Spread})_{t-1} + \beta_3 \Delta l\log(\text{Spread})_{t-2} + \beta_4 EVENT,$$

for any potential break date within the sample period. For potential break date T, we let the EVENT dummy variable take the value zero at all times prior to T and the value one thereafter; we estimate the equation and record the statistical significance of the EVENT dummy; and we repeat the exercise for each date T within the sample period. The sample is then split in two at the date where the statistical significance of the *EVENT* dummy is highest, and the procedure is repeated within each half of the sample until no statistically significant break points are detected in any sub-sample.[14]

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[13] This approach is similar to that adopted by other studies [e.g., Nellis, 1982], which use the extent of interest rate variation that is explained by the first principal component to gauge the extent of international financial integration.

[14] In cases where a spread series is unit root in a certain time period, the EVENT dummy is replaced by a dummy variable that takes the value one for only one month; this variable captures long-lasting changes in unit root series.

Some of the empirical techniques used here might raise a number of concerns. First, it might be argued that the behavior and impact of omitted variables affecting spreads in the various countries could differ across the two historical periods we analyze. We cannot think of a plausible set of omitted variables that might have these features, but the reader should keep this caveat in mind.

A second potential concern is that it might be argued that the differences between "then" and "now" could be driven by the statistical properties of the two samples, rather than by economically important phenomena: in particular, that the higher volatility in the 1990s could mechanically result in the higher observed co-movement in that period. This is an issue only if the signal to noise ratio in the links among the various countries' spreads is higher in the modern sample than in the historical sample—something which cannot be known and applies generally to comparisons of correlation coefficients across samples.

A number of recent papers [e.g., Forbes and Rigobon, 1999; English and Loretan, 2000; and Rigobon, 2000] raise this issue in the context of tests for "contagion" that compare correlations of returns before and after a crisis hits.[15] They suggest corrections that are designed to address the problem of changing volatility within a given sample (rather than between samples). In order to do that, they rely on the presence of a clear event—say a crisis in Hong Kong—that raises the variance of returns in Hong Kong and *thereby* raises the variance of returns in—say—Brazil. These proposed solutions are based on highly restrictive assumptions, which include (i) that the shock be known to originate in one specific country (Hong Kong in the example above), with no feedback from the other countries being considered; and (ii) that the variance of the error terms in the regression of returns in Brazil on returns in Hong Kong be the same before and after the increase in volatility of returns (in other words, that the signal be higher but that the noise be unchanged, after the crisis).[16] Whether these issues are relevant for our estimation and how one deals with them remain open questions, but it is clear that, at least in our case, the necessary assumptions to apply these techniques would be unwarranted.

A related issue is that, as many other financial series, emerging market spreads display changes in volatility over time, and a natural way to deal with this issue is to consider GARCH models. We see promise in latent factor models including GARCH elements in the factors, although these models are in the early stages of their development and application. Recent contributions are an econometric theory paper by Sentana and Fiorentini [2001] and a paper by Dungey, Martin, and Pagan [2000] which includes one of the first empirical applications of these models.[17] The latter paper, which we consider to be the state of the art for our purposes, is particularly relevant to our research because it considers spreads for five advanced countries vis-à-vis U.S. interest rates, and decomposes the variation in the spreads into country-specific and

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[15] Boyer, Gibson, and Loretan [1997] make a similar point related to "correlation breakdowns" during "stressful" market conditions. The first paper to make this type of adjustment to the correlation coefficient is by Ronn [1995].

[16] Rigobon [2001] discusses these issues and develops a new methodology that moves in the direction of less restrictive assumptions.

[17] A more recent application is Dungey and Martin [2001]. A precursor is King, Sentana, and Wadhwani [1994].

worldwide latent factors. Further technical details are in the Appendix. We apply this methodology to our data set, obtaining results that are broadly consistent with our story but, at the same time, identifying difficulties that suggest that the application of this technique might be problematic.

A final potential concern is that some of the methods we use may not be perfectly consistent with each other. In particular, if there are breaks in the series, this might bias our measures of co-movement. We address this issue in three ways. First, we identify "tranquil" periods in which no country's series experiences a break and show that even in these periods, co-movement is higher in the modern sample. Second, we use a measure of co-movement that is almost completely insensitive to structural breaks and the size of spread changes, namely the degree of concordance. Finally, for two countries (Argentina and Brazil) we "smooth" the break points in both the historical and the modern periods, and examine co-movement between the "break-free" series.

C. Estimation and Results - Measures of Co-Movement[18]

Pairwise correlation coefficients for the spreads of emerging markets are significantly higher in modern times than in historical times. The average correlation coefficient is 0.77 in modern times compared with 0.45 in historical times for the full sample (Table II), and 0.42 for the high-quality-data sample—a statistically significant difference. All correlation coefficients are positive and significant in modern times, whereas a number of coefficients are close to zero (or even negative) in historical times.

Moving to an overall measure of the extent of co-movement among spreads in the two sample periods, we calculate the share of variation accounted for by the first principal component in the sovereign bond yield spread series for the various emerging market countries considered. The overall result is that the proportion of variation in emerging market spreads accounted for by the first principal component was about ½ in 1877–1913, and about ¾ in the 1990s. Therefore, that proportion was high in historical times, but it is significantly higher in modern times, in both a statistical and an economic sense.

In historical times (1877–1913), the share of variation accounted for by the first principal component (with the standard error[19] of that share in brackets, in percentage points) is 53.8 percent (1.9) in our full sample of sixteen countries, and 49.8 percent (1.9) in our high-quality-data sample of twelve countries.

In modern times, the main sample considered is that of the eight emerging markets for which the EMBI spread data are available since November 1994. Monthly data are used for consistency with the estimates based upon historical data. The share of

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[18] We do not use cointegration techniques here because of our strong prior that spreads are I(0). Cochrane [1991] points out that with interest rates today not much different from those observed far back in history, the likelihood of interest rates being I(1) is infinitesimal. A fortiori, one would expect spreads to be I(0). Many of our spread series are indeed I(0) according to the standard augmented Dickey-Fuller or Phillips-Perron tests, though there are several exceptions over limited sample periods.

[19] Details on the calculation of the standard errors appear in the Appendix.

TABLE II
Correlation Matrices

Historical Sample (1877:5 - 1913:12)

	Argentina	Brazil	Canada	Chile	China	Egypt	Greece	Hungary
Argentina	1.00							
Brazil	0.40	1.00						
Canada	0.39	0.43	1.00					
Chile	0.53	0.46	0.52	1.00				
China	0.72	0.12	0.11	0.45	1.00			
Egypt	0.72	0.02	0.37	0.51	0.65	1.00		
Greece	0.64	0.24	0.54	0.54	0.21	0.70	1.00	
Hungary	0.66	-0.09	0.27	0.51	0.68	0.92	0.65	1.00
Japan	0.71	0.27	0.22	0.29	0.80	0.50	0.23	0.44
Mexico	0.70	-0.05	0.32	0.59	0.62	0.90	0.72	0.94
Portugal	0.37	0.90	0.32	0.32	0.07	-0.09	0.20	-0.21
Queensland	0.57	0.61	0.77	0.61	0.38	0.29	0.42	0.24
Russia	0.37	-0.33	0.18	0.31	0.66	0.70	0.23	0.78
Sweden	0.78	0.18	0.31	0.60	0.80	0.74	0.52	0.80
Turkey	0.50	-0.16	0.18	0.53	0.67	0.76	0.46	0.86
Uruguay	0.79	0.10	0.31	0.64	0.75	0.87	0.63	0.92
Britain	-0.13	-0.70	-0.58	-0.16	0.02	0.17	-0.03	0.32

	Japan	Mexico	Portugal	Queensland	Russia	Sweden	Turkey	Uruguay
Japan	1.00							
Mexico	0.40	1.00						
Portugal	0.26	-0.15	1.00					
Queensland	0.51	0.28	0.52	1.00				
Russia	0.40	0.69	-0.45	0.16	1.00			
Sweden	0.65	0.78	0.09	0.49	0.58	1.00		
Turkey	0.37	0.78	-0.24	0.21	0.76	0.71	1.00	
Uruguay	0.53	0.90	-0.01	0.38	0.69	0.84	0.85	1.00
Britain	-0.31	0.34	-0.69	-0.66	0.33	0.01	0.34	0.21

Average correlation in all emerging markets	0.45
Average correlation in high-quality data sample	0.42

Modern Sample (1994:11 - 2000:5)

	Argentina	Brazil	Bulgaria	Mexico	Nigeria	Philippines	Poland	Venezuela
Argentina	1.00							
Brazil	0.82	1.00						
Bulgaria	0.77	0.44	1.00					
Mexico	0.92	0.83	0.71	1.00				
Nigeria	0.87	0.79	0.58	0.77	1.00			
Philippines	0.79	0.66	0.62	0.85	0.79	1.00		
Poland	0.84	0.60	0.76	0.79	0.79	0.80	1.00	
Venezuela	0.89	0.87	0.64	0.85	0.88	0.80	0.76	1.00
United States	0.19	-0.25	0.59	0.04	0.04	-0.02	0.42	-0.03

Average correlation in all emerging markets	0.77

Data Sources: *The Economist's Investor's Monthly Manual* and J.P. Morgan website. The "high quality data" set of countries excludes Greece, Mexico, Turkey and Uruguay. For Britain and the United States, the correlations refer to the relationship between British (or U.S.) yields and emerging market spreads.

variation accounted for by the first principal component is 80.0 percent (3.1).[20] Using daily EMBI+ spreads for a larger sample of fourteen countries during 4/30/1998–5/12/2000, the share of variation accounted for by the first principal component is 72.2 percent (1.8).

It might be argued that some special features of Brady bonds or, more plausibly, the similarity of the countries for which the EMBI indices are available (they all had Brady deals) could lead us to overestimate the degree of co-movement in the modern period. Our main results are confirmed using an alternative data set for the modern sample period, consisting of the daily spreads on Eurobonds for a sample of twelve emerging markets including five countries that went through a Brady deal and seven that never did. The share of variation accounted for by the first principal component is 75.4 percent (1.4) for all these countries in 9/16/97–7/7/1999 and 74.5 percent (1.1) for 9/16/97–5/31/2000 omitting—owing to data limitations—the Philippines, South Africa, and Thailand. Either way, this is still significantly larger than the estimated share for the historical period.

The result that the share of variation accounted for by the first principal component is higher in modern times than in historical times remains unchanged when dropping any one or any two countries at a time from any of the samples considered above, or when using the same number of countries both then and now.

Consistent with the higher common component in emerging market yields today compared with the past, we find that the benefits of holding a portfolio of bonds issued by a variety of emerging market countries rather than by only one country are smaller today than in the past. To show this, for each emerging market we estimate a univariate regression with the returns (capital gain plus coupon payments) minus yields on the base country bonds on the left-hand side and the returns on a market-weighted[21] portfolio of bonds issued by all emerging market countries minus yields on the base country bonds on the right-hand side. We find that the beta coefficients tend to be considerably closer to one in the modern sample than in the high-quality-data historical sample (Table III). On average (across countries), the absolute difference between one and a country's beta coefficient is 0.46 in the historical sample and 0.26 in the modern sample. (The standard errors for the various countries' beta coefficients range from 0.04 to 0.15). The R^2 coefficients are significantly higher in the modern sample (0.74 on average) than in the historical sample (0.18 on average), suggesting that the overall emerging markets portfolio accounts for a larger fraction of the fluctuations in individual country returns today than it did in the past.

Another measure of co-movement that is almost completely insensitive to structural breaks, extreme changes in spreads, and differences in the stochastic properties of the spread series between the two periods, is the degree of concordance. In the spirit of Harding and Pagan [forthcoming], we define concordance as the

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[20] Using daily data for the same sample, the share of variation accounted for by the first principal component is 81.3 percent (0.7).

[21] Specifically, we use the EMBI+ "All Emerging Markets" return index for the modern sample and the average of the 1875 and 1905 relative market shares for the historical high-quality-data sample. The results are similar if we use the full historical sample; if we reweigh the portfolio every five years in the historical sample; and if we use daily data instead of monthly data in the modern sample.

TABLE III

Beta Coefficients on Returns in Modern and Historical Samples

	R^2	Beta	Standard error	Abs (1-Beta)
Historical Sample (1877:5 - 1913:12)				
Argentina	0.25	1.27	0.11	0.27
Brazil	0.19	1.05	0.10	0.05
Canada	0.03	0.17	0.04	0.83
Chile	0.11	0.77	0.10	0.23
China	0.02	0.26	0.09	0.74
Egypt	0.18	0.92	0.09	0.08
Hungary	0.29	0.88	0.07	0.12
Japan	0.04	0.40	0.09	0.60
Portugal	0.26	1.82	0.15	0.82
Queensland	0.19	0.41	0.04	0.59
Russia	0.58	1.28	0.05	0.28
Sweden	0.02	0.15	0.06	0.85
Average	0.18	0.78	0.08	0.46
Modern Sample (1994:11 - 2000:5)				
Argentina	0.85	0.85	0.04	0.15
Brazil	0.88	1.10	0.05	0.10
Bulgaria	0.74	1.27	0.09	0.27
Mexico	0.74	0.62	0.04	0.38
Nigeria	0.71	0.92	0.07	0.08
Poland	0.47	0.65	0.08	0.35
Philippines	0.77	0.58	0.04	0.42
Venezuela	0.75	1.31	0.09	0.31
Average	0.74	0.91	0.06	0.26

Data Sources: *The Economist's Investor's Monthly Manual* and J.P. Morgan website. The beta coefficients are estimated by regressing each country's monthly returns (capital gains and coupon payments) minus yields on the base country bonds on the returns (again minus yields on the base country bonds) on a market-weighted portfolio of bonds issued by all emerging market countries.

proportion of months in which all countries' spreads move in the same direction. In the modern period, the spreads of all eight countries move in the same direction in 25 percent of the months covered in the period. By contrast, considering the eight largest borrowing countries "then" (using average 1875 and 1905 figures), the spreads of all countries move together in only 11 percent of the months in our historical sample.

To conclude the series of co-movement tests, we apply the methodology of Dungey, Martin, and Pagan [2000] to a subset of five countries in our historical sample and five countries in our modern sample (the computational costs become prohibitive for larger samples). For cases where convergence is obtained, we tend to find that the (cross-country) average share of variation accounted for by the "worldwide factor" is higher for the modern data set than for the historical data set (there are no significance tests for this technique yet). However, our impression is that, at least with our data, the results on which countries turn out to have a larger share of the variation accounted for by the worldwide factor are rather sensitive to the choice of initial parameters, weighting matrix, optimization algorithm, and specification of the auxiliary model. Given this lack of robustness, we do not report the results, because reading too much into them would be misleading.

D. Emerging Market Crises, "Then" versus "Now"

Financial crises are certainly not a new phenomenon. They occurred frequently and with severe consequences in the late 1800s and early 1900s. "Emerging market" countries often defaulted on their debts: Turkey's default on its foreign debt in the mid-1870s was associated with an increase in sovereign spreads of a magnitude not seen since then. The crash of 1890 in Argentina led to the insolvency of Baring's, the famous London merchant bank. Other countries in our sample defaulted as well.[22] Nevertheless, a systematic analysis of sharp changes in sovereign spreads suggests that crises (and sudden improvements in a country's spreads) were less frequent "then" than they are "now." Specifically, we compute the number of instances in which spreads changed sharply, in 1877–1913 versus 1994–2000, according to the following definitions:

1) Proportional change in the spread: the spread rises or falls by more than 10 percent (20 percent, 30 percent, or 40 percent) of its initial value.

2) Absolute change in the spread: the spread rises or falls by more than 100 basis points (200 basis points, or 300 basis points).

3) Changes exceeding two standard deviations in the country's *change* in spreads (calculated using absolute changes or rates of change).

Each of these definitions has advantages and disadvantages. The "proportional change" definition is less sensitive to the fact that the absolute magnitude of spreads (in basis

[22] According to Lindert and Morton's [1989] chronology of debt defaults and reschedulings since 1820, Argentina defaulted in 1888–1893, Brazil in 1898 and 1914, Egypt in 1876, Greece in 1893, Mexico in 1867 and 1914, Turkey 1876–1881 and Uruguay in 1876.

points) is higher during some periods than others; however, it will identify many episodes as "sharp changes" when the spread is close to zero. Conversely, the "absolute change" definition will tend to identify more episodes as "sharp changes" during times of large absolute spreads, but will not do so when the spreads are close to zero. Finally, defining sharp changes with respect to the standard deviation of such changes is useful to analyze the share of sharp changes that are common to more than one country, but of course not the frequency of sharp changes in a given country.

All variations of 1) and 2) give far more frequent sharp changes in the modern period than in the historical period. Using changes of 200 basis points or 20 percent as thresholds, we find sharp changes in less than 2 percent of the number of observations in the historical sample, versus 14 percent or more in the modern sample (Table IV). This suggests that emerging market crises (and sharp improvements in spreads) have been more common in the 1990s than at the time of the classical gold standard.

Our key interest here, however, is in the frequency of instances in which sharp changes are common to a number of countries, relative to all instances in which sharp changes take place. Using any of the measures listed above, compared with the past, the modern period has a higher ratio of months with sharp changes in *more than one* country to months with sharp changes in *at least one* country (a subset of the results are reported in Table IV). Regardless of the definition of sharp changes, the ratio of the number of months with sharp changes in *more than one* country to the number of months with sharp changes in *at least one* country is about twice as high in the modern sample as in the historical sample.

Using the definition of sharp changes based on standard deviations, we confirm that global crises were relatively more common in modern times than in historical times. There are two instances during 1994:11–2000:5 (66 months) when *all eight* emerging markets in our sample experienced a sharp change in spreads. The first corresponds to the Asian crisis (October 1997), whose impact on spreads was gradually reversed in the following months. The second instance corresponds to the Russian crisis (August 1998), which had a more long-lasting impact on spreads.[23] The Mexican crisis (December 1994) raised spreads in many countries, but it raised them by more than two standard deviations of the change in spreads only in Mexico. There is only one other month (January 1996) in which a spread decline exceeding two standard deviations took place in one country alone (Poland), although the spreads of all eight countries declined in that month.

Turning to the much longer historical period 1877:5–1913:12 (439 months) with a sample of *sixteen* countries there is only one month in which 8 countries out of the 16 displayed sharp changes. There are only two months in which 5 or 6 countries

[23] Assuming independent normal distributions, eight countries would be expected to display a sharp change (defined in terms of two standard deviations) in the same month $100*0.05^8 = 3.9*10^{-9}$ percent of the time.

TABLE IV
Common and Idiosyncratic Sharp Changes, 1877-1913 and 1994-2000

	Historical Sample (16 countries, 1877:5-1913:12)			Modern Sample (8 countries, 1994:11-2000:5)		
	200 basis points	20 percent	2 std. devtns.	200 basis points	20 percent	2 std. devtns.
Sharp changes in percent of total observations	1.5%	1.8%	4.3%	14.8%	14.0%	3.4%
Number of months with characteristics listed:						
No sharp changes	365	339	241	34	26	62
Sharp changes in exactly one country	49	80	138	12	25	2
Sharp changes in exactly two countries	19	12	39	10	7	0
Sharp changes in three or more countries	6	7	20	10	8	2
Proportion of months with characteristics listed: (As a share of total months in sample period, in percent)						
No sharp changes	83.1	77.4	55.0	51.5	39.4	93.9
Sharp changes in exactly one country	11.2	18.3	31.5	18.2	37.9	3.0
Sharp changes in exactly two countries	4.3	2.7	8.9	15.2	10.6	0.0
Sharp changes in three or more countries	1.4	1.6	4.6	15.2	12.1	3.0
Ratio of months with sharp changes in *more than one* country to months with sharp changes in *at least one* country	33.8	19.2	29.9	62.5	37.5	50.0

Data Sources: *The Economist's Investor's Monthly Manual* and J.P.Morgan web site. The historical sample consists of 16 countries and the modern sample consists of 8 countries, listed in the text. The sample periods were chosen to ensure that there are no missing observations.

displayed sharp changes, 17 months in which 3 or 4 countries displayed sharp changes, and 39 months in which two countries displayed sharp changes. By comparison, there were as many as 138 months in which exactly one country displayed a sharp change.[24]

Even the onset of the most famous crisis of the period, the Baring Crisis of 1890, was associated with a sharp increase in the spreads of Argentina and Uruguay, but had little immediate impact on spreads elsewhere. When different countries experienced sharp changes at the same time, it was typically due not to a common global crisis, but rather a coincidence of unrelated country-specific events.[25]

We now turn to structural breaks in the spread series. In line with our earlier results on the co-movement of spreads "then" versus "now," we find that long-term breaks in the spread series were determined by country-specific events in the historical sample, whereas they are largely associated with global events in the modern sample. Most of the historical breaks correspond to country-specific events that might be related to the country's ability to repay its external debt (Table V). Beginnings or ends of wars and rebellions feature very prominently, as do economic news. For example, the end of a civil war, a domestic revolt, and the Baring Crisis were all associated with breaks in Argentina's spread series; similarly, an armed rising and the war against Sudan affected Egypt's spreads. Banking crises affected Queensland's spreads. In several cases, changes in monetary regime were also associated with breaks in the spread series. The case of Japan is described in detail in Sussman and Yafeh [2000], who show that the adoption of the gold standard (1897) sharply reduced Japan's spreads. Similarly, a break in the spread series is observed in Portugal at the time when that country abandoned the gold standard. There are no historical instances in which breaks occur simultaneously in a large number of countries. Even the best-documented crisis in the nineteenth century, the Baring Crisis of 1890, did not result in significant breaks in more than two countries, and certainly not in distant countries. As noted above, the Baring Crisis did not cause a global increase in spreads even in the short run, as evident in our data on sharp changes.[26]

By contrast, in modern times global events had a far more pervasive impact on emerging markets' spreads than any country-specific events. In our sample of eight emerging markets during 1994–2000, there is one major break—in August 1998, at the time of the Russian crisis—affecting all countries. In addition, the Mexican crisis of late 1994 also had a discernible impact on Mexico and Venezuela; otherwise, there are basically no breaks associated with events taking place in the country under consideration. The one country-specific break that we find convincing is associated with the introduction of the currency board in Bulgaria (which formally took place on July 1, 1997). This is not because the countries in our 1990s sample experienced any

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[24] The general pattern of the results, that sharp changes common to several countries are a higher share of all sharp changes today than in the past, is even more apparent using samples of eight countries for the historical period [see Mauro, Sussman, and Yafeh, 2000].

[25] For example, in July 1891 a national bank failed in Argentina, a civil war erupted in Chile, and a financial crisis began in Portugal, and spreads rose in each of these countries.

[26] See Eichengreen [1997] for a discussion of the crisis and its impact. Sussman and Yafeh [1999] find that the Baring Crisis did not affect Japanese spreads significantly, even when daily data are examined. If anything, Japanese spreads *declined* slightly, suggesting that investors may have shifted some of their money into Japanese bonds, rather than away from them.

TABLE V

Breaks in Historical Sample

Country	Date	Sign	Event
Argentina	March 1876	Increase	Period of revolution and crisis
	June 1890	Increase	Baring Crisis
	July 1891	Increase	Failure of national bank
	April 1879	Decrease	Success against rebellion
	April 1896	Decrease	Improvement in the fiscal position
Brazil	April 1898	Increase	Following the crushing of Canuda rebellion
	October 1890	Increase	Going off the gold standard, Baring crisis
	September 1895	Increase	Between revolt of military school and dissolution of congress
Canada	February 1912	Decrease	Pro-British Conservatives win important elections
Chile	November 1896	Decrease	Establishment of a financial inquiry commission?
	September 1891	Decrease	End of Civil war
	March 1886	Decrease	New regime
	November 1879	Decrease	Doing well in a war with Bolivia and Peru
	July 1876	Decrease	New information provided to market about financial position
China	June 1885	Decrease	?
	May 1896	Decrease	End of war with Japan
	July 1900	Increase	Boxer rebellion
Egypt	May 1879	Decrease	July, Ismail pasha deposed
	September 1881	Increase	Armed uprising
	April 1885	Increase	War against Sudan
Greece	July 1893	Increase	Financial crisis
	April 1897	Decrease	End of war with Turkey
Hungary	May 1877	Decrease	Hungary to be neutral in Balkan conflict between Turkey and Russia
Japan	August 1897	Decrease	Going onto the gold standard
	March 1904	Increase	War with Russia
Mexico	March 1879	Decrease	?
	August 1886	Decrease	Ease of tensions with the US?
	July 1894	Decrease	?
Portugal	July 1902	Decrease	Renegotiation of debt
	March 1891	Increase	Going off the gold standard; bank moratorium
	September 1907	Increase	Franco dictatorship; end of monarchy
Queensland	January 1891	Increase	Banking Crisis
	April 1893	Increase	Banking Crisis
Russia	April 1877	Increase	War with Turkey
	February 1903	Increase	Tensions with Japan?
Sweden	June 1881	Decrease	?
Turkey	July 1875	Increase	Trouble in Bosnia
	May 1878	Decrease	End of war with Russia, introduction of the gold standard
	September 1895	Increase	War against Greece
	October 1912	Increase	War in the Balkans
Uruguay	March 1892	Decrease	End of a financial crisis
	April 1877	Increase	Beginning of military rule
	February 1895	Increase	Instability leading to war
	January 1905	Decrease	End of civil war

Data Sources: *The Economist's Investor's Monthly Manual.* The breaks are identified through an iterative procedure as described in the text, and are listed in the order in which they are obtained.

shortage of major political and economic events. Coups, assassinations of key political figures, violent uprisings, the suspension of existing constitutions, the adoption of new constitutions, major changes in the party in power, changes in the domestic currency, and the establishment of common trade areas all took place in some of the countries we analyze during the modern period.[27]

The fact that we typically capture only one major break per country in the spread series in our modern sample is consistent with the finding in the earlier sections that sharp changes in the spreads are relatively frequent in the 1990s. The systematic search for breaks picks only long-lasting changes in mean spreads, whereas most sharp changes defined as changes by more than a certain number of basis points, a certain percentage, or a certain number of standard deviations tend to be reversed after a short time.

IV. Robustness Tests and Further Exercises

In this section we conduct a series of robustness tests to check that our main results on differences in co-movement between the two periods are not driven by structural breaks; by our choice of a particular sample period, group of countries, or type of bond; by our use of spreads instead of yields; or by differences then versus now in the behavior of yields in the core country (Britain and the United States, respectively). For the sake of brevity, we report our findings based upon only one summary statistic—the share of the variation in the data explained by the first principal component (reporting the standard error of that share in percentage points, in brackets). The pattern of the results is basically the same using alternative statistics, such as the average correlation coefficient.

A. Sub-Periods, Tranquil Periods, and "Smoothed" Series

In our baseline estimates for the pre-World War I era, we use the longest sample period over which data are available for our sample of emerging markets (1877:5–1913:12). This raises two questions. First, there may have been interesting changes during that long historical period. In particular, one might wonder whether the formative part of the last golden age, prior to the Baring crisis of 1890, rather than the more mature financial environment of 1895–1913, could constitute a closer parallel to today's relatively new global market for emerging market bonds. In fact, spreads were higher and more volatile before 1890 than in 1895–1913 (see Figure I), partly owing to a less widespread participation in the gold standard in the earlier part of this historical period, and perhaps also because many of the borrowers were new to the London market. Second, our full historical sample period is much longer than our modern sample period; to check whether this might influence the results, we compare the extent of co-movement for *any* 5½-year period in history with that estimated for our 5½-year period in modern times (1994:11–2000:5).

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[27] A full list of such major events that might a priori have been considered capable of having a significant impact on spreads is available from the authors upon request. In this context it is also worth noting that one could make a case that the Mexican crisis and, to a lesser extent, the Russian crisis, were prompted in part by domestic political events.

We begin by dividing the historical sample into three sub-periods: in each of them we find that the share of variation accounted for by the first principal component is significantly lower than in modern times. For our high-quality-data sample, it amounts to 60.5 percent (2.9) in the pre-Baring crisis period, 1877:5–1890:5; 51.7 percent (5.0) during the Baring crisis period and its aftermath, 1890:1–1894:12; and 61.3 percent (2.5) in the post Baring crisis period, 1895:1–1913:12. By comparison, it amounts to 80.0 percent (3.1) in 1994:11–2000:5.

Considering all possible 5½-year periods between 1877 and 1910, the first principal component accounts for a significantly lower share of the variation in each of them than it does in the modern 5½-year period. Beginning with 1906–1911 and through 1908–1913, the share of variation accounted for by the first principal component is basically the same as in the modern sample; however, this is actually because of a common trend decline (and lack of volatility) in the spreads of all countries in the sample at that time (Figure I).[28] Controlling for that trend decline, this anomaly disappears. (Controlling for trends has no effect for other periods, including the modern period.)

A related issue is that some co-movement measures such as correlation or principal components analysis (but not concordance) might be misleading in the presence of structural breaks. Therefore, for both the historical and the modern samples, we estimate the extent of co-movement during "tranquil" periods, defined as periods during which there are no structural breaks in any country. The share of variation accounted for by the first principal component is 37.8 percent (5.5) in 1881:10–1885:3; 39.3 percent (5.9) in 1886:9–1890:5; 61.3 percent (7.2) in 1898:5–1900:7; and 84.7 percent (2.7) in 1907:10–1912:1—but only 43.1 percent (5.2) again controlling for a common declining trend in spreads. This is significantly below the share of variation accounted for by the first principal component, 95.2 percent (1.2), in the modern tranquil period, 1995:3–1998:6.[29]

Finally, we "smooth" the spread series at points were structural breaks take place, and then measure the co-movement between the smoothed series.[30] We do this for Argentina and Brazil, in both the historical and the modern sample. In the historical period, once breaks are removed the co-movement (correlation coefficient) between the two countries' spreads falls. By contrast, in the modern sample, the correlation between Argentina's and Brazil's smoothed spread series remains nearly as high as in the original (not smoothed) series. We conclude that the presence of many country-specific breaks in the historical sample is not the cause for the lower co-movement observed in that period relative to the 1990s.

B. Yields rather than Spreads, and Interest Rates in the Core Country

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[28] See Ferguson [2001] for further discussion.

[29] The result mentioned in the main text is obtained excluding Bulgaria from the sample. Including Bulgaria, where a clearly country-specific break is observed corresponding to the introduction of the currency board, the share of variation accounted for by the first principal component is 91.4 percent (standard error: 2.1 percentage points).

[30] We run the usual iterative procedure to find the breaks. Having identified their dates, we run a regression of the spreads on dummies for each of the break dates: the residuals are the smoothed series.

In our baseline analysis, we use spreads (emerging market yields minus yields on bonds issued by the core country) rather than yields because our objective is to analyze the portion of co-movement across emerging markets that cannot be attributed to changes in yields in the core country. The use of spreads attains that objective under the hypothesis that a one percentage point increase in yields in the core country raises all emerging market yields by one percentage point.

The impact of core country yields on emerging market spreads is an unresolved issue from both a theoretical and, especially, an empirical standpoint. Kamin and von Kleist [1999] suggest that, in theory, an increase in interest rates in the core country should raise the *absolute* (percentage point) spreads. Using their assumptions, it is also easy to show that the *relative* spread is decreasing in the core country's interest rate. Empirically, however, neither our own estimates (notably the correlations between emerging market spreads and core country yields, reported in Table II), nor existing studies provide much evidence that would reject the hypothesis of a unit coefficient: for example, Kamin and von Kleist [1999] do not find significant and robust effects of U.S. yields on emerging market spreads.

Nevertheless, we explore the possibility that spreads might be affected by core country yields. In fact, core country yields are both higher and more volatile in the modern sample, and it might be argued that higher volatility of core country yields could raise both the volatility and the co-variation of spreads in emerging markets.[31] However, the larger common component in emerging market spreads in modern times than in historical times does not seem to be accounted for by greater variation in core country yields in modern times: to show this, we adopt three approaches.

First, we conduct the principal component analysis using yields rather than spreads. The share of variation accounted for by the first principal component is 54.6 percent (1.9) using yields for our high-quality-data sample in 1877:5–1913:12, and 81.0 percent (3.0) using yields for 1994:11–2000:5. Therefore there is significant evidence of greater co-movement in modern times than in historical times, using yields. It is also interesting to note in this context that the share of variation accounted for by the first principal component is not significantly higher using yields than it is using spreads. (The corresponding shares using spreads for the same samples are 49.8 (1.9) in historical times and 80.0 (3.1) in modern times.) This is consistent with the view that changes in core country yields do not play a significant role in explaining co-movement across emerging markets.

Second, we estimate the amount of variation that is accounted for by the first principal component using, for each emerging market—instead of the spreads—the logarithm of the ratio of the yield in the emerging market to the yield in the core country. (For small spreads, this is approximately equal to the ratio of the absolute spread to the yield in the core country.) This method ensures that the estimation ignores all instances in which the same multiplicative change affects yields in both the core country and the emerging market. Using this method, the amount of variation that is accounted for by the first principal component is 54.3 percent (1.9) for our high-

[31] Britain's low and stable interest rates in the historical sample period are probably related to its adherence to the gold standard.

quality-data sample in 1877:5–1913:12 and 81.0 percent (3.0) in 1994:11–2000:5.

Third, for each emerging market, we run a univariate regression of the emerging market yield on the yield in the core country, and save the residuals. We then run the principal components estimation on the residuals for all emerging markets. The rationale is to conduct the principal components analysis on that portion of emerging market yields that is orthogonal to core country yields. Using this approach, the share of variation accounted for by the first principal component is 54.5 percent (1.9) for our high-quality-data sample in 1877:5–1913:12 and 85.0 percent (2.4) in 1994:11–2000:5.

V. Discussion and Interpretation

The picture that emerges is one in which, today compared with the past, the co-movement of spreads across countries is higher, and sharp changes in the spread series are less related to events taking place in the country under consideration, and more often related to global events taking place elsewhere. The explanations that we offer for these phenomena focus on increased correlation of economic fundamentals among emerging markets and on differences in investor behavior.

Before proceeding, we can confidently rule out the possibility that the differences we observe are due to lack of information on the part of investors in the nineteenth century. This is because events in emerging markets were meticulously reported in the British press: for example both *The Times* of London and *The Economist* reported on events in Asia regularly and in detail [Sussman and Yafeh, 1999]. Reports on events in China explicitly emphasized the potential costs for Japan, whether through commercial links or direct military involvement, so that investors had all the necessary information regarding events in one emerging market that might have consequences for other markets.[32] The speed with which information from emerging market countries reached investors in the advanced countries is also unlikely to account for our findings, because international telegraph links to the emerging market countries in our sample were introduced in the 1870s, and most of our estimations rely on end-of-the-month data.

Another potential explanation for which we find no evidence is that common shocks, perhaps "liquidity" shocks, might be more pronounced or more frequent in modern times than in historical times. True, we are unaware of major events in historical times that might have had a large impact on the flow of capital from Britain to contemporary emerging markets. However, the same applies to the modern period.[33]

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[32] Indeed, some investors devoted a phenomenal amount of highly qualified human resources to obtaining and analyzing information on the economic fundamentals of the various emerging market countries of the day. See Flandreau's [1998] fascinating account of such applied research activities by one important investor in emerging markets in 1870–1914, the *Credit Lyonnais.*

[33] In the historical period, the only candidate event is the Boer War of 1899, but that had only a small and short-lived impact on British interest rates. In the modern period, one can perhaps think of the LTCM crisis, but that took place *after* Russia's default and the sharp increase in emerging market spreads. The Russian crisis took place in early to mid-August 1998. LTCM sent a letter to its investors on September 2. The New York Fed announced the LTCM rescue around September 21. The timing is clear: spreads went up because of Russia; LTCM had bet on a decline in spreads and went bankrupt *after*

In contrast with the lack of information and shocks to the core hypotheses, there is some evidence that the correlation among emerging markets' economic fundamentals is higher today than in the past. Probably the closest proxy for economic fundamentals that can be obtained for the historical period is exports in pounds sterling—a variable clearly related to an emerging market's ability to repay its external debt.[34] We use the annual rate of change of exports in common currency to proxy for news about each country's fundamental ability to repay its external debt. To obtain a comparable measure of the correlation of economic fundamentals at the annual frequency in modern times, we use exports in U.S. dollars during 1966–98 for our sample of countries.

For 1871–1913, the first principal component accounts for 26.9 percent (standard error: 4.6 percentage points) of the variation in the growth rate of exports of the 9 countries for which we have good data. For 1966–1998, the first principal component accounts for a significantly higher proportion—54 percent (standard error: 6.7 percentage points)—of the variation in the growth rate of exports of the 7 countries in our EMBI sample for which we have good exports data.[35] We view this finding as evidence that higher co-movement of fundamentals may be one of the factors underlying today's greater co-movement of spreads than observed in the past.[36]

However, the striking differences between the historical and modern samples are likely to be due to more than just differences in co-movements of economic fundamentals. Sussman and Yafeh [1999] present two case studies suggesting that today's investors appear to pay less attention to events that are taking place in the country whose spreads are being considered, and greater attention to events taking place elsewhere. A first case study shows that in the nineteenth century, Japan and China were close trading partners, and yet major events in China hardly had any impact on Japanese spreads, unless Japan was directly involved. By contrast, a second case study shows that events in Indonesia had a large impact on Korean spreads in the late 1990s, even though the two countries are not major trading partners and have different production structures, and the events considered had little to do with the fundamentals of the Korean economy.

A possible factor underlying the apparent differences in investor behavior

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the increase in spreads which originated in Russia and affected many other emerging markets at the same time [International Monetary Fund, 1998, pp. 54–56].

[34] Other variables, such as gross domestic product or industrial production, are available for a very limited number of countries and usually not before the 1880s. Industrial production is also available only for a smaller sample and is not representative of economic activity in emerging markets, which consisted largely of agriculture and natural resource extraction.

[35] Dropping one or two countries at a time, whether in the historical sample or in the modern sample, using more countries for a shorter historical sample period, or using other test statistics does not affect the results much.

[36] The higher co-movement of export growth today is not inconsistent with the high degree of worldwide integration and trade openness of the emerging markets in 1870–1913 documented by previous studies [e.g., O'Rourke and Williamson, 1999]. Although the degree of trade integration today seems to be broadly similar to that observed in 1870–1913, the underlying shocks affecting the various emerging markets appear to be more closely correlated now than they were in the past, perhaps owing to greater similarities in the production structures of today's emerging markets.

relates to important differences between the two periods in the institutional arrangements for investing in emerging markets. Particularly notable in this respect is the key role played by individual investors in the past. This stands in sharp contrast to the role played today by funds that seem to invest in or divest from groups of emerging markets despite the changing relative fortunes of the underlying economies. From the point of view of individuals, investing in foreign countries through funds may reduce monitoring and transaction costs. Yet when a crisis emerges, these funds tend to liquidate their holdings of securities in several emerging markets *en bloc*, apparently so as to maintain a given risk and liquidity profile. Hedge funds, for example, seem to operate in a way that forces them to sell their holdings in healthy economies when a crisis erupts elsewhere[37]. Another potential explanation is that "noise traders" or "herd behavior" [see a survey in Shleifer, 2000] might play a more important role today than a hundred years ago, perhaps because large investment funds follow each other's strategies. Finally, while news reports suggest considerable worry among investors at the time of the Baring Crisis, the slow trading technology of the past may have reduced panics by helping investors to "take a breather," thereby preventing the crisis from becoming global.

Regarding the issue of why the mean level of spreads in historical times is lower than today's, we conjecture that two factors could be at play. First, all of the emerging market countries in the modern sample had defaulted prior to the period considered whereas not all those in the historical sample had. As a result, emerging markets today might be viewed by investors as a relatively higher-risk group than emerging markets in the past were. A complementary point of view could be that the modern sample period was immediately preceded by the debt crisis of the 1980s, with its related difficulties in working out a solution. By contrast, during the historical sample period, solutions to default crises may have been easier to work out because the creditors were organized in the Corporation of Foreign Bondholders [Fishlow, 1985], or because British military intervention to enforce debt repayment was possible.[38] The Bank of England's prompt intervention, as in the case of the Baring Crisis, may also have been viewed as highly credible and effective.

Another possible reason for the lower and less volatile spreads "then" may be that several countries in our sample adhered to the gold standard and conducted policies consistent with it for at least part of the historical period we analyze. The idea that the gold standard may have reduced spreads is corroborated by several structural breaks in the spread series (with the expected signs) that take place around the time when countries go on or off gold. It is also in line with Bordo and Rockoff's [1996] result (obtained using a different sample relying on annual data) that countries' commitment to the gold standard significantly lowered their cost of borrowing.

VI. CONCLUSIONS

In this study, we analyze a newly-collected data set on sovereign bond yields in emerging markets in 1870–1913, a golden era for international capital flows, together

[37] See, for example, Eichengreen [1999]. Kaminsky and Reinhart [2000] discuss the behavior of investment funds more generally.

[38] This is what happened in Egypt and nearly happened in a number of other cases [Ferguson, 2001].

with widely used data on sovereign bond yields in emerging markets in 1992–2000. We find that, compared with the past, co-movement of spreads among emerging markets today is greater, and the proportion of sharp changes in spreads affecting more than one country is higher. Consistent with this, the benefits to investors of portfolio diversification among emerging markets are smaller. Moreover, the relationship between country-specific events and sharp, long-lasting changes in spreads is weaker.

We argue that these results may be accounted for by two factors: first, co-movement of economic fundamentals seems to be higher today than in the past; second, the institutional arrangements of foreign investment today seem to make investors place less emphasis on country-specific events than their predecessors did in 1870–1913.

APPENDIX: DATA SOURCES AND TECHNICAL ISSUES

For the historical sample, yields are calculated as the ratio of interest payments to market price. This is a reasonable approximation because, for most bonds in our sample, coupon payments take place on a regular basis and maturity is very long. This procedure is adopted in view of the difficulty of collecting detailed data on each bond's characteristics such as covenants, and options for early calls.

The data refer to the following bonds. Argentina, 6 percent public works bond until 1884 and 6 percent bond 1884 issue, 1922 maturity, thereafter; Brazil 5 percent consol, replaced by 4 percent bond in 1884; Canada 4 percent bond, 1874 issue, maturity 1910, 1935, throughout; Chile 6 percent bond, 1896 maturity, until 1885, followed by 4.5 percent bond; China 8 percent bond, 1876 issue, replaced in 1884 by 7 percent bond, replaced in 1896 by 5 percent gold loan; Egypt 4 percent bond, 1876 issue, 65 year maturity; Greece, 5 percent bonds: 1825 issue, replaced by 1879 issue, replaced by 1889 issue, 1921 maturity; Hungary 5 percent bond, 1871 issue, 1904 maturity, replaced in 1881 by 4 percent consol; Japan 9 percent bond, 1870 issue, replaced by 7 percent bond in 1873 until its redemption in 1897 with the adoption of the gold standard, replaced by 5 percent bond, 53 year maturity; Mexico 3 percent 1859 consol, replaced in 1889 by 6 percent consol; Portugal 3 percent conso;. Queensland 4 percent bond, 1913 maturity; Russia and Sweden, consols throughout; Turkey, C series bond until 1904, and Unified bond thereafter; Uruguay 6 percent bond, 1871 issue, 1893 maturity, replaced in 1883 by 5 percent unified consol (coupons reduced to 3.5 percent in 1892). The calculation of Turkish yields during the 1875–1883 period when Turkey suspended interest payments is based on the assumption that coupon payments were made. A similar approach is used in other cases of default. In late 1903 and early 1904, Turkish yields are close to those of Britain, because the bonds for which data are available are close to maturity.

The data on British consols are drawn from the NBER MacroHistory Database, series code *m13041*.

The data on U.S. long-term interest rates are drawn from the United States Treasury's web site, series code *tcm30y*.

The data on exports in local currency for 1870–1913 are drawn from Mitchell's *International Historical Statistics (1750–1993)*, volumes for *Europe* (4th edition), *The Americas* (4th edition), and *Africa, Asia, and Oceania* (3rd edition).

The data on exchange rates in 1870–1913 are drawn from Schneider et al. [1991].

The data on exports in U.S. dollars for Argentina, Brazil, Mexico, Nigeria, Philippines, Poland and Venezuela in 1966–1998 are drawn from *International Financial Statistics*, International Monetary Fund.

The data on the composition of emerging markets' debt by type of instrument are drawn from the *1999 Annual Debt Trading Volume Survey—Supplemental Analysis*, Emerging Markets Traders Association EMTA, New York, NY, and complemented using EMTA data available via the Internet at www.securities.com.

The EMBI and EMBI+ spreads are drawn from J.P. Morgan, which strives to ensure that the spreads are unaffected by specific features of particular bonds. Notably, yields on those Brady bonds that are collateralized are "stripped," that is, computed taking into account that the collateralized portion of the payments is virtually unaffected by country risk. More detailed data on the role of Brady bonds globally, and specifically for the countries in our sample, are reported in Mauro, Sussman, and Yafeh [2000].

The modern eurobond sample, drawn from Bloomberg, consists of the yields on the following sovereign eurobonds: Argentina 11 percent, maturity 10/2006; Brazil 8.875 percent, maturity 11/2001; Colombia 7.625 percent, maturity 2/2007; Indonesia 7.75 percent, maturity 8/2006; Korean Development Bank 7.9 percent, maturity 2/2002; Mexico 11.5 percent, maturity 5/2026; Philippines 8.75 percent, maturity 10/2016; Russia 9.25 percent, maturity 11/2001; South Africa, 9.675 percent, 12/1999; Thailand, 7.75 percent, 4/2007; Turkey 10 percent, 9/2007; and Venezuela 9.25 percent, maturity 9/2027. The data for the yields on eurobonds issued by the Philippines, South Africa and Thailand are either not available or implausibly stable from early July 1999.

The asymptotic standard errors of the percentage of total variation accounted for by the first principal component are computed using the routine PCA in the Stata Technical Bulletin, available via the Internet at www.stata.com/stb/stb37/. The standard errors of the share of variation that is accounted for by the first principal component should be interpreted with caution, because they are based upon the assumption that the data are multivariate normally distributed even though a majority of the spread series display considerable skewness (with the long tail in the direction of higher spreads) and, as is often the case with financial data, higher kurtosis than a normal distribution (i.e. fat tails—more frequent extreme events than under a normal distribution).

The Dungey, Martin, and Pagan [2000] estimation approach can be summarized as follows. The first stage is the computation of a realization of the spread series for the various countries by feeding random shocks into a two-factor model of spreads for an initial set of parameters. Relevant features ("the auxiliary model") of the simulated data and actual data are then computed, and compared. This procedure is iterated for a different set of initial parameters, the latter obtained using an optimization algorithm that aims at minimizing the differences between the relevant features of the simulated and actual data. More formally, the model we apply consists of the following equations (the original model includes an additional factor for base country interest rates, which we omit here for simplicity with no change in the results):

$$s_{i,t} = \phi_i f_{i,t} + \lambda_i W_t, i = 1, \ldots, n$$

$$f_{i,t} = \rho_{i,t-1} + e_{i,t}$$

$$W_t = \rho_w W_{t-1} + e_{w,t}$$

$$e_{j,t} = \sqrt{h_{j,t}} u_{j,t}, j = 1, \ldots, n, w$$

$$h_{j,t} = 1 - \alpha_j - \beta_j + \alpha_j e_{j,t-1}^2 + \beta_j h_{j,t-1}$$

$$u_{j,t} \sim N(0,1),$$

where $s_{i,t}$ is the spread in country i at time t, $f_{i,t}$ is the individual country factor and W_t is the worldwide factor. The initial parameters are obtained from generalized method of

moments estimation (without GARCH). The relevant features of the data include the covariance of the spreads across countries, and the coefficients of AR(2) models for the spreads and AR(2) models for the squares of the spreads.

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HEBREW UNIVERSITY OF JERUSALEM
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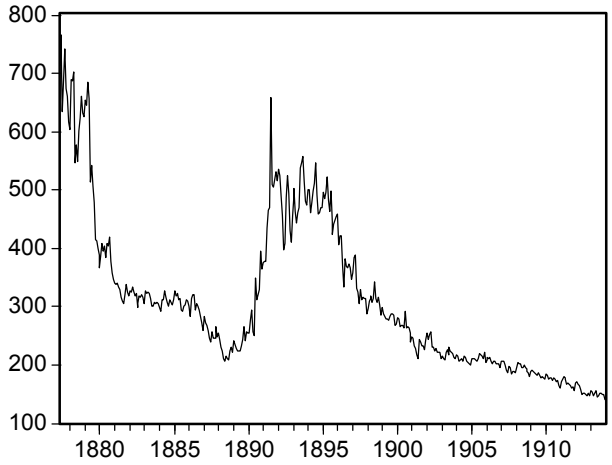
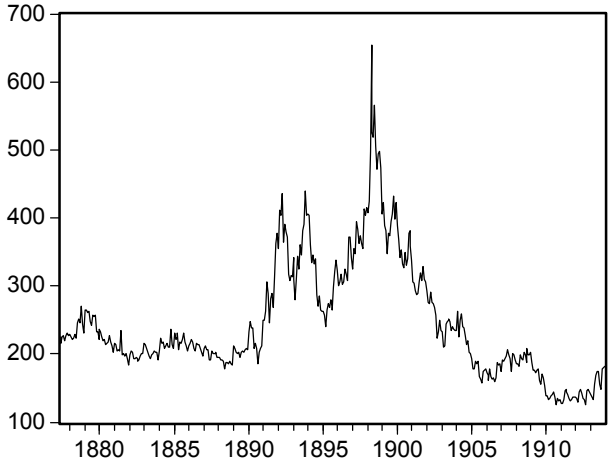
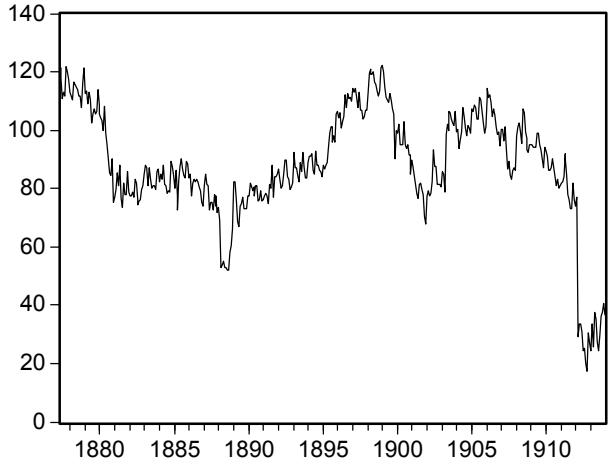
FIGURE I
Historical Spreads, 1877-1913 (in basis points, high quality sample)



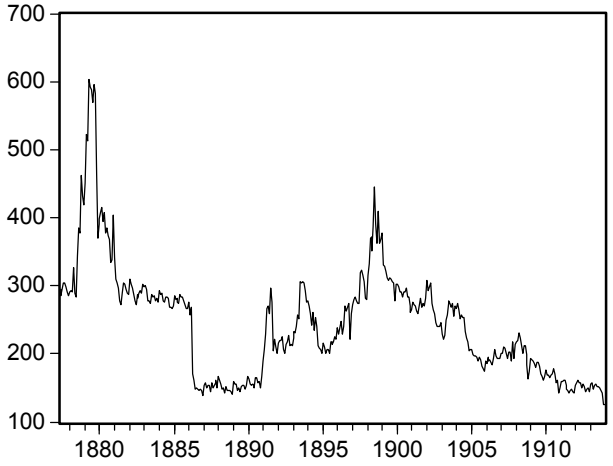
Argentina



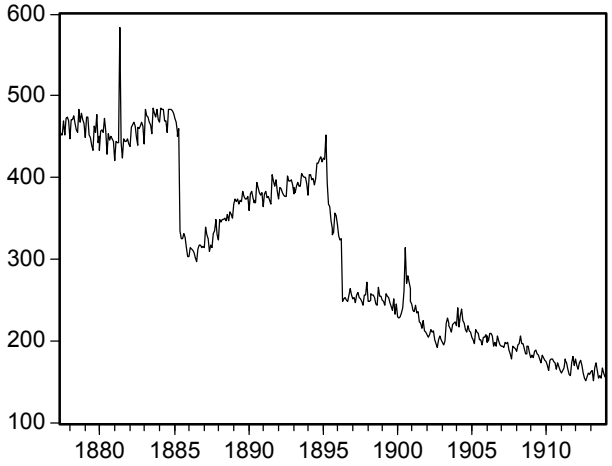
Brazil



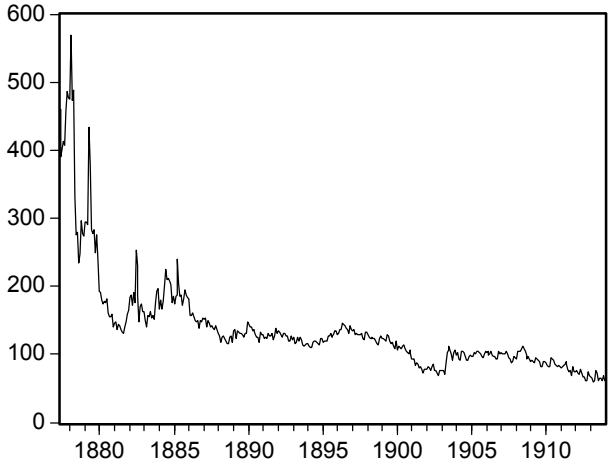
Canada



Chile



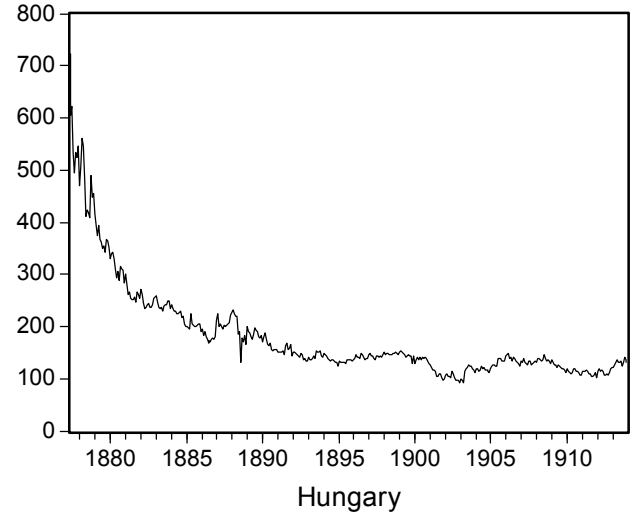
China



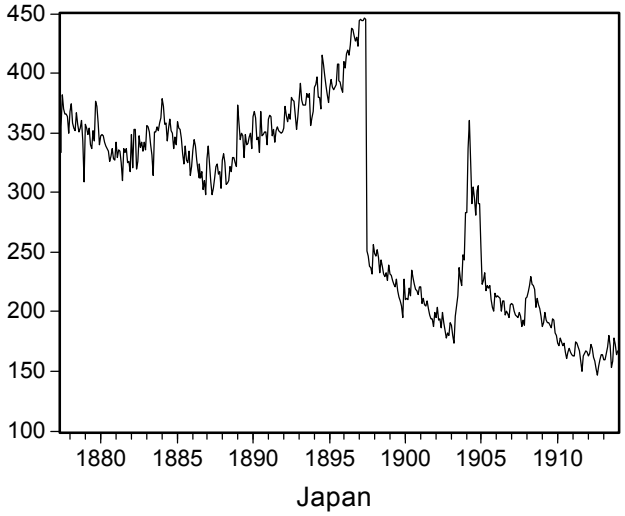
Egypt

Data Source: The Economist's Investor's Monthly Manual
Spreads are yields on each emerging market's government bonds issued in British pounds minus yields on British government bonds.

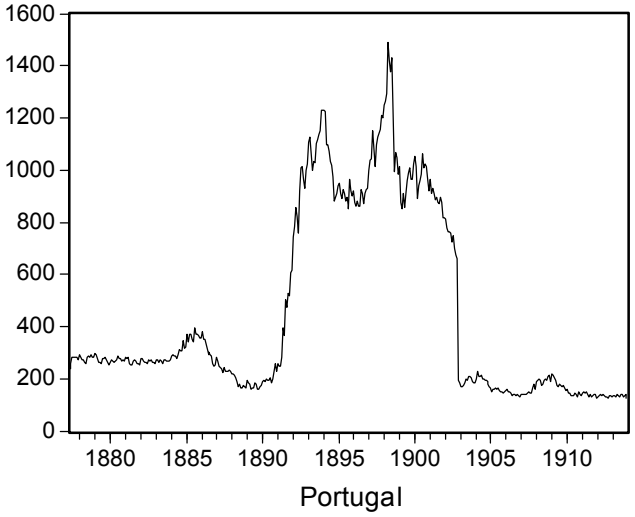
FIGURE I (continued)
Historical Spreads, 1877-1913 (in basis points, high quality sample)



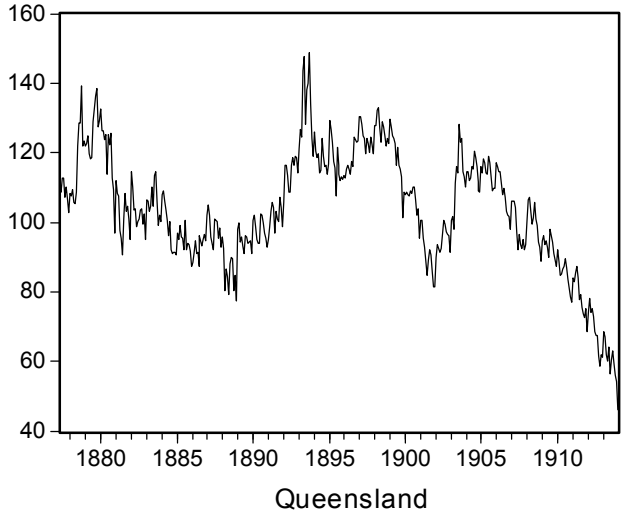
Hungary



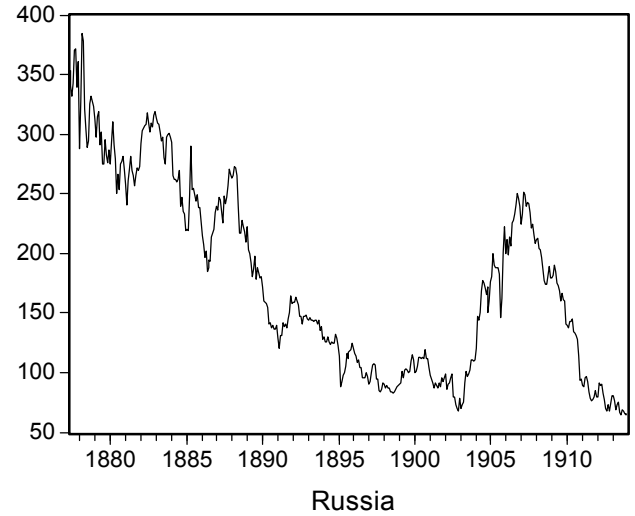
Japan



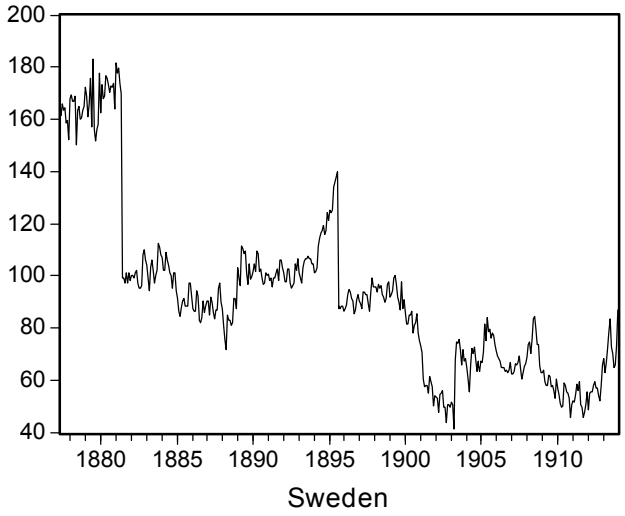
Portugal



Queensland



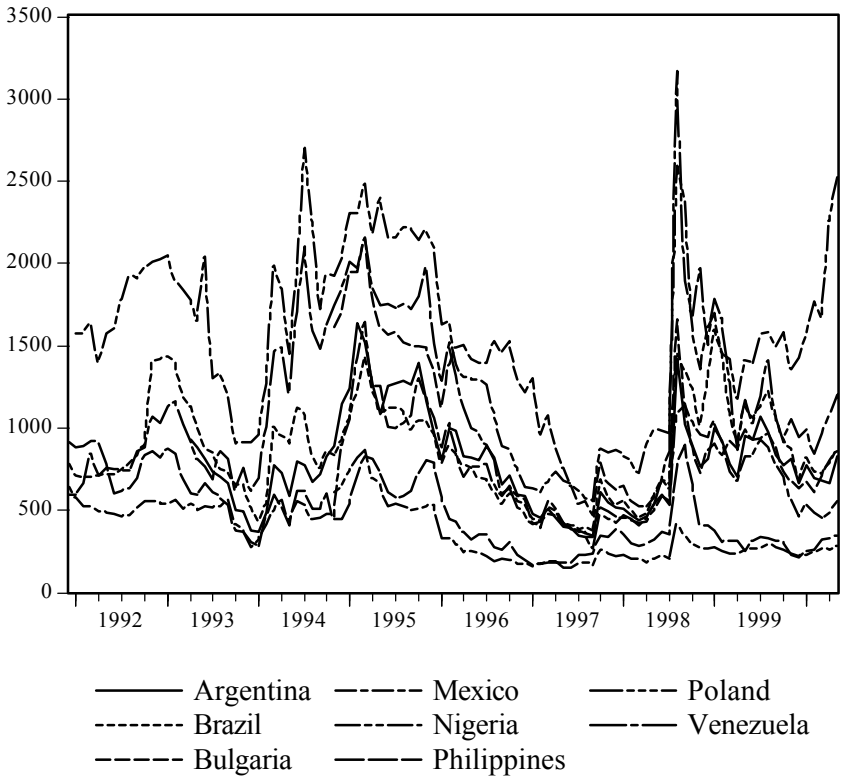
Russia



Sweden

Data Source: The Economist's Investor's Monthly Manual
Spreads are yields on each emerging market's government bonds issued in British pounds minus yields on British government bonds

FIGURE II
Modern Spreads, 1992-2000 (in basis points)



Data Source: J.P. Morgan
EMBI spreads (yields on government bonds issued in US dollars by each emerging market, minus US bond yields)