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TRANSMISSION OF SHOCKS IN FINANCIAL MARKETS

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Globalization and Changing Patterns in the International Transmission
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ABSTRACT

In this paper we compare various characteristics of the cross-country transmission of shocks in the financial markets of both advanced and emerging countries during two periods of globalization -- the pre-World War I classical gold standard era, 1880-1914, and the post-Bretton Woods era, 1975-2000. Based on principal components analysis on monthly spreads on long-term sovereign bond yields and on an EMP measure of currency crises, an index of global stress, and impulse response functions from VARs estimated using weekly data on short-term interest rates, we conclude that financial market shocks were more globalized before 1914 compared to the present. We postulate that this difference in systemic stability between the two eras of globalization reflects factors such as strong cross-country interdependence fostered through links to gold, the growing financial maturity of advanced countries, and the widening of the center to include a more diverse group of countries spanning several regions.

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1. Introduction

This paper contrasts the pattern of transmission of shocks under the pre-World War I classical gold standard, between 1880 and 1914, with that in the post-Bretton Woods era, between 1975 and 2000.

The international transmission of financial distress and financial crises is not new (Kindleberger 1978), but the propensity for shocks to be communicated across countries and the manner in which they have been transmitted has changed. This may reflect among other factors, differences in the exchange rate regime, the extent of financial integration, and the development of financial institutions. Thus a contrast of the pattern in the transmission of shocks then versus now helps us understand the consequences of these changes in the international monetary system.¹

We compare the recent period to the pre-1914 era because it *was* the previous era of international financial globalization. The extent of international financial integration before World War I according to several metrics was comparable to today (Bordo 2002, [Obstfeld and Taylor 2002](#)). Moreover along with globalization, the incidence of financial crises, especially currency crises involving emerging countries was comparable to today (Bordo et al 2001).

Although there were similarities in the economic environments of the two eras of globalization there were also several key differences which could explain the differences in the patterns of transmission of shocks that we find in this study.

First, most countries in the pre-1914 era, adhered to the fixed exchange rates of the classical gold standard. In the absence of gold flows, in today's era of managed floating and soft pegs, transmission would occur via other channels.

Second, prior to World War I, the commercial and financial centers of the world were concentrated in a few countries in Western Europe, while the emergers consisted primarily of countries of new settlement (the U.S., Canada, Australia and Argentina) and

¹ Recently a number of studies have attempted to develop these contrasts. See for instance, Bordo et. al. (2001), Mauro et. al. (2002), [Murshid \(2001\)](#), [Neal and Weidenmier \(2001\)](#) and [Eichengreen \(2001\)](#).

the European periphery. This implied that there were naturally strong ties between these satellite countries and the center. Today a more diverse group of countries spanning several regions constitute the advanced countries. Similarly diverse are the emerging countries. Consequently today's emerging countries are subject to varied influences, from a more diverse set of advanced countries. The center-periphery relationships that existed in the pre-1914 era, can be thought of in terms of a model of an atom; a *single* nucleus with orbiting electrons. It is less clear that such an analogy could be extended to describe the relationships between today's advanced and emerging countries.

Finally, the pre-1914 advanced countries had not completely developed the tools to provide financial stability, such as an effective lender of last resort, moreover adherence to gold convertibility and the attendant imperative to protect gold reserves dominated all other objectives (Eichengreen 1992); as a consequence, shocks in the past had harsher repercussions (Bordo et. al. 2001). The severity of the downturns which accompanied the negative shocks to financial markets, amplified their cross-border impact. Today better policies and improved financial systems limit the severity of shocks and minimize their international impact.

Our analysis is divided into three parts. First using principal components analysis, we examine the international co-movement in monthly long-term government bond yield spreads and exchange market pressure indices. Spreads can be viewed as evidence of stress in financial markets, while exchange market pressure (EMP) indexes are often used as a measure of currency crises (see for instance Eichengreen et. al. 1996, Kaminsky and Reinhart 1999). Our narrow treatment of crises, which emphasizes currency crises as opposed to banking crises, reflects the difficulties that are involved in constructing a metric of banking crises similar to an exchange market pressure index.

Second, we develop a global crisis index as the common or shared component in exchange market pressure across countries. Using simple frequencies and extreme value methods, we are then able to estimate the likelihood of a global crisis during each era.

Finally we estimate a number of VARs using weekly data on short-term interest rates, and use impulse response functions to identify the direction and impact of financial shocks between individual countries.

Our principal findings are the following:

- There is strong evidence of international co-movement in spreads during both eras, however in recent years this correspondence is concentrated more within groups, separated into advanced and emerging categories.
- The international co-movement in EMP indices is weaker than the pattern found for spreads. Across the two periods however, there is stronger global co-movement in the pre-1914 era. In contrast today there is strong co-movement within the group of advanced countries, and within the emerging countries there is strong intra-regional co-movement.
- The likelihood of a global crisis was higher in the pre 1914 era, although the probability of international crises within the advanced countries is about as high today as it was in the past.
- Financial shocks before 1914 were largely transmitted in one direction—from the advanced countries of Europe (especially the U.K.) to the emergers. Today while shocks are transmitted internationally within advanced countries, evidence of transmission from advanced to emerging countries is weaker than in the pre-1914 era.

A number of implications follow from our results. First, during both eras, tight integration fostered strong interdependence in financial variables between nations. Under the classical gold standard, the degree of this dependence increased over time as countries became more integrated and as global trends in price levels sparked a decline in spreads. Moreover the pattern of co-movement observed suggests that shocks were often communicated across regions and across the groups of advanced and emerging countries. In contrast, in recent years, advanced- and emerging-country-spreads have reacted differently to outbreaks of instability. Perhaps as a consequence of de-leveraging and

wake-up-call effects, crashes in asset prices in emerging markets have spilled over far beyond their epicenters, affecting capital market access for emerging countries as a group. However, advanced countries have been largely insulated from these disturbances. These results based on a sample containing both advanced and emerging countries contrast somewhat with those found by Mauro et. al. (2002) in their analysis of emerging market spreads in historical perspective, which suggests that financial stress between emerging countries has increased today compared to the pre-1914 era.

Second, the world is generally a more stable place today; crises are less likely to have global reach relative to the pre-1914 era. This is perhaps not a surprising finding. The pre-1914 gold standard was characterized by a system of fixed exchange rates, a concentration of financial and commercial power in a handful of European countries, and relatively weak financial markets even in the advanced countries. Hence, countries were neither insulated from shocks nor capable of accommodating these shocks.

Second, although today's advanced countries have developed the tools to provide greater financial stability, shocks have still been communicated through the fixed exchange rates of the European Monetary System, and through other channels. Thus speculative attacks on currencies have not been avoided, however we posit that today's advanced countries are better-able to accommodate these shocks, consequently the output-effect of these crises have been smaller (Bordo et. al. 2001). In contrast, in the pre-1914 era, banking and currency crises often gave rise to virulent twin crises. These sharp negative shocks to the center then sent impulses through the gold standard world wreaking havoc at the periphery.

Third the regional pattern of crisis-transmission within the emerging countries seems to suggest the importance of trade channels (Glick and Rose 1999) however it also underscores the vulnerability of emerging countries to financial shocks. This inability of emerging countries to insulate their economies from negative shocks reflects not just the failure of macro-policies, but weaknesses in the banking and financial structure. Yet, while financial distress exhibits a common pattern across emerging countries (Mauro et. al. 2002), emerging-country crises are overwhelmingly regional. An explanation may be

that when international capital markets tighten, as measured by the volume, cost and maturity of funds, their impact is most acute in the region in which the crisis originates ([Eichengreen et. al. 2001](#)), consequently whether or not strong intra-regional linkages between emerging countries can be identified, crises are likely to be regional ([Eichengreen 2001](#)).

The remainder of the paper is organized as follows. In section 2 we discuss the data and our empirical methodology. Section 3 examines the evidence in the cross-country co-movement in bond yield spreads and an index of exchange market pressure. In section 4, we present estimates on the likelihood of a global currency crisis under the classical gold standard and more recently in the post-Bretton Woods era. In section 5, we use vector autoregressions to trace the impact of innovations in interest rates in one country on another. Finally, in section 6, we provide some conclusions.

2. Data and Methodology

2.1. Data

We utilize data on short-term interest rates, long-term government bond yields and bond yield spreads, as well as data on exchange rates and reserves. These data were available at a monthly frequency, and in some instances at a weekly frequency.

For the pre-World War I period, we utilize data, although not necessarily for each series, for 15 countries, including five advanced countries—Belgium, France, Germany, Netherlands and the UK—and ten emerging countries—Argentina, Austria, Brazil, Chile, Denmark, Italy, Japan, Russia, Spain, and the US.²

Our data on short-term interest rates, which are open market rates on three month bills, are available for the European countries and the US. These data, which are available at a

² As in Bordo and Schwartz (1996), we classify the US as an emerging country however this classification is borderline at best. While the US was a net borrower during the first half of the gold standard era, by the turn of the century the US had become a net creditor. Though still lacking a lender of last resort, financial markets in the US were highly developed. Moreover per capita income levels were higher than those in the UK. However, for our purposes it does not matter whether we treat the US as an advanced country, or as an emerging country, in as much as our results are qualitatively unaffected.

weekly frequency, were compiled from various issues of the Economist Magazine by [Neal and Weidenmier \(2001\)](#). In addition, our interest rate data includes a monthly series on open market rates for Argentina. In most instances these data span a 34 year period from 1880 to 1914.

Our data on long-term sovereign bond yields and their spreads over UK consols,³ as well as our data on exchange rates, are available for the majority of the countries in our sample, including the Latin American countries, and in most instances span the period of investigation. However, our data on reserves, collected from the Economist Magazine, are only available for six countries—Austria, Belgium, France, Germany, the UK and the US.

For the post-Bretton Woods period the sample includes 23 countries. This includes five of the G7 countries—France, Germany, Japan, the UK and the US—as well as Greece, Portugal and Spain, and 15 emerging countries—Argentina, Brazil, the Czech Republic, Chile, Hungary, Hong Kong, Indonesia, Korea, Malaysia, Mexico, Poland, Singapore, the Slovak Republic, Thailand, and Venezuela.

With some exceptions, data on exchange rates, short-term interest rates (call money rates where available, discount rates otherwise), and reserves, observed at a monthly frequency, are available from 1975 to 2000.⁴ Our weekly data on short-term interest rates are typically available only for the 1990s.⁵ Moreover our data on emerging market bond yield spreads (over long-term—30-year—US Treasuries), are very limited, along both cross-sectional and time dimensions. Our sample includes six emerging countries—Argentina, Brazil, Mexico, Venezuela, Nigeria and Poland—for which data are available from October 1994 onward. In addition, we have data on long-term government bond

³ These data were obtained from Batley and Ferguson (1999), [Neal and Weidenmier \(2001\)](#), and [Global Financial Data: http://www.globalfindata.com](#). As yields were typically not reported, they were calculated by dividing the price of the bond by its coupon.

⁴ These data were taken from the *International Financial Statistics*, CD ROM version.

⁵ These data, which are available from [Global Financial Data: http://www.globalfindata.com](#) are domestic interbank Eurocurrency rates with a maturity of 1-3 months.

yields for four advanced countries—France, Germany, Japan, and the UK—for which we compute spreads over US Treasuries.⁶

2.2. Methodology

We employ a variety of techniques including principal components analysis, cluster analysis, extreme value methods, and vector autoregressions, to examine the strength of, and patterns in the transmission of shocks, and currency crises. Each approach brings with it a different angle from which we can view the data. When brought together we can hope for a panoramic perspective that reveals some of the many facets of “transmission,” which either directly or indirectly relates to the international transmission of financial crises.

Below we discuss the various techniques that we employ in greater detail.

2.2.1. Examining the Extent of, and Patterns in, Dependence: Principal Components Analysis⁷

Using principal components analysis and monthly data, we examine the cross-country co-movement in bond yield spreads and an index of exchange market pressure (the construction and significance of this index is discussed below).

In essence, principal components analysis linearly transforms a set of correlated variables into a smaller subset of uncorrelated variables, in a manner that aims to capture most of the variation in the data. For any given p variables, we can extract p principal components. However, all p principal components are rarely reported. The p principal components are ordered by the fraction of the total variance that they explain. When a set of variables are highly correlated, we can expect that the bulk of the variation in the data can be attributed to the first principal component alone. Hence the fraction of the variance that can be attributed to the first principal component provides a good measure of the overall degree of co-movement in the data.

⁶ The Data for the advanced countries are available in *International Financial Statistics*, CD ROM version. For the emerging countries these data can be obtained from *Datastream*.

⁷ Throughout we use the term “dependence” loosely, associating measures of linear association with dependence.

While the first principal component is usually interpreted as a measure of overall co-movement, the “higher-order” principal components often provide evidence of dependence within groups. To identify these groups we plot the factor loadings corresponding to the first three principal component vectors. These are simply the correlations between the variables and the principal components.⁸

In [Figure 1](#), we plot the factor loadings from a hypothetical example. Three distinct groups are apparent. Group one sets itself apart by virtue of its strong positive association with the first principal component, while group two is differentiated from group one, through a strong correlation with the second principal component. Finally group-three-membership entails high correlations with the third principal component.

In our hypothetical example the divisions between the three groups are clearly visible. In practice, the separation across groups may not be so obvious. Thus we employ a clustering algorithm to categorize countries into different clusters.⁹ This works by minimizing the “distance” between members of a group, while maximizing the distance across separate groups. That countries are clustered together may suggest a pattern of dependence that is common to that group. At the same time, it is important to realize that countries may be clustered into a group, not because they are strongly correlated with each other, but because the common element within that group is a weak or negative association with the rest of the sample. It is therefore important to examine the strength of correlations within each group with each of the principal components, rather than conjecturing as to a likely pattern of behavior based on cluster membership alone.

⁸ An often used strategy for identifying separate groups, or factors, involves rotating the axes so as to emphasize differences across groups. This is not a strategy that we pursue here since the differences across groups are usually clear in a plot of the un-rotated factor loadings. When they are not, we employ a clustering algorithm to isolate the various groups (see discussion below). Moreover, our goal is more than simply to identify various groups. Additionally we wish to understand the salient characteristics in the pattern of behavior within each group. To this end, the un-rotated factor loadings themselves contain useful information that can be exploited.

⁹ The use of cluster analysis takes some of the arbitrariness out of the task of identifying patterns in co-movement. However, the method is not without its drawbacks. In particular, the number of clusters needs to be defined *a priori*—in this case countries were always divided into three separate clusters. As a consequence the clustering algorithm may force a separation of countries into different groups even when there are no significant differences between them.

2.2.2. Constructing an Index of Exchange Market Pressure

To provide some evidence on crisis-transmission, we construct, for each country, a measure of currency crises, and examine the degree of, and patterns in, the co-movement of this variable. Our measure of currency crises is an index of exchange market pressure, which has been widely used in the literature (see for instance Eichengreen et. al. 1996, Kaminsky and Reinhart 1999).¹⁰ We estimate an exchange market pressure index for each country as a weighted average of movements in the exchange rate, the foreign interest rate differential and reserves.¹¹ The exchange rate and the foreign interest rate differential are measured relative to a center country. For the pre-World War I period, the UK was chosen as this center country, and for the recent period, the US was the natural choice.

The weights are based on the reciprocal of the standard deviation of each series, divided by the sum of the reciprocal of the standard deviations of all three series. Thus the weights are assigned in a manner such that no one series dominates the index and so as to ensure that the weights sum to one. The resulting index was then normalized to have a mean of zero and standard deviation of one.¹²

2.2.3. Estimating the Probability of Crises: Extreme Value Methods

As a complement to our analysis of the degree of global dependence in financial variables, we estimate the probability of a global currency crisis. As in [Murshid \(2001\)](#), we identify global currency crises as extreme values of an index which captures the degree of exchange market pressure that is common to all countries.¹³ Specifically this

¹⁰ The original exchange market pressure model, due to [Girton and Roper \(1977\)](#), was suggested as a measure of money market disequilibrium.

¹¹ The availability of data dictated whether all three variables could be utilized to construct this index. For some countries the index for the prewar period was constructed using data on the interest rate and exchange rate movements only and not on reserve changes, due to a lack of reserves data at a monthly frequency.

¹² In those countries that had experienced hyperinflations, normalizing by the historic mean and standard deviation, limited the usefulness of the EMP-index during periods of more moderate inflation. To avoid this problem Kaminsky and Reinhart (1999) suggest separating periods of high and low inflation, and constructing EMP indexes for each sub-period. This approach was modified to allow for the volatility of inflation rates by standardizing the EMP index using a rolling mean and standard deviation.

¹³ In Mody and Taylor (2002), the common component in exchange market pressure is interpreted as a measure of contagion, where the term “contagion” is used in a broad sense, as a “catch-all” of the cross-country dependence in exchange market pressure.

index is the first principal component of the exchange market pressure data. Some sensitivity analyses using Kalman filtering techniques yielded similar results.

To obtain estimates of the probability of global crises, we used two different methodologies. First, the probability of a global crisis was estimated as simply the frequency of global crises, where exceedances by our index, over a particular threshold, were associated with global crises.

The second approach involved fitting the appropriate distribution to the right tail of the global stress index by using extreme value methods. This involved using a six-month window to de-cluster the observations,¹⁴ and then selecting the maxima within these windows with which we estimate the distribution of extreme values in the global crisis index for both regimes.¹⁵ See [Murshid \(2001\)](#) for details and references cited therein.

2.2.4. Examining Cross-Country Inter-Linkages: VAR Analysis

While principal components analysis sheds light on the patterns in cross-country interdependence, it does not account for all of the complex dynamics and inter-relationships that may exist between countries. To better understand these relationships, we estimate vector autoregressions using data on short-term interest rates.

By estimating impulse response functions from these VARs, we were able to trace the impact of a shock in one country on another, and thus shed light on the direction of shocks and the degree to which they impacted on other countries.

The difficulty with estimating impulse response functions however is that it necessarily requires that we impose an ad hoc assumption regarding the order in which shocks are communicated across countries. This can have a significant bearing on our results. However, the ordering of the variables is more likely to be an issue when the data is of a lower frequency and there are a large number of variables in our system. Thus we limit our system to no more than six countries, and use weekly data, in order to sidestep these difficulties.

¹⁴ By “de-clustering” we mean to remove or lessen the serial dependence across observations over time.

¹⁵ Specifically, we use the method of maximum likelihood to estimate the parameters of a generalized extreme value distribution to the data, (see Embrechts *et. al.* 1996).

3. Patterns in Crisis Transmission: The Co-Movement in Spreads and Exchange Market Pressure

In this section, we apply principal components analysis to examine the extent of cross-country dependence, in spreads on sovereign debt and proxies for currency crises, observed at a monthly frequency. We present our results in two sets of figures.

The first set of figures is simply a plot of the variance attributed to the first three principal components. The second set of figures, plot the factor loadings corresponding to the first three principal component vectors.

3.1. Analysis of Spreads

Our analysis of spreads for the prewar period from 1880-1914, covers a sample of thirteen countries.¹⁶ The corresponding analysis for the recent period focuses on a sample of ten countries over a narrower window from October 1994 to October 2000.¹⁷ Below we summarize the main findings of our analysis and then conjecture as to their implications.

3.1.1. Main Findings

A simple time series plot suggests a strong pattern of global co-movement in spreads in both the pre-1914 era and more recently ([Figures 2A](#) and [2B](#)). In both samples the first principal component captures approximately 60% of the total variation in the data (see Figure 3). This has two implications. First, the degree of co-movement is roughly similar across the two periods. Second, the bulk of the variation that we observe in spreads can be attributed to global factors, although this does not preclude the possibility of important influences on spreads, which are either specific to countries or a subset of countries.

¹⁶ Specifically our sample includes four advanced countries—Belgium, France, Germany, and the Netherlands—and nine emerging countries—Austria, Argentina, Brazil, Chile, Italy, Portugal, Russia, Spain, and the US.

¹⁷ The countries in our sample include four advanced—France, Germany, Japan and the UK—and six emerging countries—Argentina, Brazil, Mexico, Venezuela, Nigeria, and Poland.

The findings for the pre-1914 era however mask significant differences between the first and second half of that period. The period, from 1880 to 1896 was characterized by global deflation. During that episode cross-country associations in spreads were relatively weak. In contrast in the subsequent period from 1897 to 1914, characterized by global inflation, there is a clear convergence in spreads across both advanced and emerging countries. These shifting patterns implied stronger dependence in the latter half of the gold standard era, when compared to the period as a whole ([Figure 3](#)).

As noted above, much of the co-movement in spreads during either era can be attributed to the first principal component however there is still a significant degree of “residual” co-movement, which is captured by principal components two and three. For the pre-1914 sample there are no clear patterns to this co-movement (see [Figure 4A and 4B](#)). In contrast, in the 1990s, sharp distinctions between advanced and emerging countries vis-à-vis the pattern in co-movement in spreads are apparent. This is evident from [Figure 2B](#), which plots the spreads data for the recent period, and from [Figure 4C](#), which plots the factor loadings from principal components analysis.

Within the group of emerging countries, the salient characteristics have been sharp global spikes in spreads in the aftermath of emerging market crises. However, the advanced countries have been largely insulated from these events; instead spreads have followed a downward trend. These contrasting experiences effectively split the sample cleanly into two groups, with the first principal component capturing the highly volatile response of emerging-market spreads during crisis episodes, and the second and third principal components capturing the long-run patterns in advanced-country spreads. An implication of this is that the degree of co-movement within either the group of advanced or the group of emerging countries is understated in a broader sample that includes both. Thus the conclusion in Mauro et. al. (2002), that spreads were more tightly correlated in the 1990s, compared to the pre-1914 era, reflects their focus on emerging countries.

3.1.2. Summary and Implications

Both in the past and more recently yield spreads on sovereign debt have depicted a pattern of tight international co-movement, however while the degree of co-movement

has been roughly similar across the two periods, the pattern of co-movement across the two periods has differed.

In the prewar era, in particular from 1897 to 1914, the dominant characteristic was a worldwide decline in the mean and variance of spreads (see [Figure 2A](#)). This reflected both tighter co-movement across countries made possible through greater financial integration ([Bordo and Rockoff 1996](#), [Neal and Weidenmier 2001](#)), and an easing of sovereign debt burdens consequent upon the global increase in price levels (Flandreau et. al. 1998).

Though observed over a shorter period, a similar pattern of declining spreads is evident in today's advanced countries. These nonstationary or trend components in the data underlie the strong long-run associations in advanced-country-spreads.

In contrast, no trends are evident in emerging-market-spreads; instead the bulk of the variation in the data can be attributed to sharp spikes, corresponding to a tightening of international capital markets, in the aftermath of crises. Hence what underlies the strong correspondence in emerging-market-spreads is the tendency for financial distress to explode across emerging markets as a whole, when risk perceptions shift in the face of financial disturbances. Motivating these discrete shifts in risk perceptions is imperfect information, which itself can reflect both institutional weaknesses in financial systems in emerging countries, as well as the type of capital inflows that emerging countries are attempting to attract.

The explosive pattern of financial distress in emerging countries has been interpreted as providing evidence for the global scope of, possibly contagious, financial crises. But it is important to emphasize that the pattern of transmission of financial stress, as captured by the international co-movement in spreads, should not be thought of as equivalent to the pattern in crisis-transmission, which in turn represents more severe reactions to foreign shocks. While the ability of emerging countries to withstand these shocks may be questionable, it needs to be remembered that the tightening of international capital markets which accompany periods of stress are often short-lived. Indeed recent experience suggests that spreads in emerging countries will usually return to their pre-

crisis levels relatively quickly as will private capital flows, especially in regions which have been unaffected by crises ([Eichengreen et. al. 2001](#)). In order to better understand the pattern of crisis-transmission, below we present evidence on the cross-country dependence in EMP indexes.

3.2. Analysis of Exchange Market Pressure

Both the pre-1914 and post-Bretton Woods samples include ten countries, with a similar mix, consisting of four advanced countries and six emergers.¹⁸

3.2.1. Main Findings

In relation to the extent of global dependence in the spreads data, the associations across countries, measured vis-à-vis the degree of exchange market pressure, are far weaker, however, the degree of co-movement is greater for the pre-1914 era ([Figure 5](#)).

During both periods the pattern of co-movement varies across advanced and emerging countries ([Figure 6A](#)). In the pre-1914 era, a plot of the factor loadings separates the two groups. But we need to be careful as to what distinguishes the group of advanced countries from the group of emerging countries. Importantly both advanced and emerging countries exhibit strong correlations with the first principal component, which in turn implies positive correlations across these groups. The distinguishing characteristic is that the group of emerging countries is negatively correlated with the second principal component, which with the exception of the Netherlands, is not a characteristic shared by advanced countries. This could be picking up the effect of crises within emerging countries that did not filter through to the core countries of Europe, or the channel could have also operated in reverse, with minor localized disturbances affecting the advanced nations of Europe, but not reaching the periphery.

The evidence for the recent period suggests a more pronounced pattern of separation between advanced and emerging countries. The key characteristic of the advanced group is a strong positive correlation with the first principal component, which indicates not

¹⁸ The advanced countries in our pre-1914 sample are Belgium, France, Germany, and the Netherlands and the six emerging countries are Austria, Argentina, Brazil, Chile, Japan, and the US. For the post-Bretton Woods sample the advanced countries are France, Germany, Japan and the UK and the emerging countries are Argentina, Brazil, Mexico, Indonesia, Malaysia, and Thailand.

only that there was strong co-movement within this group, but that overall a larger proportion of the variance in the EMP indices can be attributed to the advanced countries than to any other group. However, advanced-emerging country associations are not completely absent. In particular, the Asian countries exhibit weak, but positive, correlations with the first principal component ([Figure 6B](#)). Hence there is some evidence to indicate that crises affecting the advanced countries may have had repercussions for the Asian countries. In contrast however there is little indication of a pattern of dependence between the advanced countries and the Latin American countries.

In addition, the pattern of dependence within today's emergers, suggests intra-regional co-movement ([Figure 6B](#), see also evidence in Hartmann et. al. 2002) picked up by the second and third principal components.¹⁹

3.2.2. Summary and Implications

During both periods, the extent of cross-country dependence in a proxy for currency crises is significantly lower than what is observed for spreads. Thus while financial stress has spilled over relatively easily, financial crises have not. Of the two eras, the extent of crisis-transmission has been somewhat greater in the pre-1914 era. Despite some differences in their patterns of dependence, the co-movement of advanced and emerging country EMP indices suggests the presence of inter-linkages across these two groups. The underlying theme seems to have been one of “muted” global, rather than regional, co-movement across countries. In contrast, the association between advanced and emerging countries in recent years has been far weaker. Moreover, emerging market crises have rarely been global and have suggested instead a pronounced regional pattern.

4. Incidence of Global Crises

In this section, as a complement to our earlier analysis, we examine the incidence of global currency crises in the two periods. In addition, we group countries into advanced and emerging, and examine the incidence of international crises within these groups.

¹⁹ We observe similar patterns in samples differing in size, in the period of investigation, and in the composition of countries.

We use a global-crisis index (see [section 2.2.3](#), and [Figures 7A](#) and [7B](#)) to estimate the probability of these events over any six month period. Our (global) crisis-index, which is simply the first principal component of the EMP data,²⁰ aims to capture the common or shared-element in exchange market pressure across the countries in our sample.²¹ To examine the incidence of shared or common crises within particular groups of countries, we construct, in a similar fashion, a crisis-index for each group.

Global crises were defined in terms of our global-crisis index. Specifically values in excess of ten—the total variance in our sample—were defined as global crises. For the purposes of comparison across regimes, however, the actual value of the threshold is unimportant and we continue to use ten as our crisis-threshold for the smaller samples.²² The incidence of global crises was then obtained as simply a frequency of “exceedances” above this crisis-threshold. Additionally, we used extreme value methods to fit the appropriate distribution to the right tail of our global-crisis index (see [Murshid 2001](#) for details).

The results are presented in two tables. [Table 1](#) reports the incidence of global crises for both periods, while [Table 2](#), reports the incidence of international crises within each of the sets of advanced, and emerging, countries.

However we measure the incidence of global crises, we find that the probability of a global crisis in recent years has been considerably lower than that during the earlier period. In particular, the probability of a global crisis over any six-month period, during the prewar era, was more than three times as high as the probability of observing similar values of stress in the more recent period.

This result contrasts with that obtained by [Eichengreen \(2001\)](#), who estimated the incidence of international crises in a sample of 21 countries for the pre-1914 era and in a

²⁰ Several software packages report standardized principal components. Within the current context however, standardizing the principal components would not be particularly useful.

²¹ We continue to use the same sets of countries as in the previous section.

²² A comparison across groups comprised of differing numbers of countries is complicated by the fact that the overall variance in the larger sample is greater. Hence, all else equal the variance of the crisis index for the larger sample will also be greater. To allow a better comparison across groups, the global crisis indexes were appropriately re-scaled.

sample of 56 countries for the post-Bretton Woods period and concluded that the incidence of international crises has been greater since 1971 than it was before 1913. However his approach, in contrast to that taken here, does not differentiate between coincident crises in a number of countries in any given year and “connected crises,” i.e. crises that were transmitted through various channels or inter-linked through common shocks. Eichengreen’s approach is based on the conclusion from Bordo et. al. (2001) that the incidence of crises, as distinct from *global crises* as defined here, was higher in the post-Bretton Woods era relative to the last era of financial integration. Consequently the frequency estimate of the incidence of *international* crises in Eichengreen (2001), where international crises are defined as crises in some minimum number of countries in any given year, should suggest a higher incidence in the post-Bretton Woods era.

Our approach, similar to that in Mody and Taylor (2002), is different, in that international crises are defined in terms of a measure of the dependence across the elements of a multivariate vector, which captures the degree of exchange market pressure in each country. To this end our reliance on monthly data as opposed to annual data, as in Eichengreen (2001), is crucial. Hence in our approach, international crises are distinct from coincident but otherwise unconnected crises, whose repercussions are localized.

Our aggregate result, that the incidence of international crises was higher in the pre-1914 era, masks significant differences across the advanced and emerging countries. From [Table 2](#), we find that the likelihood of an international crisis within the advanced countries is just as great today as it was in the past. The key difference across the two periods is in the incidence of crises across the set of emerging countries, which has been significantly lower in the recent period (for similar evidence see Hartmann et. al. 2002).

The high incidence of international crises within the four pre-1914 European advanced countries is what we might expect, given their strong ties through a system of fixed exchange rates, and possibly linkages through commerce. By similar reasoning the high incidence of international crises within today’s advanced countries should not be surprising, since our sample is comprised mainly of European countries, which over much of the post-Bretton Woods period practiced various forms of exchange rate

targeting. Moreover, our results from the previous section did suggest evidence of strong co-movement within the advanced countries.

Separating the pre-1914 era from today is the higher incidence of international crises within the pre-1914 emergers. The implication of this might be that there were strong linkages within these countries, either directly through their ties to gold, or indirectly through their ties to the center countries of Europe. The latter interpretation is supported by the results in [Table 1](#), namely that there was a high incidence of global crises across the entire sample of pre-1914 countries. In contrast a significantly lower incidence of international crises in recent years, whether we examine the sample as a whole, or restrict our attention to the emergers, has two very different implications for the pattern of crisis-transmission today in comparison with the earlier era.

First, the inter-linkages between the emerging countries as a whole are weak. This reflects the mixed composition of our sample which spans two regions. Thus while emerging-country-crises may be regional, affecting either just the Asian countries, or just the Latin American countries, they are rarely inter-regional.²³ Second, unlike the pre-1914 era, the inter-linkages between advanced and emerging countries seem to have been weaker in recent years. This is suggested by both the low incidence of international crises within the set of emerging countries, as well as across the full sample of countries.

Thus our findings in this section have implications for the role of advanced countries in communicating crises in the past, in comparison to the role they play today. To get at this issue, in the next section we attempt to isolate the international implications of shocks to various countries.

5. Inter-Linkages between Advanced and Emerging Countries: Evidence from VAR Analysis

Our earlier analysis suggested that the relationship between the advanced and emerging countries has changed between the first era of globalization before 1914 and today.

²³ See the evidence in the previous section and in Murshid (2001), which examines the incidence of crises within regional groups, as well as Hartmann et. al. (2002).

Perhaps not unrelated to this, we observe a change in the pattern of crisis-transmission: crises today are less likely to be global and instead more likely to be regional. The divisions that exist today between advanced and emerging countries, and across regions, are underscored in a broad set of correlations in financial variables; the divisions that existed in the past are at best blurred. The implication being, that the inter-relationships between the advanced and emerging countries, and between countries across different regions, were likely stronger in the past than they are today.

These distinct patterns of behavior give rise to a number of questions. How have the inter-linkages that existed under the classical gold standard, between the industrialized core and the non-industrialized periphery changed? What are the inter-relationships across countries from the same region? In particular, do they explain the recent patterns in crisis-transmission?

To this end, we estimate a number of vector autoregressions using weekly data on interest rates. VARs provide a framework through which we can analyze the complex dynamics that exist between any two variables in a system, by isolating the impact of a shock in one variable on another. By examining impulse response functions, we can obtain a sense of these dynamics, and shed light on the extent of transmission effects across pairs of countries.

For the prewar period we examine a sample of six European countries, consisting of three advanced—France Germany and the UK—and three emerging countries—Austria, Denmark and Italy—observed over a 34-year period from 1880 to 1914.²⁴ As the US was the only non-European country for which we were able to obtain high frequency data, it would be difficult to draw any conclusions as to the importance of inter-regional linkages, hence our focus on the European countries.

In contrast the time series for the recent period, while relatively short, covered countries from several regions. For the recent period, we estimate three separate systems:

²⁴ Weekly discount rates were also available for Portugal, Russia and Spain. Rotating these countries into our sample did not qualitatively affect our results, however as the discount rate changed only infrequently in these countries, we excluded these nations from our analysis.

First we estimate a VAR comprised of six European countries with an even split between advanced—France, Germany and the UK—and emerging—the Czech Republic, Hungary, and the Slovak Republic—thus approximating the makeup of our pre-1914 sample of countries.²⁵ Our analysis is carried out over a 6-year period from 1995 to 2001.

A characteristic distinguishing the countries from the prewar era, were their ties to gold and hence their adherence to fixed exchange rates. To better understand the role of fixed exchange rates in communicating shocks we examine the relationships between member nations of the European Union over a seven-year period beginning in 1994. While the sample could no longer be split into advanced and emerging, the countries were chosen so as to emphasize differences in per capita income. Thus at one end of the spectrum we have France, Germany and the UK, and at the other end we have Greece, Portugal, and Spain.²⁶

Finally, we examine the scope of inter-linkages within the class of Asian emerging countries as well as the impact of the US and Japan on these countries. Specifically, we estimate a VAR for the US, Japan, Hong Kong, Korea, Singapore and Thailand. Our data covers a period from 1994 to 2002.

The output from our VAR analysis is presented in four separate figures in the appendix. [Figure A1](#) presents the impulse response graphs for the pre-1914 period, while [Figures A2-A4](#) present the analysis for the recent period. The impulse response functions trace out the time profiles of the effects of a one standard deviation innovation to interest rates in each country in our sample.

5.1. Main Results

Below we summarize the main conclusions that emerge from each set of regressions:

²⁵ The selection of countries was also based on the length of the time series for each country.

²⁶ With the exception of the UK the countries in our sample explicitly targeted the exchange rate. However, our data starts in 1994, by which point the exchange rate bands had been widened to +/- 15%. The exchange rate arrangements subsequently went through a change in January 1999, which effectively amounted to a hardening of the exchange rate pegs. This undoubtedly had implications for the manner in which shocks were communicated to these countries however this is not an avenue that we explore.

Pre-1914 Period. In the pre-1914 period, shocks to the advanced countries, in particular shocks to the UK and Germany, had a strong and statistically significant impact on the other European countries, both advanced and emerging. In contrast shocks in emerging countries did not spillover, although Austria is an exception to this pattern.

Recent Period, European Countries. With shocks communicated from Germany to France, and from the UK to France and Germany, there is evidence of inter-linkages within the set of advanced countries. In addition, we find evidence of linkages between the three transitional nations. In particular Hungary plays an important role in communicating shocks to its neighbors. Thus while relationships within either the group of advanced or transitional countries are evident, there is no indication of any inter-linkages between these two groups.

Recent Period, European Union. Within the European Union, Germany appears to be the dominant country, with shocks to Germany being communicated to the other member nations—Greece being the only exception. In contrast shocks to France in particular, but also the UK, have a limited effect. While there appears to be some evidence of inter-linkages between these big-three nations of Europe, it is clear that the driving force is Germany. Within the smaller three—Spain, Portugal and Greece—there is some evidence of spillovers. However, the big three countries remain insulated from these shocks. Thus the association between the advanced and emerging countries is largely unidirectional.

Recent Period, Asian Countries. The evidence of inter-linkages in our sample consisting of Asian emergers, Japan and the US, is far weaker than what we observe for the European nations. Over the period of investigation, the currencies of the Asian emerging countries were, to varying degrees, linked to the dollar. Consequently we would expect, and do observe some evidence of transmission from the US to these countries. In particular, we find that shocks to US interest rates are communicated to both Japan and Hong Kong and to a much lesser extent to Korea also. Although Japan was the dominant economic power in that region, shocks to Japanese interest rates were not communicated to the neighboring Asian countries, or for that matter the US. Within

the sample of emerging countries, we observe little evidence of cross-border transmission, except in the case of Korea.

A number of conclusions emerge from our analysis, which we summarize below:

5.2. Implications

Inter-Linkages between Advanced Countries. Both in the past and more recently, inter-linkages within the advanced countries have been evident. Consistent with the evidence in Lindert (1969), we find that the UK was the dominant country through which shocks were communicated under the pre-1914 gold standard, although the relationship was mutually reinforcing, as e.g. shocks to Germany also impacted on the UK.²⁷ Today we observe a similar pattern of inter-linkages within the advanced countries of Europe and also evidence of transmission from the US to Japan.

Inter-Linkages between Emerging Countries. The evidence of spillovers within the class of emerging countries is weaker than what we observe for the advanced countries, although not completely absent. In particular, in the pre-1914 era, shocks originating in Austria appear to have spilled over affecting advanced and emerging countries alike. More recently cross-border transmission within the transitional countries of Europe is also evident.

Inter-Linkages between Advanced and Emerging Countries. The evidence of inter-linkages between advanced and emerging countries is mixed and needs to be qualified. In the first instance, the relationships between advanced and emerging countries are often unidirectional. Thus in the pre-1914 era, a shock to the UK had a ripple effect on all the other countries in our sample, however, the UK was insulated from shocks in emerging countries. While in recent years, shocks to Germany have had a similar effect on the European Union but shocks to the smaller European nations have not had a significant influence on Germany. There have obviously been exceptions to this pattern, with pre-1914 Austria being a notable example.

²⁷ Also see Tullio and Walters (1996).

Second, evidence of inter-relationships between the advanced and emerging countries is weaker outside of the European Union. While there is some evidence of cross-border transmission from the US to the Asian countries which maintained pegs with the dollar, this evidence is weak. Moreover, there is no evidence of transmission from Japan to the Asian countries.

Inter-Linkages within Regions. Our analysis of the pre-1914 European nations suggests that regional transmission may have been an important factor through which financial shocks were communicated. However, it is difficult to separate the importance of regional ties, over the other influences, such as the exchange rate regime, without a benchmark as to the pattern of behavior. We will however note that in a system which includes the US, there was evidence of transmission from the UK to the US and from the US to the UK.²⁸

In the recent period, we do find evidence of regional transmission within Europe and Asia. Again it is difficult to isolate the importance of regional ties. However, within the Asian emergers, the evidence of regional patterns is far weaker.

6. Conclusions

In this paper we have attempted to examine the pattern of dependence in financial variables using a number of different approaches, from which we are able to arrive at a number of conclusions.

- First, tight patterns in co-movement in bond yield spreads across all countries are evident during both the pre-1914 era and the 1990s. However, in the recent era, the co-movement is less global and more concentrated within each of the advanced and emerging countries treated as separate groups.
- Second, the incidence of global crises in the pre-1914 era was higher than what is observed today. This reflects a lower incidence of international crises within the

²⁸ We do not report these results. However, they are available upon request.

emerging countries, where crises have tended to be regional. In contrast, within the advanced countries, the incidence of international crises today has been just as high as it was in the past.

- Third, before 1914, financial shocks were largely transmitted in one direction—from the advanced countries of Europe (especially the U.K.) to the emergers. Today, shocks are transmitted internationally within advanced countries however evidence of transmission from advanced to emerging countries is weaker.

The evidence of strong co-movement in spreads is not unexpected. An implication of increased financial and trade integration has been stronger interdependence between nations. Under the classical gold standard, the degree of this dependence increased over time as countries became more integrated and as global trends in prices sparked a decline in spreads. Moreover the inability in the pre-1914 era to distinguish distinct patterns in co-movement within subsets of countries, suggested the possibility of inter-linkages across regions and between advanced and emerging countries. In recent years, though we observe similar levels of co-movement in spreads, the correspondence is largely within groups, separated into advanced and emerging categories. This reflects the divergent experiences across these two groups in the aftermath of the recent crises.

The higher incidence of crises in the pre-1914 era is perhaps also not surprising. There were a number of important factors which helped to define the nature of crises in the past. First shocks and crises were communicated through gold flows. Second, adherence to gold convertibility implied subordinating all other policy objectives. The peg to gold therefore acted like “golden fetters” amplifying the effects of a negative shock (Eichengreen 1992). Moreover, even the advanced countries from that era, had not completely developed the tools to provide financial stability. Third, prior to World War I, financial power was concentrated in a handful of Western European countries, which were the major creditors of that era. In addition to exporting capital, these countries also provided export markets to the emergers. A crisis at the center therefore exposed the periphery to reinforcing shocks on the current and capital accounts (Eichengreen 1996). Consequently, as our VAR evidence suggests, in the past there were strong inter-linkages

between advanced and emerging countries. In contrast today, a large diverse group of countries now constitutes the center. Consequently emerging markets are subject to various influences and are less prone to disturbances in any one part of the center.

The high incidence of crises within today's advanced countries reflects in part the composition of countries in our sample, which includes primarily member countries of the European Union. This is consistent with our VAR evidence, which has suggested the presence of strong inter-linkages between advanced countries; in particular shocks to Germany are communicated strongly throughout Europe. The pattern is weaker for advanced countries in general, but is not inconsistent with the possibility of a tight correspondence in macroeconomic fundamentals associated with an international business cycle. Clearly advanced countries, in particular countries of the European Union, have not been immune to speculative attacks, however, importantly today's advanced-country-crises have had a more limited effect on output relative to earlier crises (Bordo et. al. 2001). Consequently their propensity to spill over into global crises has diminished.

Within today's emerging countries, crises have suggested an overwhelmingly regional pattern (see also evidence in Glick and Rose 1999, Hartmann et. al. 2002). Perhaps this is indicative of trade linkages (Glick and Rose 1999). However, as was implied from our VAR analysis, the evidence of a tight intra-regional correspondence in fundamentals between emerging countries is somewhat weaker than for advanced countries.

What then explains the pattern of emerging-market crises? Weaknesses in financial systems and a lack of transparency in emerging financial markets, has possibly heightened their vulnerability to shocks and increased the possibility of contagion. The regional pattern in emerging-market crises then simply corresponds to an unbalanced pattern in financial distress. Recent experience suggests that the reversal of capital flows that accompany crises is often most acute in the region where the crisis originates ([Eichengreen et. al. 2001](#)). For other countries, the crisis typically represents only a discrete interruption in capital-market access. Hence a cross-regional pattern in crisis-transmission is typically not observed ([Eichengreen 2001](#)).

Following a brief lull behind barriers to international capital movements under the Bretton Woods system, international financial crises have again begun to reassert themselves (Bordo et. al. 2001). Thus the restrictions on capital account transactions (as well as those on current account transactions prior to 1958), are key to understanding why crises were contained under Bretton Woods (Bordo et. al. 2001, [Eichengreen 2001](#), Kaminsky and Reinhart 1999). But even when comparing two eras of globalization, sharp contrasts in both the scope and manner in which shocks and crises were communicated are evident. Our analysis cannot provide definitive answers as to what underlies the greater stability across financial markets in the last few decades relative to the previous era of globalization. However, severing the links to gold, the adoption of a managed floating regime, the growing financial maturity of advanced countries, and the widening of the center, could be key to understanding the reduced incidence of global crises.

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Table 1 Incidence of Global Crises over a Six-Month Period, 1880-1914 and 1975-2000

Prewar		Post Bretton Woods	
(1) Frequency	(2) EVM ^a	(3) Frequency	(4) EVM ^a
0.12	0.09	0.02	0.02

^a Probability estimates were obtained by fitting a generalized extreme value distribution to the semi-annual maxima of the global crisis index.

Table 2 Incidence of International Crises over a Six-Month Period, Within the Set of Advanced Countries and within the set of Emerging Countries, 1880-1913 and 1975-2000

Prewar				Post Bretton Woods			
Advanced		Emerging		Advanced		Emerging	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Freq.	EVM ^a	Freq.	EVM ^a	Freq.	EVM ^a	Freq.	EVM ^a
0.21	0.18	0.10	0.14	0.23	0.24	0.02	0.03

^a Probability estimates were obtained by fitting a generalized extreme value distribution to the semi-annual maxima of the global crisis index.

Figure 1. Interpreting a Plot of Factor Loadings

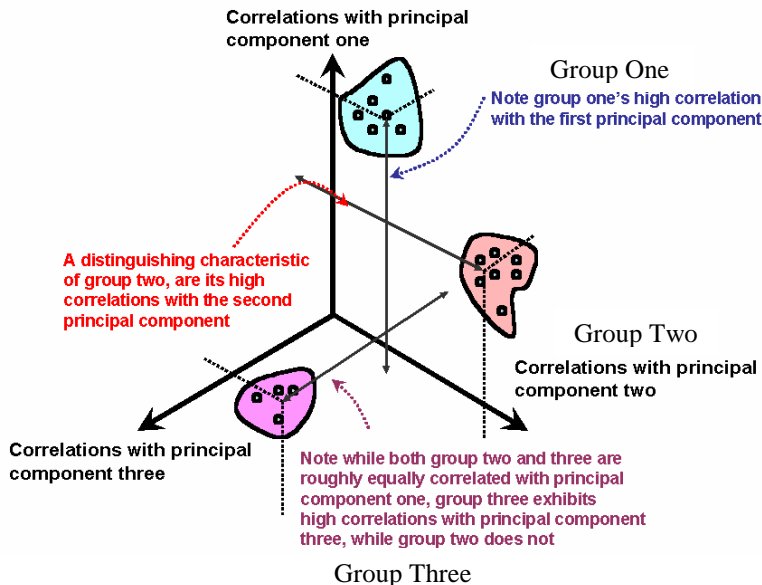
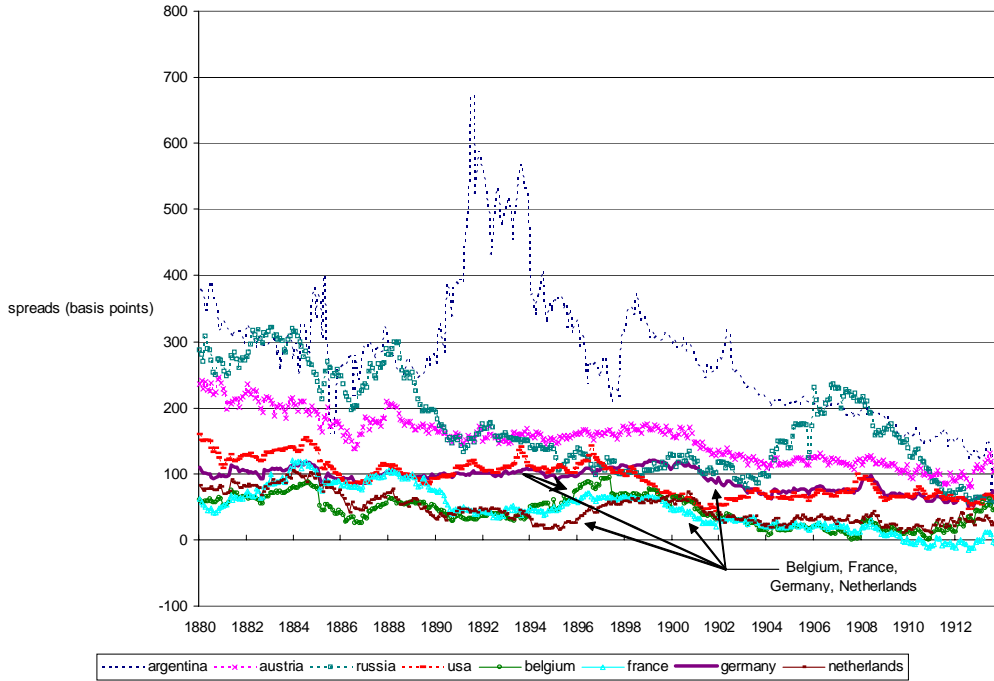


Figure 2A. Spreads Over UK Consols: 1880-1914^a



^a Spreads for selected countries.

Figure 2B. Spreads Over 30-Year US T-Bonds: 1994-2000

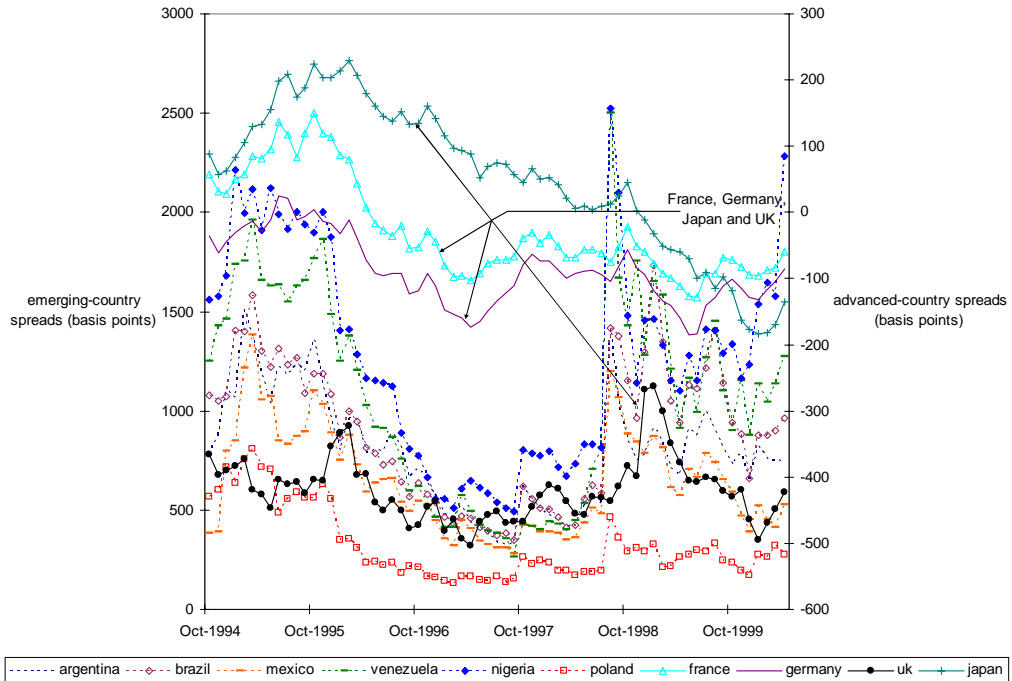


Figure 3. Overall Co-Movement in Spreads: 1880-1914 and 1994-2000

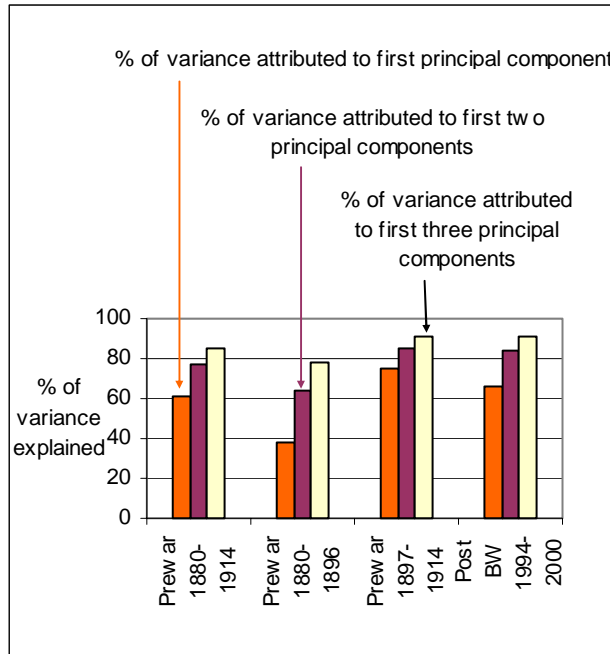


Figure 4A. Factor Loadings, Spreads Data, 1880-1914

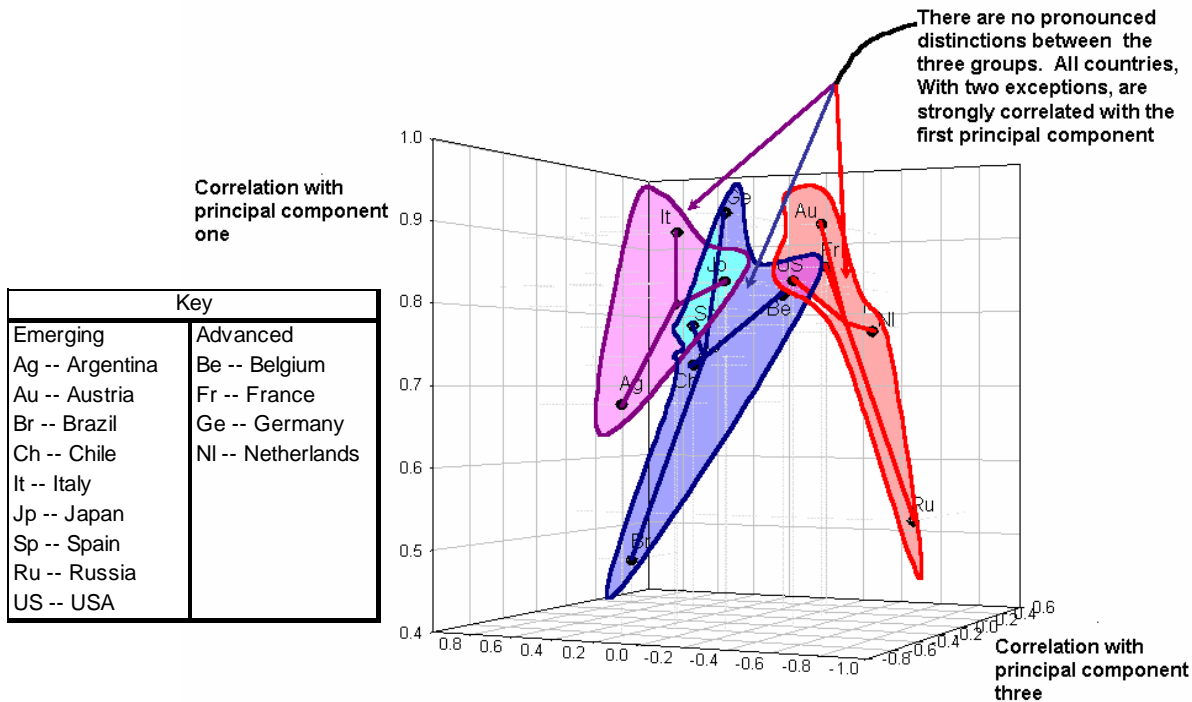


Figure 4B. Factor Loadings, Spreads Data, 1897-1914

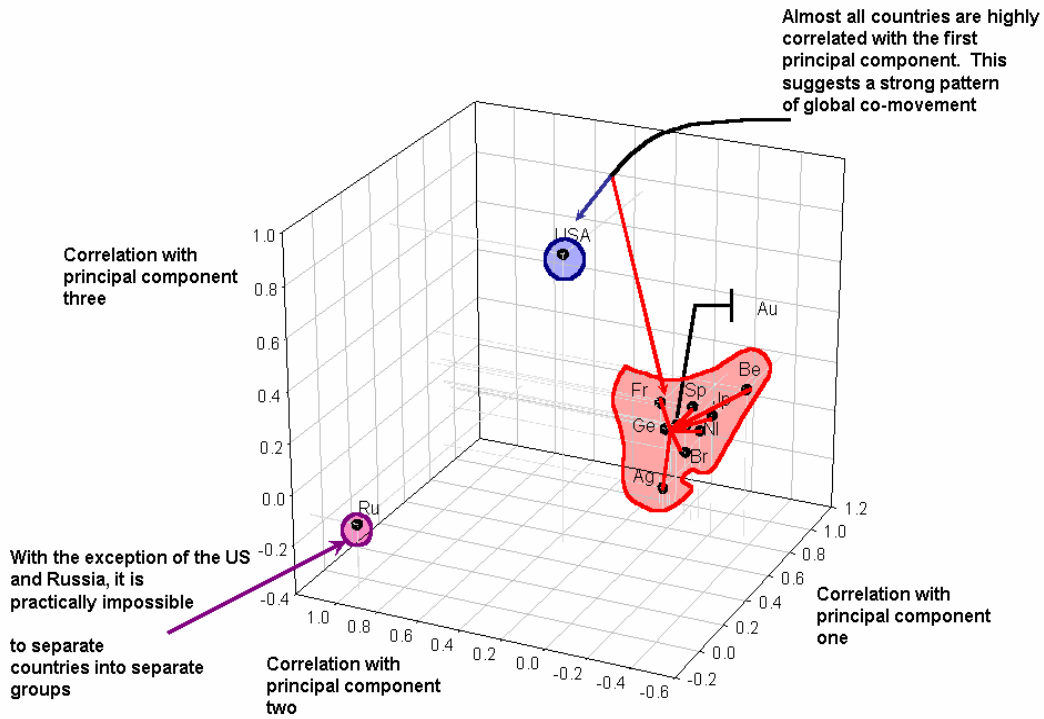


Figure 4C. Factor Loadings, Spreads Data, 1994-2000

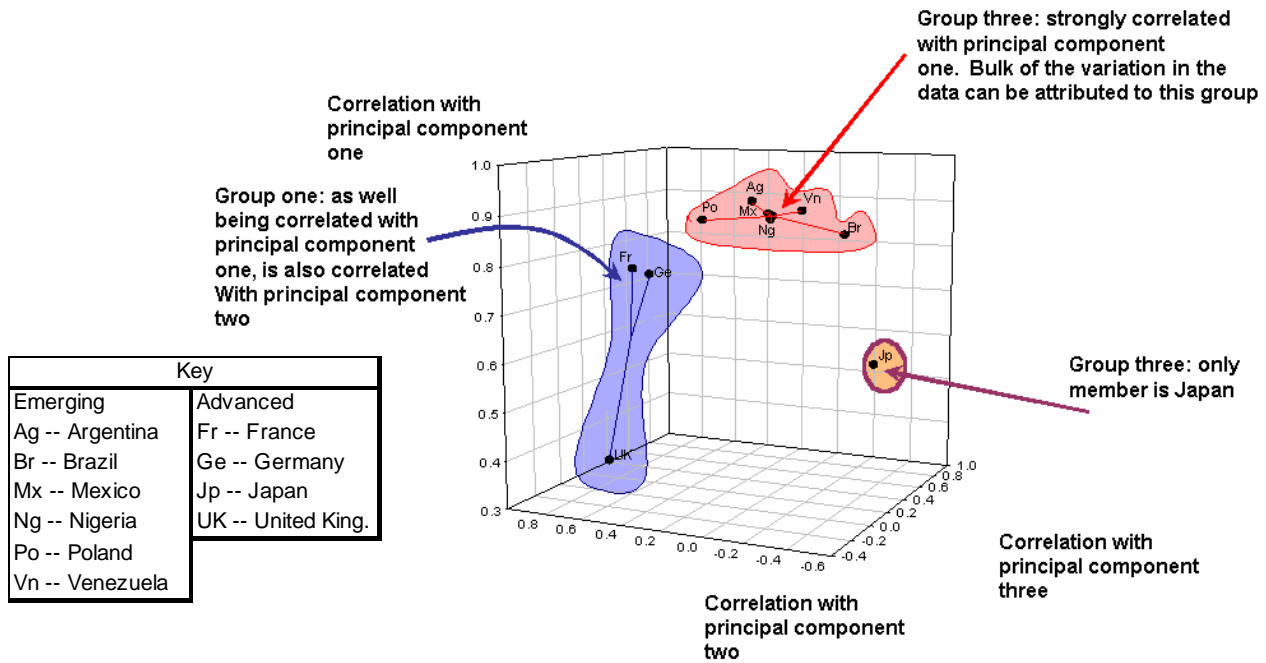


Figure 5. Overall Co-Movement in EMP: 1880-1914 and 1975-2000

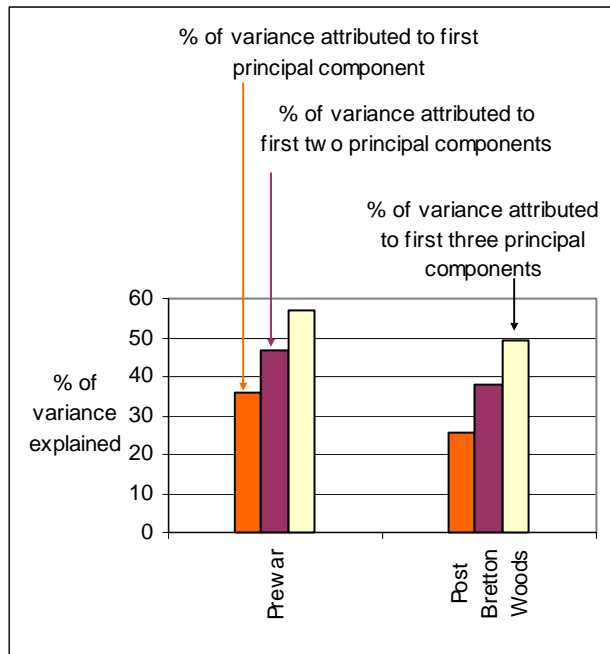


Figure 6A. Factor Loadings, EMP, 1880-1914

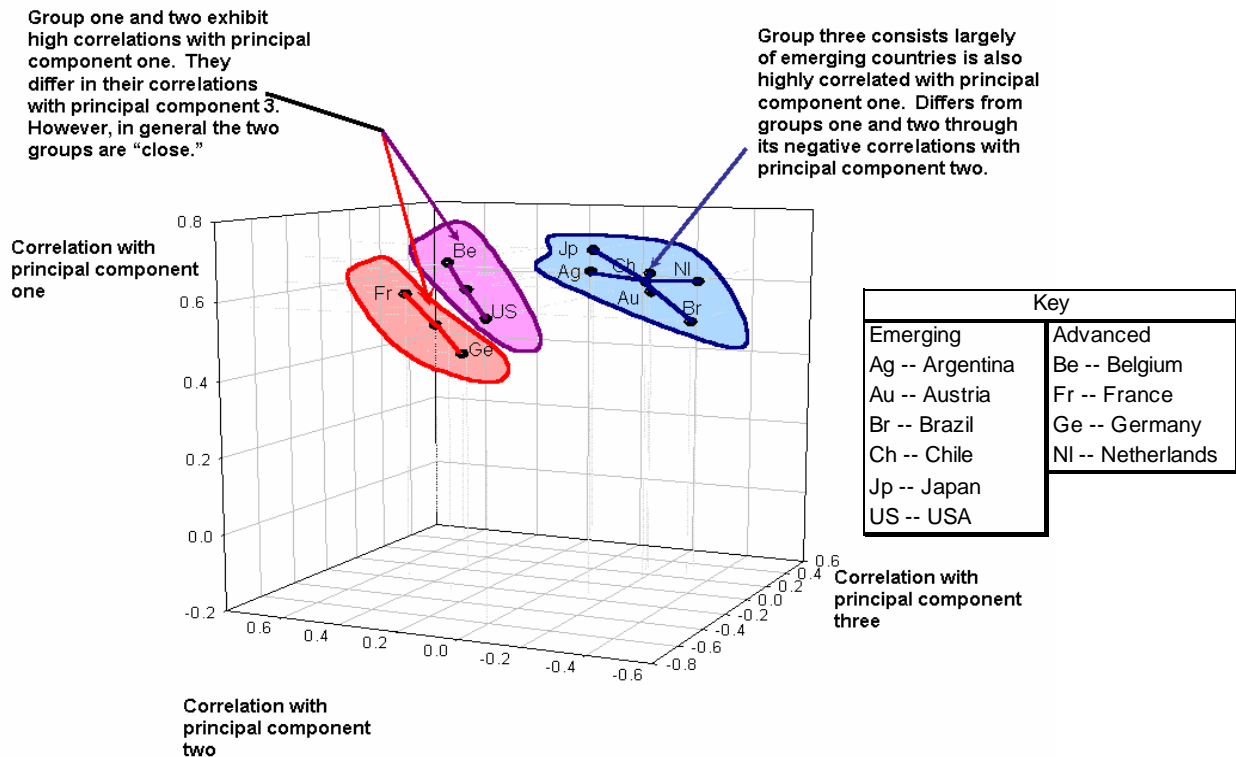


Figure 6B. Factor Loadings, EMP, 1975-2000

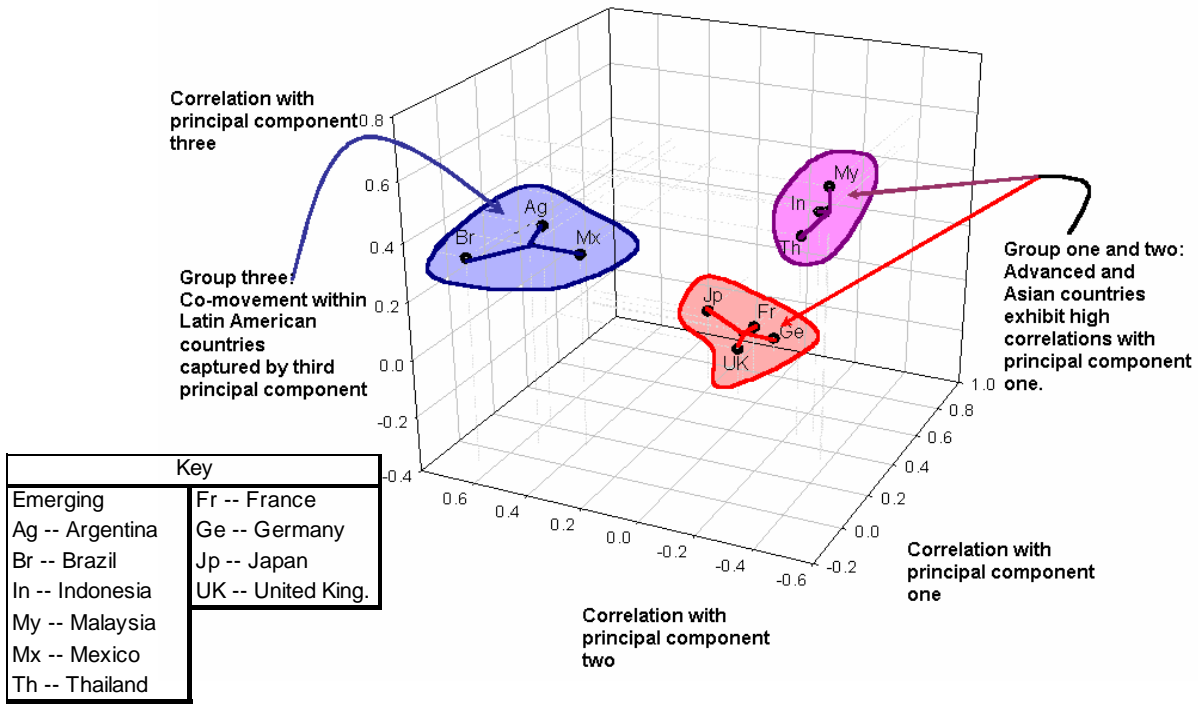


Figure 7A. Global Crisis Index, 1880-1914

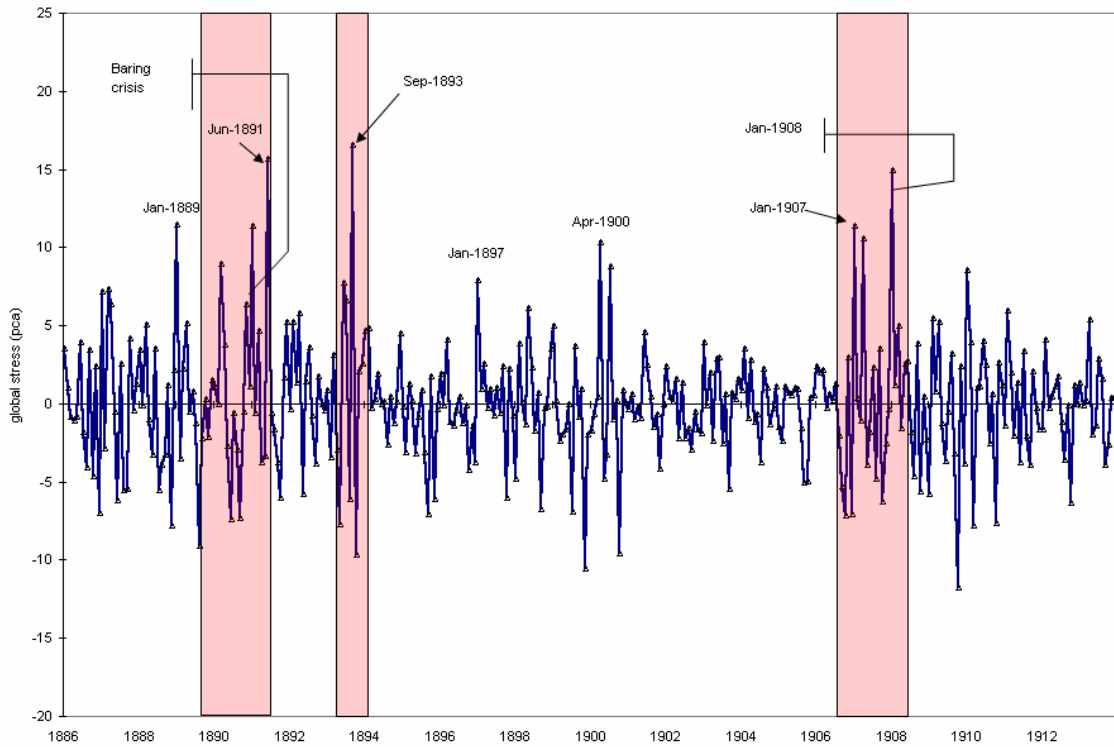
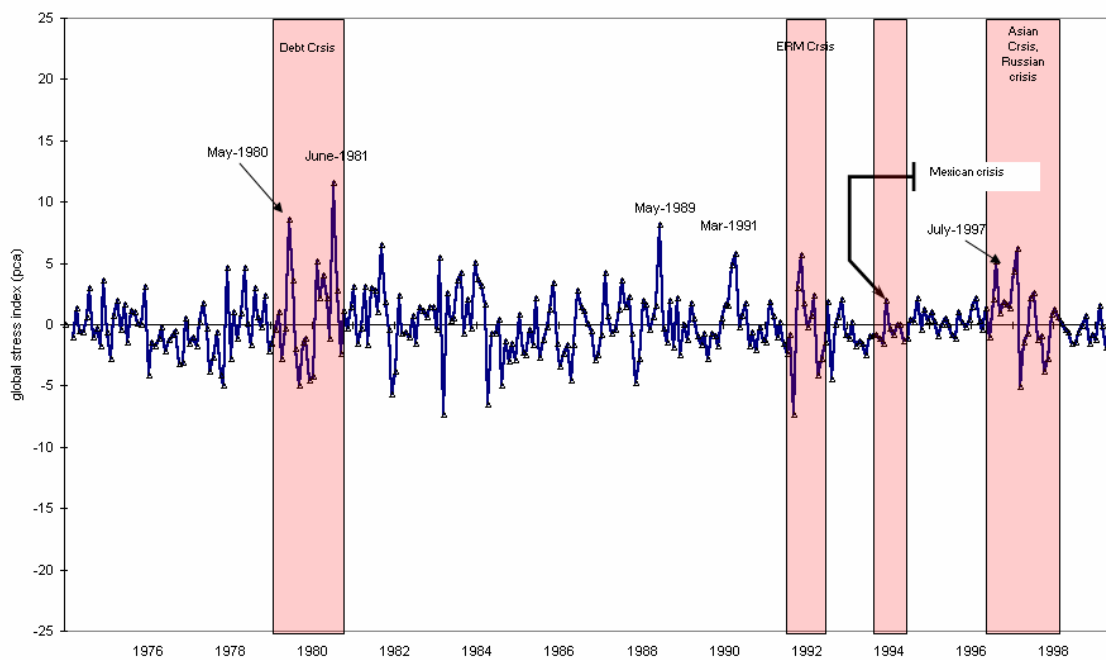


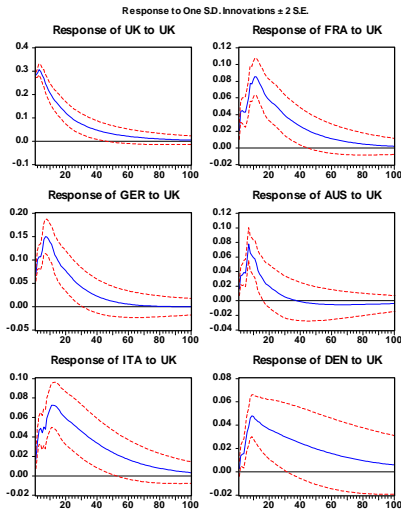
Figure 7B. Global Crisis Index, 1975-2000



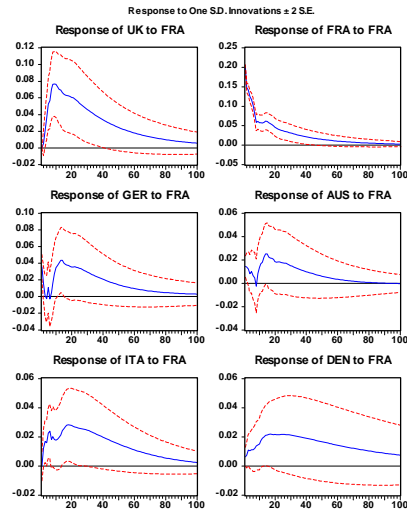
Appendix

A.1. Impulse Response Function, Advanced and Emerging European Countries: 3/21/1885 1/02/1914¹

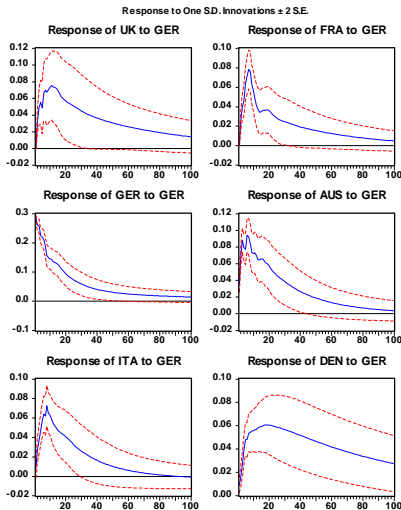
1. Impact of a one standard deviation shock to the UK



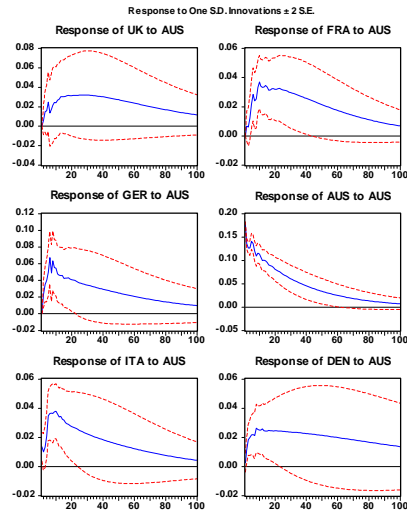
2. Impact of a one standard deviation shock to France



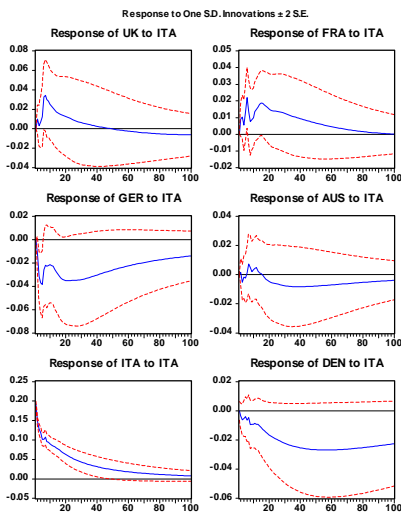
3. Impact of a one standard deviation shock to the Germany



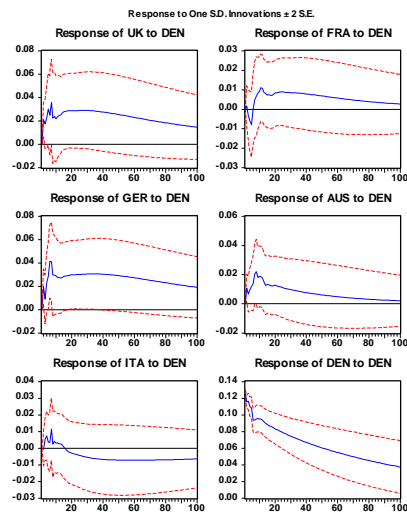
4. Impact of a one standard deviation shock to Austria



5. Impact of a one standard deviation shock to the Italy



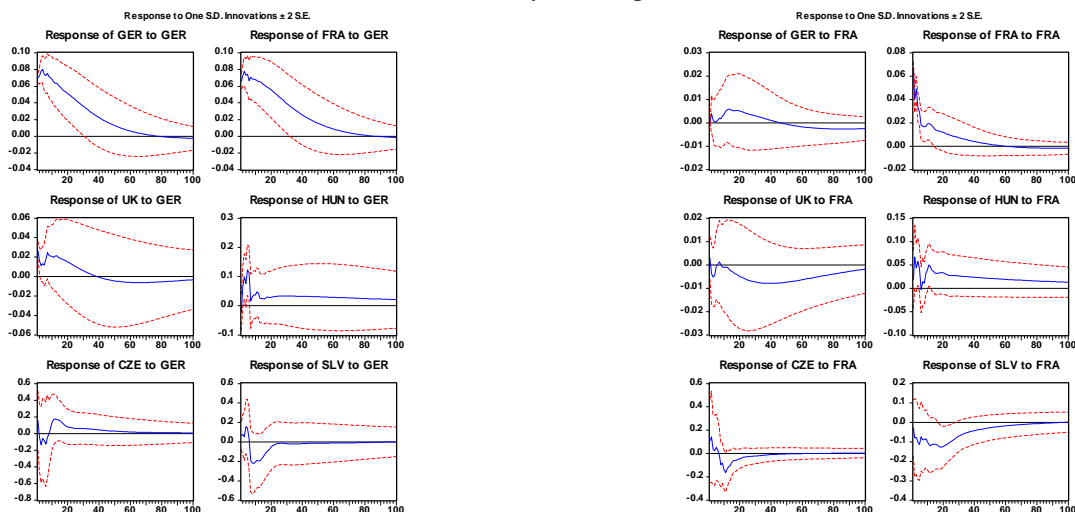
6. Impact of a one standard deviation shock to Denmark



¹VAR estimated using eight t lags. The number of lags was obtained by initially estimating a system with twelve lags and then sequentially paring down the model through a set of nested hypothesis tests. The variables were ordered as follows: UK, France, Germany, Austria, Italy, and Denmark.

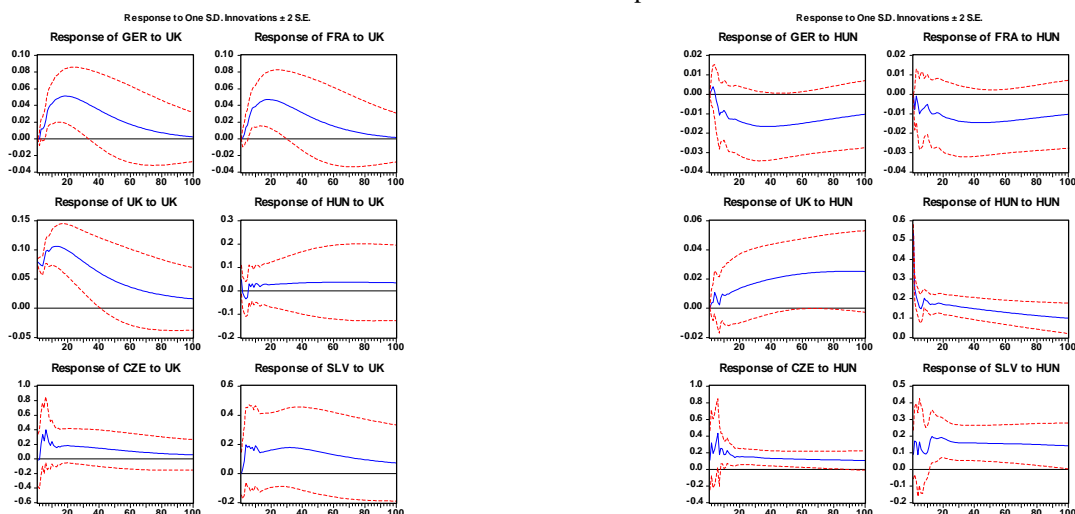
A.2. Impulse Response Function, Advanced and Emerging European Countries: 10/26/1995 9/27/2001¹

1. Impact of a one standard deviation shock to the Germany 2. Impact of a one standard deviation shock to France

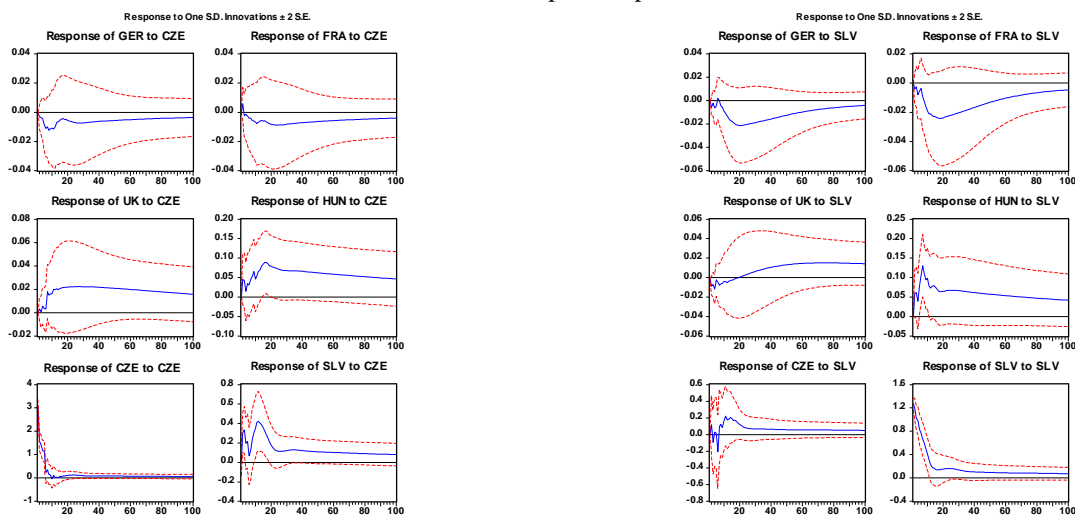


3. Impact of a one standard deviation shock to the UK

4. Impact of a one standard deviation shock to Hungary



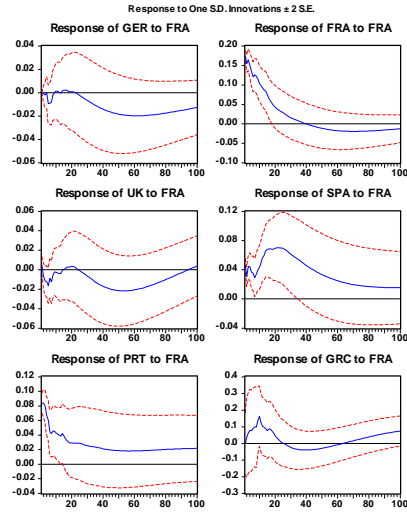
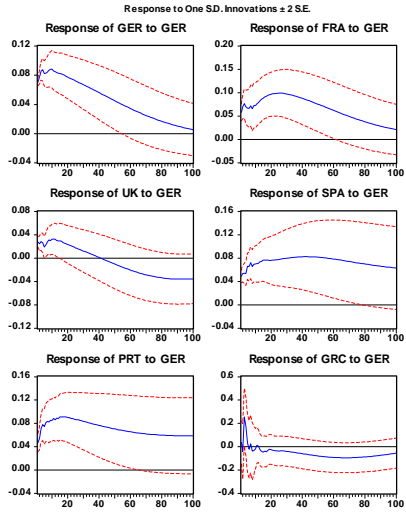
5. Impact of a one standard deviation shock to the Czech Rep. 6. Impact of a one standard deviation shock to Slovak Rep.



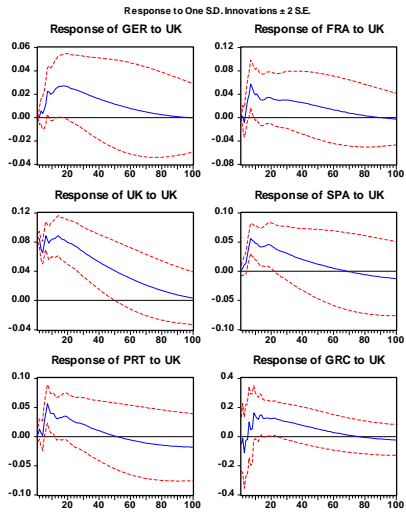
¹VAR estimated using seven lags. The number of lags was obtained by initially estimating a system with twelve lags and then sequentially paring down the model through a set of nested hypothesis tests. The variables were ordered as follows: Germany, France, UK, Hungary, Czech Republic, and Slovak Republic.

A.3. Impulse Response Function, European Union Member Nations: 10/27/1994-12/27/2001¹

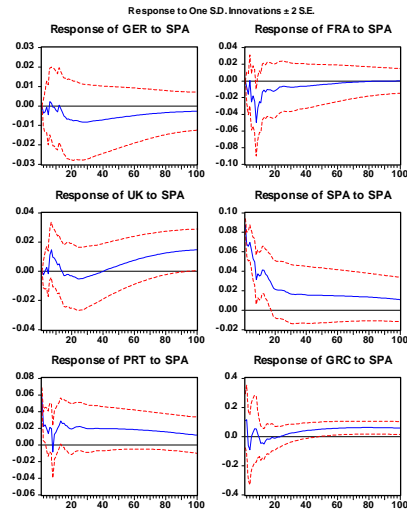
1. Impact of a one standard deviation shock to the Germany 2. Impact of a one standard deviation shock to France



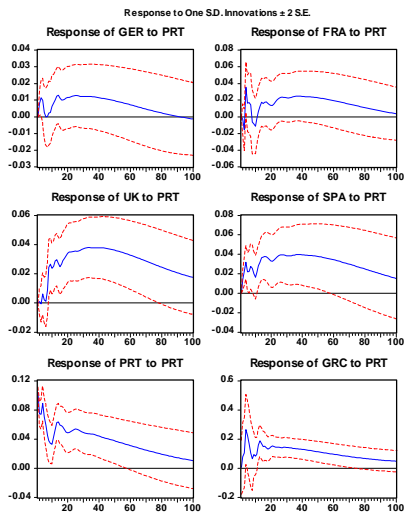
3. Impact of a one standard deviation shock to the UK



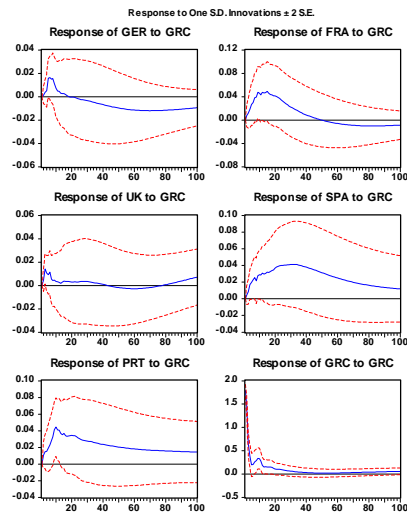
4. Impact of a one standard deviation shock to Spain



5. Impact of a one standard deviation shock to the Portugal.



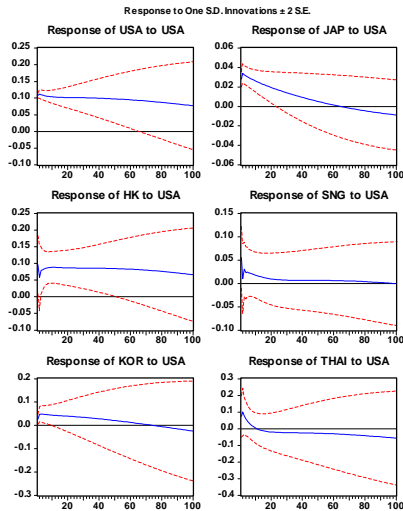
6. Impact of a one standard deviation shock to Greece.



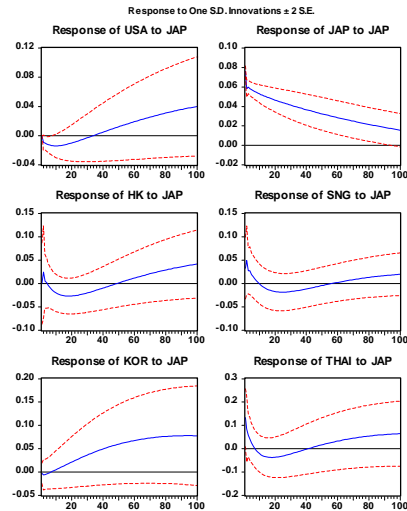
¹VAR estimated using eight lags. The number of lags was obtained by initially estimating a system with twelve lags and then sequentially paring down the model through a set of nested hypothesis tests. The variables were ordered as follows: Germany, France, UK, Spain, Portugal and Greece.

A.4. Impulse Response Function, Asian Emergers, Japan and the US: 3/10/1994-2/21/2002¹

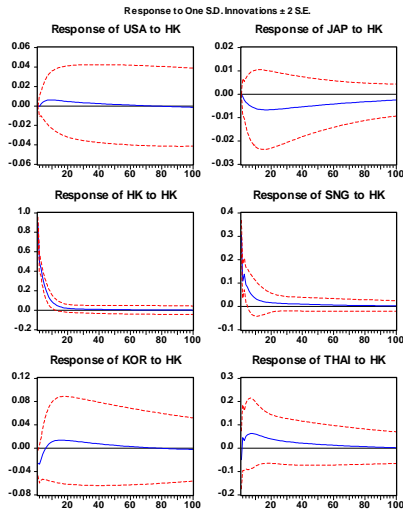
1. Impact of a one standard deviation shock to the USA



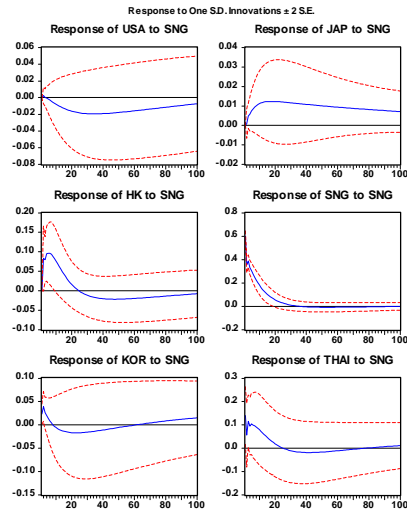
2. Impact of a one standard deviation shock to Japan



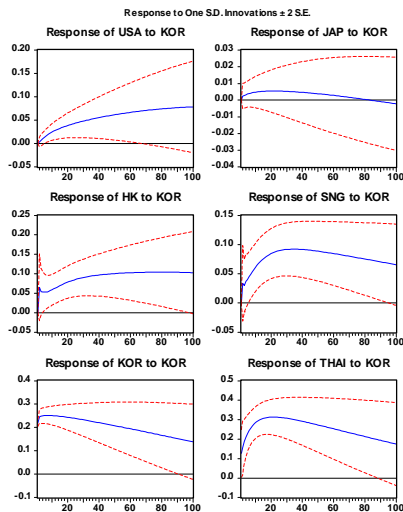
3. Impact of a one standard deviation shock to the HK



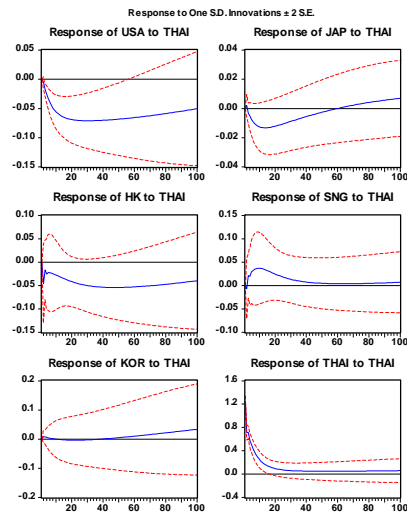
4. Impact of a one standard deviation shock to Singapore



5. Impact of a one standard deviation shock to the Korea



6. Impact of a one standard deviation shock to Thailand



¹VAR estimated using two lags. The number of lags was obtained by initially estimating a system with twelve lags and then sequentially paring down the model through a set of nested hypothesis tests. The variables were ordered as follows: USA, Japan, Hong Kong, Singapore, Korea, and Thailand.