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ABSTRACT

This paper compares the recent global crisis and recession to earlier international financial crises and recessions. Based on existing chronologies of banking, currency and debt crises we identify clusters of crises. We use an identification of extreme events and a weighting scheme based on real GDP relative to the U.S. to identify global financial crises since 1880. For banking crises we identify five global ones since 1880: 1890-91, 1907-08, 1913-14, 1931-32, 2007-2008.

In terms of global incidence the recent crisis is fourth in ranking and comparable to 1907-08. We also calculate output losses during the recessions associated with global financial crises and again the recent crisis is similar in severity to 1907-08 and is fourth in ranking. On both dimensions the recent crisis is a pale shadow of the Great depression. The relatively mild experience of the recent crisis may reflect institutional and policy learning.

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1. Introduction

A financial crisis in the US in 2007 spread to Europe and led to a recession across the world in 2007-2009. Have we seen patterns like this before or is the recent experience novel? This paper compares the recent crisis and recent recession to earlier international financial crises and global recessions.

First we review the dimensions of the recent crisis. We then present some historical narrative on earlier global crises in the nineteenth and twentieth centuries. The description of earlier global crises leads to a sense of déjà vu.

We next demarcate several chronologies of the incidence of various kinds of crises: banking, currency and debt crises and combinations of them across a large number of countries for the period from 1880 to 2010. These chronologies come from earlier work of Bordo with Barry Eichengreen, Daniela Klingebiel and Maria Soledad Martinez-Peria and with Chris Meissner (Bordo et al (2001), Bordo and Meissner (2007)) , from Carmen Reinhart and Kenneth Rogoff's recent book (2009) and studies by the IMF (Laeven and Valencia 2009,2010).[1] Based on these chronologies we look for clusters of crisis events which occur in a number of countries and across continents. These we label global financial crises.

[1] There is considerable overlap in the different chronologies as Reinhart and Rogoff incorporated many of our dates and my coauthors and I used IMF and World Bank chronologies for the period since the early 1970s.

International financial crises inevitably are associated with recessions. We then ascertain the impact of the global financial crises identified by our cluster analysis on real output in the countries affected. To do this we first demarcate business cycle turning points in the countries affected by the global crises and then measure the accumulated output losses in the recessions associated with the identified crises**.** Not surprisingly we find that the economic impact of the Great Depression dwarfed that of the recent crisis but so did several other historic global financial crises. We consider several factors that could explain the patterns of global financial crises. These include globalization, the gold standard and whether the US was in crisis. We conclude with some policy implications of our evidence.

2. Dimensions of the Recent Global Financial Crisis

The collapse in the subprime mortgage market after the collapse of a major housing boom in the U.S. (which had been propelled by expansionary monetary policy and long standing government policies encouraging home ownership) and the plunge in values of mortgage backed securities in the US in 1907, led to a crisis in the US Shadow banking system (non bank financial intermediaries that had issued and held mortgage backed securities) (Gorton 2010). These pressures led to liquidity shortages in the interbank wholesale markets that funded the financial sector. The crisis spread to European banks via the drying up of interbank liquidity which led inter alia to the run on Northern Rock in the UK in September 2007 and the exposure of European banks to mortgage backed

securities held in off balance sheet SIVs which led to threats to the solvency of banks in Germany, France, Belgium, the Netherlands, Italy and Switzerland and Iceland.

Although the Federal Reserve, ECB and Bank of England provided ample liquidity in the fall of 2007 the crisis worsened with the collapse of Lehman Brothers (in which case the US monetary authorities did an about face after having bailed out Bear Stearns in March 2008)and the near collapse of AIG (saved by a huge bailout) in September 2008.

A credit crunch and a pause in expansionary monetary policy in early 2008 reflecting a misplaced fear of commodity price hikes leading to inflation (Hetzel 2009) led to a recession in the US and Europe. The advanced country recession and a collapse in international trade finance greatly reduced exports from China and other emerging Asian countries as well as the rest of the world leading to a global downturn. In addition several eastern European countries were hit by crisis because they were overexposed to foreign currency denominated debt. They were rescued by the IMF.

The global crisis ended with government bailouts of insolvent banks, guarantees of the liabilities of the banking system, the provision of credit facilities to unclog financial markets and expansionary monetary and fiscal policy in many countries. The global recovery began in the summer of 2009 making the recession which began in late 2007 in the US and other countries the longest (and possibly the deepest one) in the postwar era.

3. Historical Patterns in International Financial Crises

We provide a brief narrative of events which could be characterized as global financial crises. We also demarcate several episodes which were primarily regional rather than global crises.

We first define our terms. The essence of a financial crisis is a banking crisis (Schwartz 1986). According to Bordo, Eichengreen et al (2001) "for an episode to qualify as a banking crisis ,we must observe either bank runs, widespread bank failures and the suspension of deposits into currency such that the latter circulates at a premium relative to deposits (a banking panic), or significant banking sector problems(including but not limited to bank failures) resulting in the erosion of most or all of banking system collateral that are resolved by a fiscally underwritten bank restructuring'

This definition allows us to distinguish between pre 1914 banking panics in which lender of last resort intervention was either absent or unsuccessful, and subsequent crises in which a lender of last resort or deposit insurance was in place and the main problem was bank insolvency rather than illiquidity.[2]

[2] Reinhart and Rogoff (2009) have a different more liberal definition " We mark a banking crisis by two types of events: (1) bank runs that lead to the closure, merging or takeover by the public sector of one or more financial institutions and (2) if there are no runs, the closure, merging, takeover or large scale government assistance of an important financial institution (or group of institutions) that mark the start of a string of similar outcomes for other financial institutions" page 10.

Financial crises are aggravated when they lead to or are accompanied by currency crises (a speculative attack on a pegged exchange rate) and debt crises (sovereign debt defaults). International financial crises are banking crises that are often accompanied by currency crises (twin crises) or by debt crises (or by both currency and debt crises together) that occur in multiple countries and across continents. They also involve both advanced and emerging countries.

Such events are often triggered by asset price booms and busts in key countries. Stock market and property booms often burst preceding financial crises (Bordo 2003).

The world has seen a number of global financial crises since the beginning of the nineteenth century and even before (Kindleberger 1978). Before World War I they occurred in an environment of globalization—the integration of goods, labor and capital markets in which free capital mobility often was at the heart of asset booms and busts that led to crises. They also occurred under the classical gold standard which linked countries together by fixed exchange rates. In the interwar period major financial crises occurred after the world returned to the gold exchange standard. After World War II under the Bretton Woods system with pegged exchange rates, capital controls and extensive financial regulation, financial crises were rare although there were frequent currency crises. Since the early 1970s along with the switch to a floating exchange rate regime (for the advanced countries), the removal of capital controls, and the liberalization of domestic financial markets, international financial crises have reappeared.

3.1 The specie standard era

A number of international financial crises involving banking crises in London, the continent of Europe, the United States and Latin America occurred during the nineteenth century when most countries were on specie standards (silver, gold, bimetallism). Also in that century after the end of the Napoleonic Wars, globalization in trade and capital increased dramatically (Bordo, Taylor and Williamson 2003). We briefly demarcate several events in the nineteenth century before our data starts in 1880 and then the crisis events after 1880.

The first international financial crisis was the crisis of 1825 (Neal 1998, Bordo 1998.). The opening up of Latin America after the overthrow of the Spanish empire led to the opening up of international trade between England and the Latin American republics and massive capital flows from London (and the continent) to finance infrastructure, mining and government. The investment was fueled by easy monetary policy by the Bank of England. Many of the ventures financed were fraudulent. This led to a boom on the London stock exchange. Once the capital outflows impinged on the Bank of England's gold reserves, Bank rate was raised and the stock market crashed.

This led to a banking panic which was not quickly stemmed by lender of last resort action. A sudden stop of capital flow from London led to debt defaults, banking panics, currency crashes across Latin America. The panic in London spread to the continent and according to some sources, to the US.

Banking panics and stock market crashes in London in 1837, 1839, 1847 and 1857 spilled over to the continent. The first two crises impacted the US via the cotton trade. The 1847 crisis involved a railroad boom, stock market crash and harvest failure. The crisis was triggered by tight Bank of England policy. The 1857 crisis started in the US with the failure of the Ohio Life Insurance Company, leading to a stock market crash and banking panic. This crisis augured the importance of the United States in future global financial crises. Major banking panics also occurred in London and Germany.

The crisis of 1873 had a global reach. According to Kindleberger (1978) it started with the collapse of a property boom in Germany and Austria, then spread through the continent and affected the US as European investors dumped US railroad stocks. The US had a major panic associated with a corporate governance scandal in the railroad sector (Benmelech and Bordo 2008). The collapse of that sector contributed to a serious and drawn out recession. The crisis spread to Latin America via a sudden stop as the Bank of England raised its bank rate to offset gold outflows (Catao 2006). This led to a series of debt defaults across the region and a banking crisis in Peru (Reinhart and Rogoff 2009)

3.2 The Classical gold standard era 1880-1913

The pre World War I classical gold standard era witnessed two major global financial crises; 1890-1893, 1907-1908. In both periods banking, currency and debt crises occurred

in countries across the world. In some of the countries affected output losses were very large (Bordo and Eichengreen 1999).

1890-1893

In the 3 year span there were two big crises centered on 1890 and 1893 with crisis events also occurring in the intervening years.

The 1890 crisis is usually termed the Baring crisis. In the 1880s substantial capital flows from the advanced countries of Western Europe to develop the infrastructure of the periphery occurred during a period of sluggish domestic demand. Major recipients of these funds were Argentina, Uruguay and Brazil. The associated land boom financed by generous bank lending ended in a bust consequent upon the Bank of England and other European central banks raising their discount rates to stem losses in their gold reserves (Bordo 2006). The sudden stop led to a banking crisis, debt default and currency crisis in Argentina. Barings Brothers (a leading London merchant bank) which was heavily exposed to Argentine debt became insolvent. It was rescued by a lifeboat operation (a consortium of key London banks that agreed to backstop Barings assets with a British government guarantee) orchestrated by the Bank of England which prevented a banking panic. But panics did occur in numerous European countries, and in Latin America. In addition to Argentina, a triple crisis occurred in Portugal while the US, Brazil, and Russia had twin crises.

In an environment of continued financial stringency following the Baring crisis, a major twin crisis broke out in the US in 1893 reflecting concerns over threats by the Free Silver movement to its continued adherence to the gold standard (Friedman and Schwartz 1963). Australia had a major banking panic at the end of a land boom financed by British capital; triggered by a decline in the terms of trade. Other countries in crisis in 1893 included New Zealand, Italy, Greece and several Latin American countries. In this period Bordo and Murshid (2002 and 2007) find evidence of both contagion between the core and periphery countries and a significant risk of a global financial crisis.

The second major global financial crisis was in 1907. A banking panic in the autumn in the US was at the heart of it. It may have been triggered by the Bank of England discriminating against merchant banks financing US trade following large payments by British insurance companies to cover losses stemming from the San Francisco earthquake (Odell and Wiedenmeir 2005).Other countries hit by banking crises included France, Italy(which had a twin crisis), Denmark, Sweden, Japan, Chile and Mexico. This crisis led to significant output losses in several countries (Bordo and Eichengreen 1999).

The last big crisis in this era was in 1914 at the outbreak of World War One reflecting a global demand for liquidity. Massive lender of last resort operations (eg the US invoked the Aldrich Vreeland Act and issued emergency currency),the closing of stock exchanges and the imposition of capital controls in many countries prevented panics in many countries .

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3.3 The Interwar period 1919-1939

The interwar period is notorious for financial crises. They occurred in two waves: 1920-25 and 1929-33.

The crises of the 1920-25 period reflected the attempts globally by central banks to unwind the inflation that had built up in the War. It also reflected global imbalances reflecting shifts in the pattern of global production and agriculture. Disinflation impinged upon the balance sheets of many European countries leading to banking crises in the Scanadanavian countries, the Netherlands, Italy as well as in Japan, Mexico and elsewhere. Some of these were twin crises. The brief global recession of 1920-22 was quite severe.

1929-33: The Great Contraction.

This episode is infamous as the worst of all crisis periods. It was preceded by stock market crashes in the US and UK. A series of banking panics in the US beginning in October 1930 were not successfully allayed by the Federal Reserve (Friedman and Schwartz 1963 and Bordo and Landon Lane 2010) and turned a serious recession into the Great Depression. The depression was transmitted around the world by the fixed exchange rate links of the gold exchange standard (Friedman and Schwartz 1963) and by the implosion of international fiduciary currency reserves built upon a thin film of

international gold reserves (Bernanke 2002). Adherents to the gold exchange standard who lacked credibility were prevented by "golden fetters" from offsetting banking panics (expansionary monetary policy would have led to a speculative attack on the gold parity) which proliferated across Europe, (Eichengreen 1992). Many countries across the world also were hit by debt and currency crises. Countries only extricated themselves from depression when they left the gold standard and followed expansionary monetary policy. The banking panics and deep deflation greatly worsened the real economies of countries which experienced them (Bernanke and James 1991).

3.4. Post World War II: Bretton Woods 1944-1973

In the Bretton Woods adjustable peg regime characterized by widespread capital controls and extensive financial regulation designed to prevent a reoccurrence of the financial chaos of the interwar, there were very few banking crises (or debt crises). However there were frequent currency crises as many countries were unable to align their domestic financial policies with their pegged currencies (Bordo 1993).

3.5 The Managed Float and a Return to Globalization 1973 -2010

After the breakdown of the Bretton Woods system the global financial economy reopened. In addition, in the face of high inflation many controls on the banking and financial system began to crumble. The financial crisis problem of earlier eras returned.

3.5.1 The 1970s.

Banking crises erupted in both advanced and emerging countries in the 1970s. In 1974 in the US, Franklin National bank was bailed out while in Germany Herstatt bank was not. Neither of these events were classic banking crises. Other European countries witnessed significant bank failures as did other parts of the world. In the emerging countries there were scores of currency crises. However in this decade it is difficult to discern a global financial crisis.

3.5.2 The 1980s.

The 1970s was the height of the Great Inflation the causes of which include a misplaced emphasis on the Phillips curve, the end of the gold discipline of the Bretton Woods system and the oil price shocks of 1973 and 1978. At the end of the 70s the US and other advanced countries shifted to a very tight monetary policy to break the back of inflationary expectations. In addition to precipitating one of the worst postwar recessions in many countries the tight policies also led many countries in Latin America and elsewhere to default on debts built up in the preceding inflationary era.

The Latin American debt crisis beginning in 1982 in which amongst others Mexico, Argentina, Chile, Ecuador and diverse countries like Egypt and Turkey defaulted on their sovereign debt, triggering financial difficulties for banks across the world. Many had lent

money to the countries affected. In the US key money center banks like Chase and Citibank were bailed out.

The IMF and World Bank report scores of banking crises in emerging countries in this decade. The period 1982-84 may constitute a global financial crisis.

3.5.2 The 1990s

The 1990s was characterized by three regional financial crises: in Europe 1990-91, the Tequila Crisis in 1994 and the Asian crisis of 1997-98.[3]

Europe

The liberalization of financial markets in many countries in the late 1980s led to a series of financial crises. In the Nordic countries freeing the banks from extensive controls led to a property boom in Sweden and Finland. A bust was triggered by the EMS crisis and the breakdown of the Soviet empire. These forces produced the Nordic banking and currency crisis (Jonung and Hagberg. 2005). Banks also failed in Norway. Other countries like Italy and Australia also had banking crises in this period.

[3] Japan had a major banking crisis after the bursting of property and stock bubbles in 1989. Although this likely contributed to the Asian Crisis of 1997 , it was not an international financial crisis.

The Tequila crisis.

Tight Federal Reserve policy in reaction to an inflation scare may have been the trigger for a massive devaluation by Mexico in 1994. This led to a banking crisis and a rescue package arranged by the US. Other Latin countries also were hit by debt, banking and currency crises referred to as the tequila effect. Impact on the advanced countries was minimal.

The Asian Crisis 1997-1998.

The causes for the massive currency and banking crises in Thailand, Indonesia, Korea as well as less dramatic disruption in Hong Kong, Malaysia, the Philippines and Taiwan include: overvalued currency pegs, original sin (liability dollarization,) the drying up of Japanese lending after its banking crisis, corporate malfeasance and corruption. These crises had contagion effects on other emerging countries possibly reflecting stringency in advanced country lending. Two prominent countries were Russia which defaulted on its debt in 1998 and Brazil which had a serious currency crisis in 1998. A threat by the Russian Crisis to the advanced countries by the incipient collapse of LTCM, a large hedge fund, which was greatly exposed to Russian debt which seriously exposed the balance sheets of important counterparties(including New York money center banks) to loss, , was offset by a Federal Reserve arranged rescue.

The Asian crisis had impact across many emerging countries but did not seriously impact the advanced countries. However many have argued that if it weren't for the generous rescue packages provided by the IMF, other governments, and other agencies it would have become one. On the other hand, others have argued that the rescues were largely bailouts which would engender future moral hazard (Bordo and Schwartz , 2000).

4. Empirical Evidence

4.1 Identifying Global Crises

In order to quantify the effect that a global financial crisis has on a country's real economy (business cycle) we first need to identify periods of global financial distress. To do this we assemble information on three types of financial crises: banking crises, currency crises, and sovereign debt crises. We have 57 countries in our sample which runs from 1880 to 2009. Multiple sources were used to accumulate information on these three types of crises and the information obtained was aggregated into our database. The raw data on banking crises can be found in Figure A.1 in the appendix and the raw data on currency and debt crises can be found in Figures A.2 and A.3 of the appendix.

The sources used were Bordo et al (2001), Bordo and Meissner (2005), Reinhart and Rogoff (2009), Laeven and Valencia (2010) and the IMF WEO. The dating of currency crises using an intersection between an EMP index and narratives is similar across the chronologies as is the dating of debt crises. However there were some differences

between Bordo and coauthors and Reinhart and Rogoff on the definition of banking crises. Their definition is generally more liberal than ours. They include a number of episodes as banking crises which we do not, such as minor banking crises in Canada in 1893, the UK in 1991, 1994 and 1995 and there are some they do not include like the major banking panic in the US in 1893. Also recent work by Nelson and Salido (2010) show different banking crises in the postwar US than either ours or Reinhart and Rogoff. They demarcate 1973-75, 1982-84 and 1988-91 as crises whereas Reinhart and Rogoff designate only 1984 as a banking crisis in that period. In addition Jalil (2010) demarcates several minor banking crises for the US in the 1920s and also in the nineteenth century that neither of us demarcates. In this paper we include all the crises reported by the different authors. We do not distinguish between major and minor banking crises.

In order to identify periods of global crisis we first look for clusters of crises. To do so, for each year, we count the number of crises for each category. These raw counts are reported in Figures A4 – A6 in the appendix.[4] Candidate global crises are then identified using a centered moving sum of order 2 of these raw counts. That is for each period we count the number of unique crises for the current period and the preceding and following period as well. Peaks in the two-period moving sum series are candidates for periods of global financial crises.

One important consideration, however, is that not all countries are the same in the sense that a crisis in a large country (e.g. the U.S.) is different to a crisis in a small country (e.g.

[4] As noted above in many instances multiple authors identify the same crisis. In these cases the crisis is only counted once so as not to bias the results towards finding a global crisis.

New Zealand) in its effect on the global economy. To account for this effect we weight each observation by the country's real GDP relative to U.S. GDP.[5] If a banking crisis occurs in a country whose real GDP is half that of the United States then the observation is given a weight of 0.5. This weighted count thus reflects the relative importance of the country (in terms of its size) when deciding whether a cluster of banking crises constitutes a global financial crisis.

In determining whether a cluster is a global crisis we use the following rule: 1) we find a local peak of the two-period moving sum of the weighted count series, y_t. A local peak is defined to be a period (t) where

$$y_t > y_{t-1} \text{ and } y_t > y_{t+1}. \quad (1)$$

In case of ties, ($y_t = y_{t+1}$) then period t is chosen if $y_{t-1} > y_{t+2}$ and period $t+1$ is chosen if $y_{t+2} > y_{t-1}$. 2) The local peak, found in 1), is an extreme value (thus the cluster must be large enough to be considered a rare event), and 3) the countries making up the cluster must be from different geographical regions.

A peak is considered an extreme event if the weighted sum of total crises is more than three standard deviations from the mean. In order to account for outliers the upper 10% of the data is first trimmed before computing the mean and standard deviation of the data. Once the cutoff is determined we look at the boundary value of the weighted series. The

[5] Here we use GDP in 1990 dollars as reported in Maddison (2009).

crisis is considered large and rare if it is in the upper tail of the distribution and has a total combined weight that is greater than the combined output of the US.

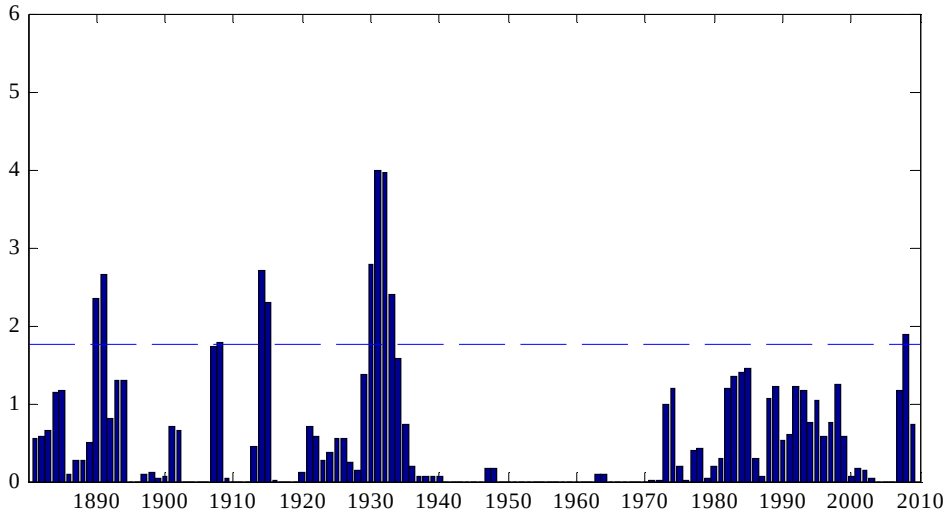
The preceding rule is applied to the data on banking crises, currency crises, and debt crises individually. It is also applied to a combined banking and currency crisis dataset to look for global “twin”-crises and to a combined banking, currency and debt crisis dataset to identify global “triple”-crises, to a combined banking and debt crisis and to a combined debt and currency crisis data set. The results are given below:

4.1.1 Global Banking Crises

The two-period weighted moving sum banking crisis series is depicted in Figure 1. The horizontal dashed line represents the three standard deviation threshold for (partly) determining a global crisis and is equal to 1.75. Thus the five identified global crises have a weighted sum greater than 1.75. Using the rule outlined above we found global banking crises in the following periods: 1890-1891, 1907-1908, 1913-1914, 1931-1932, and 2007-2008. The countries involved in each of these global banking crises are reported in Table 1.

In all of the identified periods countries from at least two (and usually more) distinct geographical regions are present. The most recent global crisis only contains countries from North America and Europe whereas the other crises contain countries from at least

Figure 1: Weighted 2-period Moving Sum of Banking Crisis Frequencies: 1880-2009



three distinct geographical areas. It is also evident from Figure 1 that the most recent global banking crisis ranks fourth in terms of the weighted sum of countries having banking crises and appears quite similar to the banking crisis of 1907-1908.

4.1.2 Global Currency Crises

Figure 2 depicts the three period moving sum of the weighted count of currency crises where again the weights are relative GDP in 1990 dollars. Using the same rule as described above we identify the following periods as global currency crises: 1890-91, 1893-94, 1931-1932, 1933-34, 1970-71, 1970-1971, 1981-1982, 1986-87, and 1992-1993.

Table 1: Global Banking Crises (Two Year Window)

Period	Countries Involved
1890-1891	Argentina, Brazil, Chile, Germany, Italy, New Zealand, Paraguay, Portugal, South Africa, UK, USA
1907-1908	Chile, Denmark, Egypt, France, Italy, Japan, Mexico, Sweden, USA
1913-1914	Argentina, Belgium, Brazil, France, India, Italy, Japan, Mexico, Netherlands, Norway, UK, Uruguay, USA
1931-1932	Argentina, Austria, Belgium, Brazil, China, Denmark, Finland, France, Germany, Greece, Italy, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, USA
2007-2008	Austria, Belgium, Denmark, France, Germany, Greece, Ireland, Netherlands, Portugal, Russia, Spain, Sweden, Switzerland, UK, USA.

The cutoff for crises to be more than 3 standard deviations away from the mean in this case is 1.5, thus all identified currency crises have total weight equal to 1.5 times the size of the U.S. economy. The countries involved in these global currency crises are reported in Table 2.

There are some noticeable differences in the occurrences of the currency crises compared with the global banking crises found above. The period from 2007-2008, where we did identify a global banking crisis, does not have a global currency crisis. In fact there are only two periods where there are both a global banking crisis and a global currency crisis. These are the 1931-1932 period, and the 1981-1982 period.

Figure 2: Weighted 2-period Moving Sum of Currency Crisis Frequencies: 1880-2009

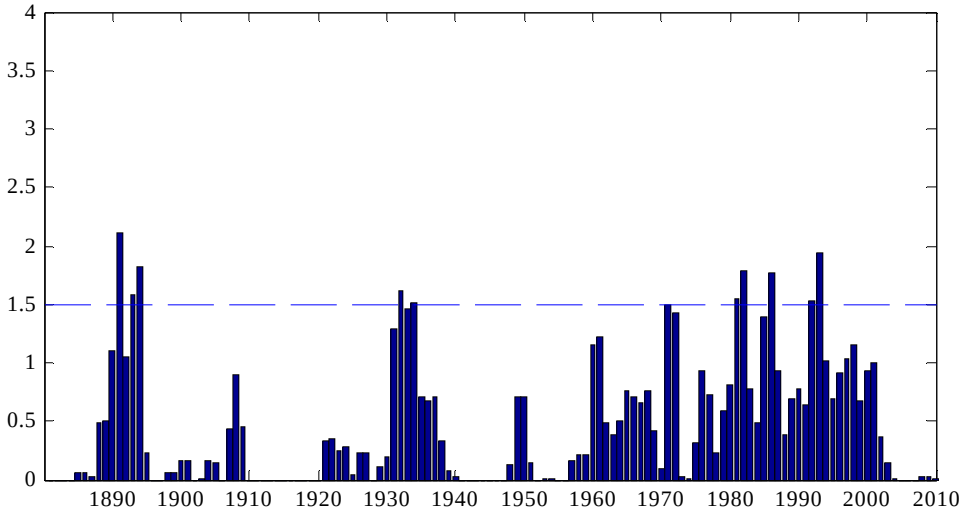
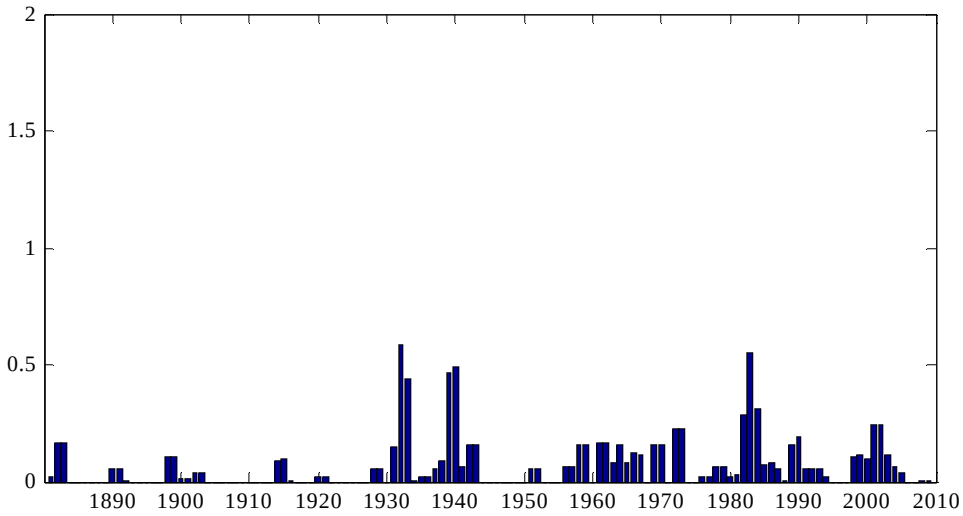


Table 2: Global Currency Crises

Period	Countries Involved
1890-91	Argentina, USA, Canada
1893-94	Canada, Germany, Italy, USA
1931-1932	Argentina , Australia, Brazil, Canada, Chile, Denmark, Finland, Germany, Greece, Japan, Norway, Portugal, Spain, Sweden, UK
1933-1934	Australia, Brazil, Germany, USA
1970-1971	Argentina, Australia, Belgium, Denmark, Finland, Greece, Netherlands, Norway Philippines, Portugal, Spain, Sweden, Switzerland, USA
1981-82	Argentina, Austria, Bangladesh, Belgium, Canada, Chile, Costa Rica, Cote d'Ivoire Denmark, Ecuador, Finland, France, Germany, Ireland, Israel, Italy, Jamaica, Mexico, Netherlands, Nigeria, Norway, Pakistan, Philippines, Portugal, Senegal, South Africa Spain , Sri Lanka, Sweden, Switzerland, UK, Uruguay, Zimbabwe
1986-87	Australia, Canada, China, Ecuador, Finland, Greece, Indonesia, Ireland, Mexico, Nigeria, Norway, Paraguay, Philippines, South Africa, Uruguay, USA, Venezuela, Zimbabwe
1992-93	China, Denmark, Finland, France, Ghana, Greece, India, Ireland, Italy, Jamaica, Netherlands, Nigeria, Pakistan, Peru, Portugal, South Africa, Spain, Sweden, UK, Zimbabwe

Figure 3: Weighted 2-period Moving Sum of Debt Crisis Frequencies: 1880-2009



4.1.3 Debt Crises

Figure 3 depicts the weighted moving sum of the number of sovereign debt crises for the period 1880-2009. Using a threshold of 3 standard deviations above the mean there are a number of peaks identified. However, in no case was the peak large enough to be considered a global crisis; the largest peak was in 1932 and had a value of 0.58. Thus our identification does not yield any debt crises important enough to be declared a global debt crisis. Again we do not observe any global debt crisis for the most recent period (2007-2008)

4.2 Global "Twin"-Crises

In the preceding sections we separately identified global crises for banking, currency, and debt crisis. We found two periods where there were both global banking and global currency crises. However, this approach did not check whether the countries included in each type of crisis overlapped or were different. That is, we do not know whether in these periods there were both a banking crisis and a currency crisis occurring in parallel (i.e. to two different sets of countries) or in unison (i.e. to the same countries). In this section we compute the weighted count of the countries having "twin" banking and currency crisis concurrently. The moving sum of this weighted count of "twin" crises is depicted in Figure 4.

Using a threshold of three standard deviations only one global "twin"-crisis is identified: 1931-1932. The two peaks in the 1890's do not constitute a global crisis as only one country is involved in each case; Brazil for 1889 and the USA for 1893. This suggests that the other period where there is an overlap of banking crisis and currency crisis: 1981-1983 (a banking crisis from 1982-83 and a currency crisis from 1981-1982) was a period where there was both a banking crisis and a currency crisis but that these crises affected different sets of countries.

Figures 5 and 6 show the weighted moving sum of the other twin crises (Currency and Debt and Banking and Debt) and we identify no periods where there were significant numbers of these types of twin crises.

Figure 4: Weighted 2-period Moving Sum of Twin Banking and Currency Crises

Frequencies: 1880-2009

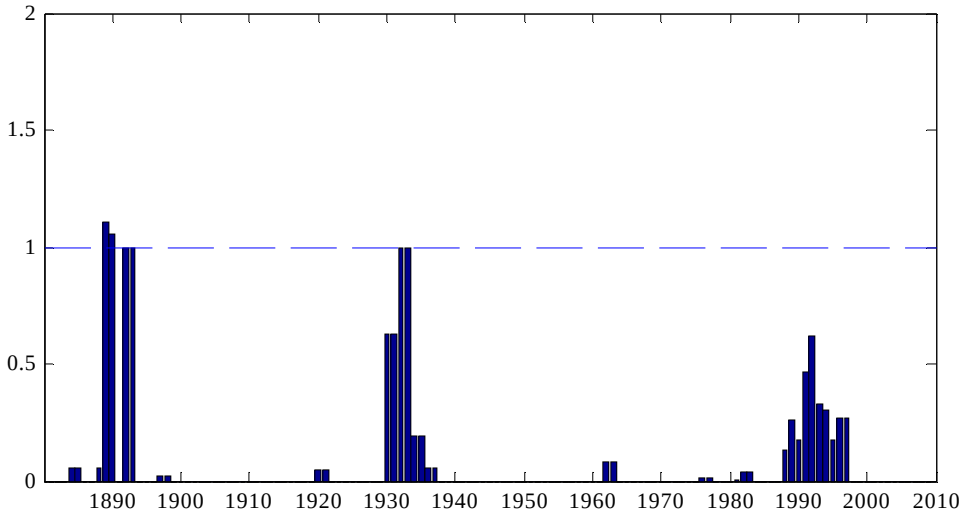


Table 4: Global Twin Crises

Period	Countries Included
1931-1932	Argentina, Brazil, Denmark, Finland, Germany, Greece, Norway, Portugal, Spain, Sweden, USA.

Figure 5: Weighted 2-period Moving Sum of Twin Currency and Debt Crisis

Frequencies: 1880-2009

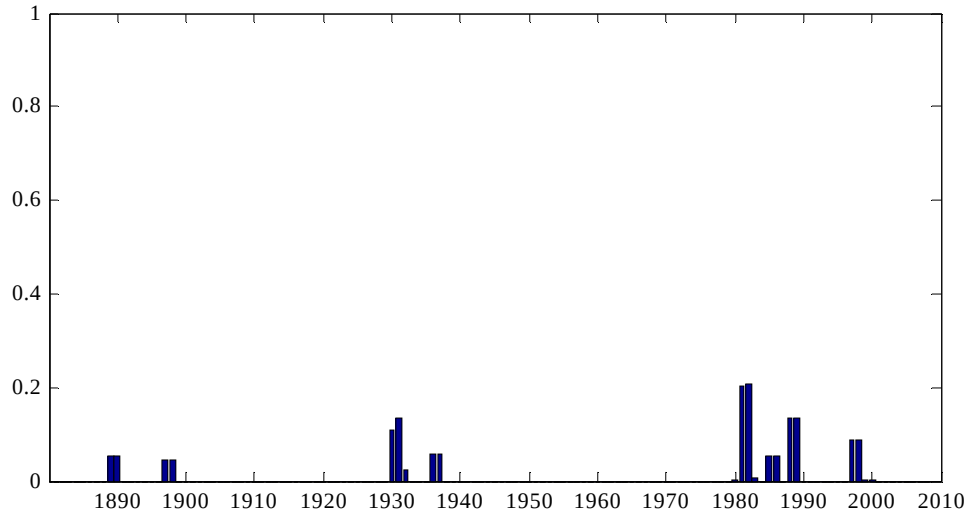


Figure 6: Weighted 2-period Moving Sum of Twin Banking and Debt Crisis

Frequencies: 1880-2009

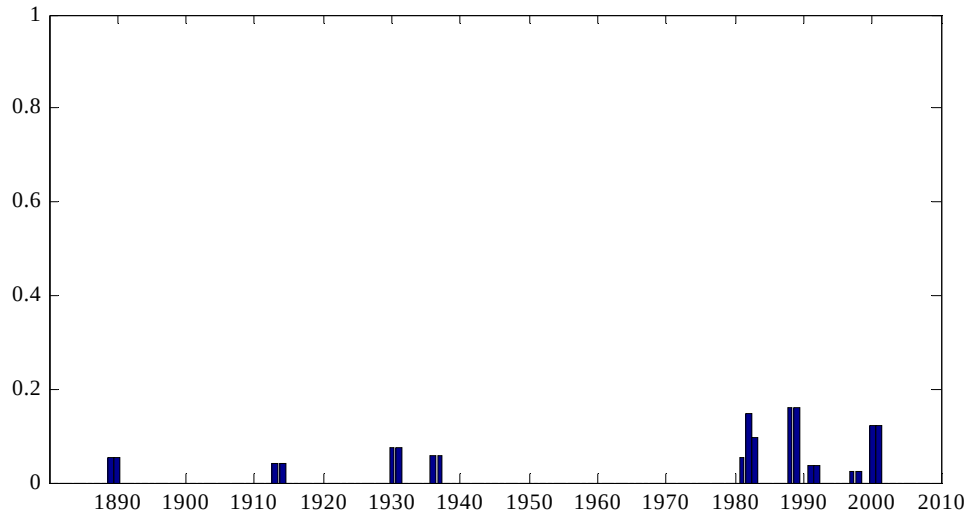
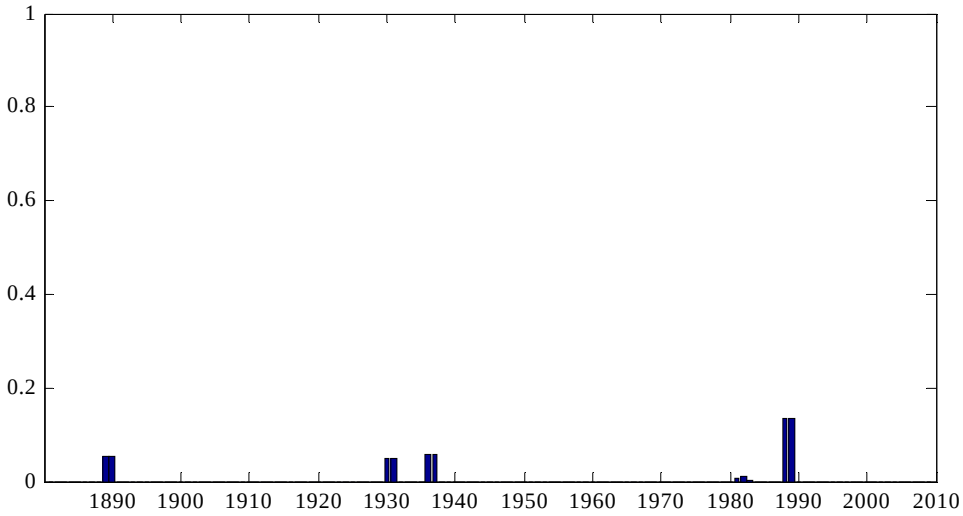


Figure 7: Weighted 2-period Moving Sum of Triple Crisis Frequencies: 1880-2009



4.3 Global "Triple" Crises

Previously we did not identify any periods where there were any global debt crises. In this section we compute weighted counts of countries having all three crises at once and the moving sum of these weighted counts is depicted in Figure 7. Again there are no periods that we can identify where there were a significant number of countries having "triple" crises.

4.4 Robustness

In order to check that our findings are robust to our method we tried a number of alternative approaches. First we used a fixed threshold to identify a global crisis rather than use the three standard deviation approach described above. Second we used a three

period moving average instead of the two-period moving average reported above. Third, we used relative per capita real income rather than relative real income as the weight. For all alternatives the main conclusions that we draw are unaltered. The main differences between the alternative approaches are the identification of smaller crises periods when using per capita real income as the weight. All the crises periods identified above are identified using the other methods.

5. Comparing and Quantifying the Crises

In Section 5 we used informal "cluster" analysis to identify global crises. In that section we combined data sets on crises from a number of sources and counted the number of observed crises to look for clusters of crises across the world. In this section we turn our attention to quantifying the "cost" of a recession and compare these costs across the different types of crisis and non-crisis periods. In order to be consistent we use a restricted dataset that consists of countries for which we have data that span the entire sample period from 1880-2009. This restricted set of countries is nonetheless quite varied and consists of countries from many regions, a variety of levels of development, and a variety of levels of openness.

The countries that are included in this analysis are Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, Denmark, Finland, France, Germany, Italy, Japan, The Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, The United

Kingdom, Uruguay, and The United States of America. In order to quantify the loss caused by a recession we first date business cycles for each country by looking for peaks and troughs of real output for each country using a common business cycle dating algorithm. We then compute the cost of each recession for each country and compare this cost across the many different types of crisis periods identified above.

The set of countries included in our analysis is kept constant over the whole sample even though data for other countries becomes available over time as we wanted to keep a consistent set of countries for the analysis and to not bias our results. If the countries to be added were chosen randomly one would not expect the results to be affected by the addition of extra countries in the later periods but it is fair to assume that the availability of data is not a random event and most likely a function of a country's development. Also the aim of this exercise is to compare recessions across different crisis periods so it is important to have a consistent set of countries across time.

5.1 Data

The data that we use is real output in constant 1990 dollars and comes from the dataset compiled by Angus Maddison. [6] This methodology is described in more detail in Maddison (2007), but nominal output for each country is first converted into 1990 local currency units and then converted into 1990 dollars using a database of international comparisons reported by the World Bank in 1990.

[6] The dataset can be found at http://www.ggdc.net/maddison .

5.2 Identifying Cycles and Measuring Loss.

In order to have a consistent set of dating rules across each country in our sample we use the business cycle dating procedure of Bry and Boschan (1971) that was updated by Harding and Pagan (2000, 2002). Here we date the classical cycle – that is the turning points of the level of real output – using the following rules: 1) the minimum length of a cycle is two years, 2) a recession or an expansion has to be at least one year in length, 3) peaks and troughs must alternate. The actual peak years and trough years that we use can be found in Table A.1 of Appendix A.

It should be noted that we could have alternatively looked at growth-cycles – turning points in the growth rate of real output – but in order to be consistent across the whole sample period of 1880—2009 we only compare classical cycles. This means that for latter periods, where the growth of real output is high, some countries have very long cycles.

There have been many different approaches to quantifying the loss of a recession. Some, for example Bordo et al (2001) and Laeven and Valencia (2010) use a measure of how long the economy took to get back to a measure of "potential" output as a measure of the severity of the recession. Harding and Pagan (2002) discuss a number of different approaches to measuring the severity of a recession including duration (time from peak to trough), amplitude (percentage loss from peak output to trough output) and accumulated loss (the sum of the percentage differences from peak output to all output levels for each

period of the recession). This last measure approximates the area above the actual level of output and the projection of peak output out horizontally for the duration of the recession. Harding and Pagan (2002) also use a measure of the steepness of the recession by measuring the difference between the actual accumulated loss and the loss if actual output followed a straight line from peak output to trough output – which they call an excess loss measure.

In our approach we use the accumulated percentage loss as our measure of the severity of a recession. This measure has the benefit of combining information about the recession's depth and duration into one number. The problem with using only amplitude or only duration is that it would be hard to compare a short but sharp recession with a long but shallow recession. Which of these recessions are worse? One would have a longer duration and the other would have larger amplitude. The accumulated percentage loss measures the total loss due to a recession as a percentage of the peak level of output and is able to compare all types of recessions. We do not use the other Harding and Pagan (2002) measure (the excess measure) as our dating rules allow for one year recessions which would necessarily yield zero excess.

The other measures mentioned above that measure how long it takes the economy to get back to a measure of potential output are not used either. The main reason is that we want to compare the severity of the most recent banking crisis in terms of the effect on the severity of recession during this period. As most economies in our sample had peaks in either 2007 or 2008 there is not enough data to compute this measure. Since we are not

able to use this duration measure to compare the severity of recessions across the different periods with the most recent recessions we do not report the severity measures of Bordo et al (2001).

5.3 Results from our Comparisons

As noted above we use a consistent classical business cycle dating algorithm to date classical business cycles for each of the 23 countries in our sample from 1880 until 2009.[7] For each recession that is identified we compute the accumulated percentage loss of the recession compared to the counterfactual that the country stayed at peak output for the entire duration of the recession. If the last identified turning point was a peak then we measured the accumulated loss from this peak until the end of the sample in 2009. For most countries the last identified peak was in 2007 and 2008 and there is considerable evidence that these countries have troughed by 2009 (although the algorithm cannot determine this without knowing the level of output for 2010). Given that we don't know the actual trough dates for the last recession we obviously run the risk of having truncated measures but we do not think this is a major issue given that most of the countries in our sample appear to have troughed by the end of 2009.

In order to account for country size we weight each loss measure by the country's relative GDP relative to that of the United States. Once we compute the measure of severity for each recession we then compare the severity of recessions over all of the sample and in particular during periods of crisis. Some summary statistical results on the severity of the

[7] For Argentina we only have data from 1884.

Table 5: Summary Statistics for Weighted Cumulative Percentage Loss in a Recession

Category	Mean	Median	Inter-Quartile Range
All Recessions	-1.12	-0.15	[-0.68, -0.05]
Non-Crisis	-0.62	-0.10	[-0.51, -0.03]
Any Crisis	-1.20	-0.15	[-0.71, -0.05]
Banking Crises			
All Countries	-3.03	-0.62	[-2.03, -0.17]
Crisis Countries	-4.56	-0.66	[-2.39, -0.17]
Currency Crises			
All Countries	-1.21	-0.15	[-0.71, -0.05]
Crisis Countries	-1.54	-0.33	[-1.29, -0.11]

recessions can be found in Table 5. The statistics that are reported are the mean of the distribution, the median of the distribution, and the 25^{th} and 75^{th} percentiles (the inter-quartile range).

The first number that is reported in Table 5 is for all recessions in our sample. The mean weighted (weighted by relative GDP) accumulated percentage loss for all recessions in our sample is -1.12% but it is clear that the distribution of accumulated losses is highly skewed to the left as the median and 25^{th} and 75^{th} percentiles are much smaller at -0.15%, -0.68%, and -0.05% respectively. Thus the distribution of accumulated loss of a recession is skewed to the left with a large number of large negative losses. That is, the distribution has a “fat” lower tail.

Next we report the mean, median, and inter-quartile range for those recessions that do not overlap any of the crisis (banking, currency, or debt) periods and for those that do overlap

with any of the crisis periods.[8] The mean accumulated loss during a crisis period is approximately twice that for recessions that occur outside of any of the crisis windows. The median and 25th percentiles are also shifted left suggesting that recessions during crises are worse, in terms of accumulated percentage loss, than recessions during non-crisis periods.

We next split the crisis periods into their respective types and report results for the three types of crises that we identify: banking crises and currency crises. Looking first at banking crises (periods where there is a global banking crisis) we observe that the loss distribution is heavily skewed to the left with a mean loss of around -3.03% and a median loss of around -0.62%. We also split the sample into those countries that actually have a banking crisis and those who do not (but nonetheless have a recession during a global banking crisis) and find that countries that have a banking crisis have slightly larger losses than those countries that do not**.**

The pattern for the currency crises is different. Again a currency crisis is a period where there is a currency crisis. First it is clear that recessions during currency crises are not as severe as during banking crises. There appears to be a discernable difference between those countries having a currency crisis (their recessions are worse) than those not having a currency crisis but having a recession during a currency crisis.

[8] A recession is deemed to overlap if any of the periods of the recession overlap with any of the periods of the crisis window.

5.3.1 Comparing Individual Banking Crises

The results of the previous section suggest that banking crises are the more important crises to consider given that recessions associated with them are large and there appears to be more spillover from crisis countries to other countries for banking crises than other types of crises. Because of this and the fact that the most recent crisis is a "pure" banking crisis we next focus our attention on the individual banking crises that we have identified.

The results reported in Table 5 are for all the banking crises across all periods and it is useful to be able to compare each crisis window to each other. This comparison is reported in Table 6. Here the summary statistics are reported for each crisis window identified in Section 5. The results show that clearly the banking crisis of the 1930's was associated with much more severe recessions than any other crisis window. The most recent crisis has relatively small losses compared to the other major banking crises.

Another interesting point to note about the most recent crisis is that the tail of the accumulated loss distribution is not as "fat" as for the other preceding crises. Figures 8 and 8a contain boxplot graphs depicting the weighted accumulated percentage loss distributions for each of the identified banking crises windows. The boxplots graphically report the same information as Table 6. More importantly they also report the tail of the distribution. Each boxplot reports a box which runs from the 25^{th} percentile to the 75^{th} percentile. The red line reports the median. The closer the red line is to the 75^{th} percentile

Table 6: Summary Statistics for Weighted Cumulative Percentage Loss: Individual Banking Crises

Crisis	Mean	Median	Inter-Quartile Range
1890-1891			
All Countries	-1.19	-0.52	[-1.39, -0.20]
Crisis Countries	-1.91	-1.11	[-2.34, -0.39]
1907-1908			
All Countries	-1.12	-0.21	[-0.35, -0.12]
Crisis Countries	-2.95	-0.30	[-5.70, -0.21]
1913-1914			
All Countries	-2.44	-0.63	[-2.31, -0.18]
Crisis Countries	-2.09	-0.63	[-2.85, -0.21]
1931-1932			
All Countries	-6.92	-1.94	[-2.98, -0.61]
Crisis Countries	-9.35	-1.18	[-2.19, -0.24]
2007-2008			
All Countries	-1.00	-0.51	[-1.19, -0.10]
Crisis Countries	-1.08	-0.15	[-1.53, -0.10]

(the top line of the box in this case) the more skewed the distribution. Any observations that lie outside the inter-quartile range are depicted with red '+' symbols.

Looking at Figures 8 and 8a we see that the most recent crisis is the only crisis without a very long lower (left) tail. Alternatively, if the distribution is skewed like the other crises the tail is much shorter. Unlike the other crises, there are no really large losses associated with the most recent crisis, with the largest accumulated loss being less than 5%.

Figure 8: Distributions of Accumulated Percentage Loss for Banking Crises: All Countries[9]

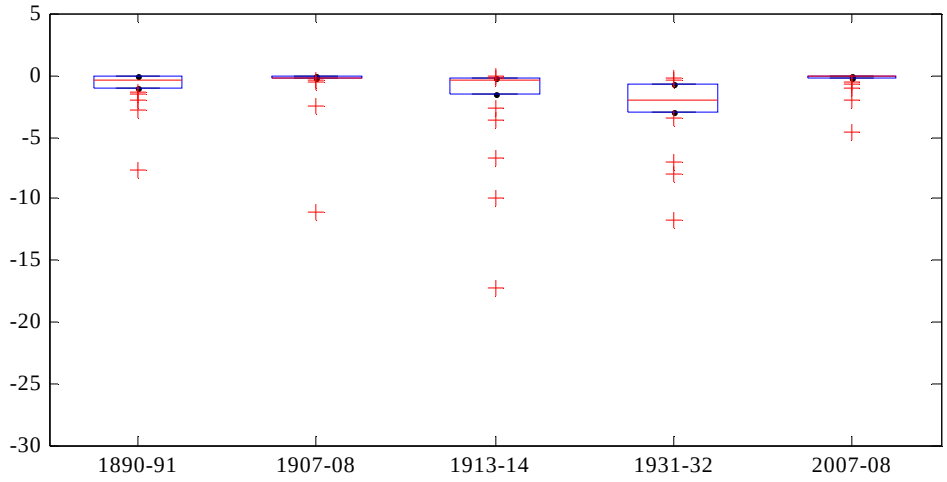
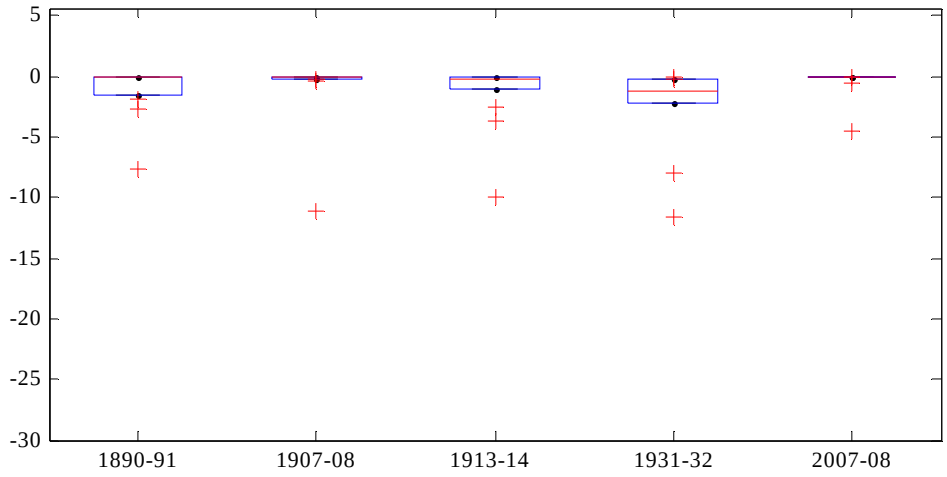


Figure 8a: Distributions of Accumulated Percentage Loss for Banking Crises: Crisis Countries



[9] For Figures 8 and 8a the left tail of the distribution for the 1931-32 crisis is cutoff at -30%. Some observations with weighted losses less than -30 are not reported.

The conclusions one can draw from these observations is that the recessions associated with the most recent financial crisis were indeed quite unprecedented given 1) the fact that the output losses were at the low end of what we would have expected after looking at the previous major banking crises and 2) we did not observe any really large negative losses (no fat left tail). This is unprecedented given the previous experience of global banking crises.

6. Discussion

Our empirical evidence in the preceding section indicates that since 1880 the world has witnessed 5 global financial (banking) crises.[10] This result is based on our aggregation of several chronologies of banking crises where we calculate a moving sum of the weighted counts by country size and condition on crisis incidence across continents. When we add in currency crises and search for global twin crises we only find one in the 1930s. When we add debt crises to the total we find that no triple global crises occurred. In terms of incidence weighted by country size the 1930s was the worst global crisis by far, followed by the recent crisis. Although the number of countries affected by crises was lower than some of the historic crises, the presence of the US and other major countries makes the recent crisis important in terms of the number and size of countries involved.

We also measured the output losses in global crises. We used a business cycle dating algorithm to date classical business cycles and for each recession we computed the accumulated percentage loss as our measure of the severity of a recession. We found that

[10] This number is increased to 9 crises when we use a larger window in our moving sum.

the distribution of recessions associated with crises was highly skewed with a fat left tail and that the mean accumulated percentage loss was higher for recessions associated with crises than those that were not associated with crises. We also found that recessions associated with banking crises were worse than those associated with currency crises and we found that banking crises appeared to affect all countries more than currency crises. The losses during recessions associated with currency crises were larger for those countries having a currency crisis than those that did not.

We then compared the 5 global banking crises that we identified and found that the recessions associated with the most recent crisis was quite similar in average loss to the crises of 1907-08 crisis but not as large as in the 1890-91 and the 1913-14 crises. The other important finding is that the most recent crisis is not associated with a highly skewed loss distribution. Unlike all other banking crises there are no really large negative losses. This result is unprecedented.

Thus, global financial crises have occurred before this one. The most recent crisis appears quite similar in its economic impact to the crisis of 1907-08 in that the recessions associated with it are small relative to other crises in history. It is certainly not the worst crisis in recent history and is most likely not the worst crisis since the Great Depression, at least with respect to output losses of recessions associated with the crisis.

Moreover from our evidence we see that there is a clear link between international financial crises and the severity of recessions. Indeed global crises may help synchronize the business cycle (Bordo and Helbling 2010).

We summarize some possible factors that can explain the incidence of global financial crises. First, international financial crises since at least 1857 seem to occur when the US (the largest economy since the end of the nineteenth century) is involved. One strong possible reason for the U.S. involvement in global financial crises is that the US banking system has long been crisis prone. In the pre 1914 era this reflected two basic problems; unit banking and the absence of an effective lender of last resort. This contrasted with many of the other advanced countries which had nationwide branch banking systems which could more easily diversity portfolios across regions and also which had central banks which had learned by the 1870s to act as lenders of last resort to the financial system. .London was also important as a focal point for the global transmission of crises before 1914 but the Bank of England had learned to become an effective lender of last resort. England had its last banking crisis in 1866.

Since 1914 the US has had a central bank, the Federal Reserve, which was established in large part to prevent the type of banking panics which characterized the National banking era (1965 to 1914). However the Fed failed in its role as lender of last resort to allay a series of banking panics in the 1930s which it is argued precipitated the Great Depression. In addition the US kept unit banking (in most states) after the establishment of the Fed until very recently.

The US has also since 1865 had a Dual banking system in which state banks (with lower capital and reserve requirements) have been regulated by state banking authorities while national banks have been regulated by the federal Comptroller of the Currency .According to White (1982) this fostered regulatory competition, inefficiency and instability). Moreover for seven decades after 1914 member banks of the Federal Reserve (all national banks and some state banks) were supervised by the Federal Reserve). Since the 1930s a new patch work of regulatory agencies has proliferated to supervise and regulate the diverse parts of the non bank financial system. Heavy regulation may explain the absence of banking crises in the U.S (as well as the rest of the world) from the 1930s to the 1970s. The lack of regulatory coordination and failures in supervision in the U.S. may have been a cause of the recent crisis.

Second, financial globalization seems to be an important part of the story of global financial crises. The free movement of global capital and frequent sudden stops was a key element in the global crisis environment of the 19th century (Bordo, Cavallo and Meissner 2010). These patterns have reemerged in the second era of globalization since the 1970s.

Third, the international monetary regime was also important in the proliferation of crises. When the world was on the gold standard both before and after World War I, crises were transmitted by fixed exchange rates and in the interwar when credibility was low “golden fetters” prevented many countries from offsetting them. Moreover the alternating waves of inflation and deflation that reflected the automatic operation of the gold standard pre

1914 may have itself triggered financial instability leading to crises (Bordo 1990). However today most countries (with the principal exception of the European Monetary Union) are in a managed float regime and global financial crises are present. This suggests that increasingly tighter linkages between global financial markets and burgeoning capital flows today operate independently of the exchange rate regime.

Fourth, asset booms fueled by capital inflows and busts triggered by sudden stops were key elements in many of the international financial crises pre WWI. In the interwar the 1920s stock market boom was similar in many respects to the railroad booms of the nineteenth century and was fueled by international capital flows (Eichengreen 1992, Bordo 2003). Finance for both the tech boom of the late 90s and the recent property booms in the US and elsewhere had an important international element manifest in the international scope of securitization and the global proliferation of derivatives.

Policy Lessons

What are some of the policy lessons to be learned from the historical record of global financial crises?

First, the historical record suggests that international financial crises before 1914 largely burned themselves out. Countries which had effective LLRs in place like Britain insulated themselves from them. Others did not and like the US had to suspend convertibility of bank liabilities into currency. Also the absence of a lender of last resort

in the U.S. and key flaws in its banking system made it an important catalyst for international crises because of its economic importance. Moreover in this era although there was minimal policy coordination eg between the Bank of England and the Banque de France in the 1907 crisis, it was minimal and episodic (Flandreau 1997, Bordo and Schwartz 1998).In the interwar period the League of Nations was largely ineffective in coordinating rescues as were other intergovernmental arrangements (Bordo and Schwartz 1999).

In the postwar the IMF and other agencies has dealt with currency crises and debt crises to some effect. The resolution of banking crises has been largely done by national monetary authorities. The growing problem of liability dollarization prevented LLR operations in dollars in the Asian countries hit by crisis in 1997-98. Their problems were solved by massive international rescues. A similar problem arose in the aftermath of the recent crisis.

In the recent crisis the question is moot whether international policy coordination was effective. Many countries did lender of last resort actions to stem the financial crisis in their own countries. They also pursued expansionary monetary and fiscal policy. These actions likely prevented the recession from being worse. It is not clear that national authorities pursued these actions because of international arrangements. More likely they did it because they had learned some lessons from the Great Depression.

The lesson from history that countries with sound financial systems, effective lenders of last resort and efficient financial supervision and regulation fared better in global financial crises than others has held up in the recent crisis (Bordo and Meissner 2005). Countries like Canada, Australia and New Zealand whose banks were less exposed to mortgage backed securities, whose banks did not have SIVs and which did not have under regulated shadow banking systems largely avoided the recent crisis.

Second, what seems to be novel about the recent crisis is the extent to which financial innovation partly in response to the supervision and regulation of the banking systems and financial markets in place in the US and other advanced countries led to the development of securitization, derivatives and off balance sheet entities designed to evade capital requirements. These innovations were globally linked through financial globalization. This increased global systemic risk. In earlier eras, stock (and bond) markets across countries were linked together during crises but the linkages are much tighter today and occur across virtually all international financial markets. This development may make the case for enhanced global financial supervision and regulation to ameliorate the systemic risks. Although how to achieve this in the face of the sanctity of sovereignty is problematic to say the least. It also may make the case for capital controls. However it is not clear that the inefficiencies of widespread capital controls and the inevitability of their evasion are worth the effort.

Finally, the fact that this crisis was one of the least costly of the global financial crises suggests that perhaps policy makers in the countries affected learned some of the lessons

from the past global financial crises. They followed aggressive expansionary monetary and fiscal policies. This was certainly not the case before World War II.

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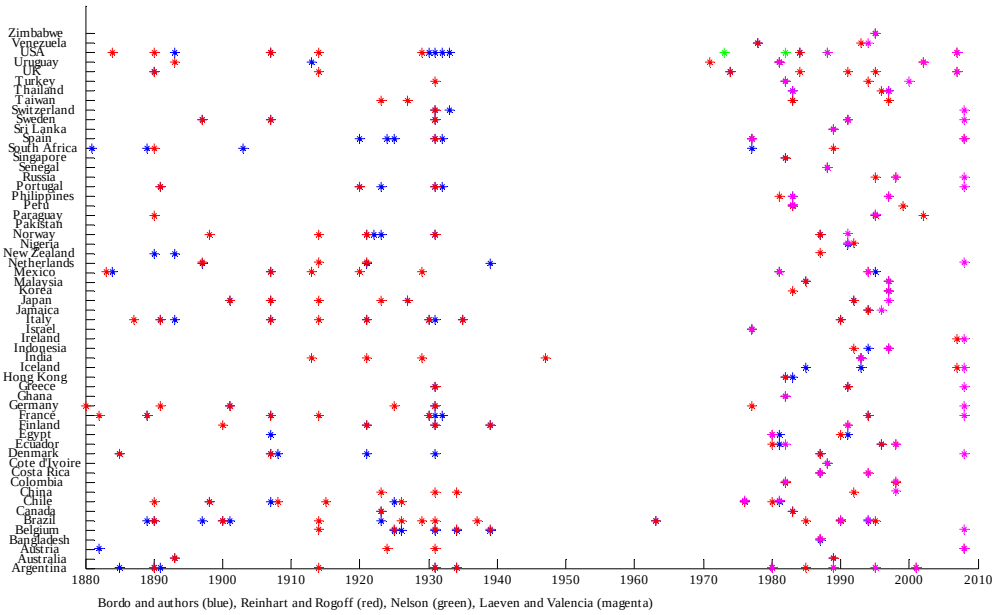
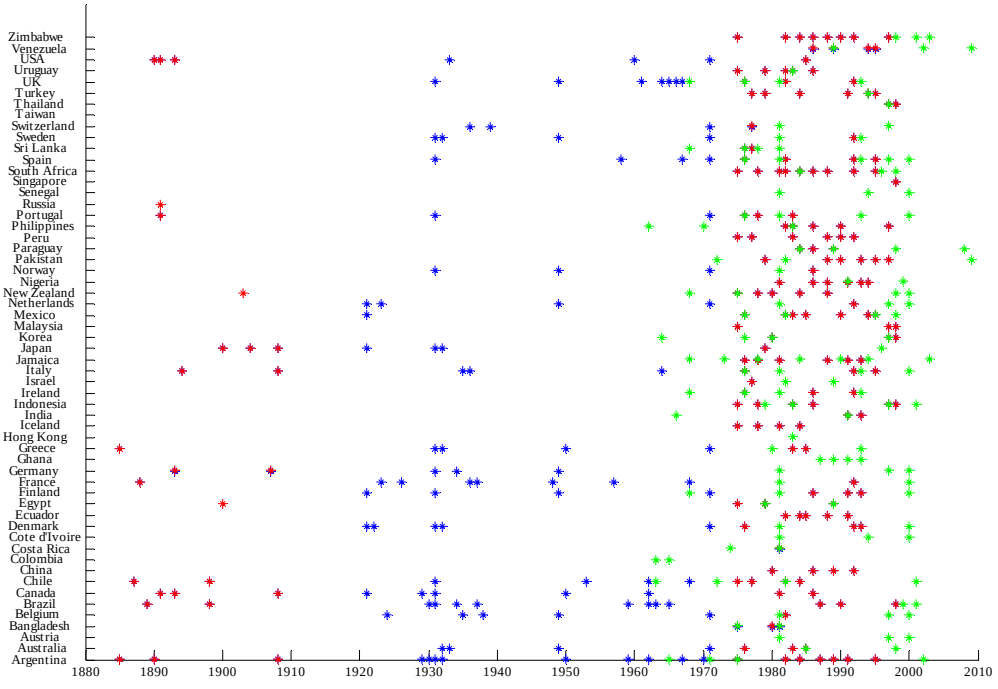
Appendix

Figure A.1: Banking Crises Dates



Bordo and authors (blue), Reinhart and Rogoff (red), Nelson (green), Laeven and Valencia (magenta)

Figure A.2: Currency Crises Dates



Eichengreen and Bordo (blue), Bordo and Meissner (red), IMF (green)

Figure A.3: Sovereign Debt Crises Dates

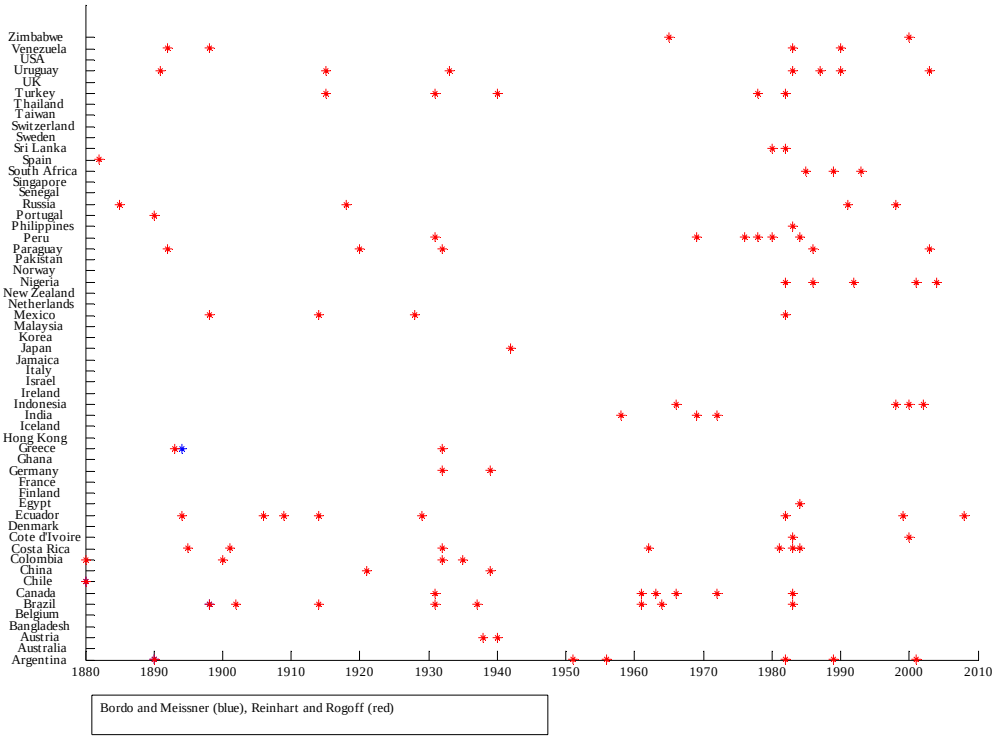


Figure A.4: Frequency of Banking Crises (Raw)

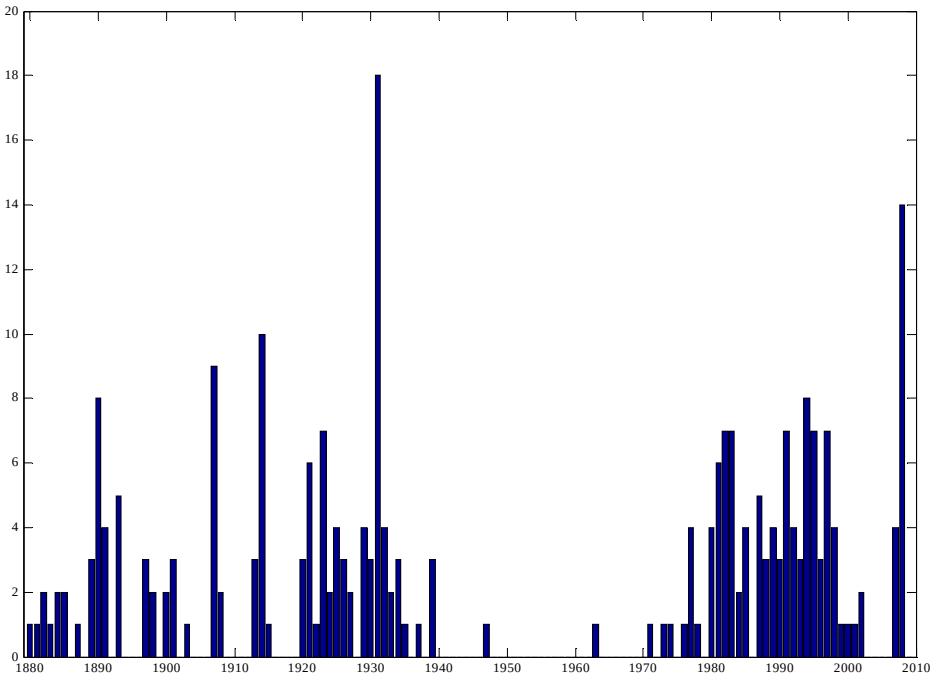


Figure A.5: Frequency of Currency Crises (Raw)

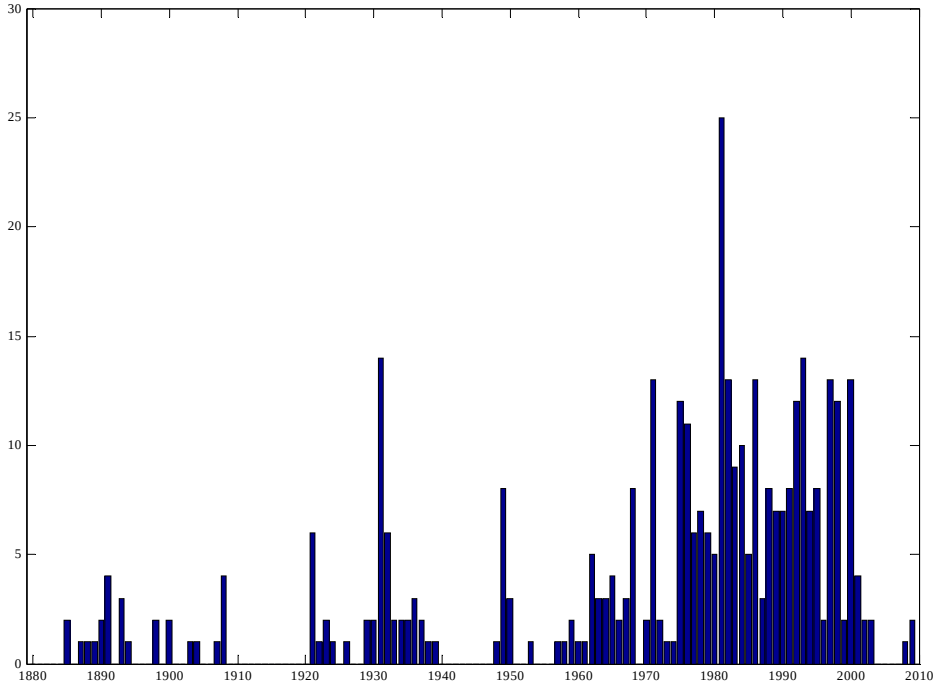


Figure A.6: Frequency of Debt Crises (Raw)

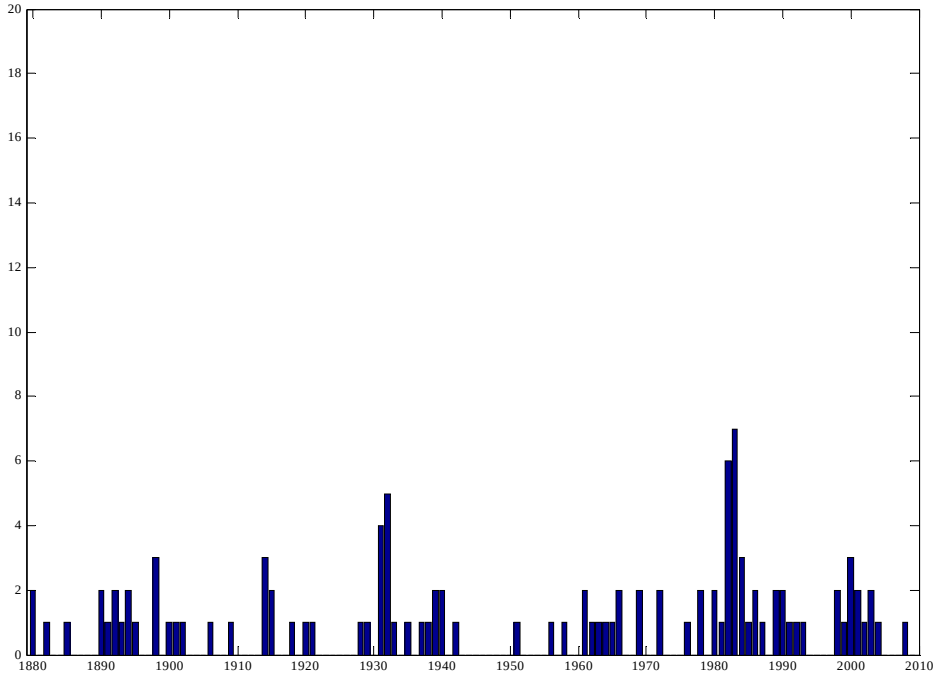


Table A.1 Peak and Trough Dates Used in Empirical Analysis

Countries	Dates
Argentina	
Peak Years	1885 1889 1894 1896 1899 1901 1906 1910 1912 1920 1924 1929 1935 1937 1941 1944 1948 1951 1958 1961 1965 1974 1977 1979 1984 1987 1994 1998 2008
Trough Years	1886 1891 1895 1897 1900 1902 1907 1911 1917 1921 1925 1932 1936 1938 1943 1945 1950 1952 1959 1963 1966 1976 1978 1982 1985 1990 1995 2002
Australia	
Peak Years	1881 1883 1885 1887 1889 1891 1894 1896 1898 1900 1904 1910 1913 1926 1938 1943 1951 1956 1960 1976 1981 1989
Trough Years	1882 1884 1886 1888 1890 1893 1895 1897 1899 1902 1905 1912 1918 1931 1939 1946 1952 1957 1961 1977 1983 1991
Austria	
Peak Years	1881 1884 1887 1892 1899 1902 1907 1912 1922 1929 1939 1941 1944 1974 1977 1980 1992 2008
Trough Years	1882 1885 1889 1893 1901 1903 1909 1919 1923 1933 1940 1942 1945 1975 1978 1981 1993
Belgium	
Peak Years	1883 1887 1890 1900 1913 1916 1928 1933 1937 1939 1951 1957 1974 1980 1982 1992 2008
Trough Years	1884 1888 1891 1901 1915 1918 1932 1934 1938 1943 1952 1958 1975 1981 1983 1993
Brazil	
Peak Years	1890 1895 1898 1901 1906 1909 1911 1913 1917 1923 1928 1938 1941 1955 1962 1964 1980 1987 1989 1997 2000 2002 2008
Trough Years	1894 1897 1900 1904 1908 1910 1912 1914 1918 1925 1931 1940 1942 1956 1963 1965 1983 1988 1992 1999 2001 2003
Canada	
Peak Years	1882 1884 1888 1891 1894 1903 1907 1913 1917 1928 1944 1947 1953 1956 1981 1989 2007
Trough Years	1883 1885 1889 1893 1896 1904 1908 1914 1921 1933 1946 1949 1954 1958 1982 1992
Chile	
Peak Years	1882 1887 1891 1893 1895 1898 1902 1904 1908 1910 1913 1918 1920 1925 1929 1937 1940 1943 1946 1948 1953 1955 1958 1963 1971 1981 1998 2008
Trough Years	1885 1888 1892 1894 1897 1900 1903 1905 1909 1911 1915 1919 1921 1927 1932 1938 1941 1944 1947 1949 1954 1956 1959 1965 1975 1983 1999
Denmark	
Peak Years	1883 1887 1911 1914 1916 1920 1923 1931 1939 1944 1950 1962 1973 1979 1992 2007
Trough Years	1885 1888 1912 1915 1918 1921 1925 1932 1941 1945 1951 1963 1975 1981 1993
Finland	
Peak Years	1883 1890 1898 1900 1907 1913 1916 1929 1938 1943 1952 1957 1975 1989 2008
Trough Years	1881 1884 1892 1899 1902 1908 1915 1918 1932 1940 1945 1953 1958 1977 1993
France	
Peak Years	1882 1894 1896 1899 1907 1909 1912 1916 1920 1924 1926 1929 1933 1937 1939 1974 1992 2007
Trough Years	1885 1895 1897 1902 1908 1910 1914 1918 1921 1925 1927 1932 1935 1938 1944 1975 1993
Germany	
Peak Years	1885 1890 1900 1913 1918 1922 1928 1939 1944 1974 1981 1989 1992 2001 2008
Trough Years	1886 1891 1901 1915 1919 1923 1932 1940 1946 1975 1982 1990 1993 2003

Table A.1 (Cont)

Italy	
Peak Years	1882 1887 1890 1893 1896 1901 1909 1913 1918 1926 1929 1932 1935 1937 1939 1974 1992 2002 2007
Trough Years	1881 1884 1889 1892 1894 1897 1902 1910 1914 1921 1927 1931 1934 1936 1938 1945 1975 1993 2003
Japan	
Peak Years	1882 1887 1890 1892 1895 1898 1901 1903 1907 1913 1919 1921 1925 1929 1933 1940 1943 1973 1992 1997 2000 2007
Trough Years	1881 1884 1888 1891 1893 1896 1899 1902 1905 1909 1914 1920 1923 1927 1931 1934 1942 1945 1974 1993 1999 2001
Netherlands	
Peak Years	1888 1892 1895 1899 1903 1906 1913 1916 1928 1937 1939 1957 1960 1974 1980 2001 2008
Trough Years	1891 1893 1896 1900 1904 1908 1914 1918 1934 1938 1944 1958 1961 1975 1982 2003
New Zealand	
Peak Years	1881 1884 1887 1890 1892 1896 1900 1903 1907 1911 1914 1920 1923 1925 1929 1938 1943 1947 1950 1954 1959 1961 1966 1969 1974 1976 1984 1987 1989 1997 2007
Trough Years	1883 1885 1888 1891 1894 1897 1901 1904 1909 1913 1918 1922 1924 1927 1932 1941 1944 1948 1951 1955 1960 1962 1968 1970 1975 1977 1985 1988 1992 1998
Norway	
Peak Years	1881 1885 1893 1897 1902 1916 1920 1923 1930 1939 1941 1957 1981 1987 2008
Trough Years	1883 1886 1895 1898 1904 1918 1921 1924 1931 1940 1944 1958 1982 1988
Portugal	
Peak Years	1888 1890 1893 1900 1904 1907 1912 1914 1916 1923 1925 1927 1929 1934 1937 1939 1941 1944 1947 1951 1973 1982 1992 2002 2007
Trough Years	1889 1892 1894 1902 1906 1909 1913 1915 1918 1924 1926 1928 1930 1936 1938 1940 1942 1945 1948 1952 1975 1984 1993 2003
Spain	
Peak Years	1883 1888 1892 1894 1901 1909 1911 1913 1916 1925 1927 1929 1932 1935 1940 1944 1947 1952 1958 1980 1992 2008
Trough Years	1887 1890 1893 1896 1905 1910 1912 1914 1919 1926 1928 1931 1933 1938 1941 1945 1949 1953 1959 1981 1993
Sweden	
Peak Years	1881 1883 1885 1891 1899 1901 1904 1907 1916 1920 1930 1939 1951 1976 1980 1990 2007
Trough Years	1882 1884 1887 1892 1900 1902 1905 1909 1918 1921 1932 1941 1952 1978 1981 1993
Switzerland	
Peak Years	1881 1886 1888 1890 1893 1899 1902 1906 1911 1915 1920 1929 1933 1938 1940 1948 1951 1957 1974 1981 1990 1994 2001 2008
Trough Years	1883 1887 1889 1891 1894 1901 1903 1908 1914 1918 1921 1932 1935 1939 1943 1949 1952 1958 1976 1983 1993 1995 2003
UK	
Peak Years	1883 1889 1899 1902 1907 1918 1925 1929 1938 1943 1949 1951 1957 1973 1979 1990 2008
Trough Years	1885 1893 1901 1904 1908 1921 1926 1931 1939 1947 1950 1952 1958 1975 1981 1992

Table A.1 (Cont)

Uruguay	
Peak Years	1883 1886 1888 1894 1896 1899 1904 1908 1910 1912 1919 1924 1928 1930 1939 1941 1954 1956 1958 1961 1966 1970 1981 1987 1994 1998
Trough Years	1881 1884 1887 1890 1895 1898 1900 1905 1909 1911 1915 1920 1925 1929 1933 1940 1943 1955 1957 1959 1963 1967 1972 1984 1988 1995 2002
USA	
Peak Years	1883 1887 1889 1892 1895 1901 1903 1906 1909 1913 1916 1919 1926 1929 1937 1944 1948 1953 1957 1969 1973 1979 1981 1990 2000 2007
Trough Years	1885 1888 1890 1894 1896 1902 1904 1908 1910 1914 1917 1921 1928 1933 1938 1947 1949 1954 1958 1970 1975 1980 1982 1991 2001