After the Fall

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Abstract

This paper examines the behavior of real GDP (levels and growth rates), unemployment, inflation, bank credit, and real estate prices in a twenty one-year window surrounding selected adverse global and country-specific shocks or events. The episodes include the 1929 stock market crash, the 1973 oil shock, the 2007 U.S. subprime collapse and fifteen severe post-World War II financial crises. The focus is not on the immediate antecedents and aftermath of these events but on longer horizons that compare decades rather than years. While evidence of lost decades, as in the depression of the 1930s, 1980s Latin America and 1990s Japan are not ubiquitous, GDP growth and housing prices are significantly lower and unemployment higher in the ten-year window following the crisis when compared to the decade that preceded it. Inflation is lower after 1929 and in the post-financial crisis decade episodes but notoriously higher after the oil shock. We present evidence that the decade of relative prosperity prior to the fall was importantly fueled by an expansion in credit and rising leverage that spans about 10 years; it is followed by a lengthy period of retrenchment that most often only begins after the crisis and lasts almost as long as the credit surge.

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* We appreciate the comments of Ken Rogoff. The views expressed, of course, are our own.
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I. Introduction

Three years have elapsed since the troubles in the United States subprime mortgage market erupted in the summer of 2007. In the interim, a global panic developed and, just as normalcy began to return this year, concerns about a Greek default and widespread contagion in Europe shook the confidence of financial markets anew. As the dust has once again begun to settle, policymakers and financial market participants have begun to ponder the economic effects of these adverse shocks beyond their immediate and evident costs.

Critical to those considerations are the intermediate- and longer-term effects of severe economic dislocations, which potentially matter for spending behavior, aggregate supply growth, asset pricing, fiscal budget prospects, and inflation determination. To shed light on these matters, this paper examines the behavior of real GDP (both levels and growth rates), unemployment, inflation, bank credit, and real estate prices in a twenty-one-year window surrounding various adverse global and country-specific shocks.

The events of the past three years are not without precedent. However, those precedents are spread across countries and over time. Two features, in particular, appear to have made the global economic contraction more virulent. First, financial intermediation was dealt a body blow. Financial institutions slashed new lending, and some markets were seriously impaired for a time. Second, the declines in output were synchronous across many countries. Virtually every country reporting export values

posted significant drops in the fourth quarter of 2008, and fully one-half of 182 countries recorded outright declines in real GDP in 2009.[1]

To capture both aspects, we examine fifteen severe post-World War II financial crises in advanced and emerging economies and three synchronous global contractions, the Great Contraction after the 1929 stock market crash, the 1973 oil shock, and the 2007 U.S. subprime collapse.

Our main results can be summarized as follows:

Real per capita GDP ***growth rates*** are significantly lower during the ***decade*** following severe financial crises and the synchronous world-wide shocks. The median ***post-financial*** crisis GDP growth decline in advanced economies is about 1 percent. [2]

What singles out the Great Depression, however, is not a sustained slowdown in growth (which was smaller than that after the 1973 oil shock) as much as a massive initial output decline. In about half of the advanced economies in our sample, the level of real GDP remained below the 1929 pre-crisis level from 1930 to 1939.[3] During the first three years following the 2007 U.S. subprime crisis (2008-2010), median real per capita GDP income ***levels*** for ***all*** the advanced economies is about 2 percent lower than it was in 2007; this is comparable to the median output declines in the first three years after the fifteen severe post World War II financial crises. However, 82 percent of the observations for per capita GDP during 2008 to 2010 remain ***below or equal*** to the 2007 income level. The comparable figure for the fifteen crises episodes is 60 percent,

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[1] See the first table in Reinhart and Reinhart (2009) for a century-long perspective on exports around crises.
[2] The five advanced economy crises are: Spain (1977), Norway (1987), Finland (1991), Sweden (1991), and Japan (1992).
[3] See the discussion in chapter 14 of Reinhart and Rogoff (2009). The advanced economy group for the 1929 and 1973 comparisons is comprised of Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and the United States. The 2007 analysis also includes Iceland.

indicating that during the current crisis episode recessions have been deeper, more persistent, and widespread. [4]

In the ten-year window following severe financial crises, unemployment rates are significantly higher than in the decade that preceded the crisis. The rise in unemployment is most marked for the five advanced economies, where the median unemployment rate is about 5 percentage points higher. In ten of the fifteen post-crisis episodes, unemployment has never fallen back to its pre-crisis level, not in the ***decade*** that followed nor through end-2009.

Real housing prices for the full period is available for ten of the fifteen financial crisis episodes. For this group, over an eleven-year period (encompassing the crisis year and the decade that followed), about 90 percent of the observations show real house prices below their ***level*** the ***year before*** the crisis. Median housing prices are 15 to 20 percent lower in this eleven-year window, with cumulative declines as large as 55 percent. The observations on unemployment and house prices, of course, may be related, as a protracted slump in construction activity that accompanies depressed housing prices may help to explain persistently higher unemployment.

Another important driver of the cycle is the leverage of the private sector. In the decade prior to a crisis, domestic credit/GDP climbs about 38 percent and external indebtedness soars. [5] Credit/GDP declines by an amount comparable to the surge (38 percent) after the crisis. However, deleveraging is often delayed and is a lengthy process lasting about seven years. The decade that preceded the onset of the 2007 crisis fits the

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[4] Using a very different approach from that adopted here, Laeven and Valencia (2010) reach the same conclusion about the severity of the output consequences of the recent episodes versus earlier post-World War II crises.

[5] This boom in lending/borrowing is importantly fed by large capital inflows (i.e., borrowing from the rest of the world) as documented in Mendoza and Terrones (2008) and Reinhart and Reinhart (2008).

historic pattern. If deleveraging of private debt follows the tracks of previous crises as well, credit restraint will damp employment and growth for some time to come.

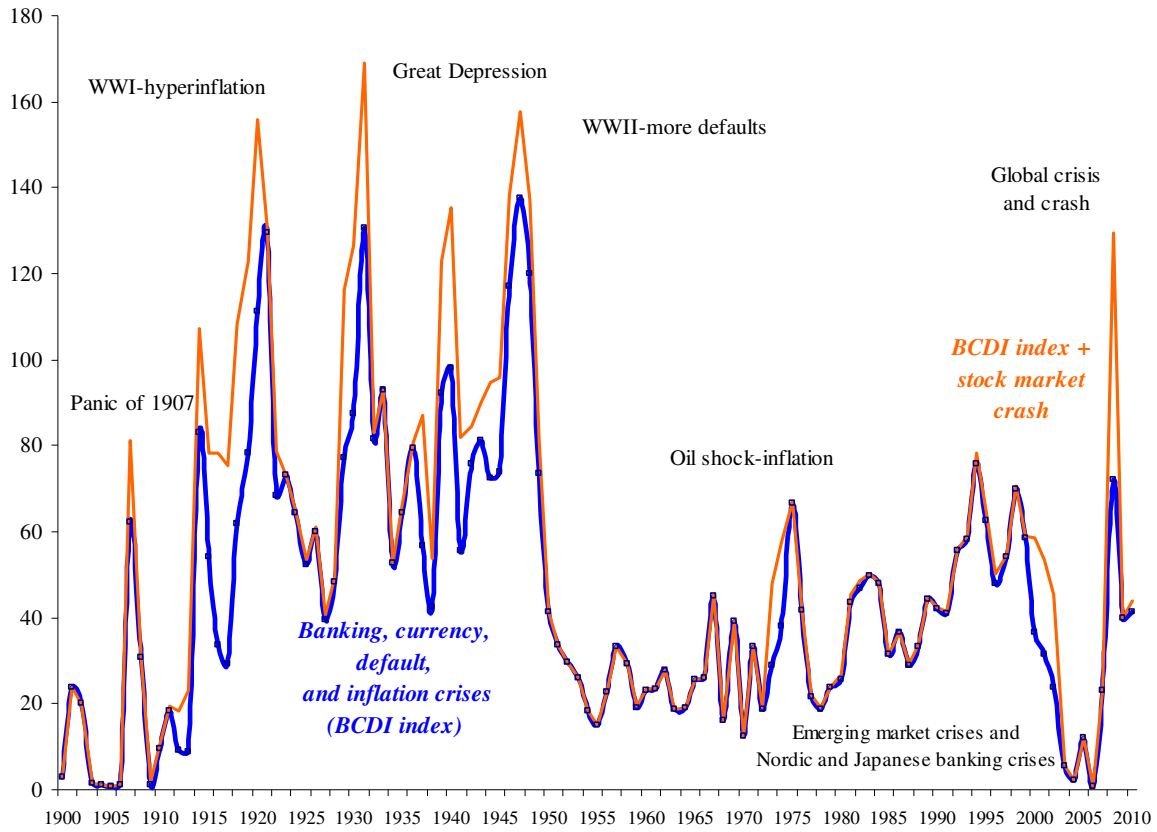
The paper proceeds as follows. Section II briefly describes our empirical strategy, although most of the methodological details are reserved for an appendix. Section III focuses on the performance of income levels and growth in the decades preceding and following fifteen severe financial crises in advanced and emerging economies; it also presents comparisons to the global (or, more accurately, advanced economies) crisis that began in 2007. The emphasis is on testing the hypothesis that there are significant differences in the decades preceding and following crises that go beyond the more immediate boom-bust pattern. The cyclical behavior of credit, external debt, and housing prices over twenty-one–year windows supplements this analysis. Section IV examines the prior episodes of severe and synchronous economic contraction, the 1929 stock market crash and the 1973 oil shock. Section V examines the post-crisis inflation performance, and some of the policy implications of our findings are taken up in the brief concluding section.

II. Empirical Strategy

The simplest way to set the stage for a discussion of economic crisis is to consider the"World" aggregate crisis indices that were introduced in Reinhart and Rogoff (2009). The updated indices are shown in Figure 1 for 1900-2010 (the entry for 2010 reflects data

through end-June) and aggregates the performance of 66 countries that account for about nine-tenths of world GDP. The indices are weighted by a country's share in world GDP.

Figure 1. Varieties of crises: World aggregate, 1900-June 2010
A composite index of banking, currency, sovereign default and, inflation crises, and stock market crashes (weighted by their share of world income)



Notes: The banking, currency, default (domestic and external) and inflation composite (*BCDI* index) can take a value between 0 and 5 (for any country in any given year) depending on the varieties of crises taking place on a particular year. For instance, in 1998 the index took on a value of 5 for Russia, as there was a currency crash, a banking and inflation crisis, and a sovereign default on both domestic and foreign debt obligations. This index is then weighted by the country's share in world income. This index is calculated annually for the 66 countries in the sample for 1800-2010:6 (shown above for 1900-onwards). We have added, for the borderline banking cases identified in Laeven and Valencia (2010) for the period 2007-2010. In addition, we use the Barro and Ursua (2009) definition of a stock market crash for the 25 countries in their sample (a subset of the 66-country sample-except for Switzerland) for the period 1864-2006; we update their crash definition through June 2010, to compile our *BCDI+* index. For the United States, for example, the index posts a reading of 2 (banking crisis and stock market crash) in 2008; for Australia and Mexico it also posts a reading of 2 (currency and stock market crash).

While inflation and banking crises predate independence in many cases, a sovereign debt crisis (external or internal) is, by definition, not possible for a colony. In addition, numerous colonies did not always have their own currencies. Thus, the country components (without stock market crashes) are compiled from the time of independence (if after 1800) onward; the index that includes equity market crashes is calculated based on data availability. The *BCDI index* stands for banking (systemic episodes only), currency, debt (domestic and external), and inflation crisis index. When stock market crashes are added to the *BCDI* composite, we refer to it as the *BCDI +*.

A cursory inspection of Figure 1 reveals a very different pattern for the pre- and post-WWII experience. Before World War II, crises episodes were frequent and severe, ranging from the banking-crisis-driven "global" panic of 1907 to the debt and inflation crises associated with World War II and its aftermath. [6]

The six decades immediately after the war were not tranquil as they included the first oil shocks in the mid-1970s; the debt crises in emerging markets, notably Latin America, in the early 1980s; the severe banking crises in the Nordic countries and Japan in the early 1990s; and the Asian crisis of 1997-1998. However, these episodes pale in comparison with their pre-war counterparts and with the "global" turmoil that begins in 2007. Like its pre-war predecessors, the recent episode is both severe in magnitude and global in scope, as reflected by the large share of countries mired in crises. Stock market crashes during 2008-early 2009 have been nearly universal. Banking crises have emerged as asset price bubbles erupted and high degrees of leverage became exposed. Currency crashes against the U.S. dollar during 2008 in advanced economies took on

[6] It is important to note that Austria, Germany, Italy, and Japan remained in default in varying duration after the end of the war.

emerging market magnitudes and volatilities. However, turmoil in Greece and other highly indebted European countries notwithstanding, it is evident from the world tally in Figure 1 that the dust has begun to settle since the 2007-2008 eruption. In this paper, we quantify some of the longer term characteristics of the post "fall" landscape.

Our analysis first focuses on fifteen severe and relatively well known financial crises since World War II (Table 1). Five are considered to be the more severe and systemic in advanced economies while the remaining ten befell middle-income emerging market economies. While Reinhart and Rogoff (2009) study the immediate antecedents and aftermath of these crises, our emphasis here extends the before-and-after window to decades rather than years.

We also study three global episodes that are dated by defining events which were associated with the onset of a considerable amount of economic turmoil across a great many countries. Two of these events originate in the United States, the stock market crash of 1929, which ushered in the great depression and the unraveling in the subprime mortgage market that began in 2007. The third global shock was the first oil price hike of 1973 (which also coincides with the break down of the Bretton Woods system of fixed exchange rates). Table 1 defines the coverage of the 10-year windows around these events.

The statistical analysis, which is described in more detail in the appendix, is based on nonparametric comparisons of the data that are applied to the episodes listed in Table 1. Simply put, we examine if key macroeconomic indicators seem to come from the same distribution before and after a dislocating event. The exact time periods of the

Table 1. Episodes and Coverage

Region or country	Beginning of crisis	10-year window before (t-10 to t-1)	10-year window after (t-10 to 1-1)
Global episodes [1]			
21 advanced economies and 20 emerging markets	1929	1919-1928	1930-1939
21 advanced economies and 49 emerging markets	1973	1963-1972	1974-1983
22 advanced economies and 49 emerging markets	2007	1997-2006	2008-2017 [2]
Country-specific severe financial crises			
Advanced economies			
Spain	1977	1967-1976	1978-1987
Norway	1987	1977-1986	1988-1997
Finland	1991	1981-1990	1992-2002
Sweden	1991	1981-1990	1992-2002
Japan	1992	1982-1991	1993-2003
Asian crisis			
Indonesia	1997	1987-1996	1998-2007
Korea	1997	1987-1996	1998-2007
Malaysia	1997	1987-1996	1998-2007
Philippines	1997	1987-1996	1998-2007
Thailand	1997	1987-1996	1998-2007
Other emerging markets			
Argentina	2001	1991-2000	2002-2012 [3]
Chile	1981	1971-1980	1982-1991
Colombia	1998	1988-1997	1999-2008
Mexico	1994	1984-1993	1995-2004
Turkey	2001	1991-2000	2002-2012 [3]

[1] The analysis of the global episodes is based on individual country data, not on an aggregation into global or regional aggregates. Details about the empirical approach are discussed in part 3 of this Section.
[2] Data is through, 2008, 2009, or 2010, as noted in individual tables and charts, for the particular time series. For instance, the comparison to post 2007 real per-capita GDP is through 2010 for all countries, as IMF forecasts for 2010 are used.
[3] Data is through, 2008, 2009, or 2010, as noted in individual tables and charts, for the particular time series.

before-and-after windows vary across our exercises, but we usually try to employ the longest possible spans of comparison.

The variables of interest to us are those of interest to policy makers and include the level and growth or real GDP, the unemployment rate, and inflation. Not all the manipulations of the data are used across-the-board for all the time series. For instance, peak-to-trough comparisons are extremely helpful in understanding pre-and post-crisis patterns in the level of GDP, housing prices, credit/GDP, etc. but less helpful for comparing growth and inflation. All exercises aim to address the broad question of whether the decade after the crisis systematically differs from the decade before it. In all instances, any cross-country or cross-period analysis requires that the data is in similar units and comparable. To this end, we work with country-specific annual growth rates (percent changes), ratios to GDP, or an index that sets the pre-crisis (t-1) year or the crisis year (T) equal to 100.

III. Post-World War II Financial Crises and 2007

To set the stage for the analysis, we first turn to the individual country crisis episodes and the more recent experience in advanced economies following what began with the subprime crisis in the United States in the summer of 2007. Irrespective of bail-out costs and swelling government deficits and debts, the most basic measure of the severity of a crisis is its impact on the standard of living. Since the standard of living is a multi-faceted concept, we will start with examining the record of per capita GDP in and following the crisis.[7]

[7] Per capita GDP is measured in 1990 international Geary-Kamiris dollars.

1. GDP levels

How bad was what just happened to the global economy? An intuitive metric is the level of real GDP in and immediately after the crisis relative to the peak year. To that end, we rebased real GDP in twenty-two advanced economies in the three years from 2008 to 2010 to their levels in 2007. For comparability, we took the forecast for the levels of real GDP in 2010 from the latest *World Economic Outlook* of the International Monetary Fund (2010).

The frequency distributions of those 66 annual observations are plotted as the blue line in Figure 2. As is evident from the figure (and the inset box providing summary statistics), economic performance has been varied. Output has been as much as 13.5 percent below and 2.4 percent above its 2007 value in this country set over the past three years. The red line provides the same calculation for fifteen severe financial crises, where the level of GDP for each of the three years following the peak (years t, t+1, and t+2) is re-indexed to the value at the peak.

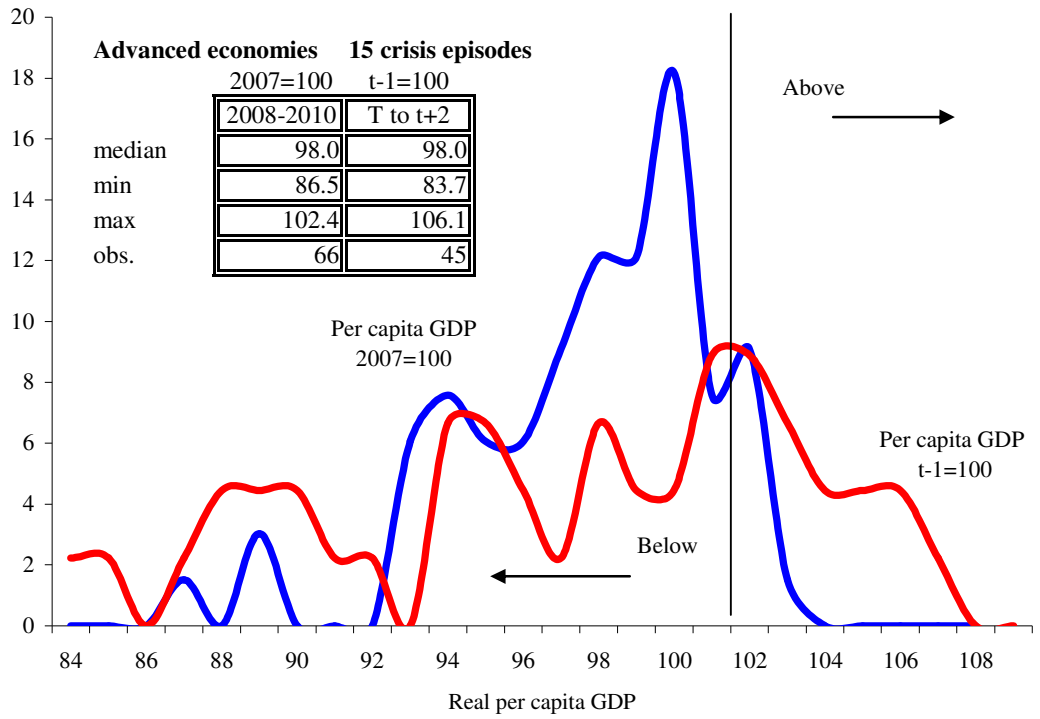
No doubt as IMF forecasts for 2010 (as of April 2010) are replaced by actual data and prior year are revised, this chart will change. But based on what is available at the time of this writing, output declines during the current crisis are comparable to those observed during fifteen+ severe post-WWII financial crises.

The post crisis median is 98 (about 2 percent lower) while upper and lower extremes are not far apart. In effect, the post-2007 output declines for the advanced economies are more comparable in orders of magnitude to those observed in emerging markets (which account for the lower tail of the t+1 to t+3 distribution). While 60 percent of the observations for per capita GDP are below or equal to 100 for the fifteen

crises episodes, the comparable figure for 2008 to 2010 is 82 percent. Using a very different approach from that adopted here, Laeven and Valencia (2010) reach the same conclusion about the severity of the output consequences of the recent episodes versus earlier post World War II crises. These authors compute output losses as the cumulative difference between actual and trend real GDP, expressed as a percentage of trend real GDP for the period T, t+3.[8]

Figure 2. Levels of Real Per Capita GDP in the First Three Years of Crises, Fifteen Post-WWII Episodes and the Second Great Contraction, 2007-2010

Probability density function



Sources: *World Economic Outlook,* International Monetary Fund, Maddison (2010, webpage), Reinhart and Rogoff (2009), and authors' calculations.
Notes: The fifteen crises episodes are those listed in Section II. Figures for real per capita GDP for 2010 are from the IMF's April 2010 *World Economic Outlook.*

[8] Trend real GDP is computed by applying an HP filter (λ=100) to the GDP series over [T-20, T-1].

Since, as noted earlier, the aim of the paper it to better understand the pre-post crisis landscape over longer horizons, we confine our attention to the analysis of the twenty-one-year window around the fifteen financial crisis episodes of interest and confine most of our comparisons to the 1997-to-2006 experience, with more limited reference (as data permit) to the world after 2007.

2. Growth and unemployment

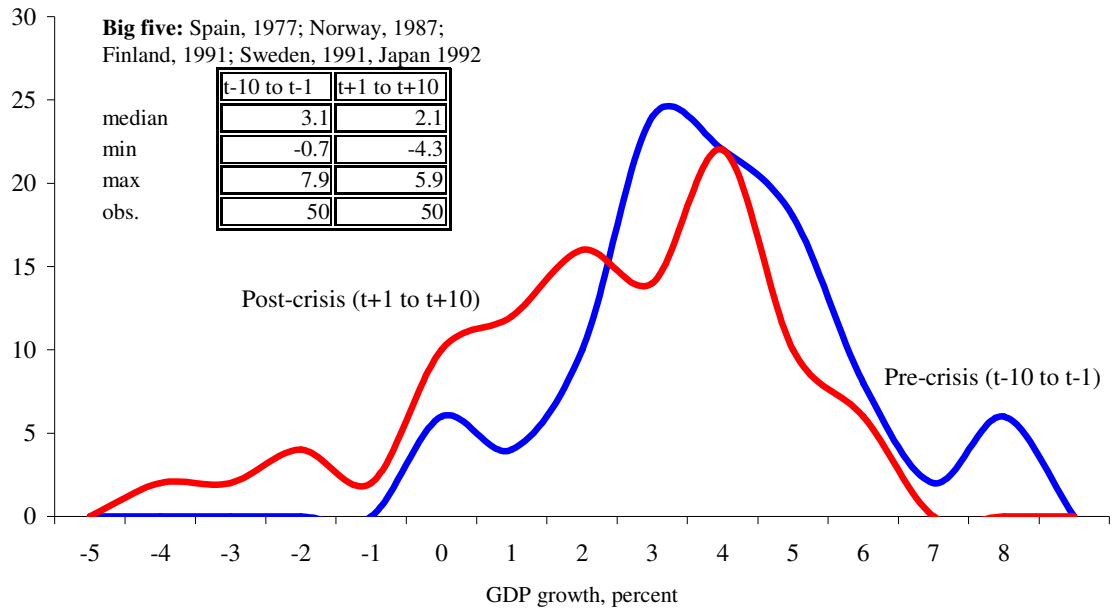
Reinhart and Rogoff (2009) demonstrated that a severe financial crisis typically produced an acute disruption of economic activity. The duration of that fallout matters critically for economic welfare. A short but sharp contraction can be made less consequential by private behaviors, such as consumption smoothing by households over their lifetimes and production-smoothing by firms, forbearance by regulators to allow financial firms to rebuild capital, and government stabilization policies. As the effect lingers, it will look more a loss to permanent income and wealth and those mechanisms may turn out to be counterproductive.

We widen the window of the pre- and post-crisis analysis to see how much appears temporary and how much is permanent. Figure 3 examines the marginal probability distributions of real per capita GDP growth for the decades bracketing severe financial crises for the most severe financial disruptions in advanced economies since WWII prior to the most recent, also known as the "Big Five". The blue line gives the performance in the years before the crisis and the red line gives that after the event. The inset provides basic descriptive statistics for the two distributions. The note at the bottom of the figure reports the Komolgorov-Smirnoff (K-S) critical value (at one percent) for the relevant number of observation and the K-S statistic. Comparable tests were done for

the ten emerging market crises combined as well as separately for the subset of five Asian crises episodes. To economize on space and avoid repetition, these figures are not reproduced here, but Appendix Table 1 presents the relevant summary and test result statistics.

Figure 3. Real Per Capita GDP Growth in the Decade Before and the Decade After Severe Financial Crises: Post-WWII, Advanced Economies

Probability density function



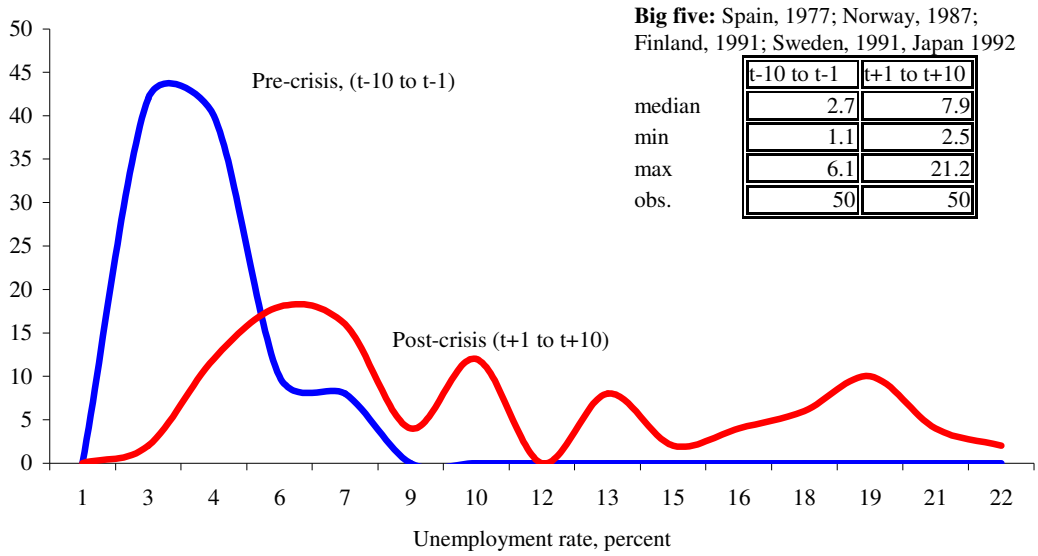
Sources: Maddison (2010, webpage), Reinhart and Rogoff (2009), and authors' calculations.
Notes: The Kolmogorov-Smirnoff 1 percent critical value and the K-S statistic are: 16.3 and 28.0, respectively. If the K-S is greater than the critical value we reject the null hypothesis that the observations are drawn from the same distribution.

Long multi-country time series for unemployment rates are not always readily available. However, the coverage for the twenty-one-year windows around the fifteen crises is nearly complete (but for three observations) and the results are provided in Figure 4. The upper panel provides the smoothed histograms of decade comparisons for

the "Big Five" countries and the bottom panel presents similar treatment for the five Asian economies in the sample.

Figure 4. Unemployment Rate in the Decade Before and the Decade After Severe Financial Crises: Post-WWII, Advanced and Asian Economies

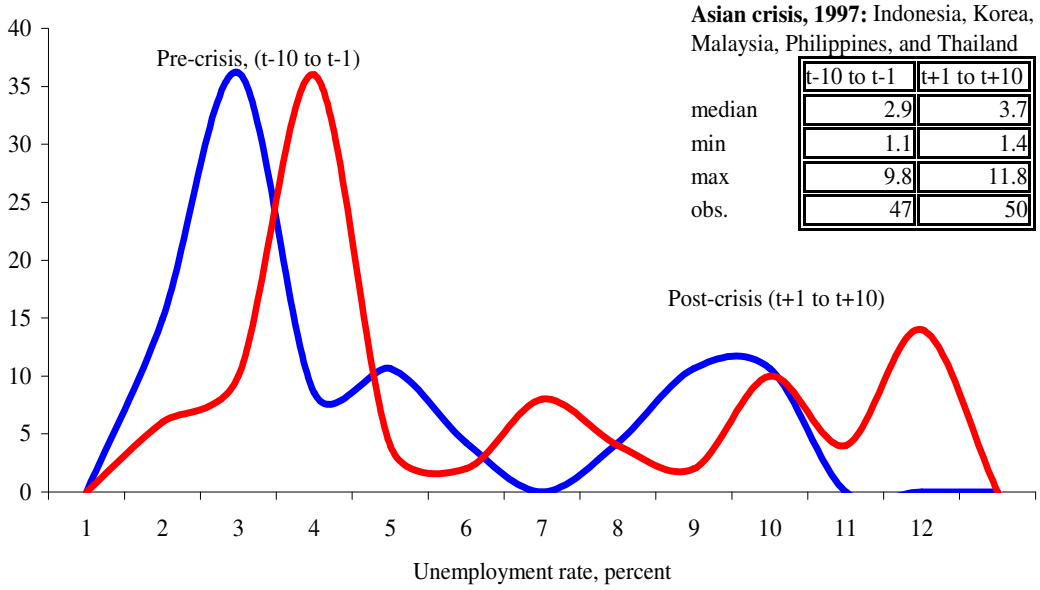
Probability density function, five advanced economies



Big five: Spain, 1977; Norway, 1987; Finland, 1991; Sweden, 1991, Japan 1992

	t-10 to t-1	t+1 to t+10
median	2.7	7.9
min	1.1	2.5
max	6.1	21.2
obs.	50	50

Probability density function, five Asian economies



Asian crisis, 1997: Indonesia, Korea, Malaysia, Philippines, and Thailand

	t-10 to t-1	t+1 to t+10
median	2.9	3.7
min	1.1	1.4
max	9.8	11.8
obs.	47	50

Sources: *International Financial Statistics,* International Monetary Fund, various issues, Nicolau (2005), Rosende Ramirez (1990), Reinhart and Rogoff (2009), and authors"' calculations.
Notes: The Kolmogorov-Smirnoff 1 percent critical value and the K-S statistic are: 16.3 and 68.0, respectively for the advanced exercise(top panel) and 16.3 and 35.1 for Asia comparison (bottom panel).

The figures require little explanation. Unemployment rates are significantly higher in the years of the decade that follow the crises than in the years of the decade that preceded it. For the advanced economies, the pre- and post-crises medians are 2.7 versus 7.9 percent, respectively. Indeed, as the cumulative density function highlights (bottom panel), nearly all the observations for the post-crisis decade show unemployment rates above the median unemployment rate for the t-10 to t-1 period. The Asian crisis comparison does not represent as stark a contrast as that for advanced economies—a finding anticipated for a shorter window in the trough-to-peak analysis in Reinhart and Rogoff (2009). Unemployment rates are about 1 percentage point higher in the post-crisis decade.

The stark difference between the pre- and post-crisis experience raises the question as to whether the unemployment rate ever returns to its pre-crisis level (t-1). Table 2 provides an answer to this question but requires stretching the post-crisis period through the end of 2009. For ten of the fifteen episodes, the answer to the question is no. In the "Big Five" economies, four-of-five Asian-crisis countries, and in Turkey, unemployment remains perched at a level above the pre-crises values. In five cases (the Philippines and four Latin American crises), lower unemployment rates do evenutally materialize after the crisis. In those five instances, however, the t-1 benchmark is high (from 6.6 to 14.7 percent) by historic norms of those countries.

Table 2. Unemployment Rates Before and Long-After Severe Financial Crises: Fifteen Post-WWII Episodes

Country and Crisis year	Level prior to crisis, *t-1*	Maximum post crisis through 2009		Has it fallen to pre-crisis level?	Lowest reached since crisis through 2009		Difference of post-crisis minimum and pre-crisis
		level	year		level	year	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(6)-(2)
Advanced economies							
Spain, 1977	4.8	21.2	1986	no	8.3	2007	3.5
Norway, 1987	2.0	6.0	1993	no	2.5	2007	0.5
Finland, 1991	3.4	18.4	1994	no	6.4	2008	3.0
Sweden, 1991	1.7	9.4	1994	no	4.0	2001	2.3
Japan, 1992	2.1	5.4	2002	no	3.8	2007	1.7
Emerging economies: The Asian Crisis, 1997							
Indonesia*	4.8	11.2	2005	no	6.1	1999	1.3
Korea**	2.0	6.8	1998	no	3.2	2008	1.2
Malaysia	2.5	3.5	1999	no	3.1	2000	0.6
Philippines	8.6	11.8	2004	yes	7.3	2007	-1.3
Thailand**	1.1	3.4	1998	no	1.4	2007	0.3
Emerging economies: Other episodes							
Argentina, 2001*	14.7	18.3	2002	yes	7.9	2008	-6.8
Chile, 1981*	10.7	21.3	1982	yes	7.1	2007	-3.6
Colombia, 1998	12.1	20.5	2000	yes	11.2	2007	-0.9
Mexico, 1994**	2.4	4.7	1995	yes	1.6	1999	-0.8
Turkey, 2001**	6.6	10.5	2003	no	9.9	2006	3.3

Notes: An asterisk (*) indicates a sovereign default (or restructuring) took place during or shortly after that episode; a double asterisk (**) are near-default episodes, as defined in Reinhart (2010), where a default was avoided with major international assistance.
Sources: *International Financial Statistics,* International Monetary Fund, various issues, Nicolau (2005), Rosende Ramirez (1990), Reinhart and Rogoff (2009), and authors''' calculations.

It is important to highlight that this study relies of official estimates of unemployment, which may underestimate under-employment that tends to rise in the years immediately after the crisis. But even the imperfect measures available show that unemployment rates tend to be persistently high and growth rates remain below their counterparts in two-decade comparisons. Providing a full and testable explanation as to why crises leave such a long and pronounced trail is beyond the scope of this paper, particularly as we are silent on the macroeconomic policy response to the crises. There are, however, two important differences in the pre- and post-crisis landscape that merit

further exploration in the remainder of this section. The first difference is the behavior of real estate prices and, by extension, the implications for construction activity. The second is the long cycles that characterize private debt and bank credit, which are a central focus of Reinhart and Rogoff (2010) and Schularick and Taylor (2009).

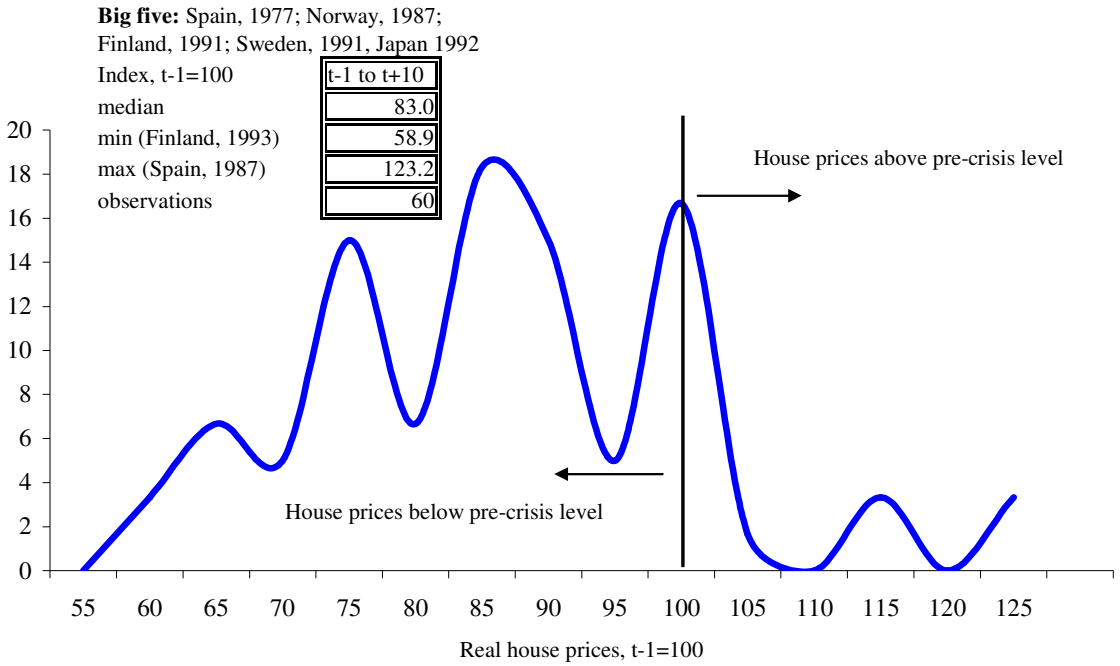
3. The housing market

The top panel of Figure 5 plots the histogram or frequency distribution for an index that sets the level of real housing prices at t-1 equal to 100 for each of the ten countries for which real estate market data are available. The choice of t-1 (rather than T as was the case for real GDP) is that housing prices usually begin their descent prior to the onset of the crisis and before the economic downturn, as documented in Reinhart and Rogoff. There are a total of 60 annual observations for the advanced economies over the 11-year period T to t+10.[9] The area under the curve to the left of the vertical line at 100 gives the share of observations for which real housing prices remained below their t-1 level. As the chart reveals, about 90 percent of the observations over an eleven-year period show real house prices remaining below their level on the eve of crisis (t-1).

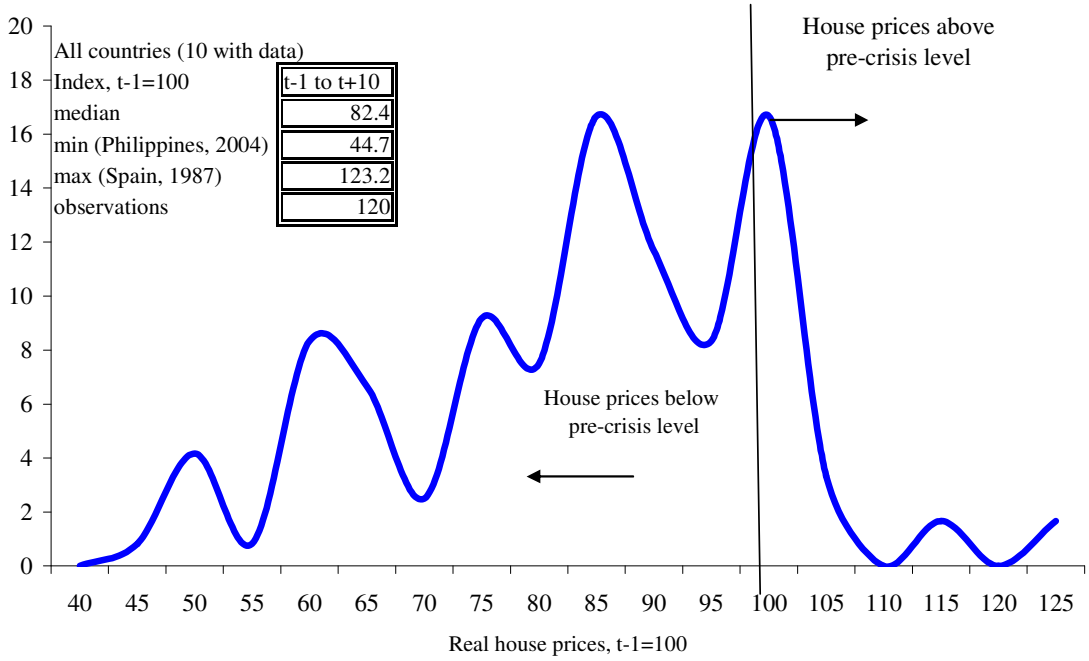
[9] This is the "advanced economy" category routinely used by the IMF, World Bank, OECD, etc. It is questionable in numerous cases whether countries several countries in that list would have classified as advanced in the pre-World War II era.

Figure 5. Real House Prices Before and Ten Years After Severe Financial Crises: Ten Post-WWII Episodes

Probability density function: Advanced economies



Probability density function: Advanced and five emerging market economies



Sources: Reinhart and Rogoff (2009) and numerous sources cited therein, and authors' calculations.
Notes: The five emerging markets for which there is complete real house price data for the relevant period are: Colombia, Indonesia, Korea, Malaysia, and the Philippines. As shown, there are only a handful of observations fully (most notably for Spain) recovering to their pre-crisis level.

Median housing prices are 15 to 20 percent lower in the ten-year post-crisis window, with cumulative declines as large as 55 percent. From 2006 to date, house prices have declined, in varying degrees in most advanced economies. This consistent feature of the post-crisis environment is not unique to the more modern crises. While real estate price data are not readily available, several chapters in the *Annual Reports* of the League of Nations for the 1930s (the equivalent to the modern-day *World Economic Outlook* from the IMF) were devoted to documenting the collapses in construction as key drivers of the abysmal performance of output and employment.[10] As noted in Reinhart and Rogoff (2009), the housing cycle exhibits a longer duration than booms and busts in equity markets and is intimately connected with the multi-year credit cycle, which we turn to examine next.

4. Bank credit and external borrowing

Reliance on banks as the main source of credit varies considerably across countries, as in many emerging markets domestic capital markets are small and access to credit by households is quite uneven. The importance of banks and bank-like institutions (included in the banking surveys) as a source of financing for the corporate sector is the smallest in the United States. Across the countries in the sample, banks play a much larger role for households. Given this variation, we complement the data with other sources of indebtedness or leverage, such as external debt or private sector indebtedness in capital markets.

Table 3 presents the usually long build-up of credit that characterizes the decade before the financial crisis and the subsequent unwinding of private debts in the decade that follows. A depiction of these long cycles on a country-by-country basis is presented

[10] See the reports for the years, 1938-1940, in particular.

along the comparable data for public debt in Reinhart (2010). While our focus remains on the twenty-one-year window bracketing the financial crisis, both the surge and retrenchment in credit/GDP extends beyond the period of analysis summarized here.[11]

Table 3. Domestic Bank Credit/GDP 10 Years Before and After Severe Financial Crises: Fifteen Post WWII Episodes

Country and crisis year	**Domestic credit surges** Minimum credit ratio in 10 years prior to crisis, level	year	Maximum credit ratio around the crisis level	year	Difference maximum less pre-crisis minimum	**Post-crisis deleveraging** Lowest ratio reached in the 10 years following the crisis level	year	Difference post-crisis minimum less maximum
	(1)	(2)	(3)	(4)	(5)=(3)-(1)	(6)	(7)	(8)=(6)-(3)
Advanced economies								
Spain, 1977	65.6	1967	102.5	1976	36.8	94.2	1980	-18.2
Norway, 1987	130.0	1980	162.4	1988	32.4	123.7	1994	-38.7
Finland, 1991	46.4	1981	92.9	1991	46.5	54.9	1997	-38.0
Sweden, 1991	56.1	1985	72.9	1989	16.8	45.0	1996	-27.9
Japan, 1992	193.8	1982	260.5	1996	66.7	221.9	1997	-38.6
Emerging economies: The Asian Crisis, 1997								
Indonesia*	23.6	1987	62.1	1999	38.4	40.6	*2007*	-21.5
Korea**	50.5	1988	64.1	1997	13.6	No post-crisis deleveraging through 2008		
Malaysia	72.7	1990	163.4	1997	90.7	113.8	2007	-49.6
Philippines	19.5	1991	78.5	1997	59.0	40.9	2007	-37.7
Thailand**	84.1	1988	177.6	1997	93.5	104.2	2007	-73.4
Emerging economies: Other episodes								
Argentina, 2001*	22.3	1992	61.9	2002	39.7	23.8	2008	-38.1
Chile, 1981*	31.1	1971	114.7	1985	83.5	60.5	1991	-53.9
Colombia, 1998	29.2	1992	42.5	1998	13.2	35.7	*2008*	-6.8
Mexico, 1994**	37.3	1990	53.0	1997	15.7	33.2	*2005*	-19.8
Turkey, 2001**	22.5	1991	52.7	2001	30.3	41.4	2004	-11.4
Memorandum item								
Median for 15 episodes					38.4			-37.7

Notes: An asterisk (*) indicates a sovereign default (or restructuring) took place during or shortly after that episode; a double asterisk (**) are near-default episodes, as defined in Reinhart (2010), where a default was avoided with major international assistance. Italics denote that the deleveraging process is ongoing according to the latest available data.
Sources: *International Financial Statistics,* International Monetary Fund, various issues, Norges Bank (website), Reinhart and Rogoff (2009), Reinhart (2010), and authors''' calculations.

[11] Our data for domestic bank credit/GDP is confined to the post-WWII period, with the series beginning usually in the late 1940s for the advanced economies and somewhat later for the emerging markets.

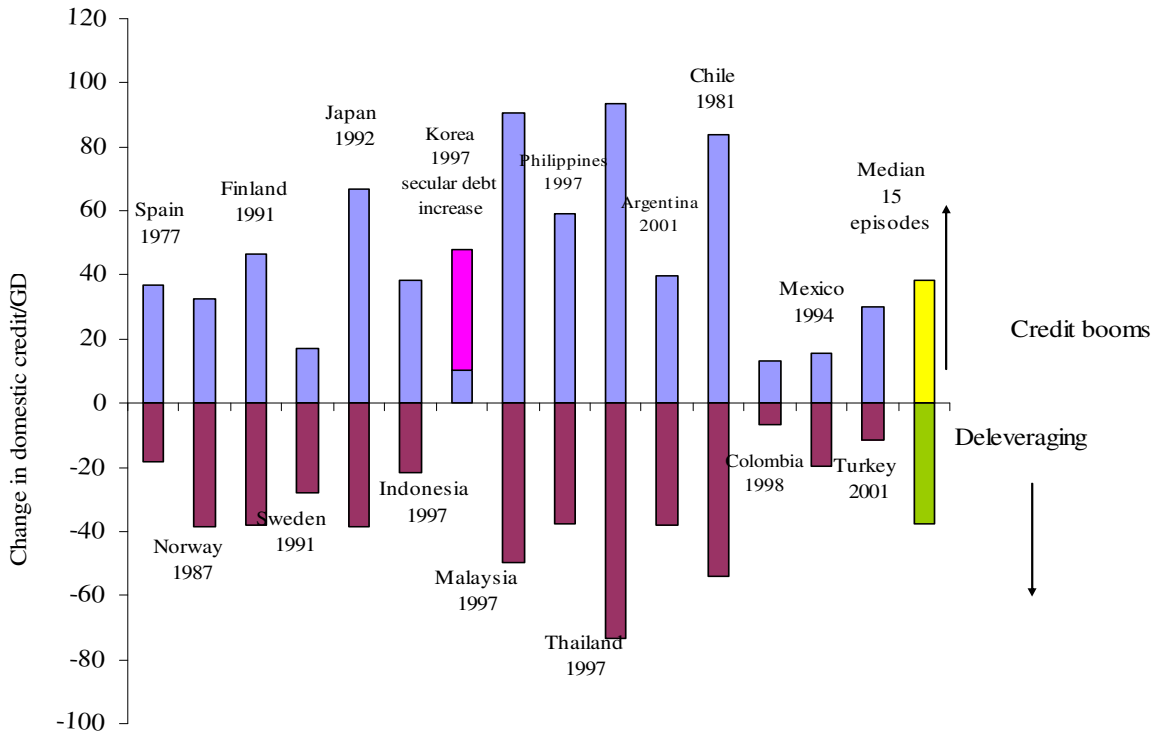
Table 3 provides a measure of the amplitude of the credit cycle for each crisis episode as well as the duration (in years) of the surges and reductions in credit/GDP.

Figure 6 focuses on the amplitude of the fluctuations. The top bar measures the increase in domestic credit/GDP from the minimum credit ratio in the 10-year window prior to the crisis (often the date for this minimum turns out to be t-10) to the maximum value reached usually shortly before, during or shortly after the financial crisis.[12] (Column 5 of Table 3 presents the relevant calculation.)

As is evident, the increases in credit/GDP in the run-up to the crisis vary in size, with surges in the 80-to-90 percent range before the crisis in Chile (1981) and Thailand (1997); among the advanced economies, Japan (1992) holds the record, with an increase of about 70 percent.[13] The median rise in domestic bank credit/GDP across these episodes is about 38 percent. Quite often, this leverage ratio continues to increase immediately after the crisis, despite the fact that a credit crunch is underway. During this stage of the crisis, sharp declines in nominal GDP (not matched by comparable write-downs in outstanding credits) importantly account for increases in the ratio of credit to GDP. Typically, the greater the unwillingness (or inability) to write down nonperforming debts, the longer the deleveraging process is delayed.[14] This pattern is most evident in post-crisis Japan, where credit/GDP continues to climb until 1996, peaking at 260.5 percent.

[12] Korea is an exception, in that the secular rise in domestic credit/GDP is largely uninterrupted by the 1997-1998 crisis. This pattern is very different from the very clear pre-crisis boom and post-crisis bust in external debt/GDP for Korea during the same period.
[13] In effect, the rapid rise in leverage pre-dates our 10-year window, which begins in 1982 for Japan.
[14] In Mexico, for example, poorly defined consumer rights delayed the adjustment in the mortgage market following the 1994-1995crisis.

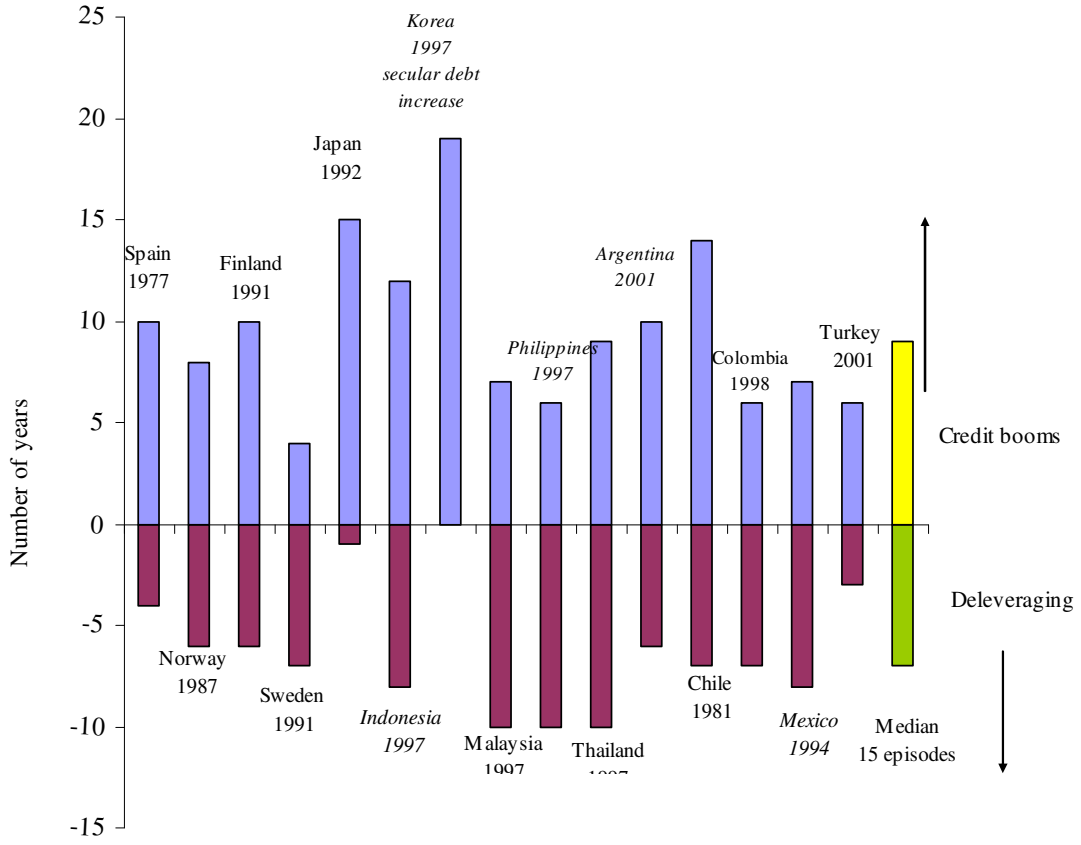
Figure 6. Domestic Banking Credit/GDP Twenty-one Years Around Severe Financial Crises: **Amplitude** of Boom-Bust Credit Cycles in fifteen Post WWII Episodes



Sources: Table 3 and sources and authors' calculations listed therein.
Notes: The magnitude of credit booms shown correspond to the difference between the maximum domestic bank credit-GDP ratio around the crisis and the pre-crisis low for the ratio during the 10-year window preceding the crisis. Similarly the extent of deleveraging is calculated as the minimum credit/GDP ratio reached during the 10-year window after the crisis and the maximum ratio reached around the crisis. The specific dates and magnitudes for each episode are listed in Table 3.
For Korea, there is an uninterrupted secular rise in domestic bank credit-to-GDP during 1987-2007 (the 10-year window around the crisis). Post-crisis deleveraging appears to be confined to external debts (see Reinhart, 2010).

The median duration (in years) of these credit booms, as shown in Figure 7, is about 10 years. The unwinding or deleveraging following a crisis (shown in the lower bars) is of comparable magnitude. Indeed, the median decline in credit/GDP is also about 38 percent. This unwinding also stretches over many years--often a full decade (and even longer). We cannot discriminate from this analysis whether the retrenchment in credit arises primarily from financial institutions inability or unwillingness to lend after the crisis or from weak demand for loans associated with slower economic growth and greater resource slack. The surge in credit does appear to fuel growth in the pre-crisis decade, while its contraction following the crisis no doubt contributes to the subpar performance in the macroeconomic aggregates and in real estate prices in the decade that follows.

Figure 7. Domestic Banking Credit/GDP Ten Years Before and Ten Years After Severe Financial Crises: **Duration** of Boom-Bust Credit Cycles in fifteen Post WWII Episodes



Sources: Table 3 and sources and authors' calculations listed therein.
Notes: The duration of credit booms shown correspond to the difference (in years) between the maximum domestic bank credit-GDP ratio around the crisis and the pre-crisis low for the ratio during the 10-year window preceding the crisis. Similarly the duration of the deleveraging phase is calculated as the number of years between the year minimum credit/GDP ratio reached during the 10-year window after the crisis and the year maximum ratio reached around the crisis. The specific dates and magnitudes for each episode are listed in Table x. Shown in *italics* are the episodes where leveraging (Korea) or deleveraging process is ongoing according to the latest available data.
For Korea, there is an uninterrupted secular rise in domestic bank credit-to-GDP during 1987-2007 (the 10-year window around the crisis). Post-crisis deleveraging appears to be confined to external debts (see Reinhart, 2010).

5. Housing prices, bank credit, and external borrowing cycles around the 2007 crisis

We now document the similarities in the decade prior to the 2007 crisis in most advanced economies (and, most markedly, in those countries that have experienced the most severe crises) to the boom in housing prices, domestic bank credit, and external borrowing in the fifteen systemic crises episodes covered in this study. Furthermore, by the standard of prior crises, the unwinding of housing prices and domestic and external debt is far from complete.

Table 4 provides evidence on selected advanced economies for 1997 to 2010. The data include real changes in housing prices, domestic bank credit/GDP, gross external debt/GDP, and real per-capita GDP growth. The period is broken up into pre-crisis (1997 to 2007) and post-crisis (2007 to 2010) sub-samples. The table also provides information on the starting point of the banking crisis in each country, an assessment of its scale (in terms of whether it is considered systemic or borderline), and median per-capita GDP growth for 1950-1996 and its difference from the 1997-2007 median.[15] As a useful scheme for summarizing the upswing of the leverage cycle, we average the change in the ratios of domestic credit/GDP and gross external debt/GDP (columns 6 and 8) for the pre-crisis decade (column 10) and rank the countries in ascending order by the magnitude of the surge in leverage.

On the whole, the countries at the bottom of the table with the largest increases in leverage (whether domestic, external or both) had larger increases in real housing prices and per capita GDP growth versus its long-run trend than those at the top. Without exception, the countries in the bottom group ended up with a full-fledged systemic

[15] See Caprio and Klingbiel (2003), Reinhart and Rogoff (2009) and Laeven and Valencia (2010) on the systemic/borderline differentiation.

banking crisis. Iceland, Ireland, the Netherlands, Spain , and the U.K. all fit this description, but the U.S. does not quite meet the above-trend GDP growth criteria. Greece's private debt accumulation is not among the largest in the set but, then again, its recent troubles had more to do with high public debt.

The downturn in housing prices and banking solvency begins earlier (2007) in Iceland, Ireland, the U.K. and the U.S., but even in these cases there is either scant or no evidence of deleveraging through 2010. In effect, in most countries, credit/GDP and external debt/GDP have continued to climb since 2007, as Figure 8 illustrates. Not unlike the crises episodes studied here, part of the continued upward march in debt/GDP owes to marked declines in real and even nominal GDP during the height of the crisis and part of it to forbearance. Missing from Figure 8 is the bottom panels of Figures 6 and 7, which document the magnitude and duration of the deleveraging phase of the cycle which has in nearly all cases followed the boom.

If the protracted unraveling of private debt (coupled with a high public debt burden) unfolds in the same pattern as previous crises, one can infer that this would exert a dampening influence on employment and growth, as in the decade following earlier crises.

Table 4. Housing Prices, Credit, External Debt and Growth: Selected Advanced Economies, 1997-2010

Country	Banking crisis date	Banking crisis magnitude	Change in real house prices [3]		Change in Domestic credit/GDP		Change in gross external debt/GDP		Average of columns 6 & 8	Median per capita GDP growth		
			1997-2007	2007-2010	1997-2007	2007-2010	2003-2007	2007-2010		1950-1996	1997 2010	Difference
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Japan			-30.1	-2.4	-8.9	17.5	8.4	-1.7	-0.3	4.7	1.6	-3.1
Germany	2008	systemic	-11.1	-0.1	-12.4	6.0	17.8	-4.6	2.7	3.2	1.7	-1.5
Austria	2008	borderline	5.6	13.4	-4.9	11.1	54.0	-9.3	24.6	3.3	2.4	-1.0
Finland			51.1	2.3	30.3	13.2	17.8	31.3	24.1	2.7	3.6	1.0
Italy			35.3	0.6	39.6	12.3	24.1	-4.5	31.9	3.4	1.6	-1.8
Greece	2008	borderline	88.6	-9.3	31.5	4.4	41.4	25.1	36.5	3.3	4.0	0.6
Belgium	2008	systemic	101.2	2.3	-7.0	4.5	85.7	68.9	39.3	2.7	2.5	-0.2
France	2008	borderline	111.6	-11.6	21.0	6.1	58.9	5.6	40.0	3.0	1.8	-1.3
Switzerland	2008	borderline	9.9	1.4	7.8	5.9	86.1	-102	47.0	2.3	2.0	-0.3
Denmark	2008	systemic	79.7	-19.8	60.9	18.5	43.3	14.3	52.1	2.0	1.8	-0.2
Sweden	2008	borderline	114.9	2.8	84.8	9.1	39.4	43.7	62.1	2.4	3.0	0.6
Portugal	2008	borderline	n.a.	-5.5	81.4	33.5	44.0	-21.5	62.7	4.2	1.5	-2.6
Netherlands	2008	systemic	74.1	-6.6	54.1	46.4	74.8	29.5	64.4	2.3	2.9	0.6
US[1]	2007	systemic	86.5	-23.4	21.7	8.5	33.0	-1.3	27.4	2.5	2.1	-0.4
					98.4	***-48.0***			***65.7***			
Spain	2008	systemic	118.5	-16.6	95.4	31.3	48.9	14.4	72.2	3.1	3.5	0.4
UK	2007	systemic	150.1	-16.0	66.1	48.0	111.9	8.3	89.0	2.3	2.6	0.3
Ireland	2007	systemic	114.8	-23.1	107.5	31.1	407.2	169.8	257.3	2.8	5.0	2.1
Iceland[2]	2007	systemic	66.9	-32.1	234.2	-66.9	511.0	428.0	372.6	3.1	3.4	0.4
Memorandum items:												
Median			79.7	-6.0	46.9	11.7	46.4	6.9	49.5	2.9	2.4	-0.5
Average			68.0	-8.0	54.4	10.2	94.9	30.0	74.7	3.0	2.6	-0.4

Sources*: Flow of Funds,* Board of Governors of the Federal Reserve, *International Financial Statistics* and *World Economic Outlook,* International Monetary Fund, Laeven and Valencia (2010), Maddison (2004 and website), Reinhart and Rogoff (2009), *Quarterly External Debt Statistics*, World Bank and Data Appendix for the multiple listings for real estate prices and authors' calculations.

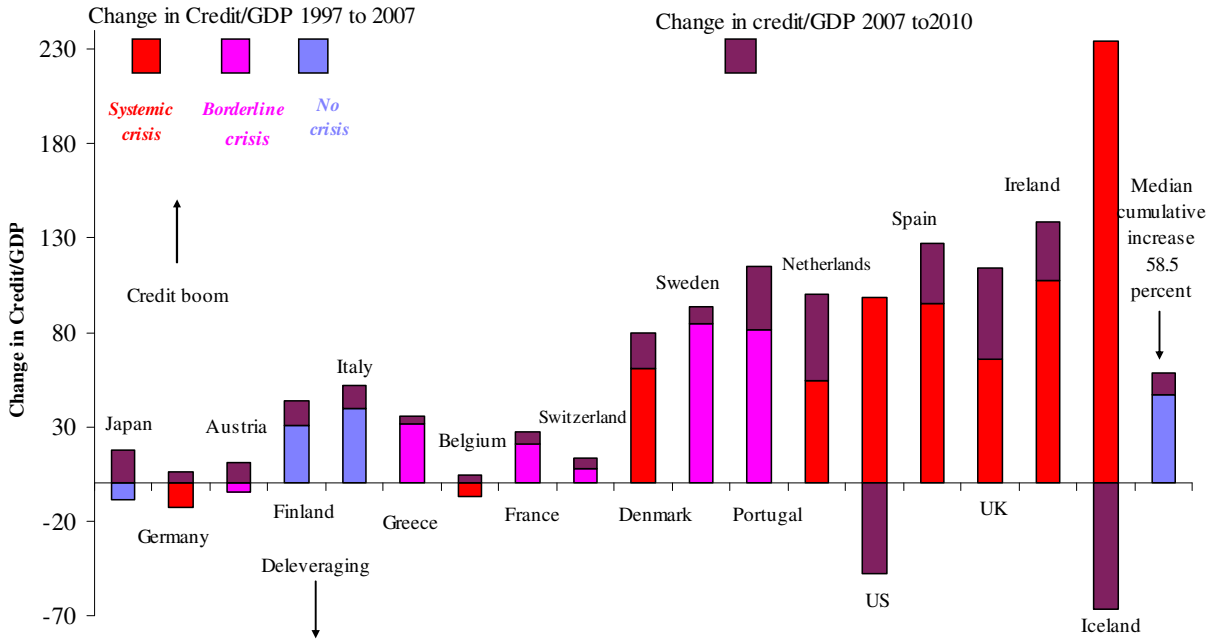
Notes: The data appendix provides a listing of the coverage of real estate prices and domestic credit. The external debt data is through 2010:Q1.

[1] For the U.S., we report bank credit but the more relevant concept (as banks do not play nearly as big a role as in other advanced economies) is private debt from the flow of funds. Beginning in 2010:Q1, almost all Fannie Mae and Freddie Mac mortgage pools are consolidated in Fannie Mae's and Freddie Mac's balance sheets and, thus, are included in the debt of government enterprises; this shows up a massive private deleveraging (about 27 percent of GDP) in Q1. Absent this shift inliabilities, the deleveraging since 2007 is closer to 20 percent of GDP.

[2] The credit boom ends in 2006, so the changes reported is 1997-2006 and 2006-2009, as no bank credit data for 2010 is available.

[3] For most countries, real housing prices peak in 2007. For the US the peak is 2006, so the 1997-2006 change is 115.3 percent and the 2007-2010 decline is -33.3 percent.

Figure 8. Domestic Banking Credit/GDP and Financial Crises : Amplitude of the Boom Phase of the Cycle, Advanced Economies, 1997-2010



Sources: Table 4 and sources cited therein.
Notes: The median rise in credit GDP in fifteen post-war severe financial crisis is about 38 percent, well below the 59 percent surge prior to the current crisis; with the exceptions of Iceland and the US, where the crises unfolded earlier, there is little evidence of deleveraging.

IV. Global Episodes: 1929 and 1973

This section offers comparisons between the pre- and post-crisis landscape around the 1929 stock market crash at the onset of the Great Depression and the first oil shock of 1973, which about doubled oil prices and coincided with stock market crashes in most of the advanced economies and numerous emerging markets. [16] Some of the results confirm well-known stylized facts. Other findings are more novel and have potential implications for the coming decade.

[16] The 1929 dividing line as the onset of the Great Depression for the U.S. has been convincingly argued in Romer (1990); our data on equity markets and output in advanced and many emerging markets offers, together with sparse data on consumer durable spending from the League of Nations (various issues), broad support for this dating.

1. Decline and recovery: Per capita GDP levels

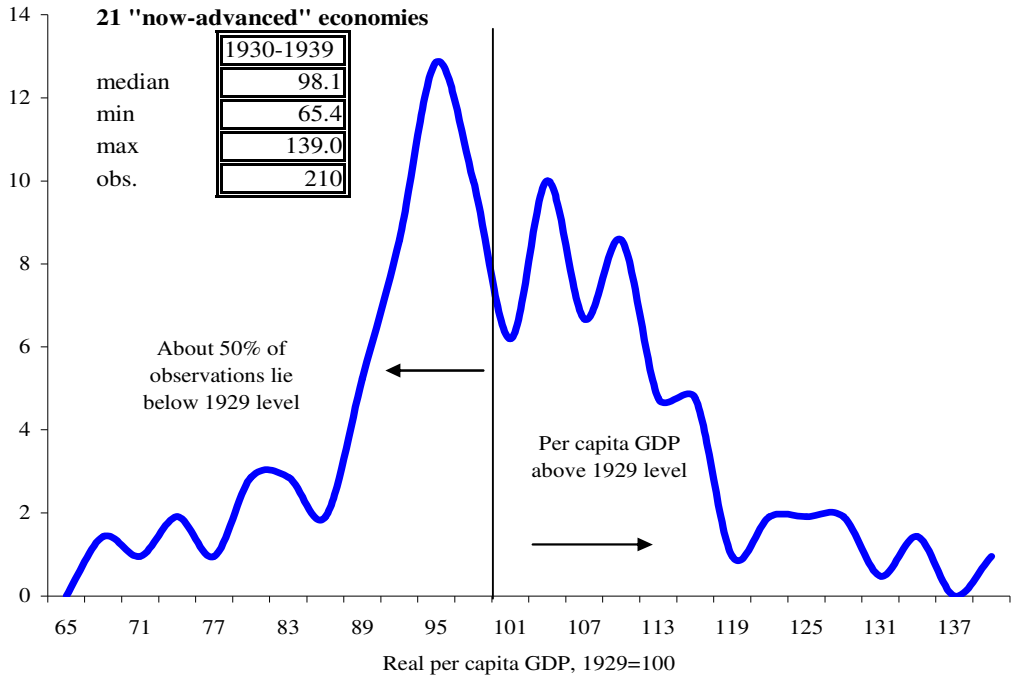
The top panel of Figure 9 plots the frequency distribution for an index that sets the level of real per capita GDP in 1929 equal to 100 for each country. There are a total of 210 annual observations for 21 "now-advanced" economies over the 10-year period 1930-1939.[17] The area under the curve to the left of the vertical line at 100 gives the share of observations for which GDP remained below its 1929 level. As the casual inspection of the chart reveals, about one half of the entries show income levels that are below that of 1929.

The bottom panel displays the same concept for the post-1973 oil shock. Not surprisingly, the stark collapse in income levels of the Depression is nowhere close to replicated in the less-than-spectacular 1970s. Less than 6 percent of the observations during 1974-1983 lie below the 1973 output level. The worst reading in post-1973 is 92.3 (a cumulative decline of about 8 percent) compared to 65.4 (a cumulative income collapse of about 35 percent). Median income levels were about 10 percent higher during the post-oil shock decade as compared to median income levels about 2 percent lower during the 1930s.

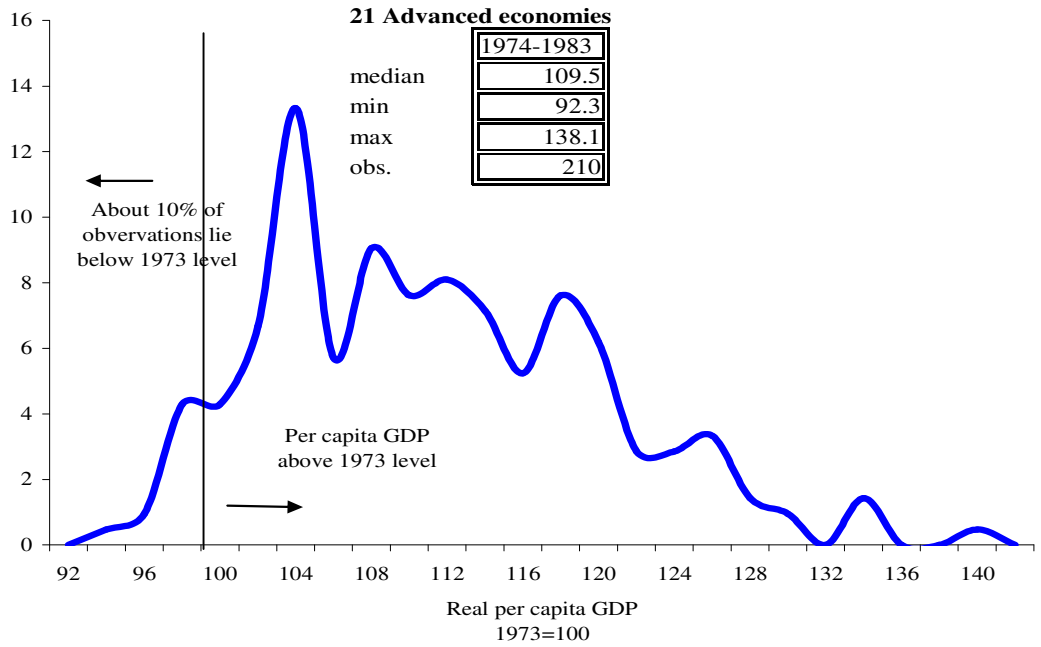
[17] This is the "advanced economy" category routinely used by the IMF, World Bank, OECD, etc. It is questionable in numerous cases whether countries several countries in that list would have classified as advanced in the pre-World War II era.

Figure 9. Levels of Real Per Capita GDP in the Twenty Years around Global Shocks:
The 1929 Crash and the 1973 Oil Shock

Probability density function, 1930-1939



Probability density function, 1974-1983



Sources: Maddison (2004 and webpage), Reinhart and Rogoff (2009), and authors' calculations.

2. Growth

A separate but related "cost of the crisis" is whether GDP growth following the crisis is comparable in the decades prior and following the crisis. This question is particularly pertinent to ongoing concerns about whether the post-subprime decade will be characterized by a "new-normal" associated with lower potential output growth for the advanced economies.[18]

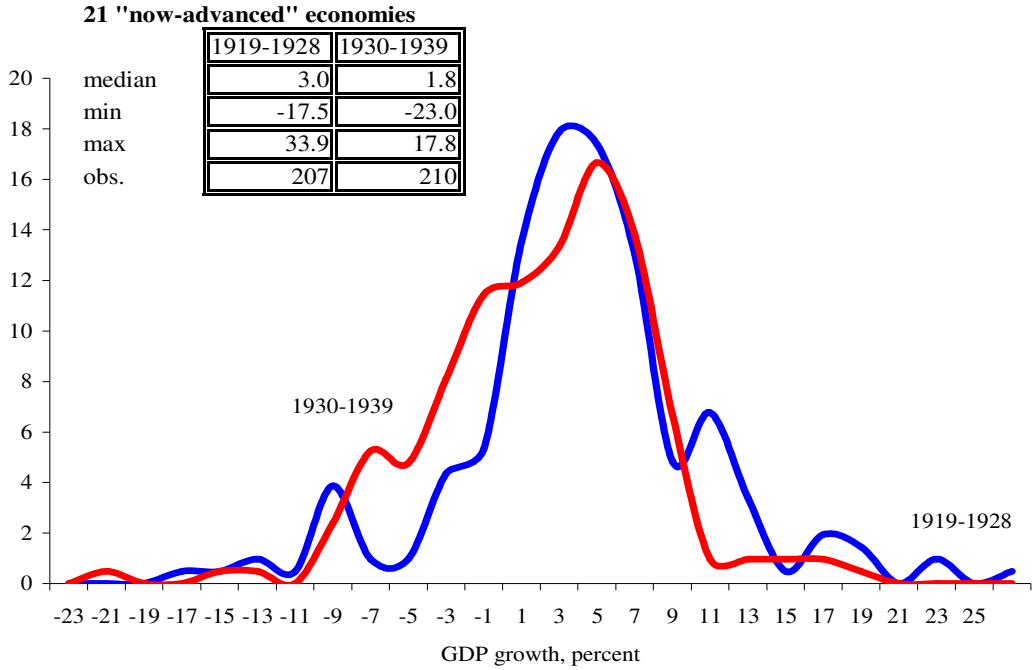
Figure 10 plots the marginal probability distributions (top panel) for the pre-crisis and the post-crisis decade. The inset provides basic descriptive statistics for the two distributions. The note at the bottom of the figure reports the Komolgorov-Smirnoff 1 percent critical value for the relevant number of observation and the K-S statistic. Adding to the precipitous output declines at the outset of the Great Depression, median growth rates for the entire decade of the 1930s for the advanced economies is 1.8 percent versus 3 percent for the 1920s.

The gap in pre-and post-1929 growth rates is even greater for the twenty emerging economies for which we have output data, with a median of 2.9 percent versus 0.7 percent in the 1930s (see Appendix Figure 1).

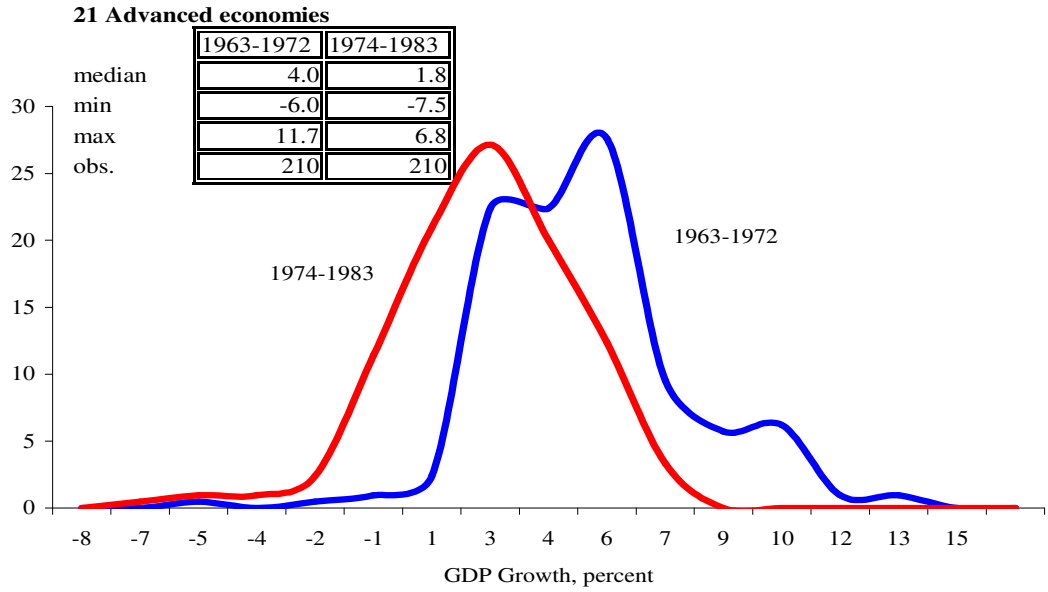
[18] El Erian (2008).

Figure 10. Real Per Capita GDP Growth in the Decade Before and the Decade After the Onset of the Great Depression, 1929 and the First Oil Shock, 1973

Probability density function, 1919-1939



Probability density function, 1963-1983



Sources: Maddison (2004 and webpage), Reinhart and Rogoff (2009), and authors' calculations.
Notes: The Kolmogorov-Smirnoff 1 percent critical value and the K-S statistic are: 7.98 and 15.5, respectively for the 1929 exercise(top panel) and 7.95 and 37.6 for 1973 comparison (bottom panel). If the K-S statistic is greater than the critical value we reject the null hypothesis that the observations are drawn from the same distribution.

The bottom panel of Figure 10 presents the comparable exercise for the 1973 oil shock. It is noteworthy that, despite the fact that income levels were higher for 94 percent of the observations and median income levels were about 10 percent higher, during 1974-1983 growth rates were significantly lower after the shock. Indeed, the slowdown in growth exceeds that of the Great Depression. For the advanced economies, median growth rates during 1974-1983 were about the same as the 1930s but these came off a far more robust growth performance (with a median of 4 percent) in the decade ending in 1972. There is a significant decline in the volatility of GDP growth for nearly all advanced economies versus the pre WWII sample.

V. Inflation

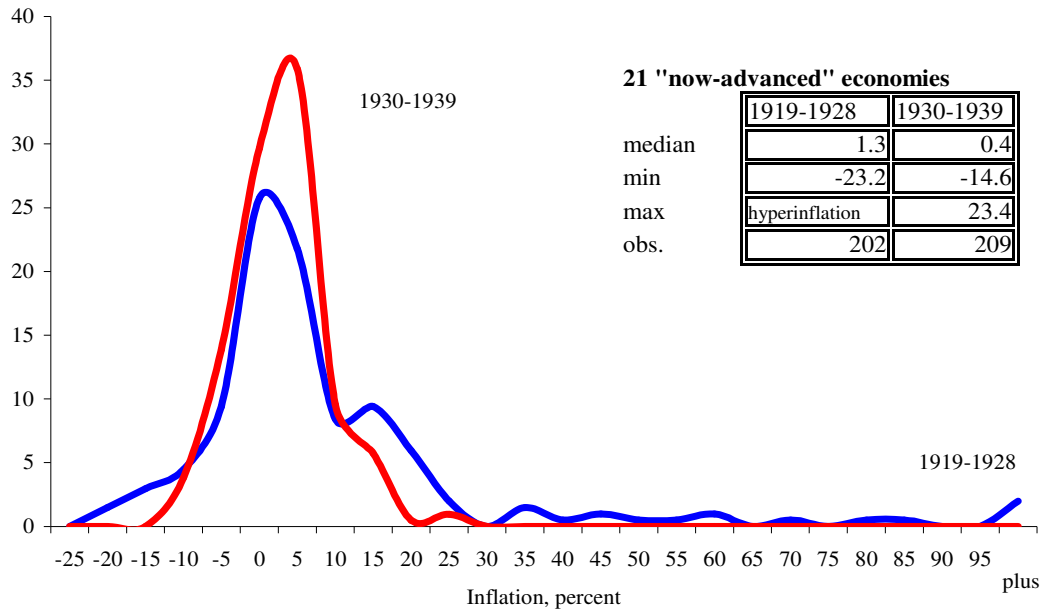
Thus far, we have shown that real per capita GDP growth has been consistently lower following the adverse shocks of: 1929, 1973, and fifteen country-specific financial crises. The more immediate output costs (in terms of declines in GDP levels during the first three years of the crisis, t+1 to t+3) were by far greatest for the Depression of the 1930s, followed by the 2007 crisis, followed by the fifteen post-World-War-II crises. The smallest declines were recorded in the wake of the 1973 oil shock. All these episodes, except the last one, involved a major domestic financial crisis and a boom-bust real estate and credit cycle of varying degrees. [19]

Applying our methods to the inflation data does not yield uniform results across these experiences. Figure 11 presents the familiar histograms comparing the decade prior

[19] We do not have complete time series for the depression episode to replicate our empirical exercises on housing and unemployment, but the League of Nations publications do provide a rich volume of cross-country information, so as to fit together this panorama (see Reinhart and Rogoff, 2009, Chapter 16). On credit prior to WWII also see Schularick and Taylor (2009).

Figure 11. Inflation in the Decade Before and the Decade After 1929 the Onset of the Great Depression, 1929 and the First Oil Shock, 1973

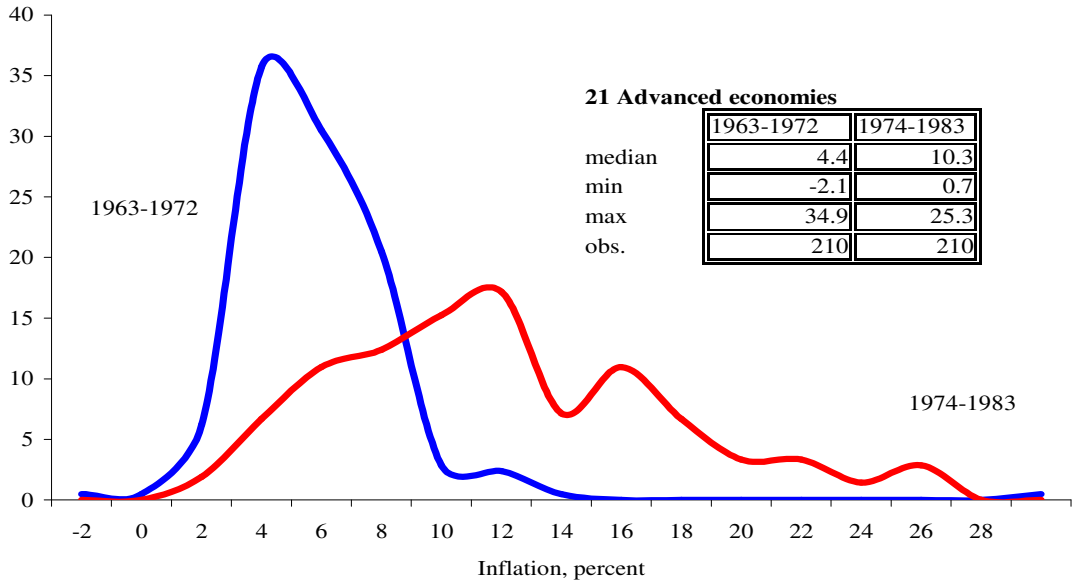
Probability density functions, 1919-1939



21 "now-advanced" economies

	1919-1928	1930-1939
median	1.3	0.4
min	-23.2	-14.6
max	hyperinflation	23.4
obs.	202	209

Probability density functions, 1963-1983



21 Advanced economies

	1963-1972	1974-1983
median	4.4	10.3
min	-2.1	0.7
max	34.9	25.3
obs.	210	210

Sources: *World Economic Outlook*, International Monetary Fund (various issues), Reinhart and Rogoff (2009), and authors' calculations.

Notes: The Kolmogorov-Smirnoff 1 percent critical value and the K-S statistic are: 8.05 and 18.06, respectively for the 1929 exercise(top panel) and 7.95 and 61.9 for 1973 comparison (bottom panel).If the K-S is greater than the critical value we reject the null hypothesis that the observations are drawn from the same distribution.

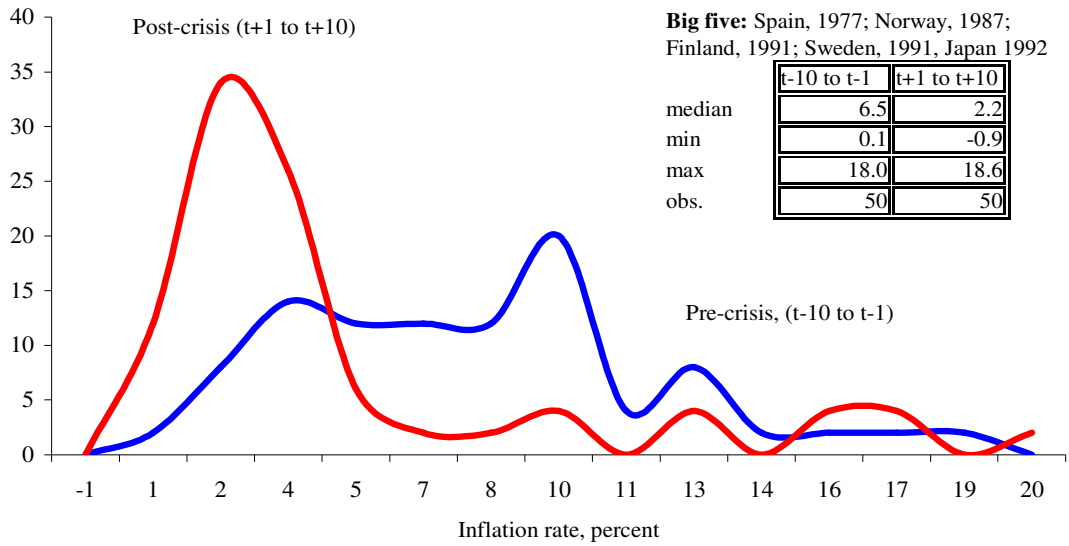
to the crises to the one that followed. The inflation performance difference between post-1929 and post-1973 could not be more disparate. There are no surprises here, as this inflation performance of these eras is well-known and documented. Median inflation falls to 0.4 percent after 1929. Indeed, nearly one-half of the observations for the 21 advanced economies during 1930-1939 record deflation. Turning to the oil shock, median inflation during 1963-1972, which was already high by historical standards, more than doubles to over 10 percent following the surge in oil prices. Deflation is not even part of this picture.

A less well-known stylized fact are the patterns documented in Figure 12, which plot the frequency distributions for the pre- and post-crisis decades inflation for the five advanced economy (top panel) and five Asian (bottom panel) crises. While the remaining five emerging market crises are not plotted here (descriptive statistics are provided in Appendix Table 1), this group also records a decline in inflation rates following the financial crises. In light of the considerable heterogeneity in monetary and fiscal policies adopted in response to the crisis the homogeneity of these results across the five advanced economies, five the emerging Asian economies, and the chronic and high inflation group (four Latin American countries and Turkey) this result is quite remarkable.[20] This is all the more remarkable considering that the emerging market countries all sustained massive devaluations/depreciations in their currencies at the height of the economic turmoil which extends into t+1.

[20] See Reinhart and Reinhart (2009) for an analysis of monetary and fiscal policy during the Depression. The study highlights the heterogeneity of the policy response across countries. See also Claessens et. al. (2010) and Laeven and Valencia (2010) for full description of the multifaceted policy responses to financial crises from the 1970s to the current episode.

Figure 12. Inflation in the Decade Before and the Decade After Severe Financial Crises: Post WWII, Advanced and Asian Economies

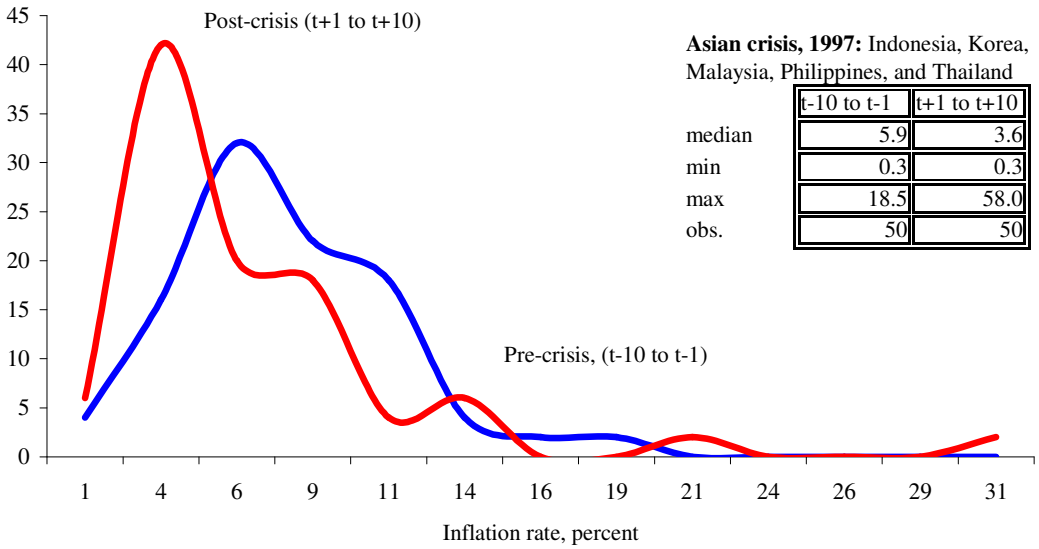
Probability density function, five advanced economies



Big five: Spain, 1977; Norway, 1987; Finland, 1991; Sweden, 1991, Japan 1992

	t-10 to t-1	t+1 to t+10
median	6.5	2.2
min	0.1	-0.9
max	18.0	18.6
obs.	50	50

Probability density function, five Asian economies



Asian crisis, 1997: Indonesia, Korea, Malaysia, Philippines, and Thailand

	t-10 to t-1	t+1 to t+10
median	5.9	3.6
min	0.3	0.3
max	18.5	58.0
obs.	50	50

Sources: *World Economic Outlook*, International Monetary Fund (various issues), Reinhart and Rogoff (2009), and authors' calculations.

Notes: The Kolmogorov-Smirnoff 1 percent critical value and the K-S statistic are: 16.3 and 48.0, respectively for the advanced exercise(top panel) and 16.3 and 28.0 for Asia comparison (bottom panel).

The post-crisis disinflation of these episodes does not match the extreme of the 1930s deflation, but it is equally significant (from a statistical and quantitative standpoint). [21] Thus, the exception on the inflation performance is the oil shock case, which also differs from the depression and the financial crisis episodes, in that there is no evidence of a credit boom-deleveraging cycle during the 21-year window around 1973. [22]

VI. Policy Reflections

Large destabilizing events, such as those analyzed here, evidently produce changes in the performance of key macroeconomic indicators over the longer term, well after the upheaval of the crisis is over. There is little good news to be found in the result that income growth tends to slow and unemployment remains elevated for a very long time after a severe shock. The human temptation to credit good fortune to good character and bad results to bad luck further complicates matters. A ubiquitous pattern in policy pitfalls has been to assume negative shocks are temporary, when these were, in fact, subsequently revealed to be permanent (or, at least, very persistent). Misperceptions can be costly when made by fiscal authorities who overestimate revenue prospects and central bankers who attempt to restore employment to an unattainably high level. Many past policy mistakes across the globe and over time can be traced to not recognizing in a timely basis that such changes have taken place.[23]

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[21] As shown in Figure 3 (inset), the median inflation rate for 1919-1928 for 21 advanced economies was 1.3—placing it at the doorstep of deflation.

[22] During 1963-1983 there is a secular rise in credit/GDP of modest magnitude in most advanced economies. These results are not reported here, but are available from the authors.

[23] Orphanides (2001) provides an exposition of a classic policy misperception—the Federal Reserve's failure to recognize the slowing of productivity after the oil shock.

What we observe, of course, is an association. Growth falls and the unemployment rate remains high after a severe economic dislocation. That observation, itself, is not informative as to the balance between changes in aggregate demand and aggregate supply.

The outcome could materialize as a consequence of the failure of policy makers to provide sufficient stimulus after a wrenching event in an economy where rigidities give ample scope to demand management. An important role for credit in supporting spending might imply that an associated collapse in financial intermediation lengthens and deepens the downturn (with the unavailability of credit serving as the propagating mechanism discussed in Bernanke, 1983). In such circumstances, slow growth might be a self-fulfilling prophecy produced by timid authorities who neither supported spending nor dealt with the capital-adequacy problems of key financial institutions.

Economic contraction and slow recovery might also feed back on the prospects for aggregate supply. A sustained stretch of below-trend investment and depreciation of human capital prompted by elevated and lengthy spells of unemployment could hit the level and growth rate of potential output. The unemployment rate stays high because it has been high, exhibiting hysteresis as described by Blanchard and Summers (1986).

The forcing mechanism for a reduction in aggregate supply might be policy itself. In adverse economic circumstances, political leaders sometimes grasp for quick fixes that impair, not improve, the situation. Included in the list of unfortunate interventions are restrictions on trade (both domestically and internationally), work rules and pay practices, and the flow of credit. The output effects of crises might be persistent because we make them so, in the manner posited for the Great Depression by Cole and Ohanian (2002).

Or, changed prospects after a crisis might reflect the correction of outsized expectations that fed the prior boom. If, for instance, investors grossly overestimated the possibilities for productivity improvement from a new technology, they might bid up asset prices, borrow against future anticipated income, and invest in myriad capital projects in an unsustainable manner. Chancellor (2000) casts many episodes of financial euphoria and ensuing crash over the centuries in exactly this sequence, from the diving bell, through the steam engine, to the radio, and thereafter. Spending advances rapidly on hope, and, on reality, contracts, and then recovers only slowly. Recent discussions about the "new normal" in reference to the post-crisis landscape leave the impression that the pre-crisis environment ***was*** "normal." In fact, there are reasons to believe that the pre-crisis decade set a high-water mark distorted by a variety of forces. We have presented evidence here that many of those patterns are reversed not only in the immediate vicinity of the crisis, (as Reinhart and Rogoff, 2009 show), but also over longer horizons that span several years.[24]

For whatever the initiating change, the real interest rate consistent with full employment of resources presumably falls as a consequence of slower economic growth. The logic is that households need less inducement to defer consumption when future consumption prospects are bleaker. In addition to the fall-out of a lower real interest rate on asset prices, monetary policy makers need to reconsider the benefits of an inflation buffer to protect from the zero lower bound to nominal interest rates. If real GDP growth has permanently tilted down as a consequence of a severe economic dislocation, or at least has done so in a time frame measured by decades, fiscal authorities face lower

[24] This also fits the pattern of adjustment after an inflow of foreign capital, or what Reinhart and Reinhart (2008) refer to as a "capital flow bonanza."

prospects for revenue and higher pressure on outlays. Similarly, the apportioning of the current budget stance into its cyclical and structural components will shift with changes in the level and rate of growth of potential output.

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Appendix: Data and Methodology

Unless otherwise noted, the pre- and post-crises decades (which forms a 21-year window centered on the crisis year) in our analysis are those defined in Table 1. Any departure from this coverage owes to lack of data and is noted accordingly.

Statistical analysis

The first benchmark exercise is to pool the data across countries into two groups, the pre-crisis decade (t-10 to t-1) and the post crisis period (t+1 to t+10). The probability distributions (marginal and cumulative) are tabulated enabling simple comparisons for per capita GDP growth, unemployment and inflation through standard statistical tests, such as the Kolmogorov-Smirnoff (K-S) for the pre-and post-crisis decades. The null hypothesis of the K-S test is that the observations for the two sub-periods are drawn from a common population.

The second type of exercise, applied to the level of real per capita GDP and real housing prices examines the marginal and cumulative probability distribution of these time series during (t+1 to t+10) relative to the benchmark level at the time of (T) or just prior (t-1) to the crisis. These calculations are informative on two grounds: first, it provides a glimpse into the duration of the shock, if there is a high share of observations below the initial level; second, it is also informative as to the magnitude of the initial decline or collapse in the series, as the 1929 and 1973 comparisons discussed in the following section make plain.

Third, to examine the cycle in credit, external debt, and real housing prices, we calculate on a country-by-country and (importantly) series-by-series basis the peak-to-trough calculations, as in Reinhart and Rogoff (2009). The calculations facilitate an

assessment the amplitude and duration of upswings and downturns in the cycle of the indicator in question. The dating of these cycle turning points also facilitates comparisons across markets and indicators, as even when we have a well-grounded dating system for recessions and recoveries (for example that of the National Bureau of Economic Research for the United States) synchronicity in cycles across sectors and indicators is not the norm.

This approach to the comparisons of the pre and post-crisis landscape is not without limitations. A pure before- and after-crisis comparison with a ten-year window is bound to be clouded by other important events that influence economic outcomes in such a long horizon before or after the crisis. At the individual country analysis comparable issues arise. For the five advanced economy episodes and the five Asian crisis episodes it is reasonable to state that the pre-crisis decade was one of relative "economic tranquility" and even prosperity. For the four Latin American and the Turkish crises listed in Table 1 a comparable statement cannot be made. Chile was mired in economic and political turmoil in the mid-1970s (the half point in the t-10 to t-1 window), while Argentina, Mexico and Turkey grappled with high (three-digit) inflation rates in the decade prior to the respective crises studied here. The 1919-1928 window prior to the 1928 crash captures the immediate aftermath of war while the tail end of the 1930-1939 episode capture the preparation for the next war.[25] The post-1973 oil shock sample includes another major subsequent shock.

[25] This is most evident in the GDP and particularly unemployment data for Germany and Japan.

Even a twenty-one-year window may not fully cover the very long debt and credit cycles.[26] The build-up in debt in Japan (among others) prior to the onset of the banking crisis in 1992 pre dates the ten-year window beginning. The post-crisis deleveraging (domestic and external debts) in countries like Chile (1981) and Indonesia (1997) lasted past the 10-year benchmarks of 1991 and 2007, respectively.[27]

Some crises begin early in the calendar year while others begin much later; in the later case, the year t+1 may also reasonably classify as a crisis year. To deal with these cases, perform sensitivity analysis that compares (t-10 to t-1) to (t+2 to t+11). Unless otherwise noted, these results not are appreciably different from the core exercise described above.

Data and country coverage

The primary time series we cover in our analysis are per-capita GDP levels and rates of growth, unemployment rates, inflation, real housing prices, domestic bank credit/GDP, external debt/GDP, and real housing prices. The coverage is not uniform across countries for all the episodes in question, so particulars are given for each exercise. The greatest amount of detail is provided for the fifteen individual crises episodes listed in Table 1 and for the 2007 crisis case. For the global episodes, the data covers 21 or 22 advanced economies, listed already in the Introduction, and 20 emerging markets for the Great Depression episodes and 49 emerging markets.

[26] See Reinhart and Rogoff (2010) , Reinhart (2010) and Schularick and Taylor (2009) for a documentation of these "long cycles."
[27] Table 3 provides sufficient information to pinpoint which cycles exceeded the time-frame boundaries imposed in this study.

Appendix Table 1. Summary of Pre- and Post-Crisis Descriptive Statistics and Kolmogorov-Smirnoff Test Results

Episode and sample	Median	Minimum	Maximum	K-S Statisitic	1% critical values
Pre- and post- 1929 comparisons of real per capita GDP growth					
21 "Now-advanced" Economies					
1919-1928	3.0	-17.5	33.9		
1930-1939	1.8	23.0	17.8	15.5	7.98
20 Emerging Economies					
1919-1928	2.9	-15.2	27.7		
1930-1939	0.7	-22.5	34.7	12.2	7.72
Pre- and post- 1973 oil shock comparisons of real per capita GDP growth					
21 Advanced Economies					
1963-1972	4.0	-6.0	11.7		
1974-1983	1.8	-7.5	6.5	37.6	7.95
48 Emerging Economies					
1963-1972	3.0	-18.0	27.0		
1974-1983	2.2	-37.2	14.7	14.6	5.26
Pre-(t-10 to t-1) and post-(t+1 to t+10) severe post WWII financial crisis					
Advanced economies, the Big Five					
Comparisons of real per capita GDP growth					
t-10 to t-1	3.1	-0.7	7.9		
t+1 to t+10	2.1	-4.3	5.9	28.0	16.3
Comparisons of the unemployment rate					
t-10 to t-1	2.7	1.1	6.1		
t+1 to t+10	7.9	2.5	21.2	68.0	16.3
Five Asian crisis, 1997episodes					
Comparisons of real per capita GDP growth					
t-10 to t-1	6.6	-2.8	11.7		
t+1 to t+10	3.8	-14.4	8.7	54.0	16.3
Comparisons of the unemployment rate					
t-10 to t-1	2.9	1.1	9.8		
t+1 to t+10	3.7	1.4	11.8	35.06	16.55
All countries					
Comparisons of real per capita GDP growth					
t-10 to t-1	3.8	-14.4	11.7		
t+1 to t+10	3.2	-15.1	8.7	18.61	9.51
Comparisons of the unemployment rate					
t-10 to t-1	3.7	1.1	18.7		
t+1 to t+10	7.8	1.4	21.3		

Sources: See Data Appendix for sources and the countries included in the 1929 and 1973 comparisons. The fifteen post-WWII crisis episodes are listed throughout the paper.

Appendix Table 2: Data Coverage

Country	Real housing prices End date	Domestic Credit End date	Gross external debt Full period	Real per capita GDP through 2010. Start date
2007 crisis analysis, latest observation				
Austria	2010:Q1	2010:M5	2003:Q4-2010:Q1	1918
Belgium	2009:Q4	2010:M5	2003:Q4-2010:Q1	1918
Denmark	2010:Q1	2009:M8	2003:Q1-2009:Q4	1918
Finland	2010:Q1	2010:M5	2002:Q1-2010:Q1	1918
France	2010:Q1	2010:M5	2002:Q4-2010:Q1	1918
Germany	2010:M6	2010:M5	2001:Q4-2010:Q1	1918
Greece	2010:Q1	2010:M5	2003:Q2-2010:Q1	1918
Iceland	2010:M6	2008:M8	1923-2010:Q1	1918
Ireland	2010:Q1	2010:M5	2002:Q4-2010:Q1	1921
Italy	2009:H1	2010:M5	2001:Q4-2010:Q1	1918
Japan	2010:M4	2009:M5	2003:Q1-2010:Q1	1918
Netherlands	2010:M6	2010:M5	2003:Q2-2010:Q1	1918
Norway	2010:M6	2008:M12	2003:Q4-2010:Q1	1918
Portugal	2010:Q1	2010:M5	2003:Q3-2010:Q1	1918
Spain	2010:M6	2010:M5	2002:Q4-2009:Q4	1918
Sweden	2010:Q1	2009:M8	2003:Q3-2010:Q1	1918
Switzerland	2010:Q1	2010:M4	1999:Q4-2010:Q1	1918
United Kingdom	2010:M6	2010:M5	2003:Q1-2010:Q1	1918
United States	2010:Q1	2009:Q4	2009:Q3-2010:Q1	1918
Net private debt		2010:Q1		
fifteen severe financial crisis episodes availability before and after crisis dates				
Argentina, 2001	1981-2007	1960-2008:12	1970-2010:Q1	1918
Chile, 1981	n.a.	1960-2009:6	1970-2010:Q1	1918
Colombia, 1998	1997:Q1-2008:Q4	1948-2009:8	1970-2010:Q1	1918
Finland, 1991	1970-2010:Q1	1948-2010:5	n.a.	1918
Indonesia, 1997	1994:Q1-2010:Q1	1969-2009:8	1970-2010:Q1	1918
Japan, 1992	1955:H1-2010:M5	1953-2009:M5	n.a.	1918
Korea, 1997	1986:M1-2010:M3	1951-2009:M9	1970-2010:Q1	1918
Malaysia, 1997	1988-2009:Q4	1959-2009:M4	1970-2010:Q1	1918
Mexico, 1994	n.a.	1948-2009:M8	1970-2010:Q1	1918
Norway, 1991	1970-2010:M6	1948-2008:M12	n.a.	1918
Philippines. 1997	1994:Q1-2010:Q1	1948-2008:M2	1970-2010:Q1	1918
Spain, 1977	1970-2010:M6	1952-2010:5	n.a.	1918
Sweden, 1991	1970-2010:Q1	1948-2009:M8	n.a.	1918
Thailand, 1997	1991:Q1-2010:Q1	1948-2009:M8	1970-2010:Q1	1950
Turkey, 2001	n.a.	1949-2009:7	1970-2010:Q1	1923

Notes: Inflation is available for all the countries listed above for the full sample covering the Great Depression through 2010.
The ***advanced economy group*** for the 1929 and 1973 comparisons is comprised of Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and the United States. The 2007 analysis also includes Iceland. The 20 ***emerging markets*** in the 1929 comparison are: Argentina, Brazil, Chile, Colombia, Costa Rica, El Salvador, Guatemala, Honduras, India, Indonesia, Korea, Malaysia, Mexico, Nicaragua, Peru, Philippines, Sri Lanka, Turkey, Uruguay, and Venezuela. In addition to these, the subsequent comparisons include another 28 emerging markets that make up the Reinhart and Rogoff (2009) sample.