Crunches and busts

SUMMARY

We provide a comprehensive empirical characterization of the linkages between key macroeconomic and financial variables around business and financial cycles, for 21 OECD countries over the period 1960–2007. In particular, we analyse the implications of 122 recessions, 113 (28) credit contraction (crunch) episodes, 114 (28) episodes of house price declines (busts), 245 (61) episodes of equity price declines (busts), and their various overlaps in these countries, over the sample period. Our results indicate that the interactions between macro-economic and financial variables can play a major role in determining the severity and duration of a recession. Specifically, we find evidence that recessions associated with credit crunches and house price busts tend to be deeper and longer than other recessions.

— Stijn Claessens, M. Ayhan Kose and Marco E. Terrones

What happens during recessions, crunches and busts?

Stijn Claessens, M. Ayhan Kose and Marco E. Terrones

International Monetary Fund

'… recessions that follow swings in asset prices are *not* necessarily longer, deeper, and associated with a greater fall in output and investment than other recessions…' (Roger W. Ferguson, Vice Chairman of the Federal Reserve Board, January 2005)

'The massive downturn in the US economy will *last longer and be more damaging* than previous recessions because it is driven by an unprecedented loss of household wealth.' (Martin Feldstein, Member of the NBER Business Cycle Dating Committee, February 2009)

1. INTRODUCTION

The financial crisis that started in the United States in 2007 has spread quickly to a number of advanced and emerging countries and transformed into the most severe global financial crisis since the Great Depression. The crisis has been

accompanied by an intense debate over its impact on the broader economy. The spillovers to the real economy have been severe, with almost all advanced economies in recession for several quarters and the global economy suffering its worst decline in output since World War II.

These developments have highlighted a number of questions about the linkages between the real economy and the financial sector during recessions. Two questions often raised in this context are: How do macroeconomic and financial variables behave around recessions, credit crunches and asset (house and equity) price busts? And, are recessions associated with credit crunches and asset price busts different than other recessions? These two questions are pertinent to the current recession, since the episodes following the crisis coincide with credit crunches, and house and equity price busts in many countries. In order to address these questions, we provide a comprehensive empirical characterization of the linkages between key macroeconomic and financial variables around business and financial cycles for 21 OECD countries over the 1960–2007 period.

We identify turning points in these variables using standard business cycle dating methods. We document 122 recessions, 113 credit contractions, 114 house price declines, and 245 equity price declines for these countries over the sample period. When recessions, credit contractions, house price and equity price declines fall into the top quartiles of all recessions, contractions and declines, we define them as severe recessions, credit crunches and house price and equity price busts. First, we analyse the characteristics of these events – in terms of duration and severity – and the behaviour of major macroeconomic and financial variables around the events. Next, we document the coincidence of recessions and credit crunches or asset price busts, and analyse the implications of recessions associated with crunches and busts. We conduct a formal analysis of the special roles played by financial market conditions in affecting the depth of a recession.

Our study contributes to the large body of research analysing the roles played by financial variables in explaining fluctuations in economic activity. Financial and macroeconomic variables interact closely, through wealth and substitution effects, and through their impacts on firms' and households' balance sheets (e.g. Blanchard and Fischer, 1989; Obstfeld and Rogoff, 1999). In particular, asset prices can influence consumption through their effect on household wealth, and can affect investment by altering a firm's net worth and the market value of the capital stock relative to its replacement value. Perhaps more importantly, the interactions between the financial sector and the real economy can be amplified by the financial accelerator and related mechanisms. According to these mechanisms, an increase (decrease) in asset prices improves a firm's (or household's) net worth, enhancing (reducing) its capacities to borrow, invest and spend. This process, in turn, can lead to further increases (decreases) in asset prices and can have general equilibrium effects. Seminal models with these dynamics include Bernanke and Gertler (1989) and Kiyotaki and Moore (1997).

Several empirical – both macro- and microeconomic – studies provide evidence of these effects. There is a large empirical literature analysing the dynamics of business cycles, asset price fluctuations and credit cycles (Bernanke and Gertler, 1989; Borio *et al.*, 2001), including studies based on micro data (banks or corporations) (Bernanke *et al.*, 1996; Kashyap and Stein, 2000). However, this literature focuses mainly on the general procyclicality of financial and macroeconomic variables, and less on how interactions between financial and real economic variables vary during recessions, which is the focus of our paper.

We contribute also to a branch of the literature on business cycles which aims to identify the turning points in macroeconomic and financial variables using various methodologies. The classical methodology of dating business cycles applied here dates back to Burns and Mitchell (1946). It has been used widely over the years (Harding and Pagan, 2006) to study recessions, but only a few studies have conducted cross-country analyses of cycles in asset prices identified by this method.[1]

Thus, although the roles played by financial variables in business cycles have received much attention, most studies consider the topics of business cycle, credit and asset prices independently (or in isolation). Furthermore, the links between real and financial variables during recessions have yet to be analysed using a comprehensive dataset of a large number of countries over a long period. Apart from analyses limited to a small number of cases and some other 'case-type' studies of individual episodes, and a group of studies that focuses specifically on the behaviour of real and financial variables surrounding financial crises, notably Reinhart and Rogoff (2008, 2009), to the best of our knowledge, there is no comprehensive empirical analysis of these links.[2]

Our paper thus fills three gaps in the literature. First, we learn about the implications of episodes of recessions, credit crunches, and house and equity price busts based on a sizeable set of macroeconomic and financial variables for a large number of countries over a long period of time. Second, our study is the first detailed, cross-country empirical analysis addressing the implications of a recession coinciding with certain types of financial market difficulties. Third, it provides the first set of empirical evidence suggesting that changes in house prices are closely associated with the costs of recessions.

The paper is structured as follows. Section 2 presents our data and methodology. Section 3 examines the basic characteristics of recessions and credit contraction (and crunch) episodes, and asset price declines (and busts). Section 4 studies the implications of recessions associated with crunches and asset price busts and, in Section 5, we provide a brief discussion of the changes in policy variables during various episodes of recession, crunch and bust. Section 6 presents a more formal

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[1] Exceptions are Helbling and Terrones (2003), which examines the implications of asset price booms and busts for a large set of industrial countries, and Borio and McGuire (2004) and Pagan and Sossounov (2003).

[2] Ferguson (2005), writing in the aftermath of the collapse of the internet bubble, considers three episodes of rapid asset price increases and credit expansions, followed by subsequent recessions: the United Kingdom in 1974, Japan in 1992, and the United States in 2001.

analysis of the roles played by financial factors in determining the cost of recessions, using some simple regression models. Section 7 concludes.

2. DATA AND METHODOLOGY

2.1. Data

We constructed a comprehensive database of macroeconomic and financial variables for 21 OECD countries over the period 1960:1–2007:4, based on IMF International Financial Statistics (IFS) and OECD Analytical Databases.[3] Our analysis focuses on the following macroeconomic variables: output, consumption, investment (of which separate residential and non-residential investment), industrial production, exports, imports, net exports, current account balance, and rates of unemployment and inflation. The quarterly time series of macroeconomic variables are seasonally adjusted, whenever necessary, and are in constant prices.

The financial variables we consider are credit, house prices, and equity prices. Credit series are from the IFS, Datastream and Haver and defined as claims on the private sector by deposit money banks.[4] These series were used in earlier cross-country studies on credit dynamics (Mendoza and Terrones, 2008).[5] The main sources for house prices are the OECD and the Bank for International Settlements (BIS).[6] Equity price indices are from the IFS. All financial variables are converted into real terms using their respective consumer price indexes (CPI).

The 'policy' variables we focus on are (real) government consumption as a proxy for fiscal policy, and short-term interest rates as a proxy for monetary policy. The data on government consumption are from the OECD Analytical Database, and short-term interest rates are from the IFS. We consider both nominal and real

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[3] The countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Switzerland, Sweden, the United Kingdom, and the United States.

[4] Information on the composition of credit by both borrower type (i.e. business and household) and maturity (i.e. short-term consumer lending vs. mortgage lending) would greatly enrich the analysis. Unfortunately, such disaggregated credit series are not available for a large number of countries over our sample period. Similarly, while the extent of credit market problems can be measured using various interest rates, spreads, surveys of senior lending officers, and the various financial conditions indices produced by private and public institutions, these measures are not available for most of the countries studied over our long sample period. For a smaller set of countries, Duygan-Bump and Grant (2009) provide an analysis of the dynamics of household debt using the European Community Household Panel.

[5] Some recent papers examine the behaviour of aggregate credit measures during the ongoing crisis in the US (see Chari *et al.*, 2008; Cohen-Cole *et al.*, 2008). These studies show that it is important to go beyond aggregate measures. However, this is extremely difficult, if not impossible, in the context of our large cross-country coverage.

[6] The BIS, our main data source for the house price series, puts considerable effort into producing these data which, typically, are obtained from national authorities and are comparable across countries. The series reflect nationwide trends in the majority of cases, but for some countries are based on price trends in the largest cities. The house price data we have are not of the Case-Shiller type (i.e. corrected for quality and repeated sales) since such series simply do not exist for most of the countries in our sample. Also, more importantly, there are drawbacks to Case-Shiller type data as they cover a smaller set of housing wealth while giving larger weight to distressed sales such as subprime sales, and to jumbo sales in a narrow set of states (see Calomiris, 2008). The house price series we employ were used in a number of earlier cross-country studies (e.g. Terrones, 2004; Cardarelli *et al.*, 2008; Organization for Economic Cooperation and Development, 2005).

(deflated using the (*ex-post*) CPI series) short-term rates. Details on the sources and definitions of all our variables are contained in the Appendix.

2.2. Methodology

Much research has been devoted to the definition and measurement of business cycles, and various approaches have been proposed (Harding and Pagan, 2006). Our study is based on the 'classical' definition of a business cycle – mainly because of its simplicity, but also because it constitutes the guiding principle of the National Bureau of Economic Research (NBER) in determining the turning points of US business cycles. This definition goes back to the pioneering work of Burns and Mitchell (1946) who laid the methodological foundation for the analysis of business cycles in the US (see further Claessens *et al.*, 2008).

They define a cycle as 'consist[ing] of expansions occurring at about the same time in many economic activities, followed by similar general recessions, contractions, and revivals which merge into the expansion phase of the next cycle; this sequence of changes is recurrent but not periodic; in duration, business cycles vary from more than one year to ten or twelve years.' Following the spirit of their characterization of a business cycle, the NBER (2001) defines a recession as 'a significant decline in activity spread across the economy, lasting more than a few months, visible in industrial production, employment, real income, and wholesale-retail trade.' A recession begins just after the economy reaches a peak of activity and ends as the economy reaches its trough.'[7]

The classical methodology focuses on changes in levels of economic activity. An alternative methodology would be to consider how economic activity fluctuates around a trend, and then to identify a 'growth cycle' as a deviation from this trend (Stock and Watson, 1999). The classical methodology, however, is more useful for our purpose since we are interested in business cycles in OECD countries where growth rates have been relatively low. This implies that growth recessions can be small in size and frequent, while level recessions are more pronounced, but less frequent (Morsink, Helbling and Tokarick, 2002). The classical methodology also provides for a well-defined set of cycles, rather than having to consider how they depend on the specific detrending method used.[8] The turning points identified by using the classical methodology are robust to the inclusion of newly available data: in other methodologies new data can affect the estimated trend and thus the identification of a growth cycle.

[7] Our approach parallels that of the CEPR whose definition of a recession for determining the chronology of the euro area business cycle is similar to that of the NBER. However, there are some differences; e.g. unlike the NBER, which focuses on monthly data, the CEPR dates episodes in quarters. Moreover, in addition to aggregate euro area statistics, the CEPR also examines individual country statistics to assess whether expansions or recessions are widespread.

[8] Alternative methodologies for analysing the features of business cycles are relevant if the particular interest is in studying cyclical deviations from a trend, i.e. growth cycles. However, in that case, the results depend very much on the choice of the detrending methodology (see Canova, 1998). Several studies document the features of business fluctuations using the methodology of growth cycles (see Backus *et al.*, 1995).

We employ the algorithm introduced by Harding and Pagan (2002a), which extends the so-called BB algorithm developed by Bry and Boschan (1971), to identify the turning points in the *log-level* of a series.[9] We search for maxima and minima over a given period of time. Then, we select pairs of adjacent, locally absolute maxima and minima that meet certain censoring rules, requiring a certain minimal duration for cycles and phases. In particular, the algorithm requires the durations of a complete cycle, and of each phase to be at least five quarters and two quarters, respectively. Specifically, a peak in a quarterly series y_t occurs at time t if:

$$\{[(y_t - y_{t-2}) > 0, (y_t - y_{t-1}) > 0] \; and \; [(y_{t+2} - y_t) < 0, (y_{t+1} - y_t) < 0]\}.$$

Similarly, a cyclical trough occurs at time t if:

$$\{[(y_t - y_{t-2}) < 0, (y_t - y_{t-1}) < 0] \; and \; [(y_{t+2} - y_t) > 0, (y_{t+1} - y_t) > 0]\}.$$

We can then define a complete cycle from one peak to the next with two phases, the contraction phase (from peak to trough) and the expansion phase (from trough to peak). We use the same approach to determine output and in the financial series cycles.[10] Our main macroeconomic variable is output (GDP) which provides the broadest measure of economic activity. We also look at cycles in other macroeconomic variables, including consumption and investment. In terms of financial variables, we consider cycles in credit, house prices and equity prices.

The main characteristics of cyclical phases are their duration and amplitude. Since we are mainly interested in examining contractions, we define these characteristics for contractions only. The duration of a contraction, D^c, is the number of quarters, k, between a peak and the next trough. The amplitude of a contraction, A^c, measures the change in y_t from a peak (y_0) to the next trough (y_k), i.e. $A^c = y_k - y_0$. For output, we consider another widely used measure, cumulative loss, which combines information on duration and amplitude to proxy for the overall cost of a contraction. The cumulative loss, F^c, during a contraction, with duration k, is defined as:

$$F^c = \sum_{j=1}^{k} (y_j - y_0) - \frac{A^c}{2}.$$

We further classify recessions based on the extent of decline in output. In particular, we call recessions mild or severe if the peak-to-trough output drop falls within the bottom or top quartile respectively of all output drops. Similarly, a credit crunch is defined as a peak-to-trough contraction in credit which falls within the

top quartile of all credit contractions.[11] Likewise, an equity (or house) price bust is defined as a peak-to-trough decline which falls within the top quartile of all price declines. We identify 122 output recessions (30 of which are severe), 113 credit contractions (28 crunches), 114 declines (28 busts) in house prices, and 245 declines (61 busts) in equity prices.

We apply a simple 'dating' rule for whether or not a specific recession is associated with a credit crunch or an asset price bust. If a recession episode starts at the same time as or after the start of an ongoing credit crunch or asset price bust, then we consider the recession to be associated with the respective crunch or bust. By definition, this rule describes a 'timing' association (or coincidence) between the two events, but does not imply a causal link.

Among the events we analyse, there is considerable overlap: 21, 33 and 47 recession episodes are associated with credit crunches, house price busts and equity price busts respectively (Figure 1).[12] In other words, in about one in six recessions, there is also a credit crunch underway, and in about one in four recessions, a house price bust is underway. Equity price busts overlap about one-third of the recession episode.
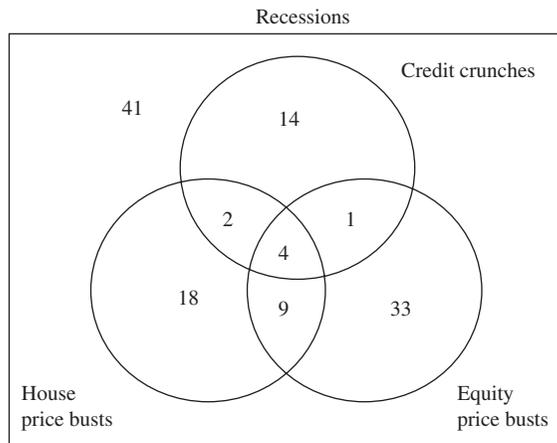
Figure 1. Associations between recessions, crunches and busts (number of events in each event category)

Notes: The rectangle shows the distribution of 122 recession episodes in the sample into those associated with crunches and busts (81) and those associated with none (41). Of 122 recessions, 21 are associated with credit crunches, 33 with house price busts, and 47 with equity price busts. 41 recessions are associated with neither a crunch nor a bust episode.

[11] We rely on changes in the volume of (real) credit to identify episodes of credit crunch. Crunches are often defined as an excessive decline in the supply of credit that cannot be explained by cyclical changes in demand (see Bernanke and Lown, 1991). It is difficult, however, to separate the roles played by demand and supply factors in credit. An alternative methodology to identify credit crunch episodes would be to consider prices measures, i.e. track changes in interest rates over time. However, data limitations do not allow us to employ such measures.

[12] Although we have only 28 episodes of housing busts, there are 34 recessions associated with housing busts. This is because housing busts last much longer than do recessions, and some housing busts are associated with multiple recessions (6 busts with 2, and 2 busts with 3 recessions each).

Our algorithm replicates the dates of US business cycles as determined by the NBER. According to the NBER, the US experienced seven recessions over the 1960–2007 period. Our algorithm provides exact matches for four out of these seven peak and trough dates and is only a quarter early in dating the remaining peaks and troughs.[13] The main features of our business cycles are quite similar as well. The average duration of US business cycles based on our turning points is the same as that reported by the NBER. In addition, the average peak-to-trough decline in output during US recessions is about −1.7% based on our dates and −1.4% based on NBER dates.

3. RECESSIONS, CREDIT CONTRACTIONS AND ASSET PRICE DECLINES

3.1. Basic features of a recession: duration and cost

Table 1 presents the main characteristics of the recessions in the countries in our sample. Throughout this paper, we most often focus on medians because they are less affected by the presence of outliers in our sample. Wherever relevant, however, we refer also to averages. A typical OECD country experienced about five recessions over the 1960–2007 period. There is no apparent pattern to the number of recessions across countries, although some countries stand out. For example, Canada, Ireland, Japan, Norway and Sweden experienced only three recessions during this period, while Italy and Switzerland suffered nine, and New Zealand twelve, the highest number.[14] A typical recession lasts about four quarters (one year) with the shortest recession (by definition) two quarters and the longest thirteen quarters. Roughly one-third of all recessions are short with only two quarters. The proportion of time spent in recession, defined as the fraction of quarters the economy is in recession over the full sample period with only completed cycles, is typically about 20%.

The median (average) decline in output from peak to trough, the recession's amplitude, is about 1.9% (2.6%). It ranges from about 1% for the typical recession in Austria, Belgium, Ireland and Spain to around 6% for recessions in Greece and New Zealand. The cumulative loss for a typical (median) recession is about 3%, but the average loss is about 6.4% since the distribution is skewed to the right (on average, there is a positive correlation (0.34) between duration and amplitude). This also shows that overall loss can differ quite widely from amplitude since durations vary. Country examples illustrate this difference further. For example, while the

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[13] These differences stem from the fact that the NBER uses monthly data for various activity indicators (including industrial production, employment, personal income net of transfer payments, and volume of sales from the manufacturing and wholesale retail sectors), whereas we use only quarterly output series to identify cyclical turning points.

[14] New Zealand experiences many recessions primarily because due to its highly volatile output and large exposure to terms-of-trade shocks. Consistent with this, for New Zealand, the number of recessions in other variables, including consumption, investment and industrial production, is also quite high. The business cycles we report for New Zealand are largely consistent with those reported in Morsink *et al.* (2002) which documents seven recessions over the 1973–2000 period. Hall and McDermott (2006), using unpublished output data, identify nine recessions during the 1946:1-2005:4 period.

Table 1. Recessions: summary statistics

Country	All recessions					Severe recessions			
	Number of recessions	Duration	Proportion of time in recession	Amplitude	Cumulative loss	Number of severe recessions	Duration	Amplitude	Cumulative loss
G-7									
Canada	3	4.00	0.27	−2.84	−6.45	2	5.00	−4.13	−9.50
France	4	3.50	0.12	−1.27	−2.57	–	–	–	–
Germany	8	3.25	0.17	−1.41	−2.56	1	4.00	−3.37	−4.90
Italy	9	3.11	0.17	−1.34	−2.67	1	3.00	−3.84	−7.94
Japan	3	4.67	0.40	−2.38	−7.39	1	8.00	−3.35	−15.38
United Kingdom	5	4.20	0.17	−3.11	−8.44	2	5.00	−4.77	−13.42
United States	7	3.43	0.14	−1.67	−3.16	–	–	–	–
Other									
Australia	7	3.43	0.20	−1.65	−3.50	1	7.00	−3.89	−12.70
Austria	6	2.50	0.14	−1.08	−1.60	–	–	–	–
Belgium	7	2.86	0.18	−1.00	−1.53	–	–	–	–
Denmark	7	4.14	0.16	−1.76	−4.11	1	7.00	−3.17	−9.58
Finland	5	4.60	0.21	−3.93	−22.51	1	13.00	−12.75	−102.76
Greece	8	3.50	0.21	−6.45	−11.83	6	3.67	−7.87	−14.63
Ireland	3	2.67	0.11	−0.90	−1.41	–	–	–	–
Netherlands	5	4.00	0.51	−2.20	−0.82	2	2.50	−3.37	−4.32
New Zealand	12	3.83	0.32	−5.94	−14.74	9	3.11	−7.31	−12.04
Norway	3	2.67	0.09	−1.99	−2.99	–	–	–	–
Portugal	4	4.50	0.16	−3.38	−6.68	1	5.00	−6.03	−12.19
Spain	4	3.00	0.16	−1.12	−2.76	–	–	–	–
Sweden	3	7.33	0.33	−3.87	−15.17	1	12.00	−5.64	−24.23
Switzerland	9	3.56	0.22	−2.28	−6.86	1	7.00	−9.81	−42.81

Continued

Table 1. Continued

Country	All recessions					Severe recessions			
	Number of recessions	Duration	Proportion of time in recession	Amplitude	Cumulative loss	Number of severe recessions	Duration	Amplitude	Cumulative loss
Country Group									
OECD									
Median	5.00	3.00	0.18	−1.87	−3.04	1.00	4.00	−4.89	−9.94
Mean	5.81	3.64	0.21	−2.63	−6.40	2.14	4.70	−6.31	−16.10
Eurozone									
Median	5.00	3.00	0.17	−1.45	−2.34	1.00	3.50	−5.36	−8.57
Mean	5.73	3.37	0.20	−2.30	−5.21	2.00	4.33	−6.67	−18.68
G-7									
Median	5.00	3.00	0.17	−1.59	−2.99	1.00	4.00	−3.46	−7.94
Mean	5.57	3.56	0.19	−1.83	−4.12	1.40	5.00	−4.05	−10.58
Non G-7									
Median	5.50	3.00	0.21	−2.01	−3.08	1.00	4.00	−6.03	−10.29
Mean	5.93	3.67	0.22	−3.01	−7.47	2.56	4.61	−7.00	−17.79

Notes: Duration is the number of quarters between a peak and the next trough of a recession. Proportion of time in recession refers to the ratio of the number of quarters in which the economy is in recession over the full sample period with only completed cycles. Amplitude is the percentage change in output from a peak to the next trough of a recession. Cumulative loss combines information on duration and amplitude to measure the overall cost of a recession and is expressed in percentages. Severe recessions are those in which the peak-to-trough decline in output is in the top 25% of all recession-related output declines. Country-specific data are means. Country-group data are means/medians.

median amplitude of recessions in Finland and Sweden is smaller than for those in Greece and New Zealand, recessions in Finland and Sweden have very large cumulative output losses (23% and 15%, respectively) since their recessions are of longer duration.

A recession is classified as severe when the peak-to-trough decline in output is below −3.15%. While many OECD countries, including Austria, Belgium, France, Ireland, Norway, Spain, and the US, did not experience severe recessions in the sample period, most recessions in Greece and New Zealand fall into this category. The 30 such recessions typically last for five quarters, a quarter longer than the average recession. By construction, therefore, they are much more costly than other recessions with a median decline of about 5%, and a cumulative loss of about 10%, almost three and five times, respectively, that of other recessions.

An extremely severe recession, in which the peak-to-trough decline in output exceeds 10%, is usually called a depression: there are five in our sample – New Zealand (1966:4–1967:2, 1974:3–1975:2, 1976:4–1978:1); Greece (1973:4–1974:3); and Finland (1990:1–1993:2). While the depression in Finland was the longest with a duration of 13 quarters and an output decline of 13%, the deepest depression occurred in New Zealand in the 1976:4–1978:1 period, and led to a roughly 15% reduction in output. The depression episodes coincide with sharp declines in consumption and investment and substantial erosion of housing and equity values.

How do the ongoing recessions compare to past depression episodes, and especially the Great Depression? The recessions in the advanced countries triggered by the ongoing financial crisis appear, so far, to be milder than the depression episodes in our sample. Although the US recession that started in late 2007 is obviously severe, its output cost so far has been much less than in past depressions, including the Great Depression (when the US economy contracted by around 30% over a 4-year period). In general, the amplitudes and cumulative losses in severe recessions in the G-7 countries are typically smaller than those in the other countries in our sample.[15]

As shown in Figure 2, most recessions lasted four quarters or less, and most of these were mild to moderate in depth, i.e. less than a 3.2% output decline.[16] Of the severe recessions, 40% lasted more than four quarters. There is also a pattern of recessions becoming shorter and less severe over time, especially after the mid-1980s. In particular, amplitude reduced from 2.6% in 1973–85 to 1.4% in 1986–2007. These patterns are in line with documented declining trends in output volatility in the industrial countries, the so called 'Great Moderation' phenomenon (see Kose *et al.*, 2003a and 2008b).

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[15] There are some other differences in the main features of recessions across the country groups we examined, but they are minor. For the country groupings we analyse, we report unweighted means and medians. These statistics would be lower, i.e. less severe, for the eurozone if we reported means and medians weighted by country size.

[16] Specifically, about 35% of all recessions last 2 quarters, 40% last 3–4 quarters, and 25% last 5 quarters or more.
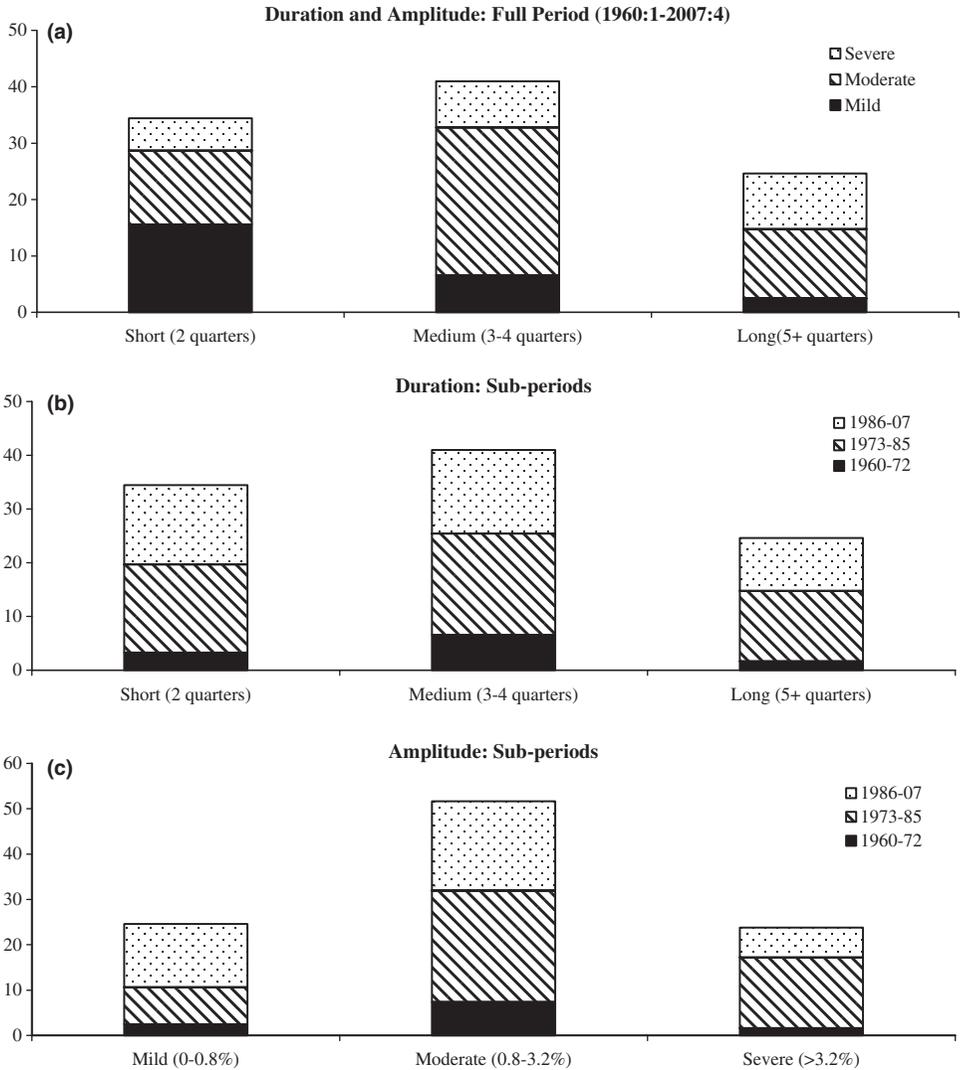
Figure 2. Recessions: duration and amplitude (share of total sample, percent)

Notes: Share of total number of recessions falling in particular categories. Duration is the number of quarters from a peak to the next trough of a recession. Amplitude is the percentage change in output from a peak to the next trough of a recession.

3.2. Changes in macroeconomic and financial variables during recessions

We examine next how the main macroeconomic and financial variables typically vary during a recession. Table 2 presents peak-to-trough changes in these variables for all, severe, and non-severe (other) recessions. We find the expected patterns, with most macroeconomic variables exhibiting procyclical behaviour. Not surprisingly, there are often significant differences between severe and non-severe recessions in terms of duration, amplitude and cumulative output loss. In a severe

Table 2. Recessions: summary statistics (percentage change unless otherwise indicated)

	Median values			Mean values		
	All recessions	Severe recessions	Other recessions	All recessions	Severe recessions	Other recessions
A. Output						
Duration[a]	3.00	4.00***	3.00	3.64	4.7**	3.29
Amplitude	−1.87	−4.89***	−1.33	−2.63	−6.31***	−1.43
Cumulative loss	−3.04	−9.94***	−2.05	−6.40	−16.10***	−3.23
B. Components of output						
Consumption	−0.07	−1.19*	0.05	−0.16	−1.21*	0.18
Total investment	−4.15	−9.73**	−3.65	−5.93	−11.35**	−4.19
Residential investment	−4.08	−12.6***	−2.56	−6.64	−15.52***	−3.78
Non-residential investment	−3.63	−7.38*	−3.19	−5.10	−9.11*	−3.78
Exports	−0.65	−4.11***	0.50	−0.74	−6.33***	1.08
Imports	−3.82	−9.18***	−2.58	−4.20	−9.41**	−2.50
Net export (% of GDP)[b]	0.62	1.61	0.48	0.76	0.79	0.75
Current account (% of GDP)[b]	0.47	0.98	0.45	0.56	0.70	0.51
C. Other macroeconomic variables						
Industrial production	−4.14	−7.01***	−2.89	−3.99	−7.35***	−3.07
Unemployment rate[b]	0.61	1.36***	0.51	1.16	2.56**	0.83
Inflation rate[b]	−0.29	0.01	−0.31	−0.27	−0.13	−0.32
D. Financial variables						
House prices	−2.31	−4.53	−2.00	−3.57	−7.15*	−2.49
Equity prices	−5.93	−14.42***	−3.67	−4.43	−13.76**	−2.01
Credit	0.75	0.83	0.75	1.07	0.82	1.15

Notes: Severe recessions are those in which the peak-to-trough decline in output is in the top 25% of all recession-related output declines. Other recessions refer to episodes that are not severe recessions. In each cell, the mean (median) change in the respective variable from peak to trough of recessions is reported, unless otherwise indicated. The symbols *, **, and *** indicate that the difference between means (medians) of severe recessions and other recessions is significant at the 10%, 5%, and 1% levels, respectively.
[a]Number of quarters.
[b]Change in levels.

recession, consumption typically drops by more than 1%, compared to almost no change in other recessions. The importance of investment for explaining the business cycle has been stressed in the literature. Indeed, the declines in both residential and total investment tend to be in double digits in severe recessions, compared to about 4% in other recessions.

Recessions often overlap with declines in international trade. Exports drop more (and significantly more) in severe recessions compared to other recessions. As expected, imports fall, by six times more than exports in a typical recession and by close to 10% in a severe recession (significantly more than in other recessions). While both net exports and current account balance improve during recessions, these changes are not significantly different across recession types.

The fall in industrial production tracks the drop in investment closely in all types of recessions and is larger than fall in output. In 90% of recessions, there is an increase in the unemployment rate, with the rise typically three times greater in severe than in other recessions. As would be expected, inflation typically drops slightly (in 60% of recessions), since aggregate demand is down. Inflation does not vary between different types of recessions, possibly because some severe recessions are of the stagflation type – recession combined with an acceleration in the rate of inflation.

Although credit typically continues to grow, it does so by less than 1%, with especially low growth rates in the initial stages of recessions. Credit growth does not vary much between severe and other recessions. Both house and equity prices typically decline in recessions, with larger declines in house prices in severe than in other recessions. Reflecting the more volatile nature of equity prices, the decline in equity prices is more than twice that of house prices. Credit declines in about 35% of recessions, house prices in about 55%, and equity prices in about 60% of all cases.

3.3. Dynamics of recessions

We next examine how various macroeconomic, trade and financial variables behave around recessions (Figure 3). We focus on patterns in year-on-year growth in each variable for a 6-year window – 12 quarters before and 12 quarters after a peak. We focus on year-on-year changes in the relevant variables since quarter-to-quarter changes can be quite volatile and provide a noisy presentation of recession dynamics. All panels include median growth rate, along with the top and bottom quartiles, and, according to our definition, the severe recessions in the bottom quartile.

The evolution of output growth around a recession is as expected, and also as observed in the current recession. Following the peak at date 0, output tends to register negative annual growth after three quarters, going down to −1% four quarters after the peak and in severe recessions, to −2%. Although in a typical recession consumption does not decrease on a year-to-year basis, it does fall during the first year of a severe recession. In terms of timing, the evolution of consumption around recessions resembles the behaviour of output.
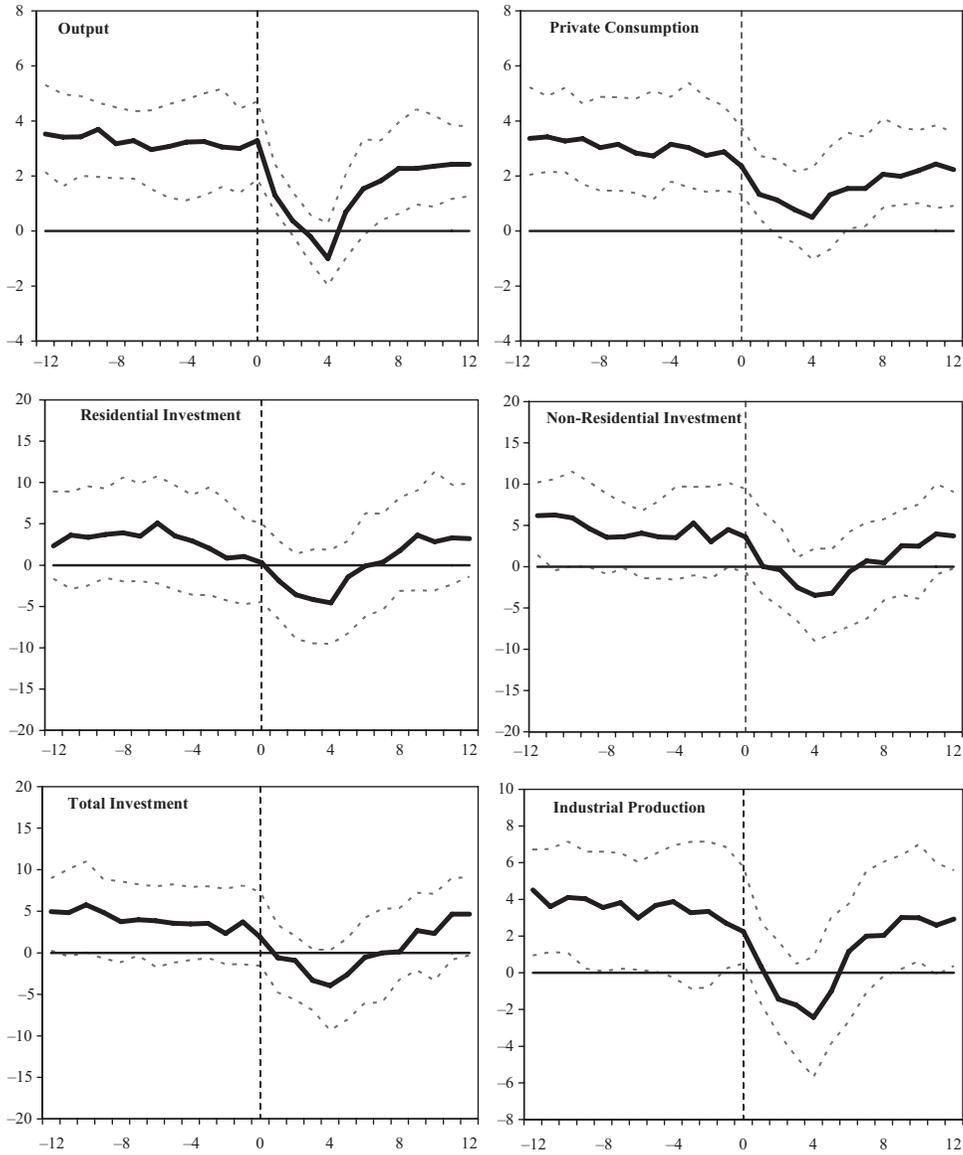
Figure 3. Dynamic of recessions (percentage change from a year earlier unless otherwise noted; zero denotes peak; x-axis in quarters)

Notes: The solid line denotes the median of all observations while the dotted lines correspond to the upper and lower quartiles. Zero is the quarter after which a recession begins (peak in the level of output). Inflation rate, unemployment rate, net exports/GDP, and current account balance are the levels of the respective variables in percentages.

Some macroeconomic variables naturally show signs of slowdown before the recession starts. For example, residential investment typically declines ahead of the onset of a recession, a very prominent feature of the current recession. Moreover, both components of investment (residential and non-residential) often register
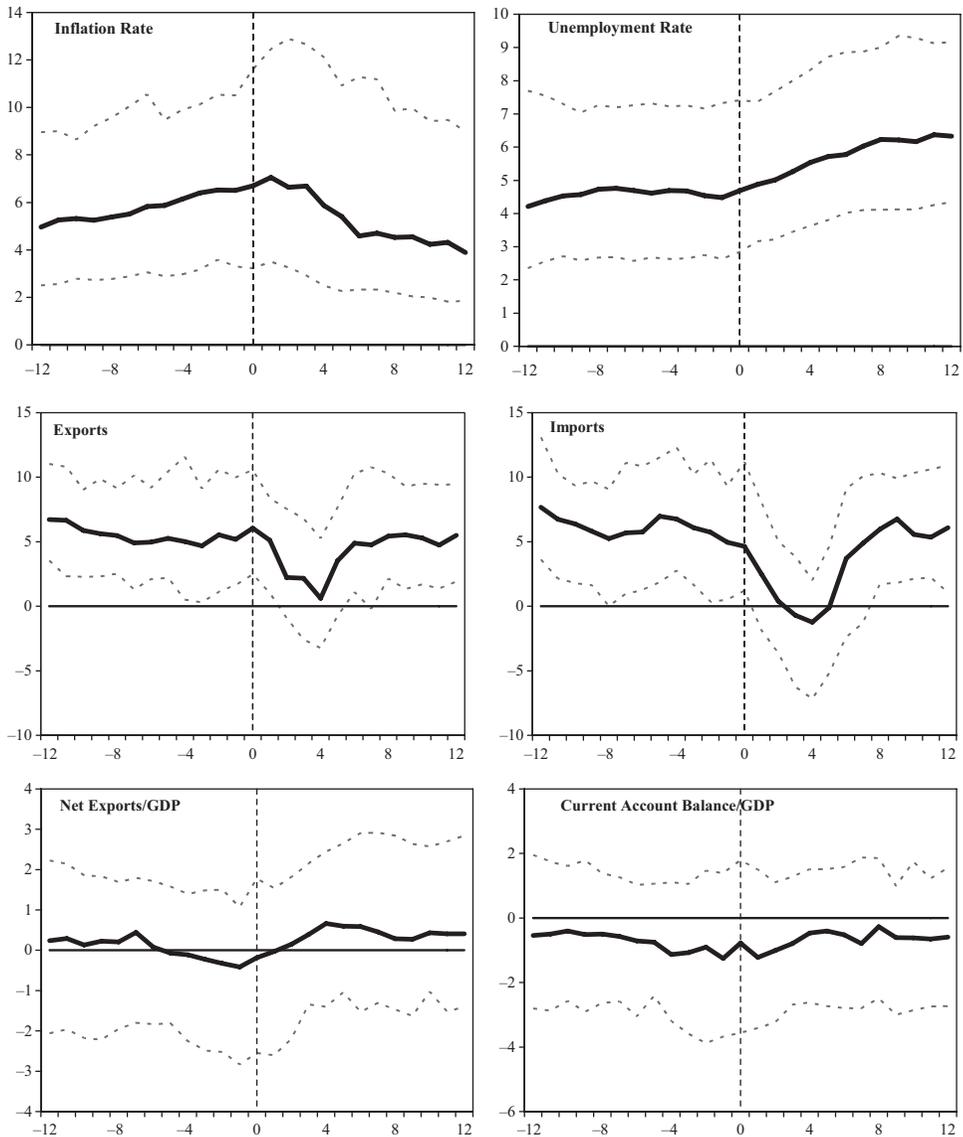
Figure 3. (Continued).

negative year-to-year changes even in the first quarter of a recession, i.e. three quarters ahead of output. And their growth rates typically stay negative for up to six quarters, i.e. recovery in investment is often later than recovery in output. In severe recessions, it can take up to three years for investment to recover.

Industrial production also typically registers a decline before a recession starts. During the onset of a recession, inflation typically is still on an increasing path, and unemployment is already starting to rise. After the recession starts, however, inflation declines and unemployment rates accelerate. Unemployment is a good leading
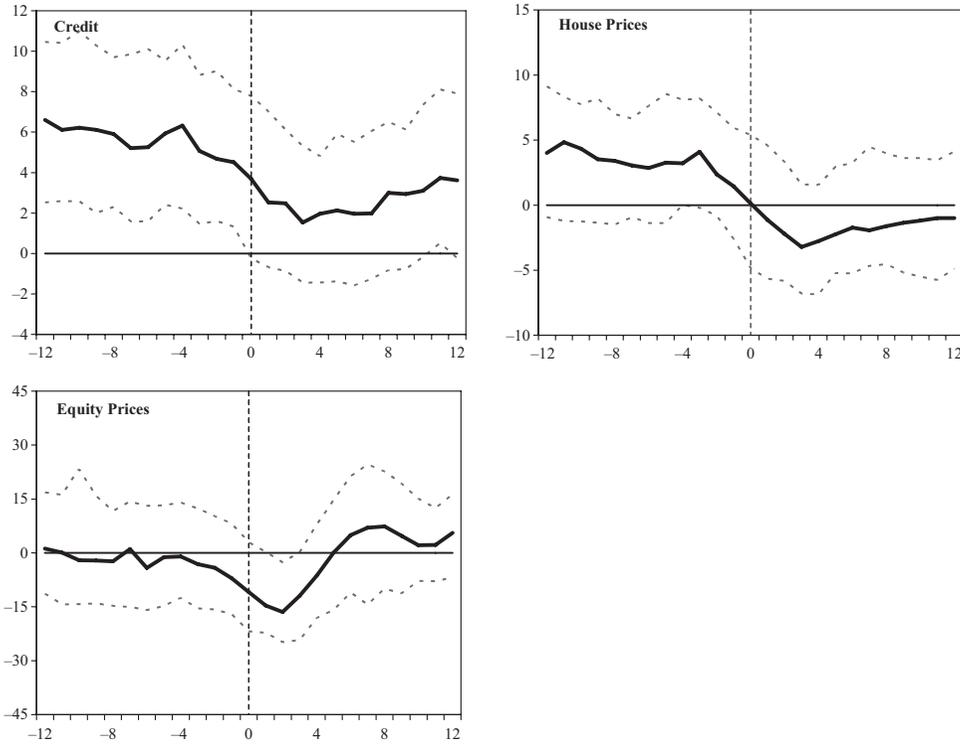
Figure 3. (Continued).

indicator of economic activity as it typically begins to climb one quarter ahead of a recession, but it cannot be used to indicate the end of a recession since it stays high for more than a year after the recession is over.

In terms of trade, in a recession, the growth rates of both exports and imports slow – the latter much more so. Import growth often falls before the recession starts and can decline to −7% in the first year of a severe recession. While both net exports and current account balances typically improve during a recession, the improvement in net exports is often earlier and more pronounced.

Credit growth also slows down, by some two or three percentage points before a recession starts, and then by another two percentage points over the recession period, typically not returning to pre-recession growth rates for at least three years after its onset. To varying degrees, depending on the importance of bank intermediated credit, for many countries this phenomenon is observed in the current recession. Recessions are often also preceded by slowdowns in the growth rates of asset prices. In the first year of a typical recession, house and equity prices decline on a year-to-year basis by roughly 3% and 8%, respectively. While equity prices often start registering positive growth after about six quarters, house prices typically decline for two more years after the end of a recession. Again, these patterns correspond closely to the current situation.

3.4. Synchronization of recessions, credit contractions and asset price declines

We next examine the synchronization of recessions, credit contractions and asset price declines across countries. Our synchronization measure is simply the fraction of countries experiencing the same event at around the same time. For recessions, Figure 4 shows this fraction over time alongside the dates of US recessions. The figure shows that recessions are bunched in roughly four periods. First, there is a large fraction of countries that suffered recession in the mid-1970s, shortly after the first oil price shock. More countries were affected during the second oil price shock in the early 1980s, which is also a period of highly synchronized contractionary monetary policies across the major industrial economies. In the early 1990s (and to a degree in the early 2000s) recessions were again highly synchronized around the world. In the first three of these four periods, more than 50% of the countries in our sample were suffering a recession.

We define globally synchronized recessions as occurring when more than half of the countries in our sample were experiencing recession. According to this definition, there were globally synchronized recession episodes in the years 1975, 1980 and 1992. Table 3 shows that these globally synchronized recessions are significantly longer and deeper than in other recessions – generally a quarter longer and with cumulative output losses more than two times greater. Moreover, they are associated with more severe contractions in industrial production and greater job losses. Typical declines in house prices also tend to be much higher.

We also investigate the synchronization of turning points in investment and consumption. A stylized fact related to business cycles is that investment is much more, and consumption somewhat less volatile than output (Backus *et al.*, 1995).[17] In our sample, investment declines in three-quarters of all cases of recessions while consumption contracts in only half. Consistent with this, the fraction of countries experiencing investment (consumption) contraction at any time is much higher (lower) than the proportion experiencing recessions. And while investment contractions are highly synchronized, consumption contractions are much less so. These results are consistent with recent findings suggesting that common factors play a much larger role in explaining fluctuations in investment than in consumption (Kose *et al.*, 2008a).

Recessions tend to coincide with contractions in domestic credit and declines in asset prices, and again, as currently observed, in most advanced countries. This is shown by the fraction of countries experiencing recessions being highly correlated with the fractions suffering credit contractions or bear assets markets (Figure 5). Credit contractions, in particular, are closely associated with recessions. House price declines are also highly synchronized across countries, with the degree of synchroni-

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[17] For a detailed analysis of the volatility and co-movement properties of business cycles for a large set of countries, see Kose *et al.* (2003b, 2003c).
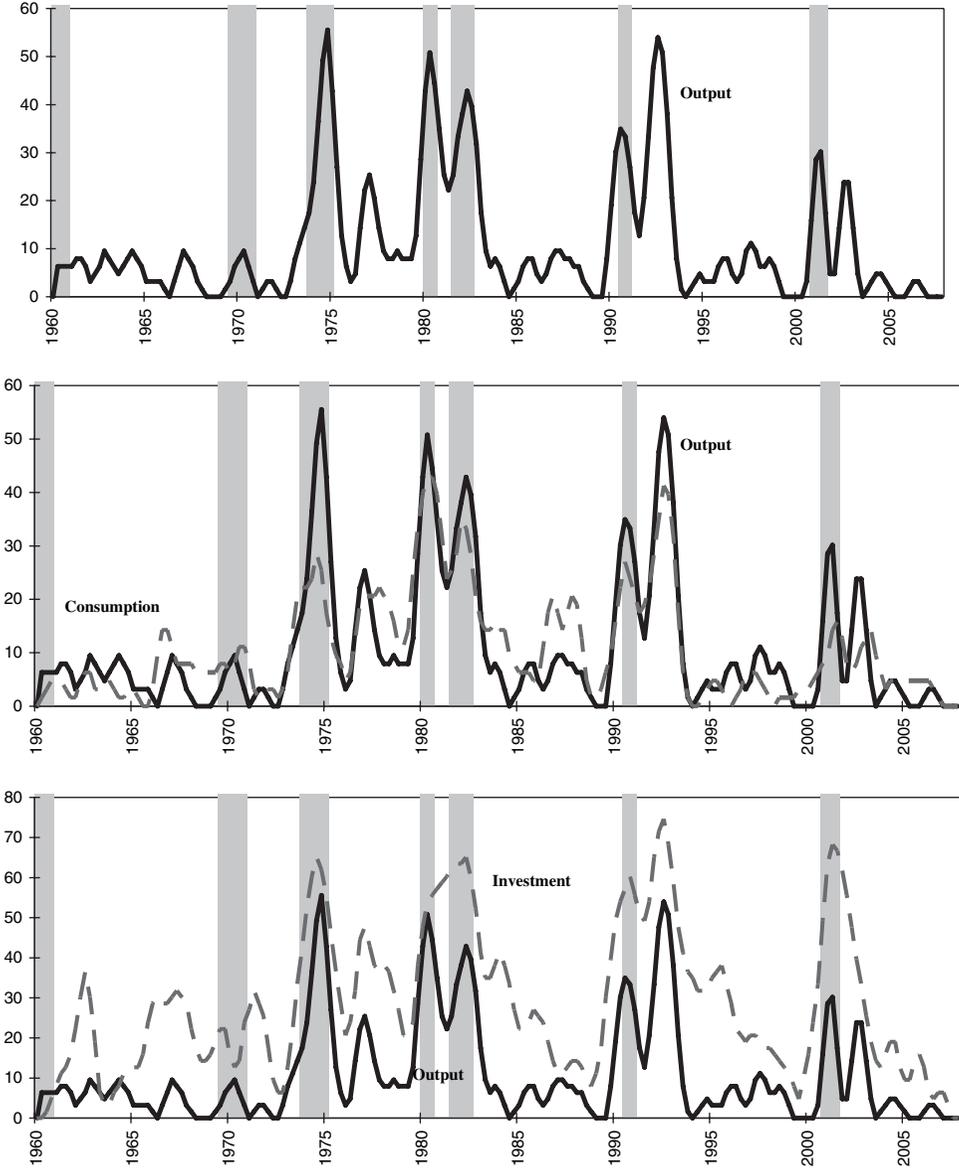
Figure 4. Synchronization of recessions

Notes: Share of countries experiencing recessions in output, consumption and investment. Shaded bars indicate periods of US recessions.

zation rising especially during recession episodes. Equity prices exhibit the highest degree of synchronization, reflecting the extensive integration of stock markets. However, the popular saying that 'Wall Street has predicted nine of the last five recessions' resonates as the fraction of countries experiencing bear equity markets frequently exceeds the fraction of countries in recession. Conversely, booms in equity markets are not necessarily associated with economic recoveries.

Table 3. Synchronized recessions: summary statistics (percentage change unless otherwise indicated)

	Median values			Mean values		
	All recessions	Synchronized recessions	Other recessions	All recessions	Synchronized recessions	Other recessions
A. Output						
Duration[a]	3.00	4.00***	3.00	3.64	4.54**	3.25
Amplitude	−1.87	−2.56***	−1.47	−2.63	−3.35*	−2.32
Cumulative loss	−3.04	−4.9***	−2.06	−6.40	−10.69*	−4.53
B. Components of output						
Consumption	−0.07	−0.93***	0.30	−0.16	−1.41***	0.38
Total investment	−4.15	−8.16***	−2.26	−5.93	−9.8**	−4.26
Residential investment	−4.08	−5.85**	−3.08	−6.64	−10.62**	−4.92
Non-residential investment	−3.63	−9.01***	−1.19	−5.10	−9.64***	−3.09
Exports	−0.65	−1.48*	0.48	−0.74	−2.22	−0.10
Imports	−3.82	−8.18***	−0.96	−4.20	−8.93***	−2.14
Net export (% of GDP)[b]	0.62	1.35**	0.40	0.76	1.44**	0.46
Current account (% of GDP)[b]	0.47	0.57	0.41	0.56	0.96	0.39
C. Other macroeconomic variables						
Industrial production	−4.14	−6.5***	−2.60	−3.99	−6.84***	−2.71
Unemployment rate[b]	0.61	1.17***	0.45	1.16	1.85**	0.84
Inflation rate[b]	−0.29	−0.36	−0.27	−0.27	0.03	−0.40
D. Financial variables						
House prices	−2.31	−5.05***	−1.89	−3.57	−7.58***	−1.62
Equity prices	−5.93	−4.18	−7.45	−4.43	−4.33	−4.47
Credit	0.75	0.34**	0.90	1.07	−1.75***	2.32

Notes: Synchronized recessions are when 10 or more of the countries in the sample experience recessions at the same time. Other recessions refer to episodes that are not synchronized. In each cell, the mean (median) change in the respective variable from peak to trough of recessions is reported, unless otherwise indicated. (The symbols *, **, and *** indicate that the difference between means (medians) of synchronized recessions and other recessions is significant at the 10%, 5%, and 1% levels, respectively.)
[a]Number of quarters.
[b]Change in levels.
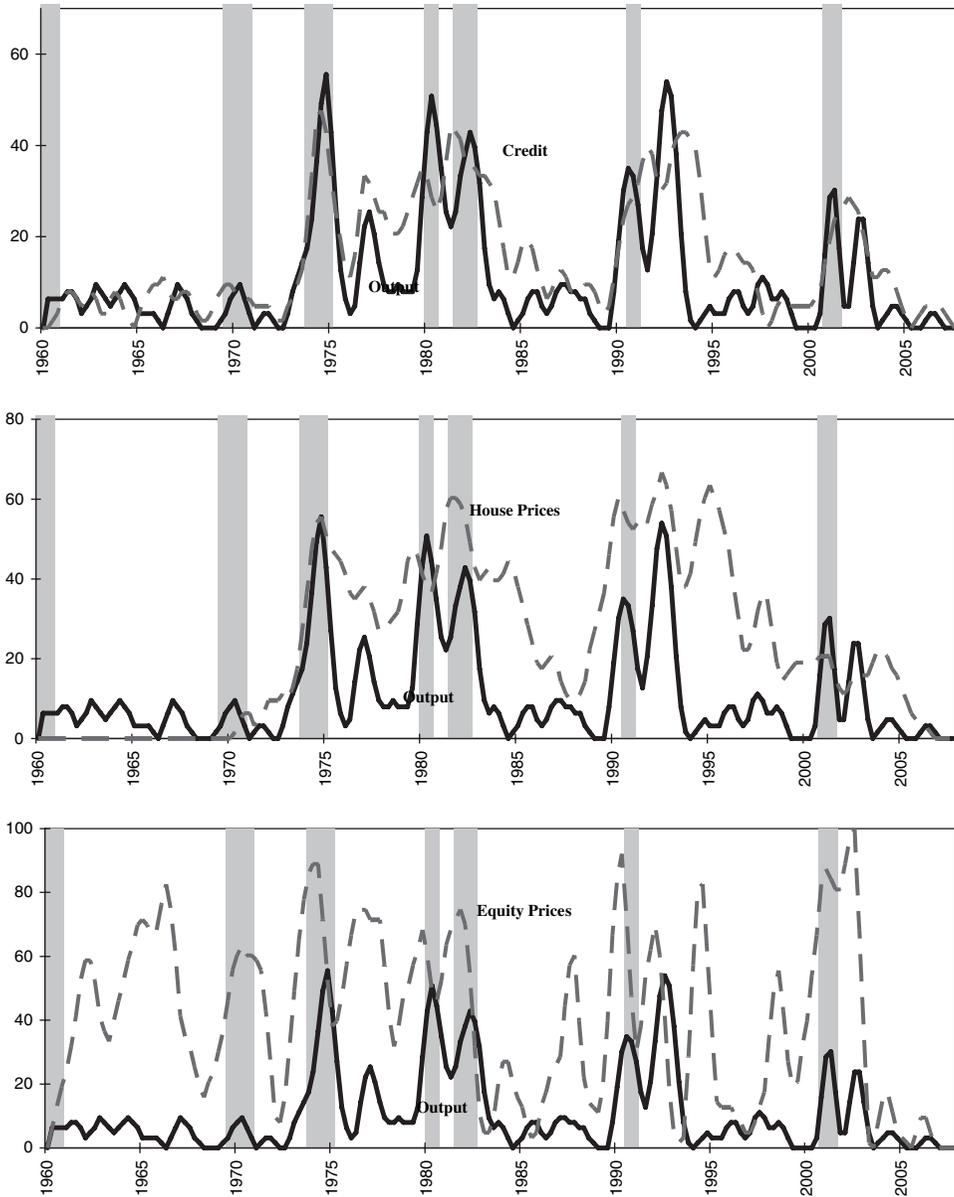
Figure 5. Synchronization of credit contractions and asset price declines

Notes: Share of countries experiencing episodes of credit contractions, house price declines and equity price declines. Shaded bars indicate periods of US recessions.

3.5. Credit contractions and asset price declines

Next, we provide similar statistics, but in summary form, on episodes of credit contraction, and house price and equity price declines (see Claessens *et al.*, 2008 for details). In terms of duration, episodes of house price declines and busts last longer than credit contractions/crunches or equity price declines/busts (Table 4). While

Table 4. Credit contractions and asset price declines: summary statistics (percentage change unless otherwise indicated)

Events	Duration[a] (mean)	Amplitude (median)	Total investment (median)	Residential investment (median)	Non-residential investment (median)	Unemployment[b] (median)
A. Credit contractions	5.52	−4.08	−0.79	−1.77	0.05	0.48
Credit crunches	10.29***	−13.26***	−6.13***	−6.37***	0.09	1.76***
Other credit contractions	3.95	−3.20	−0.17	−1.13	0.02	0.22
B. House price declines	8.47	−5.99	0.72	−4.08	2.00	0.50
House price busts	18.14***	−28.52***	−8.36***	−11.55***	−7.79**	2.8***
Other house price declines	5.33	−4.14	2.22	−0.96	2.64	0.23
C. Equity price declines	6.64	−23.70	3.67	2.96	4.17	0.05
Equity price busts	11.79***	−50.62***	0.67*	3.04	2.79	0.7***
Other equity price declines	4.93	−19.20	3.99	2.94	4.42	−0.04

Notes: Credit crunches and asset price busts correspond to peak-to-trough declines in credit and asset prices that are in the top 25% of all episodes of credit contractions and asset price declines, respectively. In each cell, the mean (median) change in the respective variable from peak to trough of the episodes of credit declines/crunches, house price declines/busts, and equity price declines/busts is reported, unless otherwise indicated. The symbols *, **, and *** indicate that the difference between means (medians) of crunches/busts and other contractions/declines is significant at the 10%, 5%, and 1% levels, respectively.
[a]Number of quarters.
[b]Change in levels.

less persistent than house price declines, drops in equity prices are much larger. In particular, a typical episode of house price decline (bust) leads to a 6% (29%) drop in house prices, while an episode of equity price decline (bust) tends to result in a 24% (51%) fall in equity prices. Both credit crunches and house price busts appear to have adverse effects on the growth rates of investment, its components and unemployment. House price busts, in particular, are associated with large drops in investment and employment. Residential investment, for example, declines by 6% and 12% during credit crunches and house busts, respectively. The current recessions and financial events reflect these patterns which are associated with severely stressed housing markets in many countries.

4. WHAT HAPPENS DURING RECESSIONS ASSOCIATED WITH CRUNCHES AND BUSTS?

4.1. Leads and lags between recessions, crunches and busts

We first examine the lag between the start of a credit crunch or bust, and the beginning of the corresponding recession. If a recession is associated with a credit crunch, it typically starts three quarters after the onset of the credit crunch, three quarters after a house price bust, and five quarters after an equity price bust (Table 5). Since credit crunches last longer than recessions, the latter tend to end two quarters before their corresponding credit crunch episodes. These findings suggest that the phenomenon of 'creditless recovery' is not specific only to sudden stop episodes observed in emerging markets (see Calvo *et al.*, 2006), but is also a feature of the business cycles of the industrial countries in our sample. House price busts typically last well beyond the end of the corresponding recession, or to put it differently, recessions end nine quarters ahead of the corresponding house price busts. This is because house price busts typically last three times longer than do recessions. The duration of a typical equity price bust is twice that of a recession, but a recession tends to end with its corresponding equity bust.

Table 5. Leads and lags: recessions, crunches and busts (number of quarters)

	Median values	Mean values
A. Leads[a]		
Credit crunches	3.00	4.11
House price busts	3.00	4.22
Equity price busts	5.00	5.26
B. Lags[b]		
Credit crunches	2.00	2.63
House price busts	9.00	10.52
Equity price busts	0.00	2.74

Notes: [a]Number of quarters between the start of a crunch/bust and the start of a recession.
[b]Number of quarters between the end of a recession and the end of a crunch/bust.

Table 6. Recessions associated with credit crunches (percentage change unless otherwise indicated)

	Median values			Mean values		
	Without crunches	With crunches	With severe crunches	Without crunches	With crunches	With severe crunches
A. Output						
Duration[a]	3.00	3.00	3.00	3.61	3.90	4.00
Amplitude	−1.76	−2.7**	−2.20	−2.33	−4.17**	−4.13
Cumulative loss	−2.66	−6.15**	−6.15*	−5.84	−9.46	−11.79
B. Components of output						
Consumption	−0.04	−0.58	−0.58	−0.15	−0.36	0.38
Total investment	−3.65	−5.57	−5.57	−5.67	−6.75	−6.28
Residential investment	−3.72	−7.52	−7.47	−6.19	−9.60	−9.13
Non-residential investment	−3.58	−4.25	−4.34	−5.18	−3.81	−4.65
Exports	−0.46	−2.44	−1.28	−0.46	−2.88	−2.26
Imports	−3.15	−6.47**	−6.47*	−3.34	−7.94	−8.64
Net export (% of GDP)[b]	0.43	1.51**	1.64**	0.51	1.81**	1.89**
Current account (% of GDP)[b]	0.42	1.24	1.39	0.49	0.97	1.23
C. Other macroeconomic variables						
Industrial production	−4.02	−5.55	−6.76*	−3.89	−4.78	−6.41*
Unemployment rate[b]	0.57	0.89	0.99	1.21	0.99	1.10
Inflation rate[b]	−0.32	0.14	0.53	−0.56	0.97	1.08
D. Financial variables						
House prices	−1.83	−3.91**	−5.95*	−3.09	−6.55	−7.64
Equity prices	−6.18	−3.09	0.60	−4.57	−1.83	2.68
Credit	1.13	−4.41***	−4.91***	2.30	−4.72***	−6.11**

Notes: Severe credit crunches are those that are in the top half of all crunch episodes. Each cell reports the mean (median) change in the respective variable from peak to trough of recessions associated with credit crunches, unless otherwise indicated. The symbols *, **, and *** indicate that the difference between means (medians) of recessions with and without credit crunches is significant at the 10%, 5%, and 1% levels, respectively.
[a]Number of quarters.
[b]Change in levels.

4.2. Recessions associated with credit crunches

Table 6 presents the main features of recessions associated with and without credit crunches. To provide a sense of their distribution, we examine separately the features of recessions coinciding with severe credit crunches or asset price busts, i.e. the top 12.5% of all credit contractions or asset price declines. The average duration of a recession associated with a (severe) credit crunch slightly exceeds that without a crunch, but the difference is not significant. Interestingly, in all but four cases, recessions ended before the end of their corresponding credit crunch episodes. Typically, there is a significantly larger output decline during recessions associated with a credit crunch compared to other recessions, −2.7 versus −1.8%, or a 0.9 percentage point difference. As would be expected, the amplitude of recessions coinciding with credit crunches differ across countries and episodes. For instance, the amplitude of the recession experienced in Portugal in 1982–84 was about 2.7% while that experienced in Belgium in 1982 was only 0.2%.

The cumulative output loss in recessions associated with (severe) crunches is typically larger than in recessions without crunches. In particular, the average (median) cumulative loss of a recession associated with a severe crunch is more than twice that without a crunch (i.e. significantly higher). Recessions with severe crunches are generally associated with larger contractions in consumption, investment, industrial production, employment, exports and imports, compared to recessions without crunches. However, with the exception of imports, net exports and industrial production, these differences are not significant.

Credit, by construction, registers a much larger (and statistically significant) decline in recessions with crunches than those without. House prices also fall significantly more in recessions with crunches than in those without. This might stem from the high sensitivity of housing activity to credit conditions, also observed in the current episode. In contrast, equity prices decrease less in recessions with crunches and even record increases in recessions with severe crunches. This may be because equity prices decline more at the onset of such recessions and markets anticipate a recovery during the recessions.

4.3. Recessions associated with house price busts

There are a number of statistically significant differences between recessions coinciding with and without house price busts (Table 7). In particular, recessions associated with house price busts on average last for more than a quarter longer than those without busts. Moreover, declines in output (and corresponding cumulative losses) are typically much greater in recessions with busts, −2.2% (−3.8%) versus −1.5% (−2.2%) without busts. These sizeable differences extend to other variables. For example, although consumption typically does not decrease much in a recession, there is a significant decline in consumption in recessions associated with house price busts. The

Table 7. Recessions associated with house price busts (percentage change unless otherwise indicated)

	Median values			Mean values		
	Without busts	With busts	With severe busts	Without busts	With busts	With severe busts
A. Output						
Duration[a]	3.00	3.00	3.00	3.18	4.55**	4.6**
Amplitude	−1.51	−2.2*	−2.64**	−1.96	−3.24*	−4.05**
Cumulative loss	−2.24	−3.84***	−5.23***	−3.48	−10.68**	−13.90*
B. Components of output						
Consumption	0.05	−0.76***	−1.16***	0.13	−1.71***	−2.25***
Total investment	−3.82	−7.77*	−6.92	−4.59	−9.48**	−9.59
Residential investment	−2.46	−6.79**	−7.47**	−4.63	−11.31**	−13.65**
Non-residential investment	−3.67	−7.7*	−6.82	−4.06	−8.84*	−7.83
Exports	−1.07	0.68*	0.67	−1.02	1.03*	1.20
Imports	−2.65	−5.23	−5.3*	−2.24	−5.26*	−6.13**
Net export (% of GDP)[b]	0.41	1.24***	1.29**	0.09	1.5***	1.48**
Current account (% of GDP)[b]	0.07	0.78**	0.6*	0.02	1.27**	1.23*
C. Other macroeconomic variables						
Industrial production	−4.43	−4.26	−4.99	−4.13	−4.35	−4.73
Unemployment rate[b]	0.47	1.36***	1.2***	0.83	2.02**	1.93
Inflation rate[b]	−0.26	−0.80	−0.59	−0.35	−0.88	−0.14
D. Financial variables						
House prices	−0.84	−6.3***	−7.05***	−0.34	−9.63***	−11.17***
Equity prices	−8.85	0.61*	−7.22	−6.87	0.06	−1.59
Credit	1.42	−0.52***	−1.24***	3.01	−2.37***	−2.99***

Notes: Severe house price busts are those in the top half of all bust episodes. Each cell reports the mean (median) change in the respective variable from peak to trough of recessions associated with house price busts, unless otherwise indicated. The symbols *, **, and *** indicate that the difference between means (medians) of recessions with and without house price busts is significant at the 10%, 5%, and 1% levels, respectively.
[a]Number of quarters.
[b]Change in levels.

large fall likely reflects the substantial effects of housing wealth on consumption. These findings taken together, suggest that recessions that coincide with house price busts result in more adverse macroeconomic outcomes than those that do not. Still, there are differences across episodes in the output costs of recessions associated with house price busts. For example, the amplitude of the recession in Austria in the early 2000s was only 0.4% while Canada's early 1980s recession was close to 5%. The duration of the former was two quarters while the latter lasted six quarters.

In terms of trade variables, there are substantial differences between recessions coinciding with house price busts and other types of recessions, in part reflecting the substantial decline in domestic demand and, thus, imports. Along with increased exports, both net exports and current account balances improve significantly more in recessions with house price busts.

With respect to financial outcomes, by construction, house prices fall much more in recessions with housing busts (by some 6 percentage points more), but credit also contracts more, with both differences significant. Equity prices also decline during recessions associated with severe busts, but less so than those without busts, because markets may already be pricing in a recovery (however, these differences are not significant). Taken together, these comparisons suggest that the more adverse effects of a recession with a (severe) house price bust, arise in part due to disturbed credit markets, which, in turn, lead to a considerable reduction in consumption and (residential) investment. This phenomenon has been considered a key factor in the current recession (see Leamer, 2007; Muellbauer, 2007). When a recession is associated with a house price bust, residential investment remains depressed for a prolonged period typically only recovering three to five quarters after the recession ends.

4.4. Recessions associated with equity price busts

Although recessions associated with equity price busts tend to be longer and deeper than those without equity busts, many of the differences are not statistically significant (see Claessens *et al.*, 2008 for details). This might reflect the fact that the link between equity price busts and developments in the real economy is weaker compared to credit crunches and house price busts. Nevertheless, non-residential and total investment, and industrial production fall significantly more in recessions with equity price busts than in recessions without equity price busts. Imports also decline significantly more and net exports improve much more in recessions with equity price busts.

4.5. Recessions associated with crunches and busts: a comparison

When associated with a credit crunch or asset price bust, which type of recession is the most painful? The answer depends in part on the metric used to measure the

Table 8. Recessions associated with crunches and busts: summary statistics

Events	Duration[a] (mean)	Amplitude (median)[b]	Cumulative loss[b] (median)
A. Recessions without credit crunches	3.61	−1.76	−2.66
Recessions with credit crunches	3.90	−2.7**	−6.15**
Recessions with severe credit crunches	4.00	−2.20	−6.15*
B. Recessions without house price busts	3.18	−1.51	−2.24
Recessions with house price busts	4.55**	−2.2*	−3.84***
Recessions with severe house price busts	4.6**	−2.64**	−5.23***
C. Recessions without equity price busts	3.49	−1.72	−2.87
Recessions with equity price busts	3.79	−1.73	−2.66
Recessions with severe equity price busts	3.68	−1.98	−3.16
D. Recessions without financial crises	3.36	−1.80	−2.65
Recessions with financial crises	5.67**	−2.52	−4.92***
Recessions with severe financial crises	6.80	−2.76	−4.92***

Notes: Severe credit crunches and equity/house price busts are in the top half of all crunch and bust episodes. Severe financial crises correspond to the big five crisis episodes listed in the text. Each cell reports the mean (median) change in the respective variable from peak to trough of recessions associated with equity price busts, unless otherwise indicated. The symbols *, **, and *** indicate that the difference between means (medians) of recessions with and without equity price busts is significant at the 10%, 5%, and 1% levels, respectively.
[a]Number of quarters.
[b]Percent change.

cost of the recession. If we use amplitude as the metric, then recessions associated with credit crunches appear to be as costly as recessions with house price busts, and both slightly more costly than recessions with equity price busts (Table 8). However, if we use the cumulative loss measure as the metric, then recessions associated with credit crunches are slightly more costly than those associated with house price busts. Recessions with equity price busts are the least costly according to this metric.

Why are recessions that coincide with house price busts more costly than those without such busts? For one, investment, and especially consumption, usually register much sharper declines during recessions coinciding with house price busts than in those associated with equity busts. The larger decline in consumption likely reflects the adverse effects on households of the substantial loss of housing wealth. Moreover, recessions with house price busts lead to more pronounced drops in employment.[18]

The differential wealth effects of housing versus equity assets may arise for several reasons. First, housing represents a large share of wealth for most households and consequently price adjustments affect consumption and output more, on both the up and down sides. In contrast, equity ownership is smaller and typically concentrated among wealthy households who likely make much smaller adjustments to their consumption over the cycle. Housing wealth has been found to have a bigger effect than equity wealth on consumption. For example, Carrol *et al.* (2006) report

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[18] Several interactions can occur between housing prices and unemployment. If households have to deal simultaneously with diminished employment prospects and lower house values, labour mobility will be less than otherwise.

that the propensity to consume based on a \$1 increase in housing wealth ranges between 2 (short-run) and 9 (long-run) cents, which is twice that for equity wealth.

Second, equity prices are more volatile than house prices, implying that changes in house prices are more likely to be permanent than changes in equity prices (Cecchetti, 2006). Kishor (2007) reports that while 98% of the change in housing wealth is permanent, this applies to only 55% of the change in financial wealth. Based on this, households will make greater adjustments to their consumption when house prices decline, leading to larger declines in output during recessions associated with house price busts. The balance sheet effects of house price changes are also more severe, as housing wealth dictates heavier household borrowing constraints overall.

We also study the implications of recessions accompanied by a credit crunch and an asset (house or equity price) bust simultaneously (see Claessens *et al.*, 2008). Although the number of observations for such cases is small, these recessions often involve larger cumulative output losses than those with only a crunch or a bust.[19] For example, the median cumulative loss from the six recessions associated with both a credit crunch and a house price bust is 5%.

We also explore how financial crises interact with recessions. Reinhart and Rogoff (2008, 2009) examine the parallels between the 2007–2008 crisis and earlier banking crises. Their sample includes the 'big five' advanced economy banking crises (Spain, 1977; Norway, 1987; Finland, 1991; Sweden, 1991; and Japan, 1992), a number of well-known emerging market episodes, and the Great Depression. They point to the strong similarities between the ongoing crisis and these major historical episodes. For example, similar to the ongoing episode, the earlier crises were preceded by a period of asset price inflation, rising leverage, large current account deficits, and slowing growth.

Since our focus is on recessions rather than financial crises, we cannot conduct a full comparison of our findings and the results provided by Reinhart and Rogoff.[20] However, we can examine briefly the implications of recessions associated with financial crises episodes (Table 8). Using the crisis dates compiled by Terrones *et al.* (2009) who extend Reinhart and Rogoff's sample, we consider a recession episode associated with a crisis, as beginning at the same time or after the start of an ongoing crisis. We find 15 recession episodes associated with financial crises, including the 'big five' crises that Reinhart and Rogoff focused on, which we call severe crises.

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[19] There are five recessions associated with both a credit crunch and an equity price bust. There are only four recessions in our sample that are accompanied by a credit crunch and a house price and equity price bust. While these cases are also associated with larger cumulative output losses, they are not significantly different from the others we examined. We also investigate the implications of recessions associated with different combinations of credit contraction/crunch and asset price decline/bust episodes. The results are similar to those reported, that recessions accompanied by financial market difficulties are generally more severe.

[20] The dating of a financial crisis is also more subjective than the dating we apply to recessions, credit contractions and asset price declines, which makes comparison across studies more difficult.

The average duration of a recession associated with a (severe) financial crisis exceeds that without one, by two (three) quarters. There is typically a larger output decline in recessions associated with crises compared to other recessions, −2.5 versus −1.8%, or a 0.7 percentage point difference (although this is not statistically significant). The cumulative output losses in recessions associated with (severe) crises are typically also larger compared to those without crises, by roughly two times (but this is not significant). Recessions with crises are generally of longer duration than those associated with credit crunches, but the cumulative losses in the former are typically smaller than those resulting from the latter.

5. POLICY RESPONSES DURING RECESSIONS, CRUNCHES AND BUSTS

There are many ways in which policy-makers can respond to a recession, credit crunch or asset price bust, including, besides monetary and fiscal policies, interventions in the financial and corporate sectors, quasi-fiscal operations, changes in exchange rate management, structural reforms etc. To keep matters manageable, and to retain comparability across the diverse set of countries and events under consideration, we consider two policy responses: monetary policies, proxied by changes in (short-term) interest rates, and fiscal policies, captured by changes in government consumption.[21] Although we are aware of the problems involved in associating these variables to the rather broad concepts of fiscal and monetary policy, in our view, these data are illustrative of some general patterns across different types of recessions.

Table 9 reports the medians for peak-to-trough changes in the policy variables for our different combinations of events. Policy responses vary across types and severity of events. Both monetary and fiscal policies tend to be countercyclical during recessions, credit contractions and asset price declines. Moreover, fiscal policy appears to be more accommodating in severe recessions, credit crunches and asset price busts.

In episodes involving credit crunches, and house price and equity price busts, government consumption rises significantly more than in other contraction and decline episodes. A more aggressive countercyclical fiscal policy is at work in recessions with credit crunches, possibly because monetary policy is less effective in these circumstances. During house price busts, the decline in nominal interest rates is also significantly larger than during episodes without house price busts. In addition, the decline in real interest rates is significantly larger during episodes with equity price busts than during episodes without. However, other differences are not significant. For example, while government consumption increases more in severe recessions than in other recessions, the difference is not significant.

With respect to recessionary episodes coinciding with crunches and busts, while most differences in policy responses are intuitively appealing, they are not

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[21] Alternative measures of fiscal and monetary policies, including government revenue and money supply, show patterns broadly consistent with those of the benchmark measures we use here.

Table 9. Changes in policy variables (recessions, credit contractions and asset price declines; median values)

Events	Short-term nominal interest rate[a]	Short-term real interest rate[b]	Government consumption[c]
A. Recessions	−0.79	−0.70	1.79
Severe recessions	0.00	−1.11	2.16
Other recessions	−0.94	−0.66	1.61
B. Credit contractions	−0.27	−1.03	2.83
Credit crunches	−0.71	−0.76	5.98***
Other credit contractions	−0.27	−1.03	2.03
C. House price declines	−0.70	−0.64	3.39
House price busts	−2.86**	0.60	8.75***
Other house price declines	−0.20	−0.82	2.59
D. Equity price declines	0.21	−0.22	3.59
Equity price busts	0.50	−1.13**	7.48***
Other equity price declines	0.17	−0.06	2.95
E. Recessions without credit crunches	−0.95	−0.66	1.57
Recessions with credit crunches	−0.17	−0.79	3.23***
Recessions with severe credit crunches	−0.17	−0.79	4.57***
F. Recessions without house price busts	−0.95	−0.77	1.73
Recessions with house price busts	−1.14	−0.58	1.82
Recessions with severe house price busts	−1.04	−0.78	2.12
G. Recessions without equity price busts	−0.80	−0.72	1.62
Recessions with equity price busts	−1.00	−0.77	2.14
Recessions with severe equity price busts	−0.87	−0.57	2.16

Notes: Severe recessions are those in which the peak-to-trough decline in output is in the top 25% of all recession-related output declines. Credit crunches and asset price busts correspond to peak-to-trough contractions in credit and declines in asset prices, that are in the top 25% of all episodes of credit contractions and asset price declines, respectively. Severe credit crunches and equity/house price busts are those that are in the top half of all crunch and bust episodes. Other contractions and declines refer to episodes that are not crunches and not busts, respectively. Each cell reports the mean (median) change in the respective variable from peak to trough of relevant episodes, unless otherwise indicated. The symbols *, **, and *** indicate that the difference between means (medians) of crunches/busts/shocks and other contractions/declines is significant at the 10%, 5%, and 1% levels, respectively.
[a]Treasury bill interest rate. Change in levels.
[b]*Ex-post* real interest rate. Deflated with each country's CPI. Change in levels.
[c]Percent change.

statistically significant. The only difference that is significant is government consumption during recessions with credit crunches, when the growth rate increases to twice that in recessions without crunches.

6. RECESSION OUTCOMES AND FINANCIAL FACTORS

In this section, we employ basic regression models to examine how the amplitude of a recession is associated with changes in financial variables, considering at the same time fiscal and monetary policies in place, and domestic and global economic conditions. This exercise provides further insights into the roles played by the various financial factors influencing the severity of recessions. A number of distinct factors can affect recession outcomes; our regressions focus on a small set of variables based on the findings in the previous sections and the literature. Our objective

here is *not* to analyse the sources of recessions, but simply to correlate some (financial) factors to the cost of recessions.

The previous sections show that recessions associated with credit crunches and house prices busts are more costly than those without such episodes. Therefore, we include changes in credit, housing and equity prices during recessions as regressors. We also analyse how general economic conditions prevailing at the onset of a recession are associated with recession outcomes. We proxy this with cumulative growth of output over the two years preceding the recession. This allows us to examine whether the strength of the expansionary phase of the cycle plays a role in determining the depth of the ensuing recession. Since external demand can buffer downturns in domestic demand that occur in a recession, we control for global economic conditions by including changes in exports. Since fluctuations in oil prices are often seen as factors affecting recession outcomes, we include growth in oil prices in the two years preceding the recession.

Fiscal and monetary policies are often employed to mitigate the costs of recessions. While many observers argue that they can have a moderating effect, others claim that they do not affect recession outcomes. In our regressions we simply include changes in government expenditure and short-term real interest rates while recognizing that these variables also respond to a recession. Thus, our regressions identify associations, not necessarily causalities.

To account for the 'Great Moderation' in the volatility of business cycles since the mid-1980s, we include a dummy, which takes the value of one after 1986:2, and zero otherwise. We also investigate the effects of financial crises on recessions by including a crisis dummy, which takes the value of one if the country experiences a banking crisis, a currency crisis, or both crises during or in the year prior to a recession, and zero otherwise.

Table 10 reports the results of our OLS regressions.[22] Each of the financial variables enters into the regressions separately in the first three columns. The coefficients of the financial variables are positive, i.e. the extent of the declines in credit, house prices and equity prices are positively associated with the depth of the recessions, with house and equity prices statistically significant. Importantly, a decline in house prices seems to have a greater influence on the cost of recession compared to a contraction in credit or a drop in equity prices.

Column 4 includes house prices and changes in credit, and Column 5 includes all of the financial variables. The coefficients for housing and equity prices remain statistically significant and positive while the coefficient of credit is significant, but with a different sign.[23] Column 6 augments the regression by adding duration of

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[22] We also ran quantile regressions to examine the effects of outliers in our sample; the results were similar. We used other robust methodologies to account for outliers and our main results were maintained.

[23] A possible reason why credit is not a robust determinant of the costs of a recession could be that the volume of credit starts to decline only after the banks tighten their lending standards. Credit standards (more than the volume of credit) are negatively correlated with economic activity (Lown and Morgan, 2006).

Table 10. Regression results for the cost of recessions (percentage change in real variables unless otherwise indicated)

	OLS regressions					
	(1)	(2)	(3)	(4)	(5)	(6)
Credit	0.053 [0.037]	—	—	−0.087** [0.036]	−0.082** [0.035]	−0.049 [0.042]
House price	—	0.165*** [0.043]	—	0.212*** [0.051]	0.204*** [0.046]	0.152*** [0.054]
Equity price	—	—	0.029* [0.015]	—	0.022** [0.010]	0.016 [0.012]
Exports	0.107** [0.041]	0.063 [0.047]	0.014 [0.054]	0.075* [0.044]	0.064 [0.048]	0.072 [0.047]
Initial output	0.198** [0.100]	0.198** [0.087]	0.199** [0.098]	0.177* [0.094]	0.167* [0.096]	0.170* [0.096]
Oil price	−0.008 [0.005]	−0.008* [0.005]	−0.003 [0.004]	−0.006 [0.004]	−0.005 [0.004]	−0.003 [0.004]
Great moderation	−0.880* [0.523]	−1.001** [0.456]	−0.832* [0.498]	−0.973** [0.439]	−0.958** [0.430]	−0.909** [0.416]
Financial crisis	−0.051 [0.556]	−0.240 [0.456]	0.246 [0.461]	−0.087 [0.409]	−0.013 [0.388]	−0.102 [0.362]
Government consumption	0.012 [0.148]	0.062 [0.164]	0.153 [0.168]	0.048 [0.155]	0.075 [0.145]	0.133 [0.154]
Short-term interest rate	0.093 [0.153]	0.082 [0.116]	0.245 [0.150]	0.059 [0.111]	0.068 [0.107]	0.006 [0.099]
Duration of recession[a]	—	—	—	—	—	0.302** [0.129]
Constant	1.801** [0.696]	1.294* [0.693]	1.299* [0.743]	1.070 [0.695]	1.052 [0.680]	0.314 [0.745]
Adjusted R-squared	0.196	0.334	0.152	0.377	0.394	0.419
Number of observations	115	94	107	94	94	94

Notes: The dependent variable is the amplitude of the recession, measured as the change in output from the peak to the next trough of the recession. Credit, house price, equity price, exports, government consumption, and short-term interest rate refer to changes in the respective variable during recessions. Initial output is the level of output at the onset of the recession minus the level of output two years earlier. Oil price is the price of oil at the onset of the recession minus the oil price two years earlier. Great Moderation and Financial Crisis refer to the dummy variables associated with the relevant periods. Robust standard errors are in brackets. The symbols *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.
ᵃ Number of quarters.

the recession. Changes in house prices are again significantly positive, but the other financial variables are no longer significant.

Overall, these results suggest that changes in house prices are important in terms of the costs of recessions, as argued by Cecchetti (2006) among others. This importance extends to changes in the main components of output in recessions associated with house price busts versus other recessions, including those accompanied by credit crunches. As reported, investment – and particularly consumption – usually register much sharper declines during recessions coinciding with house price busts than during those coinciding with credit crunches. The larger decline in consumption likely reflects the effects on households of the substantial loss of housing wealth. These sharper declines, in turn, are associated with more pronounced drops in employment.

In terms of the other factors reflecting the synchronous nature of recessions across countries, decline in exports is positively correlated to the depth of the recession, although it is significant only in two of the specifications. The higher the growth during the expansionary phase of the cycle, the larger the contraction during the recessionary phase, a finding which is significant in all specifications. This suggests that the strength of the expansion affects the degree of build-up of the imbalances. The Great Moderation of milder recessions is visible in most of the specifications.

Neither the change in oil prices nor the presence of a financial crisis appears to affect, in a statistically significant, robust way the severity of a recession.[24] This could be because the changes in the financial variables capture the effect of the crises on the costs of the recessions. However, this explanation may not be robust since the results change in some specifications. As expected, the amplitude of a recession is positively associated with its duration.

We also study the roles of fiscal and monetary policies during recessions. We find that while, as expected, expansionary policies are associated with less severe recessions, none of the relations are statistically significant. This lack of significance could have several explanations. First, we are studying only two narrow aspects of the policy choices available during a recession. Second, as noted, there are various problems involved in associating these specific measures to the rather broad concepts of fiscal and monetary policies and our measures are rough proxies at best.[25]

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[24] In some specifications (not reported), the coefficient of the crisis dummy becomes positive and statistically significant. This result echoes the findings in Bordo *et al.* (2001) that banking, currency and twin crises are positively correlated with the severity of a recession (see also Cerra and Saxena, 2008).

[25] We undertook some additional sensitivity exercises. In particular, we consider cyclically adjusted government consumption and deviations of interest rates from the monetary policy (Taylor) rule as alternative measures of fiscal and monetary policy stances, respectively. These additional regressions lead to similar findings. An alternative approach would be to consider how monetary and fiscal policies affect the probability of exiting a recession, and strength of the recovery. Terrones *et al.* (2009) report that expansionary monetary policies increase the likelihood of exiting from a recession while expansionary fiscal policies have no significant impact. They also find that both fiscal and monetary expansions during recessions are accompanied by stronger recovery. However, the state of the public balances limits the effectiveness of fiscal policies during recovery episodes.

Third, it is known that macroeconomic policies tend to affect output with a lag. Moreover, while fiscal and monetary policies often aim to be countercyclical, there are instances where procyclical monetary policies were in place, for example, to combat inflation. Importantly, the inclusion of these policy measures does not change our findings with respect to the role of financial factors in predicting the costs of recessions. In summary, our main finding is that changes in housing prices are significantly and positively correlated with the costs of recessions, while the results for the impact of most other variables are consistent with those reported in the literature.

7. CONCLUSION AND POLICY LESSONS

7.1. What have we learned?

This study provides a comprehensive analysis of the linkages between key macroeconomic and financial variables around business and financial cycles, for 21 OECD countries for the period 1960–2007. We focused first on the behaviour of these variables around recessions, credit crunches and asset (house and equity) price busts. Our results suggest that the typical recession lasts for almost four quarters and is associated with an output drop (decline from peak to trough) of roughly 2%. Severe recessions, by construction, are much more costly, with a median decline of about 5%, and last one quarter longer. While typical recessions tend to result in a cumulative loss of about 3%, severe ones cost three times as much. As would be expected, most macroeconomic and financial variables exhibit procyclical behaviour during recessions. And two key policy related variables – short-term interest rates and fiscal expenditures – often behave countercyclically.

We find that recessions are bunched in four periods over the past 40 years – the mid-1970s, the early 1980s, the early 1990s and the early 2000s – and often coincide with global shocks. Globally synchronized recessions are longer and deeper than other recessions: the average duration of a synchronized recession tends to be a quarter longer, and often accompanied by twice the cumulative output losses as in other recessions. Countries also go through simultaneous episodes of credit contractions and declines in house and equity prices.

We investigated the coincidence of a recession with a credit crunch or asset price bust. In about one in six recessions, there is also a credit crunch underway, and in about one in four recessions there is also a house price bust. Equity price busts overlap with about one in three recessions. A recession, if it occurs, can start as late as four to five quarters after the onset of a credit crunch or an asset bust. But credit crunches or asset price busts can continue for two to nine quarters after the recession has ended.

We analysed the implications of recessions associated with credit crunches and asset price busts. In terms of duration and severity, we find that recessions associ-

ated with housing busts and credit crunches are both deeper and longer-lasting than other recessions. Differences in total output loss between events with and without severe crunches and busts, typically amount to one percentage point, while the duration is more than one quarter longer in the case of housing busts. In terms of the behaviour of key macroeconomic and financial variables, we find that residential investment tends to fall more sharply in recessions with housing busts and credit crunches than in other recessions. Unemployment rates increase notably more in recessions with housing busts.

We analysed more formally the special role of financial market conditions in affecting the depth of a recession. Our results suggest that changes in house prices tend to be the financial variable most strongly associated with the depth of a recession. In terms of other factors, decline in output is influenced most strongly by the duration of the recession and also by the state of the economy at the onset of the recession.

Our analysis has implications for the current recessions. One is that they will be long-lasting and more costly than other recessions because they are taking place in the context of simultaneous credit crunches and asset price busts. This is confirmed by data showing that many countries around the world are experiencing deep recessions, with massive financial and real consequences. Indeed, the recession in the US is on track to be the longest on record. Furthermore, as our analysis suggests, these recessions have spread across the globe, confirmed by our results on the international dimensions of recessions.

7.2. Policy lessons

Our analysis provides insights on how macroeconomic and financial variables interact around episodes of business and financial cycles, and on the global dimensions of these episodes. It shows that several factors and policies can shape the nature of a recession in a particular country and highlights a number of (long-standing) questions and policy issues. While some of these have been studied in different contexts, addressing them has become more urgent in light of the ongoing deep recessions and accompanying severe financial crises in many countries. We review the implications of our work, therefore, in terms of three aspects: policy approaches to tackle recessions; the medium- and long-term reforms being considered in various forums; and lessons for global coordination.

7.2.1. Policy measures.   Our work has implications for policy actions to mitigate recessions. Policy measures employed by various governments to address the recessions triggered by the global financial crisis typically involve a mixture of accommodative monetary and fiscal policies, and various forms of financial sector support. Furthermore, in some countries, direct support is provided to housing markets to help resolve debt overhangs (by making public resources available conditional on

borrower and lender renegotiating loans), and to other sectors immediately affected by the financial turmoil and economic recession (e.g. through commercial paper programmes, trade finance, small business finance, automobile and student loans).

While our analysis, on its own, does not reveal the costs and benefits of various policy interventions – this would require a more micro-based analysis of specific plans and past experience of such interventions – our results do provide some insights. In terms of short-term policy actions, our data confirm that governments commonly adopt accommodative fiscal and monetary policies in times of recession. At the same time, our analysis provides evidence on the limitations of these policies for mitigating the effects of recessions. Our work also highlights the importance of stable credit and equity markets, as declines in these markets are often associated with deeper recessions. Our analysis thus provides support for some of the measures typically undertaken by governments, including some of those applied during the recent turmoil. Our results confirm the usefulness of measures to (directly and indirectly) support housing markets, since deeper recessions are often accompanied by steeper declines in house prices.

7.2.2. Reform options. The medium-term reform options aimed at preventing severe recessions and periods of financial turmoil that are being discussed, and bearing in mind that crises will inevitably recur, fall within three dimensions – financial sector regulation, macroeconomic policy, and a global financial architecture for stability. While the validity of many of the policy prescriptions and reform efforts being discussed needs more analysis, we think that our work provides support for some of them. Preceding this recession, and as was the case before many earlier recessions, there was a long period of high growth, low real interest rates, and moderate real and financial volatility. While generally benign, some of these elements breed 'excessive' optimism, which, in the presence of policy and regulatory deficiencies, lead to market failures.

The relationship between high growth periods and episodes of excessive optimism is consistent with our finding that the higher the economic growth before the recession, the greater the contraction during the recessionary phase. Our work thus supports the notion that policy-makers need to be cognizant of growing vulnerabilities during periods of high growth. This, in turn, points to the need to ensure that macroeconomic policies take account of the build-up of systemic financial risks, especially in housing markets, which are most clearly associated with the depth of a recession. It also confirms the need for financial regulatory policies to be able to assess the concentration of risk, and flawed incentive structures behind any real and/or financial boom. In addition, the findings we report confirm the need to adapt measures to help mitigate the procyclical effects of asset and credit booms.

7.2.3. Global policy coordination. Our finding that there is a high degree of synchronicity in business and financial cycles across countries confirms the need for

reforms to the global architecture since it suggests that cycles can emerge from common factors and cross-border spillovers. Importantly, we show that globally synchronized recessions tend to be deeper and, thus, require global approaches. Reforms will need to be *ex-ante* and *ex-post* type, that is, reforms to help prevent the build-up of global risks in the expansionary phase of the cycle, and reforms to help deal with the aftermath in the contractionary phase.

Reforms, such as improvements in international surveillance to detect growing vulnerabilities and cross-country links, would help reduce global risks during the expansionary phase of the cycle. Our data and findings could be a valuable input to such an improved surveillance system in providing historical evidence that would help to identify unsustainable patterns in real and financial variables, highlight circumstances conducive to recessions, and forecast their depth should they occur. In addition to economic growth prior to a recession, and asset prices, the other factors identified as being important in terms of the depth of a recession include the state of the economy, global oil price dynamics, and export growth.

To avoid large spillovers during the contraction phase of the cycle, macroeconomic policies and structural reforms at global level will be needed. Clearly, fiscal and monetary policies will be more effective if coordinated globally. Our analysis does not specifically address the global structural reforms that are needed, but presumably they would include correcting for weaknesses in cross-border banking resolution and limits on liquidity provisions through which spillovers in financial markets can occur.

7.3. Caveats and future research

While our broad cross-country study sheds much new light on the implications of recessions, crunches, and busts, it must be accompanied by certain caveats. As this is primarily an event study, no causal inferences are made (or intended) as to how recessions come about, whether financial variables affect macroeconomic outcomes or vice versa, and how policies affect economic and financial outcomes.

One important caveat to our analysis is the implication that initial conditions, external developments in terms of both demand and supply, and policy responses would help to predict the path of an economy during a recession. Although we attempt to control for some of these factors in our preliminary regressions, our analysis makes clear that more work is required to get a better grasp of the important macroeconomic and financial linkages in order to be better informed about how to adjust policies and institutional environments to lower the costs of recessions, and to make better forecasts about the shape of economic outcomes.

For example, our analysis does not explore the channels through which financial and real variables interact. As noted by a diverse set of theoretical studies, besides general wealth and substitution effects, financial variables will impact on the balance sheets of financial institutions, firms and households, thereby affecting the

extension of credit and thus the performance of the real economy. While some empirical work has been done on the importance of these channels in normal times, little is known about how they operate in a recession. This points to an exciting future research agenda. One approach that should shed more light on these channels and how they operate, would be to use individual firm data for a similarly large sample of countries. It would also be useful to focus on alternative metrics for economic activity, such as various measures for the output gap, the different patterns in recessions associated with financial stress or crisis episodes, and how various types of recessions interact with global and emerging market cycles.

Discussion

Gianmarco I.P. Ottaviano
Bocconi University and CEPR

This is a timely well-written paper. Its contribution is accurately placed into context. The descriptive work is careful and references are up to date. On the other hand, the scope of the paper is admittedly limited. Improving the regression analysis and the discussion of policy implications should be part of the authors' future research agenda.

In terms of its strengths, the paper moves beyond the existing literature in at least two respects. First, it details the interactions between recessions, credit crunches, house and equity price busts for a large set of macroeconomic and financial variables for a sizeable number of countries over a long period of time. Second, it provides some preliminary evidence suggesting that the change in house prices during recessions appears to be an important factor influencing the 'cost' of recessions.

Its weaknesses can be understood with respect to the authors' statement of purpose: 'Our objective here is not to analyse the sources of business cycles, but is simply to correlate some financial factors to the cost of recessions'. There are two obvious questions: Has this objective been achieved? Could/should one aim for more?

As for achievement, the paper is best described as a good event study. Nonetheless, even within the limited scope of the paper, the regression analysis should have been enriched. In particular, the 'cost' of recessions should have been explored, discussed and measured along additional dimensions. For example, while the descriptive analysis is developed around the duration, amplitude and cumulative loss of various variables, the regression analysis is restricted only to studying how the output amplitude of recessions is 'affected' by financial variables. Moreover, when considered in some specification, the duration of recessions is introduced as a control variable. But isn't duration a component of the cost of recessions?

Turning to ambition, as a result of its self-limited scope, the paper tries to provide 'policy lessons' without causality analysis. This is honestly acknowledged by the authors but dismissed as a final 'caveat' in the conclusions. However, the dataset collected by the authors would have been rich enough to allow them to push the analysis a bit further. For example, take the results on monetary and fiscal policies: 'while the measures of fiscal and monetary policies we consider do not appear to have a significant impact on the depth of recessions, the inclusion of these factors does not change our main results either'. This result is puzzling and the authors do not provide much insight on what could explain it. This screams for further investigation, possibly through alternative measures of monetary and policy intervention.

Panel discussion

Silvana Tenreyro and David Thesmar began the discussion focusing on the variation in the shape and duration of the recoveries. Sylvana Tenreyro believed it was important to analyse the co-movement of variables around the trough, something which is not fully addressed in the paper.

Alessandro Turrini asked the authors to expand on the motivation for the variables they included in their model specifications as this is not evident in the paper. He was interested in their interpretation of the insignificant financial crisis dummies in explaining the recessions in their model. Fabrizio Perri commented that this was a nice paper which redirected attention on how financial variables relate to real business cycles in contrast to related papers over the last number of years which have focused on the relationship between real variables and real business cycles.

Harold Hau believed the authors should place more emphasis in the paper on their finding of a lack of association between equity market busts and recession. It would help contribute to the current debate, particularly in Europe where many hold the perception that there is a causal link between equity market busts on the current recessions. Richard Portes added that the beginning of the current recessions in the US and Euro area began in December 2007 and January 2008 respectively. He believed it was hard to argue that the financial turmoil which began in August 2007 was sufficient in itself to have caused the magnitude of this recession, especially when compared to the financial turmoil in autumn 1998 which was far greater.

Richard Portes drew the authors' attention to the first and second declarations of the Euro Area Business Cycle Committee which rejected the BBQ methodology because it gives different results on business cycles compared to NBER results and for the Euro area as a whole. Richard Portes also mentioned the use of unweighted Euro area aggregate summary data in the paper gives the impression that the Euro area is very unstable but explained that this is due to the substantial costs of the

Finnish recession. He added the Euro area countries are treated separately in the paper but suggested they could be treated as a single entity from 1999 onwards and statistics indicate there is currently no house price bust in the Euro area.

On the duration and shape of recoveries, Ayhan Kose noted they only examine recessions in this paper. He added that in other work they have found it is not a very straightforward process classifying the shape of recessions and recoveries into L-shaped and V-shaped patterns when using quarterly data. In response to Alessandro Turrini's question, Ayhan Kose explained that the financial crises are associated with sharp movements in assets prices and variation in asset prices is much greater than the small number of financial crisis.

In anticipation of a discussion on the timing of the movement in financial market and real variables, which was subsequently raised by Fabrizio Perri and Richard Portes, Ayhan Kose provided some evidence which suggests the typical credit crunch starts five quarters before the recession, a house price bust begins around three quarters and an equity price bust begins around five quarters beforehand. They find equity busts end around the same time as recessions, credit crunches persist for two quarters while house prices last for nine quarters after the end of the recession.

In response to Richard Portes' comment on the dating of business cycles, Ayhan Kose acknowledged the BBQ methodology has its limitations but pointed out that the turning points are very close to NBER results.

Ayhan Kose agreed with Victor Gaspar's comment that it was important to consider previous episodes of booms and recessions and how they relate to structural change and financial innovations. He believed this would help provide insight for policy discussions.

Regarding questions on the paper's policy conclusions, Stijn Claessen's pointed out that the paper does not necessarily prove policy implications but does show areas of policy emphases such as financial restructuring and housing measures. As they do not have specific measures of past policy action during similar events they are unable to extrapolate.

APPENDIX: SOURCES AND DEFINITIONS OF VARIABLES

Variable	Variable definition	Source
Output		OECD
Consumption	Private final consumption expenditure, volume; 1960:1–2007:4	OECD
Government consumption	Government final consumption expenditure, volume; 1960:1–2007:4 (except Spain: 1961:1–2007:4)	OECD

Variable	Variable definition	Source
Investment	Gross fixed capital formation, volume; 1960:1–2007:4	OECD
Residential FCF	Private residential fixed capital formulation, volume; 1960:1–2007:4 (except Canada: 1961:1–2007:4, France: 1963:1–2007:4, New Zealand: 1961:3–2007:4, Portugal: 1988:1–2007:4)	OECD
Non-residential FCF	Private non-residential fixed capital formulation, volume; 1960:1–2007:4 (except Canada: 1961: 1–2007:4, France: 1963:1–2007:4, UK: 1962:1–2007:4, Denmark: 1971:1–2007:4, New Zealand: 1961: 3–2007:4, Norway: 1962:1–2007:4, Portugal: 1988:1–2007:4, Switzerland: 1961:1–2007:4)	OECD
Total FCF	Private total fixed capital formulation, volume; 1 960: 1 –2007:4 (except Canada: 1961 :1–2007:4, Denmark: 1971:1–2007:4, France: 1963:1–2007:4, New Zealand: 1961:3–2007:4, Norway: 1962:1–2007:4, Portugal: 1977:1–2007:4, Spain: 1964:1–2007:4, Switzerland: 1961:1–2007:4, UK: 1962:1–2007:4)	OECD
Industrial production	Industrial production; 1960:1–2007:4 Generally, the coverage of industrial production indices comprises mining and quarrying, manufacturing and electricity, and gas and water, according to the UN International Standard Industrial Classification (ISIC). For most OECD countries, the data come from the OECD database.	IPS
Exports	Exports of good and services, volume; 1960:1–2007:4	OECD
Imports	Imports of good and services, volume; 1960:1–2007:4	OECD
Net export-GDP ratio	Net exports/GDP; 1960:1–2007:4 (except France: 1963:1–2007:4)	Both net exports and GDP are from OECD.
Current Account – GDP ratio	Current account balances/GDP; 1 960: 1 –2007:4 (except Austria: 1970:1–2007:4, Belgium: 1975: 1–2007:4, Denmark: 1988:1–2007:4, Finland: 1975: 1–2007:4, France: 1975:1–2007:4, Germany: 1971: 1–2007:4, Greece: 1975:1–2007:4, Ireland: 1975: 1–2007:4, Italy: 1971:1–2007:4, Japan: 1968:1–2007:4, Netherlands: 1967:1–2007:4, New Zealand: 1971:1–2007:4, Norway: 1975:1–2007:1, Portugal: 1975:1–2007:4, Spain: 1975:1–2007:4, Sweden: 1975: 1–2007:4, Switzerland: 1972:1–2007:4)	(1) Current account balances are from OECD and GDS; (2) GDP is from OECD.

Variable	Variable definition	Source
House prices	Nominal house prices deflated using CPI (BIS data only); 1970:1–2007:4 (except Austria: 1986:3–2007:4, Belgium: 1988:1–2007:4, Greece: 1993:4–2007:4, Portugal: 1988:1–2007:4, Spain: 1971:1–2007:4)	OECD and BIS (Austria, Belgium, Greece and Portugal)
Stock prices	Share Price (Index) deflated using Consumer Price Index; 1960:1–2007:4 1960:1–2007:4 (except Denmark: 1970:1–2007:4, Greece: 1994:1–2007:4, New Zealand: 1961:1–2007:4, Portugal: 1988:1–2007:4, Spain: 1961:1–2007:4) Indices shown for Share Prices generally relate to common shares of companies traded on national or foreign stock exchanges. All reported indices are adjusted for changes in quoted nominal capital of companies. Indices are, in general, base-weighted arithmatic averages with market value of outstanding shares as weights.	Both Share Price (Index) and Consumer Price Index are from IFS.
Real credit	Nominal credit deflated using Consumer Price Index; 1960:1–2007:4 (except Italy: 1970:1–2007:4, UK: 1963:1–2007:4, Spain:1962:1–2007:4, Sweden: 1969:4–2007:4, Switzerland: 1964:1–2007:4) Nominal credit from IFS is generally titled "Claims on Private Sector", "Claims on Other Resident Sector", etc. Nominal credit from Datasteam is generally titled "Loans to Resident Private Sector", "Lending to Enterprises and Individuals", etc.	(1) Nominal credit is from IFS, Datastream and Haver; (2) Consumer Price Index is from IFS.
Short-term real interest rate	Treasury bill rate deflated using inflation rate; 1960:1–2007:4 Treasury Bill Rate is the rate at which short–term securities are issued or traded in the market. (except Australia 1969:3–2007:4)	(1) Short-term nominal interest rate is from IFS; (2) Inflation rate is the annual growth rate of CPI (from IFS).
Long-term real interest rate	Government bond yield deflated using inflate rate; 1960:1–2007:4 Government Bond Yield refers to one or more series representing yields to maturity of government bonds or other bonds that would indicate longer-term rates. (except Austria 1970:1–2007:4, Finland 1970:1–2007:4, Greece 1992:4–2007:4, Spain 1970:1–2007:4)	(1) Long-term nominal interest rate is from IFS; (2) Inflation rate is the annual growth rate of CPI (from IFS).

Variable	Variable definition	Source
Unemployment rate	Unemployment rate; 1960:1–2007:4 The unemployment rate is the ratio of number of persons unemployed to the number of persons in the labour force. The labour force is the sum of the numbers of persons employed and unemployed. The criteria for a person to be considered as unemployed or employed are defined by the ILO guidelines. (except Australia 1964:1–2007:4, Denmark 1966:1–2007:4, Greece 1985:1–2007:4, New Zealand 1978: 1–2007:4, Portugal 1980:1–2007:4, Spain 1980:1–2007:4, Switzerland 1970:1–2007:4)	OECD and WEO.
Inflation rate	Inflation rate; 1960:1–2007:4 Inflation rate is calculated as [CPI(quarter i, year t)/CPI(quarter i, year $t-1$)–1]*100, where i=1,2,3,4.	CPI is from IFS.

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