



## How do business and financial cycles interact? ☆

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### ABSTRACT

This paper analyzes the interactions between business and financial cycles using an extensive database covering 44 countries for the period 1960:1–2010:4. Our analysis shows that there are strong linkages between the different phases of business and financial cycles. In particular, recessions associated with financial disruptions, notably house and equity price busts, tend to be longer and deeper than other recessions. Conversely, while recoveries following asset price busts tend to be weaker, recoveries associated with rapid growth in credit and house prices are often stronger. These findings emphasize the importance of financial market developments for the real economy.

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## 1. Introduction

The past four years have seen recessions in virtually all advanced economies and many emerging markets. A common feature of these recessions is that they were accompanied by various financial disruptions, including severe contractions in credit and sharp declines in asset prices. These developments have led to an intensive debate in the profession about the links between macroeconomics and finance, and have propelled the study of interactions between business cycles and financial cycles to the forefront of research (Caballero, 2010; Woodford, 2010).

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This paper aims to broaden our empirical understanding of these interactions using a rich database covering a large number of countries over a long period. The main question we ask is: “how does the nature of business cycles vary across different phases of financial cycles?” In addressing this question, we analyze the behavior of major macroeconomic and financial variables over business and financial cycles.

Our work relates to an extensive literature studying the interactions between macroeconomic and financial market developments.<sup>1</sup> Many theoretical models emphasize the roles played by movements in credit and asset (house and equity) prices in shaping the evolution of macroeconomic aggregates over the business cycle (Bernanke et al., 1999; Kiyotaki and Moore, 1997). These theories suggest that in a world with financial frictions, wealth and substitution effects can be amplified because of changes in access to external financing, including through the financial accelerator and related mechanisms. In addition, changes in the supply of external financing can affect corporations and households, and thereby aggregate business cycles.

Empirical research to date has explored some basic aspects of the links between macroeconomic and financial variables. Many studies, for example, focus on the links between credit and output over the business cycle. Changes in house prices are also found to have a close

<sup>1</sup> Fisher (1933) and Keynes (1936) were among the first to emphasize these interactions during the Great Depression. Gertler (1988) provides a review of the early literature.

relationship with the business cycle. Related work has examined whether asset prices are leading, coincident, or lagging indicators of economic activity.<sup>2</sup> Some recent studies, notably Reinhart and Rogoff (2009), concentrate on the behavior of real and financial variables surrounding financial crises.

In spite of this rich research program, our knowledge of the interactions between real and financial sectors during various phases of business and financial cycles remains limited. The multiple phases of business cycles—recessions and recoveries—and financial cycles—downturns and upturns—have yet to be studied for a large sample of countries, including both advanced and emerging economies. While the literature on crises has used broader samples, it relies on annual data, its focus is typically only on a single phase of the cycle—the aftermath of a crisis—and the identification of crises has some drawbacks.

This paper addresses some of these gaps in the literature. First, it is the first detailed, cross-country analysis exploring business and financial cycles and the interactions between their different phases for a large number of countries over a long period of time. Specifically, our dataset includes more than 240 episodes of business cycles and 870 episodes of financial cycles in 44 countries over the period 1960:1–2010:4. Second, in parallel with the literature on business cycles, it uses a well established and reproducible methodology for the dating of financial disruptions and booms. Related, since it uses quarterly data, rather than the annual data typically employed in other studies, it is better able to identify and document the main features of these cycles. Third, taking advantage of the rich database with many countries and long time series, it undertakes a rigorous analysis using regression models of a wide range of factors associated with the duration and depth of recessions and recoveries.

In an earlier paper (Claessens et al., 2009), we analyzed the implications of credit crunches and asset price busts for recessions for a sample of advanced countries over the period 1960–2007. This paper extends our earlier work in a number of dimensions. First, it extends the sample to 2010:4 which allows us to examine the business and financial cycles associated with the global financial crisis. Second, our previous paper considers only advanced countries whereas this one examines both advanced and emerging economies. This increases the sample size substantially, as we add 23 emerging markets to 21 advanced countries. This extension permits us to study the differences between business and financial cycles of these two country groups. Third, while the earlier paper focuses only on recessions, credit crunches and asset price busts, i.e. the “down side” of business and financial cycles, this paper also provides an analysis of the “up side” of business cycles (recoveries) and financial cycles (upturns).

Moreover, the econometric analysis in this paper is quite different. Our earlier paper has only a simple exploratory regression of the amplitude of recessions and has no analysis of the implications of recessions associated with different types of financial disruptions. Our new regression analysis considers the correlates of both duration and amplitude of recessions, and also examines the amplitude of recoveries. It attempts to uncover the linkages between the implications of recessions and recoveries, and their coincidence with financial disruptions and booms.

Our comprehensive analysis of business and financial cycles leads to three major findings. First, interactions between business and financial cycles play a key role in shaping recessions and recoveries. Specifically, recessions associated with financial disruption episodes, notably house and equity price busts, are often longer and deeper than other recessions. Conversely, recoveries following asset price busts tend to be weaker, while recoveries associated with rapid growth in credit and house prices are generally stronger. Second, financial cycles tend to be longer, deeper, and sharper than business cycles. Third, both business and financial cycles are often more pronounced in emerging markets than those in advanced countries.

The paper is organized as follows. In Section 2, we introduce our database, explain our selection of variables, and present our methodology. In Section 3, we document the main features of business and financial cycles. We analyze the implications of the coincidence of business and financial cycles in Section 4. The stylized facts documented in earlier sections set the stage for the more formal empirical analysis in Section 5, where we employ various regression models to examine the role of financial cycles in determining the duration and amplitude of business cycles. We conclude in Section 6 with a brief summary of our main results and provide a general perspective about the use of these results in future research.

## 2. Database and methodology

### 2.1. Database

Our database comprises a total of 44 countries, 21 “advanced” OECD countries and 23 emerging market countries. For the former group, the data coverage is 1960:1–2010:4 while for the latter it is 1978:1–2010:4 (since quarterly data series are less consistently available for these countries prior to 1978). Which variables to use to study business and financial cycles and their interactions? For business cycles, the natural choice is output (GDP) since it is the most comprehensive measure to track economic activity for a large group of countries over a long time period.

For financial cycles, we study three distinct but related financial markets: credit, housing, and equity markets. Credit is a natural aggregate to analyze financial cycles as it constitutes the single most important link between savings and investment. Our measure of credit is aggregate claims on the private sector by deposit money banks. This measure is often used in cross-country studies on financial sector development and credit dynamics (Mendoza and Terrones, 2008).<sup>3</sup> The two other financial variables we use are asset (house and equity) prices. House prices are various indices of house or land prices depending on the source country. Equity prices are individual share prices weighted by their outstanding market values.

All macroeconomic and financial variables we use are at the quarterly frequency, seasonally adjusted whenever necessary, and in constant prices. In addition to these variables, we use a number of other variables in our formal empirical analysis. We provide additional information about country coverage, and all variables in the dataset and their sources in the Data Appendix I.

### 2.2. Methodology

#### 2.2.1. Dating business cycles

A number of methodologies have been developed over the years to characterize business cycles. Our study is based on the “classical” definition of a business cycle which provides a simple but extremely effective procedure to identify cyclical turning points. This definition goes back to the pioneering work of Burns and Mitchell (1946) who laid the methodological foundation for business cycle analysis in the United States.<sup>4</sup>

The classical methodology focuses on changes in levels of economic activity, in other words, it tracks absolute declines and increases.<sup>5</sup>

<sup>3</sup> For a broader perspective on financial cycles and alternative measures of credit and asset prices that could be considered, see Claessens et al. (2011a).

<sup>4</sup> Moreover, the classical approach constitutes the guiding principle of the Business Cycle Dating Committees of the National Bureau of Economic Research (NBER) and of the Center for Economic Policy Research (CEPR) in determining the turning points of U.S. and euro area business cycles.

<sup>5</sup> Since our methodology tracks absolute declines and increases, if the trend growth rate is high in a country, then the likelihood of finding a recession in that country might be lower compared to the growth cycle methodology. In practice, however, countries with higher trend growth rates (which are mostly emerging markets) tend to, on average, exhibit higher volatility as well, so it is not necessarily the case that they exhibit smaller number of recessions than those countries with relatively lower trend growth rates.

<sup>2</sup> For the interactions between credit and output, see Helbling et al. (2011) and references therein. For the links between various asset prices and real aggregates, see Engel and West (2005).

An alternative methodology would be to consider how economic activity fluctuates around a trend, and then to identify “growth cycles” as deviations around this trend (Backus and Kehoe, 1992; Stock and Watson, 1999). While there is a rich research program using such detrended series (and their second moments, such as volatility and correlations), this approach is less suited for our objective.

To produce a well-defined chronology of business and financial cycles for a large number of countries over an extended period of time, the classical methodology presents a number of advantages. Specifically, the turning points identified by 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 (Canova, 1998). Moreover, it does not suffer from the usual critique of trend-cycle dichotomy, which the growth cycle approach centers on.

We employ the algorithm introduced by Harding and Pagan (2002), 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.<sup>6</sup> This algorithm searches for maxima and minima in the series over a given period of time. Then, it selects pairs of adjacent, locally absolute maxima and minima that meet certain censoring rules. In particular, the algorithm requires a complete cycle and each phase to last at least five quarters and two quarters, respectively. Specifically, a peak in a quarterly series  $y_t$  occurs at time  $t$ , if:

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

Similarly, a cyclical trough occurs at time  $t$ , if:

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

A complete business cycle typically comprises of two phases, the recession phase (from peak to trough) and the expansion phase (from trough to the next peak). The early part of the expansion phase, the recovery from a recession, has been widely studied (Balke and Wynne, 1992; Mussa, 2009). Recovery is usually defined as the time it takes for output to rebound from the trough to the peak level before the recession. Some others associate recovery with the growth achieved after a certain time period, such as four or six quarters, following the trough (Sichel, 1994). Given their complementary nature, we use both definitions.

### 2.2.2. Dating financial cycles

We identify financial cycles using the same methodology as used to determine business cycles.<sup>7</sup> We use different terms though to describe the phases of financial cycles: we call the recovery phase of a financial cycle the “upturn,” and the contraction phase the “downturn.” Our dating of financial cycles relates to several recent studies that identify financial crises and analyze the evolution of macroeconomic aggregates around these episodes (notably Reinhart and Rogoff, 2009).

Our approach for dating financial cycles has some obvious advantages over the methods used in earlier literature (Kose, 2011). First, in parallel with the business cycle literature, it uses a well-established and reproducible methodology for dating different phases of a cycle, whereas crisis dating is often based on narrative records and can be subjective, especially for banking crises (in many cases, the end date of a crisis is selected in an ad hoc manner). Second, our approach allows us to consider financial downturns that were not necessarily crises, yet did create financial stress with possible adverse macroeconomic

<sup>6</sup> The specific algorithm we employ is known as the BBQ algorithm since it is applied to quarterly data.

<sup>7</sup> Since asset prices can show much greater intra-quarter variation, the constraint that the contraction phase must last at least two quarters is ignored if the quarterly decline exceeds 20% (Claessens et al., 2011b).

outcomes. Moreover, it considers three types of financial cycles, allowing us to investigate which of these are more important, whereas a crisis dummy often lumps such events together.

### 2.2.3. Characterizing business and financial cycles

The main characteristics of cyclical phases are duration, amplitude, and slope. The duration of a recession/downturn,  $D_c$ , is the number of quarters,  $k$ , between a peak and the next trough of a variable. Likewise, the duration of a recovery/upturn,  $D_u$ , is the number of quarters it takes for a variable to reach its previous peak after the trough. The amplitude of a recession/downturn,  $A_c$ , measures the change in  $y_t$  from a peak ( $y_0$ ) to the next trough ( $y_k$ ), i.e.,  $A_c = y_k - y_0$ . The amplitude of a recovery/upturn,  $A_u$ , measures the change in  $y_t$  from a trough ( $y_k$ ) to the level reached in the first four quarters of an expansion ( $y_{k+4}$ ), i.e.,  $A_u = y_{k+4} - y_k$ . Lastly, the slope of a recession/downturn is the ratio of the amplitude to the duration of the recession/downturn and the slope of a recovery/upturn is the ratio of the change from the trough to the last peak divided by the duration. Thus, the slope measures the violence (or speed) of a given cyclical phase.

For recessions only, we consider another widely used measure, cumulative loss, which combines information on duration and amplitude to proxy for the overall cost of a recession. The cumulative loss,  $F_c$ , of a recession, with duration  $k$ , is defined as<sup>8</sup>:

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

## 3. Business and financial cycles: basic features

### 3.1. Business cycles: recessions and recoveries

#### 3.1.1. Frequency of business cycles

Using our methodology, we identify 243 recessions and 245 recoveries in our sample (Table 1). The number of recessions and recoveries differs slightly because of the timing of the events. Of these, 142 recessions and 142 recoveries are in advanced countries, and 101 recessions and 103 recoveries are in emerging markets. Given that most earlier studies focuses on the U.S., with only eight recession/recovery episodes since 1960, the depth of our dataset provides substantial value added to the knowledge on various aspects of business cycles. The number of business cycle episodes is smaller for emerging markets, primarily because we cover a shorter period for this group.

#### 3.1.2. Duration and amplitude of business cycles

We next briefly analyze the main features of recessions and recoveries. Although we most often focus on medians, because they are less affected by the presence of outliers, we refer to means wherever relevant. A recession lasts on average close to 4 quarters while a recovery takes about 5 quarters. There is no noticeable difference between advanced and emerging market countries in terms of the duration of recessions, but it takes about 2 quarters longer for emerging economies to recover than it does for advanced countries.

The typical decline in output from peak to trough, the recession's amplitude, is about 2.7% for the full sample, and the typical cumulative output loss is about 4.7%. The slope (violence) of a recession, the ratio of its amplitude to duration, tends to be about 0.8. The amplitude of a recovery, defined as the increase in the first four quarters following the trough, is typically about 4.2%. Although the majority of recessions (recoveries) are associated with moderate declines (increases) in output, these events can result in much larger changes as well, as the differences between the medians and means show.

<sup>8</sup> This formula is based on a triangular approximation of lost output during a recession. Details of its derivation are available from the authors upon request.

**Table 1**  
Business cycles: basic features.

	Output				
	Number of events	Duration	Amplitude	Cumulative loss	Slope
<b>Recessions</b>					
Full sample	243	3.83 [3.00]	-2.73 [-4.47]	-4.71 [-11.18]	-0.83 [-1.22]
Advanced countries	142	3.88 [3.00]	-2.17*** [-3.08***]	-3.62*** [-7.91**]	-0.55*** [-0.84***]
Emerging markets	101	3.76 [3.00]	-4.90 [-6.41]	-8.79 [-15.78]	-1.34 [-1.75]
<b>Recoveries</b>					
Full sample	245	5.06 [3.00]	4.23 [5.22]	...	1.19 [1.67]
Advanced countries	142	4.28** [3.00**]	3.09*** [4.04***]	...	0.78*** [1.40**]
Emerging markets	103	6.43 [4.00]	6.41 [6.93]	...	1.56 [2.02]

Notes: All statistics except "Duration" correspond to sample medians. Means are in brackets. For "Duration" means are shown with medians in brackets. Duration for recessions is the number of quarters between peak and trough. Duration for recoveries is the time it takes to attain the level of output at the previous peak after the trough. The amplitude for the recessions is calculated based on the decline in each respective variable during the peak to trough decline in output. The amplitude for the recoveries is calculated based on the one year change in each respective variable after the trough in output. Cumulative loss combines information about the duration and amplitude to measure the overall cost of a recession and is expressed in percent. The slope of the recessions is the amplitude from peak to trough divided by the duration. The slope of the recoveries is the amplitude from the trough to the period when output has reached the level at its last peak, divided by the duration. Significance refers to the difference between emerging and advanced country means or medians.

\*\*\* Implies significance at the 1% level.

\*\* Implies significance at the 5% level.

The absolute value of the slope of a typical recovery, 1.2, is larger than that of a recession, i.e., the pace of recoveries tends to exceed that of recessions.<sup>9</sup>

Business cycles in emerging markets are more pronounced than those in advanced economies. In particular, the median decline in output during recessions is much smaller in advanced countries (2.2%) than in emerging markets (4.9%), and recoveries in advanced countries are half as weak as those in emerging markets. In terms of cumulative loss, recessions in emerging market economies are almost three times more costly than those in advanced countries. Recessions in emerging economies are also more intense, with a slope more than two times as large. In a similar fashion, recoveries in emerging markets tend to feature a larger slope than those in advanced countries. These results echo the findings of earlier studies which report that business cycles in emerging markets are more volatile than those in advanced countries (Kose et al., 2006)

How do the recessions associated with the 2008–2009 global financial crisis compare with those of earlier periods? In order to answer this question, we identify those complete recession episodes that took place over the period 2007–2010. There are 37 such episodes: 20 in advanced countries and 17 in emerging markets. As one would expect, given that the financial crisis had its epicenter in the advanced countries, the typical recent recession in these economies is about 2 quarters longer and more than two times as deep than those in earlier periods (i.e., before 2007). The typical recent decline in output was also faster as evidenced by a much higher slope. In

the case of emerging markets, the typical recent recession is shorter, but slightly deeper than those in earlier periods.

We find 39 completed recoveries over 2007–2010, of which 20 took place in advanced countries and 19 in emerging markets. The recent recoveries are faster compared with those of earlier periods by about 1 quarter. There is large variation though, with recoveries in advanced countries slower than those in the earlier periods by 1 quarter and recoveries in emerging markets faster by about 3 quarters. As expected, recent recoveries are less strong registering about 1 percentage point smaller growth in GDP in the first 4 quarters. These findings together suggest that most recent recoveries in advanced countries are weaker and those in emerging markets are slightly stronger than the ones in the earlier periods.

### 3.2. Financial cycles: upturns and downturns

#### 3.2.1. Frequency of financial cycles

We identify 879 financial downturns and 904 upturns (Table 2). The full sample features 253 downturns in credit, 183 in house prices, and 443 equity prices, and 260, 187, and 457 upturns, respectively. The growth rates of equity price series are more volatile than those of credit and house prices, so it is normal that the equity price series feature a larger number of upturns and downturns. Advanced economies have more financial cycles than emerging markets do, largely because we have a longer period and more data series for the former group. In the case of house prices, for example, the number of downturns (upturns) in advanced countries is 142 (142) whereas it is only 41 (45) in emerging markets, reflecting in large part the scarcer coverage of house prices for emerging markets. Similarly, the number of full equity cycles in emerging markets is about half that in advanced countries since active equity markets have only been in existence for the past two decades in many of these economies.

#### 3.2.2. Duration and amplitude of financial cycles

Downturns (upturns) of financial cycles tend to last longer than recessions (recoveries) do. Episodes of house price downturns, for instance, typically last slightly longer than 8 quarters, while other financial downturns last some six quarters. Upturns are often longer than downturns, by about 4 quarters for credit and house prices and by about 12 quarters for equity prices.

Financial cycles are often more pronounced than business cycles are, with downturns particularly deeper and more intense than recessions. A typical credit downturn corresponds to about a 6% decline in real credit, house price downturns amount to some 7%, and equity price downturns to 30%. The strength of upturns also differs across financial markets. Equity price upturns are the largest, about 26%. Also measured by slope, financial cycles are more violent than business cycles are, confirming the results of many earlier studies that asset prices are more volatile than economic fundamentals (Campbell, 2003).

The main features of financial downturns vary across advanced and emerging market countries. While not necessarily longer, financial downturns are much sharper in emerging markets than in advanced countries. Credit downturns, for example, last slightly longer, but are three times as deep in emerging markets than in advanced countries. Equity downturns in emerging markets last as long as those in advanced countries, but upturns take much shorter in emerging markets. Comparisons between mean and medians show that the distributions of duration and amplitude of the phases of financial cycles are more skewed to the right for emerging markets than for advanced countries. These differences are also reflected in the slope, with the slope being much higher for emerging markets than for advanced countries.

We also compare the features of financial downturns associated with the latest global crisis with those of earlier periods. We identify 36 downturns in credit, 42 in house prices, and 59 in equity prices over the period 2007–2010. The majority of these recent episodes

<sup>9</sup> We also analyze the behavior of other macroeconomic aggregates, including consumption, investment, industrial production, and unemployment rate, and examine the distributions of the duration and amplitude of the various phases of business and financial cycles (Claessens et al., 2011b).

**Table 2**  
Financial cycles: basic features.

	Financial downturns				Financial upturns			
	Number	Duration	Amplitude	Slope	Number	Duration	Amplitude	Slope
<b>Credit</b>								
Full sample	253	5.83 [4.00]	−5.56 [−12.31]	−1.33 [−2.06]	260	9.70 [4.00]	5.61 [9.27]	1.65 [2.77]
Advanced countries	134	5.39 [4.00]	−4.00*** [−6.37***]	−0.92*** [−1.22***]	135	7.82** [4.00]	4.33*** [6.05***]	1.23*** [1.97***]
Emerging markets	119	6.32 [4.00]	−11.07 [−19.05]	−1.84 [−3.00]	125	11.93 [5.00]	9.78 [12.69]	2.31 [3.73]
<b>House price</b>								
Full sample	183	8.14 [6.00]	−6.78 [−11.42]	−1.13 [−1.47]	187	12.68 [5.00]	4.55 [6.72]	1.34 [1.83]
Advanced countries	142	8.33 [6.00]	−6.30* [−10.58]	−1.06*** [−1.23***]	142	13.74** [5.00]	4.10** [5.73**]	1.20** [1.58**]
Emerging markets	41	7.49 [6.00]	−8.38 [−14.31]	−1.34 [−2.31]	45	8.25 [5.00]	6.98 [9.91]	2.19 [2.85]
<b>Equity price</b>								
Full sample	443	6.18 [5.00]	−30.31 [−32.65]	−5.07 [−6.04]	457	18.36 [7.00]	26.44 [38.22]	6.13 [8.49]
Advanced countries	279	6.64 [5.00]	−23.70*** [−27.38***]	−4.07*** [−4.70***]	285	21.93*** [7.00]	20.09*** [24.08***]	4.75*** [5.99***]
Emerging markets	164	5.93 [5.00]	−36.63 [−38.03]	−6.29 [−7.33]	172	12.32 [7.00]	38.48 [63.67]	8.54 [13.02]

Notes: All statistics except “Duration” correspond to sample medians. Means are in brackets. For “Duration” means are shown with medians in brackets. Duration for downturns is the number of quarters between peak and trough. Duration for upturns is the time it takes to attain the level at the previous peak after the trough. The amplitude for the downturns is calculated based on the decline in each respective variable during the peak to trough decline in the financial variable. The amplitude for the upturns is calculated based on the one year change in each respective variable after the trough in each respective financial variable. The slope of the downturns is the amplitude from peak to trough divided by the duration. The slope of the upturns is the amplitude from the trough to the period where the financial variable has reached the level at its last peak, divided by the duration. Significance refers to the difference between emerging and advanced country means or medians.

\*\*\* Implies significance at the 1% level.

\*\* Implies significance at the 5% level.

\* Implies significance at the 10% level.

took place in advanced countries which were of course at the epicenter of the financial crisis. While recent financial downturns are shorter, they are, in most cases, deeper than those in the past. In particular, recent declines in house and equity prices are often larger than those in earlier periods. Moreover, the latest episodes witnessed much faster declines in especially equity prices, with much higher slope coefficients.

Conversely, we identify 60 upturns in credit and house prices, and 105 in equity prices over 2007–2010. These events are about equally divided between advanced countries and emerging markets. While credit upturns after 2007 are less sharp in advanced countries compared to those of earlier periods, equity upturns in advanced countries are much faster and larger in the recent period. In emerging markets, financial upturns are comparable or more intense compared to those of earlier periods.

#### 4. Implications of coincidence of business and financial cycles

In this section, we turn our attention to the main features of recessions and recoveries when they are accompanied by intense episodes of financial cycles, i.e., disruptions and booms. To identify disruptions and booms, we rank the changes in each financial variable during respective downturns and upturns. We then classify an episode as a disruption (boom) if the change in the variable during the downturn (upturn) falls into the bottom (top) quartile of all respective changes. We call disruptions crunches or busts depending on the variable (i.e., credit crunch, house or equity price bust). Similarly, we have credit, house, and equity price booms.<sup>10</sup>

<sup>10</sup> We provide a detailed analysis of the features of these episodes in Claessens et al. (2011b). Our sample of disruptions and booms is based on disruptions and booms in advanced and emerging market countries separately. If we used the full sample to identify episodes of disruptions and booms, we would end up with a somewhat biased sample, since financial cycles in emerging markets are more pronounced than those in advanced economies. We also used alternative cut off points of 20 and 30% to identify disruptions and booms. Our main results remain robust to this change.

If a recession (recovery) episode starts at the same time or after the beginning of an ongoing disruption (boom) episode, we consider that recession (recovery) to be associated with the respective disruption (boom). These associations, by definition, imply coincidence of events, but do not imply causation. To provide a sense of distributions, we also examine those recessions (recoveries) coinciding with severe disruptions (strong booms). These severe disruption (strong boom) episodes consist of the bottom (top) 12.5% of all financial downturns (upturns), or, in other words, the bottom (top) half of all disruptions (booms).

##### 4.1. Recessions associated with disruptions

A major advantage of our database is that we have a large number of recessions accompanied by various forms of financial disruptions (Table 3). Specifically, we identify 36, 46, and 76 recession episodes associated with credit crunches, house price busts, and equity price busts respectively. In other words, in about one out of six recessions, there is also a credit crunch underway, and, in about one out of three recessions, also a house price bust (note that the total number of cases varies by the coverage of variables).

Recessions accompanied with financial disruptions tend to be longer and deeper than other recessions. In particular, recessions associated with house price busts are significantly longer than recessions without such disruptions, by some 1½ quarter on average. Recessions with credit crunches and house price busts result in significantly larger drops in output and correspondingly greater cumulative output losses (more than 4 percentage points in case of house price busts) relative to those without such episodes. Recessions accompanied with equity busts are also associated with significantly larger output declines than recessions without such a bust, although the typical cumulative loss in such a recession is somewhat smaller than in those recessions accompanied with a credit crunch or a house price bust.

A recession associated with one type of financial disruption is often accompanied with stress in other financial markets. For

**Table 3**  
Business cycles with intense financial cycles.

Recessions associated with financial disruptions	Output					Financial variables		
	Number of events	Duration	Amplitude	Cumulative loss	Slope	Credit	House price	Equity price
A. Recessions without credit crunches	204	3.82	−2.74	−4.43	−0.84	1.13	−3.33	−12.98
Recessions with Credit Crunches	36	3.97	−3.62*	−7.80**	−0.83	−8.35***	−5.24*	−7.22
Recessions with Severe Credit Crunches	20	3.85	−3.54	−8.26	−0.96	−13.51***	−6.30*	−2.63
B. Recessions without house price busts	95	3.38	−1.96	−3.08	−0.60	1.25	−1.53	−14.42
Recessions with house price busts	46	4.74***	−2.76**	−7.29***	−0.62	−0.08***	−10.47***	−9.65
Recessions with severe house price busts	26	5.04**	−2.76**	−5.86***	−0.78	−2.28***	−10.74***	−9.65
C. Recessions without equity price busts	144	3.55	−2.15	−3.41	−0.57	0.74	−2.36	−4.55
Recessions with equity price busts	76	4.21**	−3.85***	−6.85***	−0.98***	1.06	−4.89**	−31.58***
Recessions with severe equity price busts	38	4.47**	−5.17***	−9.73***	−1.27***	1.10	−4.86*	−40.52***
Recoveries associated with financial booms	Output					Financial variables		
	Number of events	Duration	Amplitude	Slope		Credit	House price	Equity price
A. Recoveries without credit booms	216	5.22	3.94	1.07	1.38	−0.83	14.78	
Recoveries with credit booms	21	4.15	8.84***	2.13***	8.86***	3.26	14.48	
Recoveries with strong credit booms	11	4.45	10.41***	2.21***	13.02***	4.76	42.75**	
B. Recoveries without house price booms	126	4.76	2.89	0.75	0.81	−1.35	14.46	
Recoveries with house price booms	14	2.29***	6.14***	1.35***	5.99**	7.96***	15.23	
Recoveries with strong house price booms	9	2.44***	6.65***	1.59**	5.93	7.91***	18.37	
C. Recoveries without equity price booms	161	4.89	3.96	1.11	2.66	−0.38	5.36	
Recoveries with equity price booms	55	4.69	4.36	1.13	0.86	−0.44	38.53***	
Recoveries with strong equity price booms	30	5.18	4.46	1.21	0.57	−0.44	47.90***	

Notes: All statistics except “Duration” correspond to sample medians. For “Duration” means are shown. Booms are the top 25% of upturns calculated by the amplitude. Disruptions (Crunches, Busts, and Collapses) are the worst 25% of downturns calculated by the amplitude. Significance refers to the difference between recessions (recoveries) with and without financial disruptions (booms). For definitions of other statistics see notes to Tables 1 and 2.

\* Implies significance at the 10% level.

\*\* Implies significance at the 5% level.

\*\*\* Implies significance at the 1% level.

example, recessions accompanied by credit crunches mean not only a significant decline in credit, but also coincide with substantial drops in house prices. Our sample also includes recessions accompanied by combinations of credit crunches and asset busts at the same time. Although the number of such episodes is small for statistical analysis, a recession associated with both a credit crunch and an asset price bust often results in a larger cumulative output loss than a recession with only a crunch or only a bust.<sup>11</sup>

We also check the features of recessions associated with financial disruptions during the global financial crisis. The majority of these recessions are indeed associated with financial disruptions. For example, out of 37 recessions we identified, 24 of them are accompanied with equity busts. These recessions tend to be even deeper and longer than ones without disruptions over the recent period. In particular, the latest recessions associated with house price busts are significantly more costly and longer lasting than those without such busts.

#### 4.2. Recoveries associated with booms

We have altogether 21, 14, and 55 recovery episodes associated with booms in credit, house prices, and equity prices, respectively. Similar to how financial disruptions are associated with longer and deeper recessions, so are recoveries associated with credit or house price booms shorter and associated with stronger output growth.<sup>12</sup> With respect to duration, recoveries coinciding with house price booms tend to be significantly shorter, by some 2 quarters. Output growth is some 3–4 percentage points higher in cases of recoveries associated by credit and house prices booms. The speed of recovery is also faster for those episodes associated with a financial boom. Recoveries with financial

<sup>11</sup> There are 9 recessions in our sample associated with a credit crunch and an equity price bust at the same time, 5 with a credit crunch and a house price bust, and 16 with an equity price bust and a house price bust.

<sup>12</sup> In the working paper version, we also study the changes in other macroeconomic variables during recessions and recoveries associated with disruptions and booms respectively (Claessens et al., 2011b).

booms are not necessarily accompanied with rapid growth in every financial variable, reflecting the persistence of previous financial downturns that still linger on during the recovery.

### 5. Interactions between business and financial cycles: a formal analysis

The regularities we have reported in the previous sections suggest that financial cycles tend to play key roles in affecting both the duration and strength of recessions and recoveries. In particular, recessions associated with financial disruptions tend to be longer and deeper, and recoveries combined with booms in financial markets, especially in housing and credit markets, are slightly shorter and stronger. These univariate findings, however, do not account for concurrent developments in the other financial markets we study. In addition, they do not control for other factors that potentially influence the nature of business cycles. External factors, such as the strength of the global economy or changes in world commodity prices, and domestic structural factors, including openness to trade and financial flows, could all influence the features of business cycles.

In this section, we therefore use various multivariate regression models to study how developments in different financial market segments and other factors collectively shape countries' business cycles, both recoveries and recessions. This also allows us to run a horse race among our financial variables to identify which are most closely associated with business cycles. We examine first the factors explaining the duration and amplitude of recessions, and then those explaining the strength of recoveries.

#### 5.1. Duration and amplitude of recessions

##### 5.1.1. Duration of recessions

A large body of literature studies the duration of business cycles motivated by the objective to determine whether different phases of business cycles exhibit duration dependence—that is the possibility that a recession (recovery) is more likely to end the longer it lasts. There is a

**Table 4A**  
Determinants of the duration of recessions. (Percent change in real variables unless otherwise indicated).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Recession with a house price bust		−0.593** [0.236]				−0.848*** [0.249]			−0.883*** [0.270]	−1.266*** [0.332]
Recession with an equity price bust			−0.400** [0.168]				−0.954*** [0.254]		−0.994*** [0.270]	−0.702*** [0.268]
Recession with a credit crunch				−0.316 [0.235]				0.254 [0.349]	0.035 [0.386]	
House price growth (3-year average before the peak)										−0.038** [0.018]
Equity price growth (3-year average before the peak)										−0.016 [0.012]
World output growth (1-year average following the peak)										0.242*** [0.079]
Oil price growth (3-year average before the peak)										0.013* [0.008]
Trade openness (at the peak)										0.047*** [0.011]
Constant	−3.486*** [0.367]	−3.330*** [0.301]	−3.304*** [0.324]	−3.477*** [0.385]	−3.605*** [0.491]	−3.411*** [0.397]	−3.194*** [0.384]	−3.662*** [0.493]	−3.057*** [0.350]	−4.936*** [0.669]
P (Weibull distribution parameter)	2.384 [0.090]	2.409 [0.090]	2.401 [0.088]	2.399 [0.089]	2.439 [0.134]	2.541 [0.135]	2.575 [0.136]	2.447 [0.137]	2.665 [0.129]	3.16 [0.256]
Number of Observations	254	254	254	254	134	134	134	134	134	134
Log likelihood	−171	−167	−168	−170	−89	−83	−81	−89	−75	−58

Notes: All regressions include country fixed effects. Coefficients shown along with robust standard errors in brackets below respective coefficient estimate. The dependent variable is the duration of a recession. A recession associated with a financial disruption (credit crunch, equity price bust, house price bust) dummy variable takes on a value of 1 when a disruption is ongoing when the recession begins or ended at most one quarter before the recession began. World output growth is the PPP weighted annualized quarterly output growth from OECD countries. Growth is the annualized quarterly growth rate. Trade openness is defined as (exports + imports) as percent of GDP.

\*\* Implies significance at the 5% level.

\*\*\* Implies significance at the 1% level.

\* Implies significance at the 10% level.

great variety of parametric duration models that allows one to study this issue, with the Weibull model the most commonly used (Diebold et al., 1993; Ohn et al., 2004). These studies, however, do not control for country-specific characteristics, economic and financial conditions in the run-up to the recession (expansion), and whether the recession coincides with a financial event. We also employ the Weibull regression model, but our approach differs from others in that we use panel regressions with fixed effects and examine the influence of financial variables for the likelihood of exiting from a recession.

The first column of Table 4A reports results with only country fixed-effects. In this specification, country fixed-effects have a proportional impact on the baseline hazard function. We find evidence of positive duration dependence in recessions—that is, recessions are more likely to end, the longer they have gone on.<sup>13</sup> While this finding is consistent with the evidence in other studies on recessions in advanced countries, we are the first to confirm this positive duration dependence for recessions in a sample of both advanced and emerging market countries.

We next examine the effect of financial disruptions on the duration of recessions. For this, we include three dummy variables, which take the value of one if the recession coincides with a credit crunch or an asset (house and equity) price bust and zero otherwise, as additional explanatory variables. Of the three disruptions we examine, asset price busts have negative and significant coefficients (columns 2–4). This confirms that recessions associated with house price or equity price busts tend to go on longer than other recessions do, even after taking account of individual country circumstances (through our fixed effects).<sup>14</sup>

<sup>13</sup> The parameter  $p$  in the Weibull model defines the extent of duration dependence. When  $p = 1$ , the hazard rate is constant; when  $p > (<)1$  the hazard rate shows positive (negative) duration dependence. In the tables, we report Weibull regression coefficients in log form, from which the hazard rate can be obtained as  $h(t/x_i) = pt^{p-1} \exp(\beta_0 + x_j \beta_j)$ , where  $\beta$  refers to the relevant coefficient,  $x$  is the set of explanatory variables,  $t$  denotes duration, and  $j$  is the event index.

<sup>14</sup> In other words, a house price bust reduces the hazard of ending a recession to almost 0.55 of what it would be otherwise (calculated as  $e^{\beta_1}$ , where  $\beta_1$  is the house price bust coefficient reported in column (2) in Table 4A).

In order to better understand the roles played by asset price busts in influencing the duration of recessions, we next run a series of regressions where we control for other, time-varying factors. These factors include global conditions—proxied by the growth rate of world output in the first year of each recession and the growth rate of oil prices in the run-up to each recession. In addition, we include two country-specific aspects: the extent of growth in house prices prior to the recession and the degree of trade openness. Since data for some of these variables are not available for all years and all countries, our sample size reduces to 134 observations. To be consistent across specifications, we first re-estimate all of our previous regressions using this set of observations (columns 5–8) and then consider additional specifications (columns 9–10).

When we rerun the model for the smaller sample without any other explanatory variables (column 5), we find the Weibull distribution parameter to remain greater than one, implying that recessions in our sample are characterized by positive duration dependence. We next investigate whether recessions associated with a financial disruption—credit crunch, house price bust and equity price bust—last longer. We confirm that the simultaneous occurrence of a house price or equity price bust tends to lower the hazard rate of ending of a recession (columns 6 and 7), while a simultaneous credit crunch does not significantly relate to the length of a recession (column 8). When we consider all three dummies together (column 9), the housing and equity price bust dummies remain significantly negative. The fact that the credit bust dummy is positive but not statistically significant, likely reflects the strong relationships and feedback effects between housing and credit markets discussed before and documented in detail in Claessens et al. (2011a).

We next examine how, besides the occurrence of financial busts, the growth of asset prices prior to the recession correlates with the recession's duration (column 10, which becomes our baseline regression). The regression reconfirms that a typical recession associated with a house price bust is often substantially longer than other recessions. It also shows the increase in house prices prior to the recession to be significantly positively related with the recession's duration, while equity price growth does not have a significant correlation. In

terms of global and country factors, we find the buoyancy in world output to help countries emerge faster from a recession and greater trade openness to reduce the duration of the recession. An increase in the world oil price in the run-up to the recession is associated with shorter recessions, suggesting that recessions due to exogenous factors last shorter, but this effect is small economically and disappears when we conduct robustness analysis, which we discuss next.

### 5.1.2. Robustness of results: duration of recessions

We check whether our results are robust to the introduction of other potential factors. We do so by augmenting our baseline specification with a wide range of factors (Table 4B). These regression results show that our baseline result (column 10 of Table 4A, repeated in Table 4B column 1) does not change with the inclusion of these factors. In terms of financial indicators, financial openness (column 2) has a statistically significant impact, but financial sector development (column 3) does not have a statistically significant effect on the hazard function. This is also so when they appear jointly, since both of these variables remain insignificant (column 4). All of our previous regression results are maintained, however.

Similarly robust results obtain when we include the increase in credit in the run-up to the recession (column 5). We next include the current account balance in the run up to the recession to allow for the possibility that the effects are driven by countries with large current account deficits which might be more vulnerable to reversals in capital flows and subsequent recessions. However, the current account balance does not have a significant impact on the recession's duration (column 6).

Finally, we consider whether the occurrence of a banking crisis makes a difference to our regression results. Some recent studies, notably Reinhart and Rogoff (2009), show that financial crises tend to be associated with protracted periods of output contraction, i.e., recessions accompanied with such events are longer than normal recessions. We find that recessions with banking crises indeed tend to be significantly longer (column 7). This finding does not, however, change our baseline results with respect to the importance of asset price busts and the run-up in house prices prior to the recession. This suggests that it is important to account for the critical role played by disruptions in specific asset markets before arriving at strong conclusions about the linkages between financial crises and the duration of recessions. While recessions associated with financial crises tend to be longer, disruptions in asset markets also appear to affect the length of recessions, and, as we will see next, their amplitude.

### 5.1.3. Amplitude of recessions

We next study the determinants of the amplitude of recessions using the same set of explanatory variables as above and again including country-fixed effects (Table 5A). The first set of regressions confirms our basic findings that recessions associated with financial disruptions are deeper than those without such disruptions (columns 1–3). The coefficients for the three financial disruption dummies are all positive, although the one for the association with a credit crunch is not statistically significant. When we use the sample with the full set of explanatory variables, the results are mostly same (columns 4–6). In particular, we find that recessions associated with house and equity price busts are statistically significantly deeper, but those

**Table 4B**

Determinants of the duration of recessions: robustness. (Percent change in real variables unless otherwise indicated).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Recession with a house price bust	−1.266*** [0.332]	−1.253*** [0.335]	−1.193*** [0.336]	−1.251*** [0.343]	−1.238*** [0.345]	−1.279*** [0.368]	−1.181*** [0.347]
Recession with a equity price bust	−0.702*** [0.268]	−0.619** [0.282]	−0.708*** [0.266]	−0.612** [0.284]	−0.697*** [0.270]	−0.668** [0.283]	−0.599** [0.281]
House price growth (3-year average before the peak)	−0.038** [0.018]	−0.042** [0.018]	−0.035** [0.018]	−0.041** [0.018]	−0.032 [0.022]	−0.048** [0.020]	−0.035* [0.019]
Equity price growth (3-year average before the peak)	−0.016 [0.012]	−0.015 [0.012]	−0.011 [0.012]	−0.014 [0.013]	−0.015 [0.011]	−0.024* [0.013]	−0.015 [0.011]
World output growth (1-year average following the peak)	0.242*** [0.079]	0.223*** [0.081]	0.226*** [0.080]	0.217*** [0.080]	0.240*** [0.080]	0.199** [0.078]	0.229*** [0.078]
Oil price growth-3 year average (3-year average before the peak)	0.013* [0.008]	0.011 [0.008]	0.012 [0.008]	0.011 [0.008]	0.012 [0.009]	0.007 [0.009]	0.011 [0.008]
Trade openness (at the peak)	0.047*** [0.011]	0.052*** [0.009]	0.048*** [0.011]	0.051*** [0.010]	0.046*** [0.011]	0.041*** [0.011]	0.048*** [0.011]
Financial openness (at the peak)		−0.001* [0.001]		−0.001 [0.001]			
Financial development (at the peak)			−0.004 [0.004]	0 [0.005]			
Credit growth (3-year average before the peak)					−0.011 [0.032]		
Current account balance level (3-year average before the peak)						0.024 [0.034]	
Recession with a banking crisis							−0.622* [0.331]
Constant	−4.936*** [0.669]	−4.949*** [0.604]	−4.475*** [0.883]	−4.915*** [0.824]	−4.892*** [0.717]	−4.670*** [0.657]	−4.873*** [0.666]
P (Weibull distribution parameter)	3.16 [0.256]	3.183 [0.240]	3.163 [0.252]	3.173 [0.237]	3.159 [0.256]	3.192 [0.259]	3.19 [0.252]
Number of Observations	134	134	133	133	134	127	134
Log likelihood	−58	−56	−57	−56	−58	−53	−56

Notes: All regressions include country fixed effects. Coefficients shown along with robust standard errors in brackets below respective coefficient estimate. The dependent variable is the duration of a recession. A recession associated with a financial disruption (credit crunch, equity price bust, house price bust) dummy variable takes on a value of 1 when a disruption is ongoing when the recession begins or ended at most one quarter before the recession began. World output growth is the PPP weighted annualized quarterly output growth from OECD countries. Growth is the annualized quarterly growth rate. Trade openness is defined as (exports + imports) as percent of GDP. Financial development is defined as credit as a percent of GDP. Financial Openness is defined as (Total Assets + Total Liabilities)/GDP.

\*\*\* Implies significance at the 1% level.

\*\* Implies significance at the 5% level.

\* Implies significance at the 10% level.

**Table 5A**

Determinants of the amplitude of recessions. (Percent change in real variables unless otherwise indicated).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Recession with a house price bust	1.112** [0.549]			1.351** [0.518]			1.552*** [0.353]	1.708*** [0.360]	1.705*** [0.364]
Recession with an equity price bust		2.264*** [0.671]			2.993*** [0.438]		3.066*** [0.396]	1.856*** [0.641]	1.851*** [0.651]
Recession with a credit crunch			1.832 [1.399]			−0.405 [0.658]	−0.432 [0.827]	−0.228 [0.725]	
House price growth (3-year average before the peak)							0.080** [0.032]	0.081** [0.032]	
Equity price growth (3-year average before the peak)							−0.02 [0.018]	−0.02 [0.018]	
World output growth (1-year average following the peak)							−0.520** [0.194]	−0.519** [0.193]	
Oil price growth (3-year average before the peak)							0.003 [0.014]	0.003 [0.014]	
Trade openness (at the peak)							−0.024 [0.019]	−0.023 [0.019]	
Constant	4.639*** [0.099]	4.163*** [0.201]	4.581*** [0.198]	2.914*** [0.170]	2.152*** [0.176]	3.400*** [0.069]	1.658*** [0.256]	3.968** [1.805]	3.882** [1.720]
Number of observations	254	254	254	134	134	134	134	134	134
Number of countries	42	42	42	31	31	31	31	31	31
Adjusted R-squared	0.001	0.031	0.008	0.033	0.239	−0.006	0.283	0.41	0.414

Notes: All regressions include country fixed effects. Coefficients shown along with robust standard errors in brackets below respective coefficient estimate. The dependent variable is the amplitude of a recession. A recession associated with a financial disruption (credit crunch, equity price bust, house price bust) dummy variable takes on a value of 1 when a disruption is ongoing when the recession begins or ended at most one quarter before the recession began. World output growth is the PPP weighted annualized quarterly output growth from OECD countries. Growth is the annualized quarterly growth rate. Trade openness is defined as (exports + imports) as percent of GDP.

\*\* Implies significance at the 5% level.

\*\*\* Implies significance at the 1% level.

with credit crunches not. This finding is preserved when all three financial disruption dummies are introduced together (column 7). When including the same additional explanatory variables used to explain the duration of recessions, the two dummies for recessions accompanied with asset price busts remain significant, i.e., such asset price busts are associated with more severe recessions (column 8).

We also consider the importance to our baseline specification of house and equity price increases prior to the recession (column 9). Besides the presence of a house price bust during a recession, the growth in house prices prior to the recession is also significantly and positively associated with the amplitude of the recession. Although the dummy for the coincidence of a recession with an equity price bust remains significantly positive, the change in equity price growth does not appear as a significant correlate with the depth of recessions. Results are economically large: the depth of a recession is on average about 1.7–1.9 percentage points larger when it coincides with an asset price bust. In addition, a 10% increase in house prices in the run-up to a recession implies a 0.8 percentage point deeper recession.

In terms of the other control variables, our previous regression results on duration are largely confirmed. Higher growth in world output helps reduce the severity of recessions, while trade openness has the expected negative sign, albeit not significant. These findings confirm the role of external demand in mitigating recessions, i.e., as it can offset some of the contraction in domestic demand. It is also consistent with earlier research which suggests that trade openness helps reduce the risk of crises and mitigate the negative impact of cyclical volatility on economic growth (Kose et al., 2006).

#### 5.1.4. Robustness of results: amplitude of recessions

We examine the robustness of our main finding that recessions associated with asset price busts are significantly deeper than other types of recessions by controlling for other variables that potentially affect the amplitude of recessions (Table 5B, where column 1 repeats the baseline regression). We first investigate how, in addition to our other financial variables, the growth rate of credit prior to recessions affects the severity of events. Surprising perhaps, credit growth prior to a recession is not significant in explaining its amplitude (column

2). Important for our main result, however, the coefficients of the dummies representing recessions associated with asset price busts remain positive and significant. Although house price growth prior to recessions stays positive, it is no longer significant.

We next consider whether structural characteristics, such as financial openness and financial development, change our main results (columns 3–5). Financial openness has a significant and positive association with the depth of recessions, possibly reflecting the impact of volatile capital flows, but financial development is never significant. Importantly, the inclusion of these additional variables does not change our main findings. When we assess the extent to which the pre-recession current account balance is associated with more severe recessions, we do not find a statistically significant coefficient (column 6). We also examine whether recessions associated with a banking crisis are different and whether controlling for such a crisis changes any of our findings (columns 7). While these recessions appear to be deeper than others, the crisis coefficient is not statistically significant, and all our regression results are maintained.

We conclude our robustness tests by controlling for fiscal and monetary policies that may have mitigated the severity of recessions. We measure fiscal policy by the change in the growth rate of government expenditures following the beginning of the recession, and monetary policy by the change in the short-term nominal rate during the same period. These measures themselves are not significantly associated with the amplitude of recessions (columns 8–10). This may be due to several reasons. First, the measures of policies we use might be rather rough approximations of actual policy changes. Second, we cover only two aspects of a larger spectrum of possible policy choices, including financial and regulatory policies. Third, the impact of policies on output takes time to materialize, i.e., there are lags between the implementation of policy and outcomes which we do not necessarily capture. Regardless, our benchmark findings are robust to their inclusion.

#### 5.2. Amplitude of recoveries

We next study the factors correlated with the amplitude of recoveries, that is, the increase in output within the first four quarters after

**Table 5B**  
Determinants of the amplitude of recessions: robustness. (Percent change in real variables unless otherwise indicated).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Recession with a house price bust	1.705*** [0.364]	1.548*** [0.377]	1.722*** [0.439]	1.673*** [0.357]	1.938*** [0.421]	1.836*** [0.457]	1.571*** [0.415]	1.698*** [0.365]	1.809*** [0.341]	1.802*** [0.341]
Recession with an equity price bust	1.851*** [0.651]	1.834*** [0.621]	1.827*** [0.647]	1.863*** [0.623]	1.725*** [0.581]	2.096*** [0.699]	1.764*** [0.629]	1.835*** [0.652]	1.886*** [0.655]	1.870*** [0.660]
House price growth (3-year average before the peak)	0.081** [0.032]	0.035 [0.053]	0.079** [0.032]	0.081** [0.030]	0.095*** [0.029]	0.084** [0.038]	0.076** [0.034]	0.081** [0.032]	0.082** [0.031]	0.083** [0.031]
Equity price growth (3-year average before the peak)	-0.020 [0.018]	-0.025 [0.017]	-0.025 [0.017]	-0.019 [0.018]	-0.017 [0.020]	-0.021 [0.019]	-0.021 [0.018]	-0.021 [0.018]	-0.025 [0.017]	-0.025 [0.017]
World output growth (1-year average following the peak)	-0.519** [0.193]	-0.519*** [0.186]	-0.475** [0.199]	-0.531*** [0.178]	-0.518*** [0.180]	-0.494** [0.200]	-0.493** [0.208]	-0.519** [0.193]	-0.570*** [0.174]	-0.570*** [0.175]
Oil price growth-3 year average (3-year average before the peak)	0.003 [0.014]	0.004 [0.014]	0.006 [0.014]	0.003 [0.013]	0.003 [0.013]	0.006 [0.015]	0.006 [0.016]	0.003 [0.014]	0.004 [0.015]	0.004 [0.015]
Trade openness (at the peak)	-0.023 [0.019]	-0.023 [0.017]	-0.047* [0.024]	-0.025 [0.023]	-0.049** [0.024]	-0.022 [0.018]	-0.025 [0.018]	-0.021 [0.019]	-0.027 [0.018]	-0.025 [0.019]
Financial openness (at the peak)			0.297* [0.158]		0.439** [0.171]					
Financial development (at the peak)				0.000 [0.012]	-0.015 [0.013]					
Credit growth (3-year average before the peak)		0.074 [0.068]								
Current account balance level (3-year average before the peak)						-0.042 [0.058]				
Recession with a banking crisis							0.857 [0.868]			
Government expenditure growth (1-year average following the peak)								-0.009 [0.040]		-0.008 [0.039]
Short term nominal interest rate change (1-year average following the peak)									0.096 [0.102]	0.095 [0.104]
Constant	3.882** [1.720]	3.549** [1.628]	4.852** [1.835]	4.026** [1.633]	6.037*** [1.777]	3.698** [1.650]	3.888** [1.699]	3.673** [1.725]	4.102** [1.602]	4.013** [1.630]
Number of observations	134	134	134	133	133	127	134	133	132	132
Number of countries	31	31	31	31	31	31	31	30	30	30
Adjusted R-squared	0.414	0.421	0.455	0.415	0.478	0.455	0.419	0.41	0.423	0.419

Notes: All regressions include country fixed effects. Coefficients shown along with robust standard errors in brackets below respective coefficient estimate. The dependent variable is the amplitude of a recession. A recession associated with a financial disruption (credit crunch, equity price bust, house price bust) dummy variable takes on a value of 1 when a disruption is ongoing when the recession begins or ended at most one quarter before the recession began. World output growth is the PPP weighted annualized quarterly output growth from OECD countries. Growth is the annualized quarterly growth rate. Trade openness is defined as (exports + imports) as percent of GDP. Financial development is defined as credit as a percent of GDP. Financial Openness is defined as (Total Assets + Total Liabilities)/GDP.

\*\*\* Implies significance at the 1% level.

\*\* Implies significance at the 5% level.

\* Implies significance at the 10% level.

the trough (Table 6A).<sup>15</sup> We begin with including the depth of the preceding recession to investigate whether economies tend to bounce-back faster from deeper recessions, as argued by some studies. Results indicate indeed that the deeper the preceding recession, the stronger the recovery (column 1), consistent with results reported in studies for the U.S. (Balke and Wynne, 1992; Friedman and Kuttner, 1993; Sichel, 1994). The importance of this relation does not change when we include other controls (columns 2–8). In addition, we test for the importance of external demand and find a statistically significant positive coefficient, again in all specifications (columns 2–8). Global demand thus helps lift the economy from a recession, similar to how world output helps reduce the severity of a recession.

Since our earlier results suggest that recessions accompanied by asset price busts are significantly deeper than other recessions are, it is logical to ask whether recoveries following recessions with asset price busts are different from other recoveries. To address this question, we include dummy variables that take the value of 1 if the preceding recession is associated with a house or with an equity price bust and zero otherwise. When we include these dummies in our regressions, we find that their coefficients are significantly negative as well as economically sizeable (columns 3 and 4). In particular, the amplitude of recoveries following recessions with house (equity)

price busts is on average 1.4 (2.1) percentage points less than that of other recoveries.

We next introduce dummy variables capturing recoveries associated with financial booms to examine whether booms are positively correlated with the strength of recoveries (columns 5–7). The presence of a simultaneous house price boom or a credit boom tends to have a statistically significant and positive impact on the amplitude of a recovery. Simultaneous booms in equity prices, however, do not appear to influence the strength of recoveries. This is consistent with the stylized fact documented in the previous section that recoveries associated with equity booms are not different from those without booms. When we use all three financial boom dummies together, the presence of credit and house price booms during a recovery is significant, along with the amplitude of the preceding recession and the strength of global recovery (column 8).

### 5.2.1. Robustness of results: amplitude of recoveries

We next study the robustness of our findings to the addition of other variables that could affect the amplitude of recoveries (Table 6B, where column 1 repeats the base regression result). Our main results regarding the roles of asset price busts and growth of asset prices during recoveries are broadly robust to the inclusion of these additional controls. Openness to trade and financial flows appear not to be important in shaping recoveries (columns 2–3). Financial sector development is statistically significant and negative, suggesting that impairments in larger financial systems hamper the recovery (column 4). When both financial openness and financial

<sup>15</sup> We do not study the duration of recoveries in the same way since the amplitude of a recovery is measured over a fixed period of four quarters.

**Table 6A**

Determinants of the amplitude of recoveries. (Percent change in real variables unless otherwise indicated).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Amplitude of preceding recession	0.699** [0.275]	0.710** [0.287]	0.715** [0.286]	0.744** [0.283]	0.748** [0.283]	0.736** [0.290]	0.741** [0.286]	0.738** [0.291]
Amplitude of recovery in world output		0.784** [0.324]	0.786** [0.325]	0.794** [0.328]	0.788** [0.326]	0.752** [0.345]	0.766** [0.345]	0.731** [0.357]
Preceding recession with a house price bust			−1.390** [0.578]	−1.399** [0.567]	−1.407** [0.580]	−1.296** [0.572]	−1.549** [0.597]	−1.442** [0.609]
Preceding recession with an equity price bust				−2.136** [0.987]	−2.219** [1.004]	−2.088** [1.000]	−2.302** [0.939]	−2.300** [0.976]
Recovery with a house price boom					2.087*** [0.658]			1.737** [0.806]
Recovery with a credit boom						2.099** [0.968]		1.739* [0.982]
Recovery with an equity price boom							0.789 [0.809]	0.642 [0.712]
Constant	2.782** [1.322]	0.429 [2.269]	0.644 [2.229]	1.11 [2.015]	1.017 [2.022]	1.069 [2.021]	1.101 [2.021]	0.991 [2.039]
Number of observations	250	250	250	250	250	250	250	250
Number of countries	42	42	42	42	42	42	42	42
Adjusted R-squared	0.212	0.229	0.229	0.24	0.24	0.241	0.238	0.238

Notes: All regressions include country fixed effects. The dependent variable is the amplitude of output for four quarters after the trough in output. Coefficients are shown along with robust standard errors in brackets below respective coefficient estimate. A recession associated with a financial disruption (credit crunch, equity price bust, house price bust) dummy variable takes on a value of 1 when a disruption is ongoing when the recession begins or ended at most one quarter before the recession began. A recovery is said to be associated with a boom if the boom is ongoing as the recovery begins (and started at most four quarters before the recovery) or starts at most two quarters after the recovery begins. A boom occurs if the four-quarter change in the variable from the trough is in the top 25% percentile. World output growth is the PPP weighted annualized quarterly output growth from OECD countries.

\*\* Implies significance at the 5% level.

\*\*\* Implies significance at the 1% level.

\* Implies significance at the 10% level.

development are jointly entered in the regressions, both variables are significant, with opposite signs. This suggests that international financial markets can accelerate recoveries while financial disruptions in domestic markets can have adverse effects on the real economy during recoveries (column 5).

We also control for the roles played by the exchange rate and current account deficit in recoveries. A dummy for rapid exchange rate depreciation during a recovery is positive, but not statistically significant (column 6). We find that countries with better current account positions tend to recover more strongly (column 7), perhaps as they are less vulnerable to adverse international developments, including curtailments in external financing. If the preceding recession is associated with a banking crisis, then the recovery tends to be significantly weaker (column 8). The effects of a house price and a credit boom on the strength of the recovery are always positive (albeit in some specifications not statistically significant).<sup>16</sup>

### 5.3. Interpretation of results

These results together indicate that changes in asset prices tend to play a critical role in determining the duration and cost of recessions and the strength of recoveries. What is the intuition behind this finding? As mentioned, interactions between financial variables and the real economy have been long studied. Research shows that financial and real shocks can be amplified through the financial accelerator and related mechanisms. According to these mechanisms, decreases (increases) in asset prices worsen an entity's net worth, reducing (increasing) its capacity to borrow, invest and consume. This process, in turn, can be amplified and propagated across corporations and households, leading to further decreases (increases) in asset prices over

<sup>16</sup> We also check for the robustness of our results when recovery is measured by the amplitude over 6 quarters after the trough (instead of four quarters in our baseline regressions). Although all of our headline results are preserved, the presence of a credit boom during the recovery is no longer statistically significant (results are available upon request).

time, and thereby create general equilibrium effects (Bernanke et al., 1999; Kiyotaki and Moore, 1997).

Most studies focus on the role of credit in transmitting and amplifying shocks. Some recent studies analyze specifically how endogenous developments in housing markets can magnify and transmit various types of shocks to the real economy in DSGE models, which allow for some quantification of these mechanisms (Iacoviello, 2005). Other studies consider how movements in equity prices can be associated with leverage cycles that are in turn closely related to movements in the real economy (Adrian and Shin, 2008; Mendoza, 2010). More recently, the emphasis has been on how shocks to the supply of financing can lead to real effects, including recessions and recoveries (Gertler and Kiyotaki, 2010; Brunnermeier and Sannikov, 2011). In addition to these theoretical studies, recent empirical work emphasizes the importance of house prices and credit dynamics in shaping business cycles (Leamer, 2007).

Our results contribute to this evolving literature. They emphasize the significant role played by asset price busts and the growth of house prices prior to recessions in determining the duration and depth of recessions. The growth of equity prices prior to the recessions does not appear to be significantly related to the depth of recessions, and recoveries accompanied with equity booms are not stronger than those without such booms. What explains the relatively more important role played by developments in housing markets in shaping the length and magnitude of cyclical outcomes?<sup>17</sup> First, housing represents a large share of wealth for most households. Related,

<sup>17</sup> The importance of housing extends to changes in the main components of output as well (Claessens et al., 2011b). Consumption and investment usually register sharp declines during recessions coinciding with house price busts, in turn accompanied by more pronounced drops in employment. In the working paper version, which covered the pre-crisis sample (1960:1–2007:4), we also report that recessions with house price busts are significantly longer and deeper. Current results include the recessions associated with the global financial crisis, for which recessions accompanied with equity busts also tend to be longer and deeper. This is intuitive as almost two-thirds of recessions that took place during the recent crisis period were associated with equity price busts and many were often deep and long (in fact, the 2009 episode was the deepest worldwide recession since the Great Depression).

Table 6B

Determinants of the amplitude of recoveries: robustness. (Percent change in real variables unless otherwise indicated).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Amplitude of preceding recession	0.738** [0.291]	0.748** [0.291]	0.755** [0.288]	0.734** [0.285]	0.747** [0.281]	0.732** [0.283]	0.325* [0.173]	0.764** [0.290]
Amplitude of recovery in world output	0.731** [0.357]	0.731** [0.338]	0.628 [0.416]	0.555* [0.321]	0.524 [0.380]	0.689** [0.341]	0.361** [0.156]	0.741** [0.362]
Preceding recession with a house price bust	-1.442** [0.609]	-1.659** [0.718]	-1.436* [0.757]	-1.103* [0.641]	-0.687 [0.745]	-1.419** [0.607]	-0.643 [0.538]	-1.176* [0.632]
Preceding recession with an equity price bust	-2.300** [0.976]	-2.441** [0.949]	-2.246** [0.976]	-1.930** [0.896]	-2.086** [0.915]	-2.106** [0.927]	-1.087 [0.749]	-1.883** [0.850]
Recovery with a house price boom	1.737** [0.806]	1.866** [0.877]	1.855** [0.783]	1.698* [0.843]	1.485** [0.687]	1.600* [0.803]	0.999 [0.902]	1.482* [0.777]
Recovery with a credit boom	1.739* [0.982]	2.050* [1.074]	2.322** [1.064]	1.416 [1.121]	2.164** [1.067]	1.594 [1.012]	2.659** [1.237]	1.598* [0.948]
Recovery with an equity boom	0.642 [0.712]	0.624 [0.718]	0.64 [0.739]	0.806 [0.705]	0.592 [0.728]	0.557 [0.710]	0.906 [0.626]	0.67 [0.690]
Trade openness (at the trough)		0.004 [0.031]						
Financial openness (at the trough)			-0.005 [0.184]		0.521*** [0.179]			
Financial development (at the trough)				-0.033** [0.015]	-0.053** [0.022]			
Recovery with an exchange rate depreciation						1.007 [0.652]		
Current account balance level (3-year average before the trough)							0.201** [0.079]	
Preceding recession with a banking crisis								-2.473** [1.094]
Constant	0.991 [2.039]	0.635 [2.161]	1.095 [2.030]	3.504** [1.361]	3.784*** [1.352]	0.683 [2.164]	2.641*** [0.724]	1.002 [2.004]
Number of observations	250	239	238	242	233	250	211	250
Number of countries	42	41	42	41	41	42	42	42
Adjusted R-squared	0.238	0.242	0.244	0.246	0.262	0.238	0.251	0.243

Notes: All regressions include country fixed effects. The dependent variable is the amplitude of output for four quarters after the trough in output. Coefficients shown along with robust standard errors in brackets below respective coefficient estimate. A recession associated with a financial disruption (credit crunch, equity price bust, house price bust) dummy variable takes one a value of 1 when a disruption is ongoing when the recession begins or ended at most one quarter before the recession began. A recovery is said to be associated with a boom if the boom is ongoing as the recovery begins (and started at most four quarters before the recovery) or starts at most two quarters after the recovery begins. A boom occurs if the four-quarter change in the variable from the trough is in the top 25% percentile. World output growth is the PPP weighted annualized quarterly output growth from OECD countries. Trade openness is defined as (exports + imports) as percent of GDP. Financial development is defined as credit as a percent of GDP. Financial Openness is defined as (Total Assets + Total Liabilities)/GDP.

\*\* Implies significance at the 5% level.

\* Implies significance at the 10% level.

\*\*\* Implies significance at the 1% level.

houses are an important form of collateral against which households can borrow and adjust their consumption patterns (as house prices vary). In contrast, equity ownership is a smaller share of wealth for many households and typically more concentrated among wealthy households who likely make much smaller adjustments in their consumption over the cycle and during recessions and recoveries. Moreover, equity wealth cannot as easily as housing wealth be used as collateral.

Second, equity prices are more volatile than house prices are, implying that changes in house prices are more likely to be permanent than those in equity prices (Cecchetti, 2006; Kishor, 2007). With changes in wealth more permanent, households can be expected to adjust their consumption more when house prices increase (decline), leading to larger increases (declines) in output during recoveries (recessions) associated with house price booms (busts). In studies with micro data, housing wealth has indeed been found to have a larger effect on consumption than equity wealth does (Carrol et al., 2006). Consequently, house price adjustments can be expected to affect aggregate consumption and output more than equity prices.

Our regression results indicate that credit growth is not a significant correlate of the length and depth of a recession, but it does appear to play a role during recoveries. How can we explain these results? First, as mentioned, there are strong linkages between developments in credit and housing markets. For example, house purchases are often financed with mortgages which account for a sizeable share of activity in credit markets. This may mean that the housing bust dummy and house price growth variable pick up most of the effects associated with credit growth in our regressions. Second, earlier studies document that there are other

measures of credit market activity, rather than the volume of credit we use, are better equipped to capture the linkages between credit dynamics and real sector. For example, indicators of credit standards applied by lenders have been found to be negatively correlated with economic activity (Lown and Morgan, 2006). In addition, credit spreads appear to play an important role in explaining business cycles (Helbling et al., 2011).<sup>18</sup> For the large sample of countries and long time period we consider here, however, these types of indicators are not available.

## 6. Conclusion

Our empirical knowledge about the interactions between real and financial sectors during different phases of business and financial cycles is rather limited. This is partly because most studies rely on a small set of observations, using a single country (often the U.S.) or a small number of countries. Although the literature on the macroeconomic implications of financial crises has used a broader sample of cases, that approach has some clear disadvantages as well.

We analyze the linkages between the real economy and financial sector using an extensive database on business and financial cycles.

<sup>18</sup> Bordo and Haubrich (2010) analyze cycles in money, credit and output between 1875 and 2007 in the U.S. They argue that credit disruptions tend to exacerbate cyclical downturns, but their study is limited to a small number of recessions (27 recession episodes with only 7 observations in some regressions). Our study (with a much larger sample and with fixed effects panel regressions) shows that housing market dynamics, rather than credit, play an important role in understanding the amplitude of recessions.

Our key finding is that the duration and amplitude of recessions and recoveries are often shaped by linkages between business and financial cycles. In particular, recessions accompanied with financial disruption episodes, notably house and equity price busts, tend to be longer and deeper. Recoveries combined with rapid growth in credit and house prices tend to be stronger. Overall, we find movements in house prices to be most closely associated with the depth of recessions and strength of recoveries. We also document the main features of business and financial cycles. Financial cycles tend to be longer, deeper, and sharper than business cycles. Moreover, both business and financial cycles tend to be more pronounced in emerging markets than those in advanced countries.

These results provide important insights for research analyzing the linkages between the real economy and financial sector. First, a set of well-defined regularities on the basic empirical linkages between developments in financial markets and aggregate activity has not been established using a comprehensive cross-country database with quarterly series. Our study presents these aggregate empirical regularities and shows that there are indeed strong associations between movements in financial variables and output.

Second, as discussions following the global financial crisis have clearly shown, it is critical to have a better understanding of the amplitude and duration of business and financial cycles and their interactions, not just of their second moments. Most models with financial frictions are evaluated in terms of their ability to replicate the standard second moments, such as volatility, of key macroeconomic and financial aggregates. The performance of these models has, however, not been assessed against aggregate empirical regularities associated with different phases of business and financial cycles. We document a rich set of such regularities that can be used to help differentiate the performance of models in terms of matching various characteristics of different phases of business and financial cycles, including their duration and amplitude.

Third, our study presents a clear mapping between disruptions and booms in specific financial market segments and the changes in output over the business cycle. In particular, our stylized facts and regression results can help guide theoretical studies in analyzing the implications of shocks originating in a particular segment of financial markets for the real economy. Our regression analysis also provides a quantification of the relevance of various types of disruptions and booms in different financial market segments for the amplitude of recessions and recoveries, and the duration of recessions. Given that not all downturns (or upturns) in financial markets necessarily lead to financial crises, it is critical to have a comprehensive perspective about the state of various financial cycles to design models that are compatible with the basic regularities of business and financial cycles.

Lastly, the empirical literature on the roles played by countries' institutional structures and regulatory frameworks in shaping the interactions between business and financial cycles is still limited. Future studies could examine this issue in a cross-country context using the regularities we document here as a baseline. These extensions suggest fruitful areas for future research.

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