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How the Credit Cycle Affects Growth: The Role of Bank Balance Sheets

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Asset market conditions affect output growth through changes in bank lending. This paper is the first to analyze how this channel changes over the credit cycle. We use newly collected data for 37 countries over 1970-2012 to construct measures for the upswing ('credit boom') and downswing ('credit bust') phases of the credit cycle. We find that real income grows faster during a credit boom in countries where house prices rise more and where banks have a higher share of mortgage credit in total credit. In a second analysis, we find that industries which are more dependent on external finance experience growth in value added which is significantly higher in a credit boom and significantly lower in a credit bust, when banks in their economy have a higher share of mortgage credit in total credit. Since credit cycle upswings transform bank balance sheets such that economies are more vulnerable to the credit market downturn that follows, the policy implication is that macroprudential monitoring should take place over the entire credit cycle.

JEL: E32; E44; E51

Keywords: Credit Cycle; Bank Lending Channel; Asset Prices

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I. Introduction

In this paper we ask what the impact of the credit cycle dynamics is on output growth depending on asset market conditions. The recent financial crisis has renewed interest in asset markets and credit cycles (Gambacorta and Marques-Ibanez, 2011; Disyatat, 2011; Aikman et al., 2014). Credit conditions may amplify or even originate shocks, which change real outcomes (Brunnermeier and Sannikov, 2014). Among them are monetary policy shocks and shocks emanating from asset markets. For shocks emanating from monetary policy, various channels have been examined (Bernanke, 1983; Stein and Kashyap, 2000; Peek et al., 2003; Kishan and Opiela, 2000; Ashcraft, 2006; Paravisini, 2008). A smaller literature explores shocks emanating from asset markets (Gan, 2007; Black et al., 2010; Jimenez et al., 2012). We follow Disyatat (2011)'s reformulation of this bank lending channel as working primarily through the impact on banks' balance sheet strength and risk perception, rather than on changes in deposits. Banks' balance sheet strength and risk perception are importantly modified by the dynamic interaction between real estate prices and mortgages in banks' balance sheets (Basurto et al., 2006; Davis and Zhu, 2009). This is what we analyze.

Our paper presents new data, new variables and new analysis. We present new data on bank lending in 37 economies from 1970 at the earliest until and including 2012. A unique feature of our panel time series data is that we observe, in a cross country consistent manner, both total bank lending and its components - household mortgage credit, nonfinancial business lending, nonsecured consumer credit and lending to financial business. We construct a measure for three phases in the credit cycle: 'credit boom', 'credit bust' and 'normal' times. Following Braun and Larrain (2005), credit cycle episodes are defined with reference to turning points and to deviations from trend growth. We analyze how the bank lending channel changes over credit cycle phases. The central idea in the bank credit channel of asset market transmission is that there are changes in bank lending due to asset market conditions, unrelated to changes in the demand for loans. We follow Gan (2007) and Jimenez et al. (2012) in focusing on real estate asset markets. We take the change in the real house price index as capturing changes in asset market conditions. Whether or not asset market conditions translate into credit supply shocks depends on risk perceptions (Disyatat, 2011). An important dimension of risk perceptions is the sensitivity of bank lending to asset market conditions (Davis and Zhu, 2009). We adopt banks' share of mortgage credit in total credit as a measure for the sensitivity of bank lending to asset market conditions.

Previewing the results, we find that a boom in bank lending correlates to GDP growth conditional on the combination of rising house prices and a high share of mortgage credit in total credit in bank balance sheets. In a second analysis we ask if industries which are more dependent on external finance experience faster growth in value added if banks in their economy hold more mortgage credit as a share of total credit. In a difference-in-difference analysis, we find that the answer is 'yes' in a credit boom, but that value-added growth is significantly lower in credit busts. We interpret this as evidence of a credit channel of asset market transmission. Additional analysis suggests that a higher level of financial development may make the impact of the bank lending channels in the presence of credit cycle boom/bust dynamics. The channel also appears to operate more strongly in emerging economies.

The paper proceeds as follows. In the next section we review theoretical channels from asset prices to output, as a guide to the empirical specification. We also discuss related empirical studies. Section 3 describes the data and develops our measure for credit booms and credit growth contractions and the estimation strategy. Section 4 presents results and robustness tests. Section 5 concludes.

II. Identifying the bank credit channel of asset market transmission

In this section we review related literature and motivate the empirical specification in the next section. We delineate the mechanism we research from three other channels from assets to output (Mishkin, 2001), which do not include bank balance sheet effects and which do not affect loan supply. Note that while channels from asset prices to output have been researched mostly in the context of monetary policy shocks, we make no assumption on the source of a shock to asset prices.

First, monetary policy which lowers interest rates may make bonds less attractive and stocks more attractive, raising their price. This increases investment spending and thus output, as firms can raise more funds through stock issuing. In this channel bank lending is not part of the causal chain from asset prices to output.

Alternatively, monetary policy leading to increased stock prices may strengthen firm balance sheets and their Tobin's q values, and so reduce problems of adverse selection and moral hazard in obtaining bank loans. This loosens bank credit constraints and increases investment and output. This channel is referred to as the 'credit view' or the 'balance sheet channel' (Bernanke and Gertler, 1995). Although this involves increased borrowing from banks, here the effect of asset prices on output runs through firm balance sheets, not through bank balance sheets, which is the focus of the present paper.

Third, monetary policy lowering interest rates may affect household balance sheets, and so household spending decisions on consumer durables and housing. If stock prices and other asset prices rise, consumers are less worried about the possibility of financial distress, and are therefore more willing to spend on illiquid real estate assets and durable consumer goods. This increase in spending increases output. Alternatively, a rise in stock prices also changes consumers' optimal level of consumption in a Modigliani-type life cycle consumption model. Since real estate spending and durable consumer goods are typically financed by bank credit, this will also increase bank lending. This channel involves household balance sheets, not bank balance sheets, and runs through an increase in demand for loans, not an increase in the supply of loans. Another effect of policy on household spending, which does not involve balance sheets, is that lower interest rates decrease the cost of lending and increase spending on real estate, so that more construction takes place, increasing output.

Fourth, there is a bank balance sheet channel, which is the focus of our study. It exists because bank engage in substantial amounts of real estate lending, in which the value of real estate acts as collateral' (Mishkin, 2001). Rising real estate prices (due to monetary policy or some other reason) decreases bank loan losses and increase their capital, proportional to the amount of real estate loans on their books. In both ways, rising real estate prices induce more bank lending not only as mortgages but also to nonfinancial business (Davis and Zhu, 2009). In the context of pervasive credit rationing to due information asymmetries typical for credit market, this will increase output. (Mishkin, 2001) summarizes the bank lending channel in the following causal schematic:

$$M \uparrow \Longrightarrow P \uparrow \Longrightarrow NW \uparrow \Longrightarrow L \uparrow \Longrightarrow I \uparrow \Longrightarrow Y \uparrow$$

where $M \uparrow$ denotes expansionary monetary policy, P denotes real estate prices, NW denotes bank capital and thus their net worth, L denotes bank lending, I denotes nonfinancial business investment and Y denotes output. The same sequence operates with falling real estate prices and a 'capital crunch', as in the US in the early 1990, Japan after its real estate bubble burst in the late 1980s, and many countries after the 2008 global financial crisis. Different from the other ways in which asset prices affect output, this channel runs through bank balance sheets. It changes the supply of loans, not the demand for loans.

This schematic will guide the empirical analysis. We will also account for the fact that the bank lending channel is likely to operate in an asymmetric fashion over the credit cycle. That is, there is no particular reason why the response of bank lending and output growth to rising asset prices is identical to the response to falling asset prices. It may therefore not be possible to establish the existence of the channel by estimating the average effect of real estate prices on output growth, conditional on bank balance sheet conditions. This would impose one output growth coefficient of real estate prices mediated by bank balance sheets, while the true coefficients in the upswing and downswing phases may differ. The estimated coefficient may then be insignificantly different from zero even when the true coefficients are not. In the empirical analysis below, we will therefore estimate the effect of real estate prices on output growth, conditional on bank balance sheet conditions, *separately* for credit boom and credit contraction phases of the credit cycle.[1] This requires defining the phases of the credit cycle, which we will do following Braun and Larrain (2005). Distinguishing between the bank lending channel in a credit boom from the bank lending channel in a credit contraction and in normal times is a unique contribution of our study.

We also undertake a second analysis on industry data, which are less susceptible to endogeneity problems (Rajan and Zingales, 1998). The industry-level analysis also allows us to explore the presence of a possible crowding-out effect (Jimenez et al., 2012). Bank may increase lending in response to asset market conditions to some firms or industries while reducing lending to other firms or industries. Thus, there may be a firm-level effect or industry-level effect, but this does not imply an aggregate effect. In the presence of a crowding-out effect, bank balance sheets would affect valued-added growth in matched bank-firm data and in industry data, but not in aggregate GDP data.

Our paper relates to a large literature which aims at identifying the transmission of shocks to banks' balance sheets to value added and real income growth. After a number of studies had introduced the bank lending channel in the 1990s and explained its relevance, later studies before the crisis questioned the strength of the bank lending channel (Ashcraft, 2006). But recent evidence shows again

[1] Alternatively, one could estimate the bank channel effect in real estate price booms and busts. We explored this but found that it is empirically challenging given the much more gradual development of real estate prices, which are part of a long term (18 year on average) financial cycle rather than the shorter term credit cycle that we research (Borio, 2013). Using established methods such as in Braun and Larrain (2005), house price boom and bust episodes would be longer and fewer, and more sensitive to boom/bust definition cut off points.

that "bank-specific characteristics can have a large impact on the provision of credit" (Gambacorta and Marques-Ibanez, 2011). In their study, they show that banks with weaker core capital positions and greater dependence on market funding and on non-interest sources of income restricted their loan supply more strongly during the crisis period. Specific to real estate markets, Gan (2007) studies how an exogenous shock to the financial health of banks, caused by the real estate market collapse in Japan in the early 1990s, affected the real economy. She shows that banks with greater exposure to real estate prior to the shock reduced their lending more. Paravisini (2008) show that financial shocks to constrained banks in Argentina have an immediate and persistent effect on the aggregate supply of credit. Davis and Zhu (2009) show that commercial real estate prices have a marked impact on the behaviour and performance of individual banks. They suggest that real estate provides important forms of collateral that are perceived by banks to reduce risk and encourage lending.

Jimenez et al. (2012) use matched bank-firm level data in Spain and confirm a local bank-lending channel. They show (as we do) that more exposure to real estate increases bank lending, which they attribute to the larger opportunities for securitization that more mortgage lending offers. The 2008 collapse in securitization leads to a reversal in this lending channel. In a sample of Euro-area and U.S. banks, Maddaloni and Peydro (2011) also find that softening of loan standards leads to more mortgage lending and that this effect is amplified by securitization activity. In their study, countries with softer lending standards (and thus more mortgage lending) before the crisis experienced a worse economic performance afterwards.

The results in the present paper are substantially in agreement with these studies, but it covers more countries, utilizes more recent data, and adds the credit cycle dimension. Before we turn to the empirical analysis, in the next section we first introduce our new data, develop measures for credit booms and credit growth contractions, and study some stylized trends.

III. Methodology and Data

This section presents the empirical specifications and discusses the estimation strategies and the data used. We adopt two approaches to assess the credit channel of asset market transmission over the credit cycle. Firstly, we employ a panel analysis using aggregate GDP growth while controlling for a variety of time-varying factors as well as fixed effects and time trends. Second, we employ a panel analysis using industry-level data on real value added growth and controlling for a wide range of time-varying fixed effects.

We rely on two sets of data. Our country-level sample covers an unbalanced panel of 37 countries during the period 1970-2012. Our industry-level sample consists of an unbalanced panel of 23 two-digit manufacturing industries in 36 countries during the period 1970-2010. Annual raw data are retrieved from various sources. Below, we present the construction of our variables and their sources.

A. Identifying credit cycle phases

To examine how the credit channel of asset market transmission operates over the credit cycle, we identify three phases of the credit cycle, namely credit booms, credit busts and normal periods. Different approaches have been proposed in the literature for constructing chronologies of credit cycles and there is no consensus on the preferable methodology. However, according to Agnello and Schuknecht (2011), a "good" methodology should be simple to implement, reasonably objective (i.e. does not depend on the judgment of the analyst) and yield plausible results.

In the present paper, we identify credit booms and busts as deviations from long-term trends in total credit stocks, similar to the work by Braun and Larrain (2005) on business cycles. Several other studies use deviation from credit trend growth in connection with output growth. Biggs et al. (2010) develop an analytical framework showing that output growth varies with credit growth and with differenced credit growth. Basurto et al. (2006), researching the interaction between credit and real estate prices in 17 OECD economies, find that this relationship is clearer when the variables are entered as a deviation from trend.

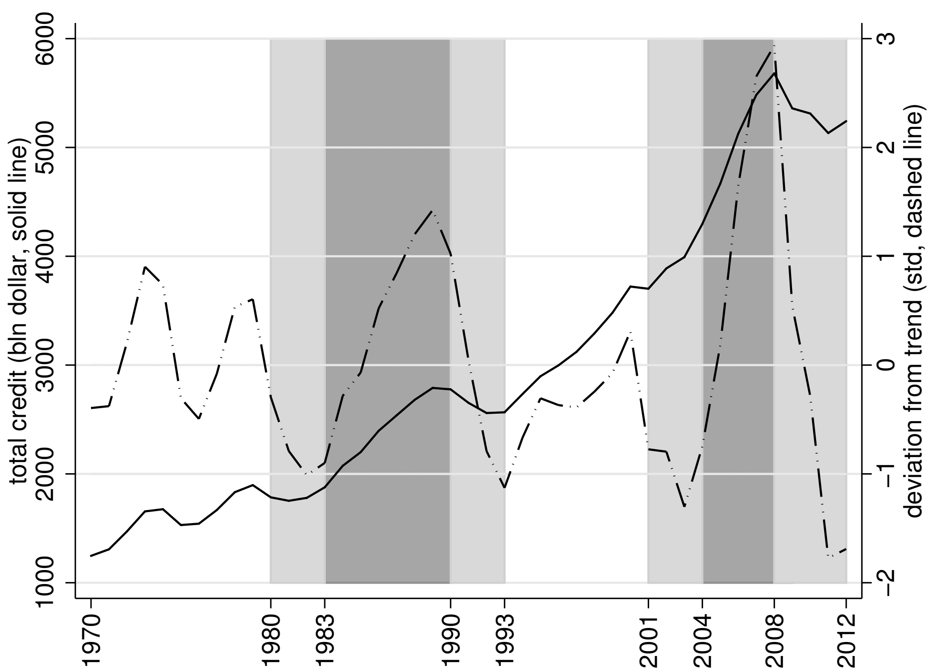
We denote the level of total credit in domestic currency deflated by the consumer price index in country i and year t by TC_{it}. We compute the trend in TC_{it} using the Hodrick-Prescott filter with a smoothing parameter of 100. We denote the deviation of total credit from its trend (i.e., the cyclical component) $\widetilde{TC}_{it}$. The standard deviation of $\widetilde{TC}_{it}$ is $\sigma(\widetilde{TC}_{it})$. Note that $\sigma(\widetilde{TC}_{it})$ is not computed based on the pooling of all countries but is country-specific, so that cyclical movements are country-specific.

We identify credit booms as follows. For each country, we first identify peaks in which $\widetilde{TC}_{it} > \alpha\sigma(\widetilde{TC}_{it})$ with $\alpha = 1$, as in Braun and Larrain (2005): the cyclical component of total credit is more than one standard deviation above the trend. Then we go back in time until we find a local trough. A local trough is defined as the latest preceding year for which $\widetilde{TC}_{it} < \widetilde{TC}_{it-1}$ and $\widetilde{TC}_{it} < \widetilde{TC}_{it+1}$ both hold: the cyclical component $\widetilde{TC}_{it}$ is lower than in both the previous and posterior years. We then define a binary variable "boom" which takes value one for years between the peak and trough (excluding the trough year), and zero otherwise.

We employ the same procedure to identify credit busts. We first identify troughs, defined as years for which $\widetilde{TC}_{it} < -\alpha\sigma(\widetilde{TC}_{it})$ for $\alpha = 1$ holds: the value of the cyclical component of total credit is more than one standard deviation below trend. Once a local trough is found, we then go back in time until we find a local peak. A local peak is defined as the closest preceding year for which $\widetilde{TC}_{it} > \widetilde{TC}_{it-1}$ and $\widetilde{TC}_{it} > \widetilde{TC}_{it+1}$ both hold: $\widetilde{TC}_{it}$ is higher than in both the previous and posterior years. We then define a binary variable "bust" which takes the value one from the year after the peak (i.e. excluding the peak year) to the trough, and is zero otherwise.

Those country-year observations which are not identified as either 'boom or 'bust are labelled 'normal years. Thus, this methodology identifies three phases of the credit cycle, each with a duration of one or several years. Figure 1 illustrates the results of this procedure for the U.S., showing credit boom and bust phases (shaded dark and light) and normal periods (non-shaded) from 1970 to 2012.

Figure 1. : Credit booms and busts in the United States



By applying the above-discussed methodology, we come to a total of 187 episodes, among which 63 booms, 63 busts and 60 normal episodes. Table A1 in the appendix lists the identification of all episodes. We further describe the main features of cyclical phases in terms of duration, amplitude and slope. Duration counts the number of years covered in each cyclical phase. The amplitude measures the difference of a variable between the value at the end and the beginning of the phase. The slope is the ratio of the amplitude to the duration. The slope measures the violence/speed of a given cyclical phase. We primarily rely on (various) credit-to-GDP ratios to measure the amplitude and slope of cyclical phases. We report the median to mitigate the influence of extremely long and short phases.

Table 1 describes the characteristics of identified cyclical phases. We find that the frequencies of three cyclical phases, i.e., booms, busts and normal times are roughly similar. Approximately 30 percent of observations are identified as booms, 30 percent are busts and the rest are normal times. Regarding duration, we find that a typical boom lasts 5 years, which is slightly longer than a bust, which lasts 4 years. The normal period has the longest duration. In terms of the amplitude of a typical credit boom phase, the total credit as a share of GDP increases by 11.5 percentage points, equivalent to 3.5 per annum (i.e. slope). In contrast, the credit-to-GDP ratio drops by 1.4 percentage points, equivalent to 0.262 per annum for a typical bust.

Table 1—: Credit cycle phases: descriptives

	Number	Proportion of years	Duration	Amplitude	Slope
The Whole Sample (37 countries, 187 episode)					
Boom	63	0.286	4	10.951	3.55
Bust	64	0.327	4	-1.259	-0.251
Normal	60	0.386	6	3,261	0.758

Note: The medians of duration, amplitude and slope are reported.

It's important to note that a credit boom is not necessarily followed by a credit bust, and vice versa. Table 2 shows the transition matrix. Two interesting findings emerge from the transition matrices. First, credit booms do not necessarily emerge from credit busts. 35.56% of credit booms emerge from normal times. Second, credit booms do not always end up in credit busts. Approximately 58.93% of credit booms end in busts.

We check the robustness of our identification methods. First, we change the

Table 2—: Transition Matrices

The Whole sample (150 episodes)				
		To		
		Boom	Bust	Normal
	Boom	0.00	33(58.93)	23(41.07)
From	Bust	29(64.44)	0.00	16(35.56)
	Normal	23(46.94)	26(53.06)	0.00

Note: The last episodes for each country (i.e. 37 episodes) are excluded. Number denotes the episode counts. Transition probabilities are in parentheses.

threshold for defining booms and busts from 1 to 0.75 and then to 1.25 standard deviations. Second, we employ two different smoothing parameters used in the Hodrick-Prescott filter, namely 50 and 150. Lastly, we apply the Butterworth filtering technique to identify cyclical phases. Table 3 summarizes the identified episodes. It's apparent from Table 3 that there are considerable differences in the identification of cyclical phases across different specifications. The number of episodes varies depending on the specification method implemented. We identify between 158 to 228 episodes and among which 54 to 74 are booms, 40 to 88 are busts and 59 to 67 are normal periods. As shown, the identification of credit busts are more sensitive to different specifications.

Another way to test the robustness of the identification methods is to examine whether different methods display coherent and synchronized results. In other words, whether alternative methods give a similar diagnostic regarding the state of the credit cycle a country is in. Table 4 show the pairwise correlation matrix among various specifications. It follows, from Table 4 that credit booms and busts are consistently defined across methodologies. The pairwise correlations among different specifications are all significant at 1 percent level. Lastly, we also check whether our estimation results are sensitive to the identification methods

Table 3—: Credit cycle phases: robustness

	Number	Proportion of year	Duration
CYCLE75: Varied threshold (0.75), 215 episodes			
Boom	74	0.313	4
Bust	78	0.395	5
Normal	63	0.292	4
CYCLE125: Varied threshold (1.25), 158 episodes			
Boom	54	0.251	4
Bust	40	0.185	4
Normal	62	0.564	10
CYCLE50: Smoothing parameter (50), 228 episodes			
Boom	73	0.296	4
Bust	88	0.398	4
Normal	67	0.306	4
CYCLE150: Smoothing parameter (150), 209 episodes			
Boom	76	0.33	4
Bust	74	0.395	5
Normal	59	0.275	5
BWCYCLE: Butterworth filter, 177 episodes			
Boom	64	0.282	4
Bust	54	0.339	6
Normal	59	0.379	7

Table 4—: Credit cycle phases: correlations

	CYCLE	CYCLE75	CYCLE125	CYCLE50	CYCLE150	BWCYCLE
CYCLE	1					
CYCLE75	0.846***	1				
CYCLE125	0.811***	0.687***	1			
CYCLE50	0.766***	0.813***	0.620***	1		
CYCLE150	0.804***	0.922***	0.658***	0.736***	1	
BWCYCLE	0.726***	0.663***	0.724***	0.528***	0.690***	1

Note: ***significant at 1 percent

in the following section.

B. Aggregate Analysis

To assess the credit channel of asset market transmission at the aggregate level, we first pool all episodes and estimate the following specification:

(1a)

$$GR_{i,t} = \alpha_0 + \beta_1 SHARE_{i,t} + \beta_2 HPCHANGE_{i,t} + \beta_3 SHARE_{i,t} \times HPCHANGE_{i,t} + \gamma X_{i,t} + \varphi_i + \phi_t + \epsilon_{i,t}$$

where i denotes episode, t denotes year, and GR is the growth rate of real GDP per capita in 2005 constant dollars, taken from the World Bank World Development Indicators (WDI). $HPCHANGE$ is measured as the annual percentage change in the real house price index. The data on house price index is taken from the Property Price Statistics published by Bank of International Settlement (BIS). $SHARE$ is the proportion of mortgage credit in total credit on banks' balance sheet, based on data described in Bezemer et al. (2014).

Further, γ is a $1 \times n$ parameter vector; X is $n \times 1$ vector of control variables commonly used in the finance-growth literature. This includes the log of lagged GDP per capita, trade openness, government consumption as a share of GDP, inflation and the average years of schooling of the population above 25 years of age. All these country-level variables are taken from the WDI, except education, which is retrieved from Barro and Lee (2013)'s database on educational attainment. Variables φ_i and ϕ_t are episode-specific fixed effects and year fixed effect, respectively; and finally $\epsilon_{i,t}$ is an error term.

It's important to note that the cross-section dimension of equation (1a) is episode, not country. For example, if a country experiences two credit booms during the sample period, these two booms are treated as two independent events. This treatment recognizes the potential differences of episodes that occur over time. We nevertheless check the robustness of our results including country-fixed effects instead of episode-fixed effects. Due to the availability of the house price data, we are forced to drop episodes with missing or incomplete house price data. We effectively use 130 episodes (41 booms, 47 busts and 42 normal times) over 1976-2012 for our aggregate analysis. Table 5 presents the definition, source and descriptive statistics of the variables used in the aggregate analysis.

We introduce an interaction term which is $SHARE_{i,t} \times HPCHANGE_{i,t}$ in equation (1a). We will use this to calculate the marginal effect of changes in house prices $HPCHANGE_{i,t}$ on output growth $GR_{i,t}$ conditional on the share of mortgage credit in total credit in banks' balance sheets $SHARE_{i,t}$, as follows:

$$\text{(1b)} \qquad \frac{\partial GR_{i,t}}{\partial HPCHANGE_{i,t}} = \beta_2 + \beta_3 SHARE_{i,t}$$

Thus, the interaction term captures that the combination of changes in house prices and the share of mortgage credit matters, rather than any of the two variables in isolation (Borio and Lowe, 2002). We make no claim on exogeneity or the direction of causality between changes in house prices and on the share of mortgage credit. In fact, Basurto et al. (2006) show two-way interaction between these variables.

We estimate equation (1a) for the three cyclical phases of the credit cycle. Our testable hypothesis is that the impact of house price change on growth increases with larger shares of mortgage credit in total credit on banks balance sheets. This would be evident in a significantly positive coefficient β_3.

C. Industry-level Analysis

In a second analysis, we use Rajan and Zingales (1998) industry-level methodology. We utilize an industry-specific index of external financial dependence, de-

Table 5—: Descriptive statistics

Name	Definition	Source	Count	mean	sd	min	max
Panel A. Credit cycle variables							
CYCLE	Credit cycle (HP-filtered), benchmark, 1-boom, 2-bust, 3-normal	own calculation	525	2,057	0.827	1,000	3,000
CYCLE75	Credit cycle (HP-filtered), 0.75 std, 1-boom, 2-bust, 3-normal	own calculation	525	1,920	0.775	1,000	3,000
CYCLE125	Credit cycle (HP-filtered), 1.25 std, 1-boom, 2-bust, 3-normal	own calculation	525	2,229	0.874	1,000	3,000
CYCLE50	Credit cycle (HP-filtered), 50 s.p., 1-boom, 2-bust, 3-normal	own calculation	525	1,971	0.782	1,000	3,000
CYCLE150	Credit cycle (HP-filtered), 50 s.p., 1-boom, 2-bust, 3-normal	own calculation	525	1,884	0.779	1,000	3,000
BWCYCLE	Credit cycle (Butterworth-filtered), 1-boom, 2-bust, 3-normal	own calculation	525	2,010	0.839	1,000	3,000
Panel B. Other variables							
GR	Growth rate in GDP per capita (constant 2005 US dollar)	WDI	525	1.718	3.000	-14.265	14.978
HPCHANGE	Change in real house price	BIS	525	0.047	0.104	-0.346	0.780
SHARE	Mortgage credit in total credit	Bezemer et al. (2014)	525	37.321	14.376	4.257	74.560
LGPPPC	Log of lagged GDP per capita ((constant 2005 US dollar)	WDI	525	10.116	0.813	6.786	11.382
TRADE	Trade openness (import and export as a share of GDP)	WDI	525	84.563	70.482	15.924	444.100
INFLATION	Inflation (change in consumer price index (CPI))	WDI	525	2.709	2.235	-4.480	14.715
EDUC	Years of schooling	Barro and Lee (2013)	525	10.104	1.947	3.992	13.302

fined as capital expenditures minus cash flow from operations, divided by capital expenditures. Rajan and Zingales (1998) observed that industries more dependent on external finance grow faster in countries with more developed financial systems, measured as the credit-to-GDP ratio. By exploiting cross-industry variations while controlling for a range of country-specific and industry-specific factors, this widely used methodology alleviates endogeneity concerns.[2] In contrast to past studies based on industry-level cross sectional data (including Rajan and Zingales, 1998), we use panel data. Our industry-level analysis covers an unbalanced panel of 23 ISIC two-digit manufacturing industries for 36 countries (excluding the United States) during 1970-2010 from the United Nations Industrial Development Organization Industrial Statistics Database (INDSTAT2).[3] We ensure that the number of industries available through time is constant across each individual country, while the number of industries across countries may vary. We take the external dependence measure from Popov (2014) whose industry classification is most close to ours. Table A2 in the appendix reports the 23 two-digit ISIC industries and the external dependence measure we use.

The advantage of our approach is that we control for a number of time-varying fixed effects. We ask whether the share of mortgage has differential growth effects across industries during credit booms, credit busts and in normal times. The specification we use is

$$growth_{j,i,t} = \theta_0 S_{j,i,t-1} + \theta_1 Share_{i,t} \times ED_j + D_{i,t} + D_{j,t} + \epsilon_{j,i,t} \tag{2}$$

where j denotes industry, i denotes episode and t denotes year. *growth* is measured as the annual percentage change of industry real value added.[4] S is

[2]See also Raddatz (2006), Kroszner et al. (2007) and Bena and Ondko (2012).

[3]Rajan and Zingales (1998) use data of U.S. companies to compute the external financial dependence index and argue that it is a good proxy for the demand for external finance in the other countries. Therefore, US is excluded from the estimations.

[4]As the industry-specific deflators are not available across a large number of countries, we choose to deflate industry nominal value added by the country-specific consumer price index (CPI), as in Braun and Larrain

the size of each industry as a percentage of manufacturing value added at year $t-1$. As in the specification (1a) above, $SHARE$ is the proportion of mortgage loans on banks balance sheet. ED is the external financial dependence indicator, taken from Popov (2014). We include a series of dummy variables to control for episode-time and industry-time fixed effects. Finally, $\epsilon_{j,i,t}$ is an error term. We estimate equation (2) for credit booms, credit busts and normal periods, respectively. We conduct the same set of robustness checks as our aggregate analysis above.

IV. Empirical Results

This section presents the empirical results. We first report the aggregate results and then show the industry-level results.

A. Aggregate Results

Table 6 presents the results for the fixed-effect panel model based on equation (1a). Our main focus is the interaction of house price change and the mortgage share. Column (1) presents the results pooling all credit cyclical phases together, whereas columns (2), (3) and (4) present the results for credit booms, busts and normal periods, respectively.

We find that the interaction term enters with a statistically significant positive sign in column (1), suggesting that the growth effect of house price change depends on the mortgage share. Furthermore, we find that in credit booms, house price change carries a statistically negative sign, whereas the interaction term enters with a statistically significant positive sign in column (2). The interaction terms are insignificant during credit busts and normal episodes in columns (2) and (3). This confirms that the relationship between house price change and growth strongly depends on the level of mortgage share on banks balance sheets, which seems only operating in credit booms.

(2005). Albeit imperfect, this provides a good approximation for a wide range of countries in our sample.

Table 6—: Main Results - Aggregate Analysis

VARIABLES	(1) All	(2) boom	(3) bust	(4) normal
SHARE	0.119*	-0.035	0.158	0.114
	(0.060)	(0.088)	(0.254)	(0.091)
SHARE*HPCHANGE	0.259***	0.183**	0.186	0.131
	(0.093)	(0.070)	(0.257)	(0.178)
HPCHANGE	-5.019	-7.188***	9.861	-3.544
	(3.366)	(2.572)	(13.888)	(5.762)
LGPPPC	-27.475***	-11.079	-39.347***	-27.867***
	(3.838)	(7.800)	(8.484)	(4.257)
TRADE	0.093**	0.003	0.125**	0.023
	(0.039)	(0.035)	(0.047)	(0.042)
GVT	0.049	-1.429***	0.139*	-0.379**
	(0.126)	(0.282)	(0.073)	(0.185)
INFLATION	-0.095	-0.493**	-0.079	-0.283**
	(0.082)	(0.196)	(0.130)	(0.119)
EDUC	0.157	0.868	1.992	1.678
	(0.842)	(1.390)	(1.753)	(1.381)
Constant	266.543***	132.744*	363.071***	269.761***
	(38.565)	(78.631)	(99.377)	(46.364)
Observations	525	165	165	195
R-squared	0.693	0.848	0.819	0.725
No.of id	124	40	43	41

This table presents the main results based on equation (1a). The dependent variable is the annual growth rate of real GDP per capita (constant 2005 US dollar); $HPCHANGE$ is annual percentage change in real house price; $SHARE$ is the proportion of mortgage credit in banks' balance sheet; $LGDPPC$ is the log of lagged real GDP per capita; $TRADE$ measures trade openness, defined as total imports plus exports divided by GDP; GVT is government consumption as a share of GDP; $INFLATION$ is the change in CPI; $EDUC$ is the average year of schooling; All specifications include episode-specific dummies and time dummies (coefficients not reported); Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

To further illustrate the magnitude of the interaction effect, we calculate the marginal effect of house price change on growth, conditional on the mortgage share based on equation (1b). Figure (2a) and (2b) plot conditional marginal effects, with their 95 percent confidence intervals, against the level of the mortgage share for all episodes and credit booms.

Figure 2. : The marginal effects of house price changes on growth depend on the mortgage share

(a) All episodes　　　　(b) Credit booms

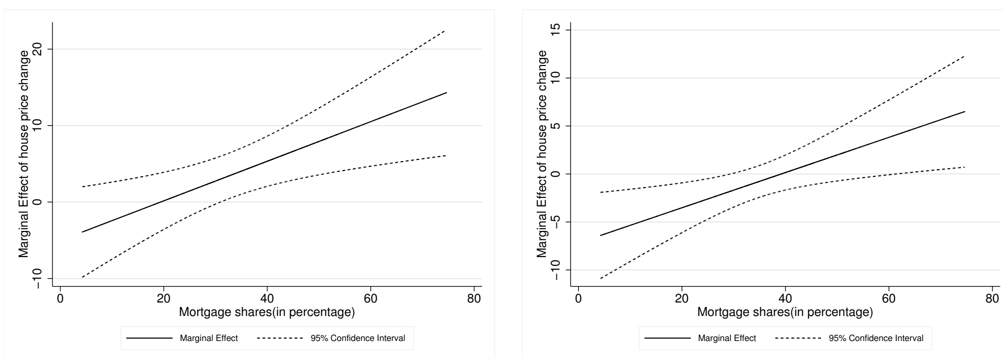


Figure (2a) demonstrate that house price change has a significant positive correlation with growth if the level of the mortgage share reaches. The marginal effect at the sample mean is 4.647 (-5.019+0.259*37.321). When the mortgage share is at its lowest (at the bottom left corner of (2a)) the marginal effect of house price change is only -3.916 (-5.019+0.259*4.257) and when house price change peaks (in the top right corner of (2a)), the marginal effect is a high 14.292 (-5.019+0.259*74.56). These figures illustrate that bank balance sheet conditions, here captured in the share of mortgages in total credit in banks balance sheets, have a profound impact on lending and growth, for given levels of house price change.

During credit booms, Figure (2b) demonstrate a clear threshold effect. A significant positive effect of house price change on growth obtains only if the mortgage share is above 39.278%, corresponding to approximately the 50^{th} percentile of the distribution of the mortgage share. It is important to note that the marginal effects varies widely over levels of the mortgage share in total credit. For example, the marginal effect of house price change on growth at the minimum level of the mortgage share in total credit equals -6.4 (-7.188+0.183*4.257), while it reaches 6.456 (-7.188+0.183*74.56) if the mortgage share reaches the maximum value at the top right corner of Figure (2b).

We conduct a series of robustness checks. The results are summarized in Tables 7. For each specification, Panel A shows the results for pooling all episodes, whereas Panel B, C and D show the results for credit booms, bust and normal episodes, respectively. For brevity, we only report the main variables of our interest.

First, we re-run columns (1)-(4) in Table 7, now including total credit as a share of GDP, to control for the level of financial development. The results do not quantitatively change much. Next, we change the threshold for defining boom and bust from 1.0 to 0.75 and then to 1.25 standard deviations. We find that the interaction term remains positive and significant during credit booms, but not in busts. Last, we introduce a triple interaction term between the mortgage share, house price change and a developed country group dummy (0-emerging countries, 1-advanced and G7 countries) to gauge the heterogeneity of effects across countries. The interaction effect appears stronger in emerging economies. Columns (1)-(5) check whether our results are sensitive to the credit cycle identifications discussed in the previous section. Columns (1) and (2) apply different thresholds in identifying credit booms and busts, namely 0.75 and 1.25 standard deviations, instead of 1 standard deviation used for the benchmark. Columns (3) and (4) employ different smoothing parameters, i.e., 50 and 150 to code cyclical phases. Column (5) uses an alternative Butterworth filtering technique. We find that the interaction term between house price change and the mortgage share is always significantly positive at 1 percent level in Panel A of Table 7, confirming the notion that the strength of the growth effect of house price changes depends on the mortgage share on banks' balance sheet. Furthermore, in line with the main results presented in 6, we find that the interaction term is significantly positive during credit booms and largely insignificant during credit busts and normal episodes.

We further check whether our results are sensitive to an alternative specification by controlling for country-specific instead of episode-specific fixed effects in equation (1a). The results for credit booms in Panel B in column (6) are quantitatively similar. Column (7) presents results including total credit as a share of GDP as an additional explanatory variable, to control for the level of financial development. The results do not quantitatively change much. Last, we introduce a triple interaction term between the mortgage share, house price change and a developed country group dummy (0-emerging countries, 1-advanced and G7 countries) to gauge the heterogeneity of effects across countries in column (8). The interaction effect appears stronger in emerging economies, particularly for credit busts.

B. Industry-level Results

Table 8 shows the industry-level results. We start by estimating equation (2) for all episodes in column (1) and then separately for credit booms, credit busts and normal periods in columns (2), (3) and (4). During booms, the share of mortgages in total credit on banks' balance sheets correlates more positively to growth in value added for those industries which are more dependent on external finance. During busts, the reverse is true. These results are in line with our hypotheses. In countries where banks have a higher share of mortgages in total loan assets, their lending to non-financial firms respond more strongly to house price changes. More financially dependent industries benefit more from this in terms of borrowing when house prices rise, and suffer more when house prices

Table 7—: Robustness Checks - Aggregate Analysis

	(1) 0.75std	(2) 1.25std	(3) 50s.p.	(4) 150s.p.	(5) butterworth	(6) country	(7) All	(8) group
Panel A: All Episodes								
SHARE	0.023	0.108*	0.129	0.006	0.109	0.037	0.121**	0.124**
	(0.070)	(0.055)	(0.084)	(0.063)	(0.066)	(0.033)	(0.060)	(0.056)
SHARE*HPCHANGE	0.266***	0.296***	0.255***	0.259***	0.280***	0.136	0.258***	0.470***
	(0.094)	(0.092)	(0.095)	(0.093)	(0.092)	(0.137)	(0.092)	(0.161)
HPCHANGE	-2.569	-5.901*	-3.212	-2.400	-5.177	1.958	-5.111	-6.038
	(3.272)	(3.286)	(3.657)	(3.188)	(3.182)	(4.537)	(3.328)	(3.713)
SHARE*HPCHANGE*								-0.264**
GROUPE								(0.116)
Obs	525	525	525	525	525	525	525	525
No. of id	148	110	150	144	124	36	124	124
R-squared	0.710	0.674	0.698	0.718	0.694	0.62	0.694	0.711
Panel B: Boom Episodes								
SHARE	-0.016	0.200	-0.066	0.048	0.179	0.017	-0.035	-0.033
	(0.098)	(0.141)	(0.110)	(0.129)	(0.130)	(0.088)	(0.088)	(0.082)
SHARE*HPCHANGE	0.163*	0.279***	0.248***	0.173*	0.203***	0.209***	0.184**	0.250***
	(0.099)	(0.061)	(0.081)	(0.098)	(0.069)	(0.071)	(0.071)	(0.074)
HPCHANGE	-3.483	-10.195***	-7.755**	-4.128	-7.708***	-7.931***	-7.192***	-7.106**
	(3.717)	(2.205)	(3.307)	(3.644)	(2.601)	(2.603)	(2.575)	(2.884)
SHARE*HPCHANGE*								-0.101**
GROUPE								(0.043)
Obs	180	154	168	193	182	165	165	165
No. of episodes	50	38	49	52	45	32	40	40
R-squared	0.842	0.801	0.811	0.828	0.800	0.827	0.848	0.853
Panel C: Bust Episodes								
SHARE	0.105	-0.010	0.173	0.089	-0.049	0.103	0.151	0.103
	(0.143)	(0.270)	(0.165)	(0.141)	(0.220)	(0.103)	(0.250)	(0.206)
SHARE*HPCHANGE	0.201	-0.141	0.166	0.229*	0.386*	-0.143	0.200	0.929***
	(0.176)	(0.294)	(0.206)	(0.131)	(0.192)	(0.333)	(0.264)	(0.343)
HPCHANGE	2.337	26.370	6.644	2.070	-7.338	25.701	9.381	5.964
	(7.356)	(17.200)	(8.854)	(4.756)	(7.795)	(15.996)	(14.069)	(11.960)
SHARE*HPCHANGE*								-0.882***
GROUPE								(0.230)
Obs	207	97	204	200	156	165	165	165
No. of id	58	27	58	54	36	27	43	43
R-squared	0.702	0.896	0.771	0.710	0.810	0.747	0.819	0.858
Panel D: Normal Episodes								
SHARE	0.016	0.069	0.193***	-0.070	-0.021	0.214**	0.119	0.111
	(0.114)	(0.053)	(0.046)	(0.120)	(0.079)	(0.078)	(0.086)	(0.090)
SHARE*HPCHANGE	0.083	0.049	0.051	0.196*	0.154	0.029	0.145	0.374
	(0.125)	(0.178)	(0.157)	(0.109)	(0.129)	(0.259)	(0.178)	(0.397)
HPCHANGE	-0.597	-0.560	4.696	-5.780*	-2.616	-0.069	-4.188	-6.090
	(3.431)	(5.735)	(3.901)	(3.363)	(4.167)	(8.547)	(5.958)	(6.504)
SHARE*HPCHANGE*								-0.207
GROUPE								(0.262)
Obs	138	274	153	132	187	195	195	195
No. of id	40	45	43	38	43	30	41	41
R-squared	0.772	0.679	0.822	0.769	0.711	0.735	0.728	0.731

This table presents the main results based on equation (1a). The dependent variable is the annual growth rate of real GDP per capita (constant 2005 US dollar); $HPCHANGE$ is annual percentage change in real house price; $SHARE$ is the proportion of mortgage credit in banks' balance sheet; The control variables $LGDPPC$, $TRADE$, GVT, $INFLATION$ and $EDUC$ are included. The coefficients are not reported here. All specifications include episode-specific dummies and time dummies (coefficients not reported); Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 8—: Main Results - Industry-level

	(1)	(2)	(3)	(4)
	All	booms	busts	normal
lagged industry share	-0.140***	-0.142*	-0.061	-0.236**
	(0.048)	(0.080)	(0.090)	(0.092)
$SHARE * ED$	0.012	0.173**	-0.129**	0.069
	(0.037)	(0.088)	(0.065)	(0.061)
Episode-time FE	Yes	Yes	Yes	Yes
Industry-time FE	Yes	Yes	Yes	Yes
Observations	9,241	2,795	2,854	3,592
R-squared	0.334	0.398	0.411	0.437

This table presents the industry-level evidence based on equation (2). The dependent variable is the annual growth rate of real value added. Lagged industry share is the share of each industry in a country's s total manufacturing value added at year $t-1$. *Share* is the share of mortgage credit in banks' balance sheet. *ED* is dependence on external finance, taken from Rajan and Zingales (1998). The set of dummies includes episode-year and industry-time fix effects (coefficients not reported). All standard errors in parentheses are adjusted for industry-country level heteroskedasticity and autocorrelation, *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

fall.

We apply the same robustness checks as we did for the aggregate analysis. The results are reported in Table 9. For each specification, Panel A shows the results for pooling all episodes, whereas Panel B, C and D show the results for credit booms, bust and normal episodes, respectively.

First, we use alternative boom/bust indicators by applying thresholds of 0.75 and 1.25 standard deviations in generating the cyclical phases. Using the less strict 0.75 s.d. criterion in column (1), the coefficient of the interaction term of mortgage share and financial dependence remains positive of similar magnitude and significant in booms, but less so in busts. Using the stricter 1.25 s.d. criterion - which only captures more extreme but fewer booms and busts -, we find no significant results, possibly due to the smaller number of observations. Next, we explore alternative boom/bust indicators by employing different smoothing

Table 9—: Robustness Checks - Industry-level

	(1) 0.75std	(2) 1.25std	(3) 50s.p.	(4) 150s.p.	(5) butterworth	(6) country	(7) All	(8) group
Panel A: All Episodes								
SHARE*ED	0.022	0.018	0.015	0.017	0.015	0.010	-0.009	0.030
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.035)	(0.044)	(0.073)
ALL*ED							0.011	
							(0.013)	
SHARE*ED*GROUP								-0.017
								(0.055)
Panel B: Credit booms								
SHARE*ED	0.152*	0.119	0.155*	0.151*	0.090	0.173**	0.157*	0.291**
	(0.086)	(0.095)	(0.084)	(0.082)	(0.090)	(0.077)	(0.095)	(0.141)
ALL*ED							0.007	
							(0.018)	
SHARE*ED*GROUP								-0.096
								(0.097)
Panel C: Credit busts								
SHARE*ED	-0.073	-0.094	-0.072	-0.112**	-0.113*	-0.129**	-0.165*	-0.087
	(0.055)	(0.080)	(0.053)	(0.055)	(0.061)	(0.056)	(0.087)	(0.123)
ALL*ED							0.025	
							(0.034)	
SHARE*ED*GROUP								-0.045
								(0.096)
Panel D: Normal periods								
SHARE*ED	0.088	-0.004	0.035	0.094	0.062	0.069	0.036	0.091
	(0.074)	(0.050)	(0.067)	(0.070)	(0.061)	(0.055)	(0.079)	(0.138)
ALL*ED							0.019	
							(0.028)	
SHARE*ED*GROUP								-0.021
								(0.109)

This table presents the industry-level evidence based on equation (2); The dependent variable is the annual growth rate of real value added; Lagged industry share is the share of each industry in a country's s total manufacturing value added at year $t-1$; $SHARE$ is the share of mortgage credit in banks' balance sheet; ED is external finance dependence, taken from Popov (2014); The set of dummies includes episode-year and industry-time fix effects (coefficients not reported); $Developed$ is a developed country group dummy, 0 indicates emerging countries, whereas 1 indicates advanced countries; All standard errors in parentheses are adjusted for industry-country level heteroskedasticity and autocorrelation, *** p<0.01, ** p<0.05, * p<0.1.

parameters in column (3) and (4). We find quantitatively similar results compared to Table 8. In addition, the interaction term loses significance in column (5) when we use Butterworth filter to identify credit cycles.

We then use an alternative specification by including a series of country-time and industry-time dummies, instead of episode-time and industry-time dummies in column (6). The results are almost identical to those in Table 8. Next, we test whether different levels of mortgage shares are just reflections of higher levels of financial development. We include an additional interaction term of mortgage share and total bank credit as share of GDP. The interaction effect remains significant in booms and busts, suggesting that the mortgage share does not simply reflect high financial development. Last, we introduce a triple interaction term of the share of mortgage, external dependence and a developed country group dummy (0-emerging countries, 1-advanced and G7 countries) in column (8). Again, the results are stronger for emerging countries in credit booms.

V. Summary and Conclusion

How do asset markets affect output growth via bank balance sheets? And what is the role of credit cycle boom-bust dynamics in this nexus? In this paper we analyze the impact of bank lending on output growth in credit booms and in credit busts. The effect is mediated by the combination of house price changes and bank balance sheet features, captured in banks' share of mortgage credit in total credit. The paper is part of a strand of recent studies which show that bank-specific characteristics can have a large impact on the provision of credit, and thus on output growth (Gan, 2007; Black et al., 2010; Jimenez et al., 2012; Maddaloni and Peydro, 2011; Gambacorta and Marques-Ibanez, 2011).

Different from older credit view literature, this strand studies the impact through banks balance sheets and then on growth, rather than through changes in deposits (Disyatat, 2011). What we add is a new data set on bank lending in 37 economies from 1970 at the earliest until and including 2012. A unique feature of our panel time series data is that we observe, in a cross country consistent manner, both total bank lending and its components - household mortgage credit, nonfinancial business lending, nonsecured consumer credit and lending to financial business. A second contribution we make is that we construct a measure for credit booms and credit busts, defined as deviations from long-term trends in total credit stocks (Braun and Larrain, 2005). By applying this methodology, we observe 187 episodes, of which 63 booms, 64 busts and 60 normal episodes.

We so distinguish between the bank lending channel in a credit boom from the bank lending channel in a credit bust and in normal times. We find that real income grows faster during a credit boom in countries where house prices rise more and where banks have a higher share of mortgage credit in total credit. In a second analysis, we find that industries which are more dependent on external finance experience growth in value added which is significantly higher in a credit boom and significantly lower in a credit bust if banks in their country have more mortgage loans on their balance sheets.

We interpret this as evidence of a bank lending which varies over the credit cycle. Additional analyses suggest that the bank lending channel combined with credit cycle boom/bust dynamics is more costly in countries which are more financially developed: they benefit less in a boom and suffer more in a bust. The channel also appears to operate more strongly in emerging economies. This merits further research.

A policy implication is that macroprudential monitoring should take place over the entire credit cycle, not only in or after a crisis. Our analysis shows that an asset market-induced stimulus to growth in credit cycle upswings, which increases mortgage lending, transforms bank balance sheets such that economies are more vulnerable to the credit market downturn that follows. This confirms other research: Borio and Lowe (2002) showed that sustained rapid credit growth combined with large increases in asset prices increase the probability of an episode of financial instability. This suggests the need for “a stronger focus on monitoring those financial factors that are likely to influence the functioning of the monetary transmission mechanism particularly in periods of crisis", (Gambacorta and Marques-Ibanez, 2011, p. 711), but also that this applies equally to boom periods, which may sow the seeds of crisis. This is not simple: not all booms lead to busts, constraining credit growth or asset markets in a boom bears unknown costs in terms of growth, and the harmful effects of booms are part of complex interactions with long term effects. For instance, Basurto et al. (2006) show that the interaction of bank credit and house prices increases the probability of bank default in OECD economies, but with a long lag. Another complication is the question of causality between real estate asset prices, bank lending and output growth; Davis and Zhu (2009) construct a model where real estate asset price cycles are driven by the dynamic linkage between real estate, bank credit and the macroeconomy. All this implies that the present paper should be part of a more encompassing understanding of macrofinancial fragility, with implications for macroprudential policy over the credit cycle.

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Data Appendix

Country	Code	Time Span	Episode	Boom	Bust	Normal
Australia	AUS	1990-2012	4	2003-2009	2000-2002	1990-1999
					2010-2012	
Austria	AUT	1995-2012	5	1997-2000	2001-2004	1995-1996
				2005-2008	2009-2012	
Belgium	BEL	1999-2012	3	2005-2008	2009-2012	1999-2004
Brazil	BRA	1994-2012	5	1994	2001-2006	1995-2000
				2010-2012		2007-2009
Canada	CAN	1990-2012	5	1990	2000-2004	1991-1999
				2005-2008		2009-2012
Switzerland	CHE	1977-2012	11	1989-1991	1981-1985	1977-1980
				1997-1999	1992-1993	1986-1988
				2006-2007	2000-2005	1994-1996
				2011-2012		2008-2010
Chile	CHL	1983-2012	6	1995-1997	1998-2004	1983-1994
				2005-2008	2009-2010	2011-2012
Czech Republic	CZE	1993-2012	5	1994-1997	1998-2002	1993
				2003-2008		2009-2012
Germany	DEU	1970-2012	9	1976-1980	1986-1989	1970-1975
				1990-1991	1992-1995	1981-1985
				1996-2002	2003-2006	2007-2012
Denmark	DNK	2000-2012	3	2004-2008	2009-2012	2000-2003
Spain	ESP	1992-2012	3	2004-2009	2010-2012	1992-2003
Estonia	EST	1999-2012	3	2005-2008	2009-2012	1999-2004
Finland	FIN	1997-2012	3	2003-2008	1997-2002	
					2009-2012	
France	FRA	1993-2012	6	1993	2001-2004	1994-2000

Continued...

Country	Code	Time Span	Episode	Boom	Bust	Normal
				2005-2008	2011-2012	2009-2010
UK	GBR	1986-2012	6	1987-1990	1991-1996	1986
				2006-2009	2010-2012	1997-2005
Greece	GRC	1990-2012	4	1990		1991-2003
				2004-2010	2011-2012	
Hungary	HUN	1989-2012	6	1989-1990	1995-1996	1991-1994
				1999-2006	2007-2012	1997-1998
Indonesia	IDN	2002-2012	4	2010-2012	2002-2006	2007-2008
					2009	
India	IND	2001-2011	4	2001	2002-2005	2009-2011
				2006-2008		
Ireland	IRL	2003-2012	3	2004-2008	2003	2009-2012
Israel	ISR	1999-2012	5	2000-2002	1999	2003-2005
					2006	2007-2012
Italy	ITA	1998-2012	6	2005-2007	2001-2004	1998-2000
				2010	2011-2012	2008-2009
Japan	JPN	1976-2012	8	1996	1997-1985	1997-1999
				1986-1989	1990-1992	2006-2012
				1993-1996	2000-2005	
Lithuania	LTU	1993-2012	3	2003-2008	1993-2002	
					2009-2012	
Luxembourg	LUX	1999-2012	6	2007-2008	2002-2004	1999-2001
					2011-2012	2005-2006
						2009-2010
Morocco	MAR	2001-2012	3	2001	2002-2005	2006-2012
Mexico	MEX	2000-2012	4	2000	2001-2005	2009-2012
				2006-2008		

Continued…

Country	Code	Time Span	Episode	Boom	Bust	Normal
Netherlands	NLD	1990-2011	5	1990	1991-1997	1998-2006
				2007-2008	2009-2011	
Norway	NOR	1995-2012	4	2006-2008	2001-2005	1995-2000
						2009-2012
New Zealand	NZL	1990-2012	4	2004-2008	2000-2003	1990-1999
					2009-2012	
Philippine	PHL	1997-2012	5	1997	2005-2006	1998-2004
				2010-2012		2007-2009
Poland	POL	1996-2012	4	2007-2009	2000-2006	1996-1999
						2010-2012
Portugal	PRT	1979-2012	6	1997-2002	1992-1996	1979-1991
				2006-2009	2010-2012	2003-2005
Singapore	SGP	1990-2012	7	1994-1998	2004-2006	1990-1993
				2011-2012	2009-2010	1999-2003
						2007-2008
Sweden	SWE	1996-2011	4	2005-2009	1999-2004	1996-1998
					2010-2011	
Turkey	TUR	1993-2012	7	1995-1998	2001-2004	1993-1994
				2010-2012	2008-2009	1999-2000
						2005-2007
United States	USA	1970-2012	8	1983-1990	1980-1982	1970-1979
				2004-2008	1991-1993	1994-2000
					2001-2003	
					2009-2012	

Table A.2—: Industries and NACE Codes

Two-digit ISIC Industry	External Dependence
15. Food, beverages and tobacco products	-0.12
16. Tobacco manufacturing	-0.92
17. Textile mills products	-0.36
18. Wearing apparel and fur	-0.61
19. Leather and leather products	-0.96
20. Wood products	0.04
21. Paper and allied products	0.06
22. Printing and publishing	0.07
23. Petroleum and coal products	0.09
24. Chemicals and allied products	0.28
25. Rubber and plastics products	0.25
26. Stone, clay, glass and concrete	-0.2
27. Primary metals	0.03
28. Fabricated metal products	-0.24
29. Industrial machinery and equipment	0.01
30. Office, accounting and computing	0.22
31. Electrical and electronic equipment	0.22
32. Radio, television and communications	0.22
33. Medical, precision, and optical instruments	-0.04
34. Other transportation equipment	0.01
35. Furniture	0.01
36. Recycling	0.01
37. Miscellaneous manufacturing	0.01

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