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Discerning Good from Bad Credit Booms: The Role of Construction

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EXECUTIVE SUMMARY

Credit booms are a focal point for policymakers and scholars of financial crises. Yet our understanding of how the real sector behaves during booms, and why some booms may go bad, is limited. Despite a large and growing body of literature, most of the work has focused on aggregate economic activity, and relatively little is known about which industries benefit and which suffer during these episodes. This note aims to fill this gap by analyzing disaggregated output and employment data in a large sample of advanced and emerging market economies between 1970 and 2014. We ask:

- Which industries benefit (suffer) during credit booms (busts)?
- What is the long-term impact of credit booms on a country's industrial structure?
- Does the sectoral composition of output and employment during a credit boom help us tell good booms apart from bad ones; that is, those followed by a costly bust down the road?

Our key findings are as follows.

Credit booms do not lift all boats alike. During booms, aggregate value-added and employment growth increase. But the aggregate performance hides substantial industry-level heterogeneity. Industries that are less tradable, more labor-intensive, and more reliant on external finance tend to benefit the most from credit booms. Indeed, most of the extra value-added and employment growth concentrates in a few industries—specifically, construction and, as a distant second, finance. However, the same industries that benefit the most during booms experience the most severe downturns during busts. This implies that credit booms tend to leave few long-term footprints on a country's industrial composition.

Construction is special. Construction is the only sector that consistently overperforms in bad credit booms. On average, output and employment growth in construction are roughly 3 percentage points higher in bad booms than in good ones. In all other sectors, the difference is smaller and not statistically significant. This finding holds in advanced economies and emerging markets and is robust to the exclusion of the post-2003 period. Hence, the uniqueness of the construction sector goes beyond the housing boom-bust cycle that characterized the global financial crisis.

An unusually rapid expansion of the construction sector can help discriminate bad from good credit booms. An additional percentage point of value-added or employment growth in the construction sector during a boom raises the probability of the boom being bad—followed by subpar economic performance or a systemic financial crisis—by 2 and 5 percentage points, respectively. Construction growth is also a more robust predictor of the economic costs of bad booms than other variables. One percentage point higher value-added growth in the construction sector during a bad boom corresponds to nearly a 0.1 percentage point drop in aggregate output growth during the bust. Such predictive power goes beyond other variables previously identified in the literature as good predictors of troublesome booms (such as the magnitude and duration of the boom, household credit growth, or house price growth). The broad cross-country availability of data on construction (relative, for instance, to household credit growth or house prices) is an additional advantage. Strikingly, in our sample, long-lasting booms that featured rapid construction growth never ended well.

I. INTRODUCTION

Since the global financial crisis, the dangers associated with credit booms have become a focal point for policymakers and academics alike. It is by now well established that, at the aggregate level, credit booms present a trade-off between immediate buoyant performance and the danger of a future crisis. These booms are associated with rapid economic growth, and many (but not all) are followed by financial distress and subpar economic performance ("bad booms").[1] But our understanding of how different sectors of the real economy behave during and after these episodes is limited. Most of the literature has studied booms at the macroeconomic level, and relatively little is known about how these episodes affect different industries and possibly contribute to shape the economy's long-term industrial structure (Braun and Larrain 2005; Abiad, Dell'Ariccia, and Li 2011; Mian and Sufi 2011; and Mian, Sufi, and Verner 2019 are exceptions). Yet looking at how different economic sectors behave during booms may lead to a better understanding of these phenomena and to the design of more effective policy responses. In particular, it may contribute to our ability to differentiate dangerous booms that need to be controlled from episodes of buoyant but healthy credit growth.

This note takes a step in this direction by documenting patterns in industrial output (measured by value added) and employment during credit booms in a large sample of advanced economies and emerging markets between 1970 and 2014. Combining industry-level data with a new disaggregated bank credit data set, we address the following questions:

- Which sectors benefit the most during credit booms, compared with tranquil times? Are the sectors that benefit the most from booms also the ones that suffer the most during busts? What are the typical characteristics that make a sector more likely to be sensitive to the credit cycle?
- What is the long-term impact of credit booms on a country's industrial structure?
- Perhaps more important from a policy standpoint, can granular data about industry performance help us distinguish good credit booms from bad ones? In other words, is the sectoral composition of output and employment during a credit boom telling us anything about what happens afterward?

We document that all sectors do not behave the same during and after credit booms. At the aggregate level, value-added and employment growth accelerate, but this hides substantial industry-level differences. Sectors that are less tradable, more labor-intensive, and more dependent on external finance are more sensitive to the credit cycle.[2] A few sectors—namely, construction and finance—

[1] Gourinchas, Valdes, and Landerretche (2001); Borio and Lowe (2002); Enoch and Ötker-Robe (2007); Igan and Tamirisa (2008); Mendoza and Terrones (2008); Dell'Ariccia, Igan, and Laeven (2012); Igan and Pinheiro (2011); Schularick and Taylor (2012); Dell'Ariccia and others (2016); IMF (2017, 2018). See also IMF (2019) on credit growth, house prices, and economic performance.

[2] The sensitivity to the credit cycle of sectors with these characteristics could be explained by financing constraints, local conditions, and price elasticities. See Section II.B for a more detailed discussion.

grow consistently more than others, both in terms of output and employment. And the sectors that benefit the most during booms experience a more severe slowdown during busts.

Against this backdrop, the construction sector plays a special role. First, construction displays the strongest acceleration (deceleration) in both value-added and employment growth during booms (busts). Since the construction industry is nontradable, very labor-intensive, and heavily reliant on external finance, it is not surprising that it ranks as the sector most sensitive to the credit cycle. Second, among all sectors, construction is the only one that consistently overperforms during bad booms. On average, output and employment growth in construction is roughly 3 percentage points higher in bad booms than in good ones—a difference larger than for any other sector. Notably, the patterns for finance are not as significant or robust, suggesting that it might be the link to construction that drives the extra procyclicality observed for finance. Importantly, this finding extends to emerging markets, is robust to the exclusion of the global financial crisis from our sample, and holds when we include house (or stock) prices in the empirical specification. In other words, the uniqueness of the construction sector goes beyond the latest, very pronounced, housing boom-bust cycle in some advanced economies (for example, Ireland or Spain), and its power to predict bad booms adds to other variables already identified in the literature.

This systematic overperformance in bad booms implies that monitoring construction activity could be a litmus test for bad booms. This is true even when taking into account other critical information, such as the size and duration of an ongoing boom, which have already been shown to be associated with the occurrence of bad booms (Dell'Ariccia, Igan, and Laeven 2016). In fact, in our sample, credit booms characterized by both a rapid expansion of the construction sector and long duration never ended well. We estimate that 1 percentage point value-added or employment growth in the construction sector during a boom raises the probability of the boom being bad by roughly 2 and 5 percentage points, respectively. Monitoring the expansion of the construction sector can also complement other important signals, such as household credit growth (Mian, Sufi, and Verner 2017; IMF 2017). This is especially true in emerging markets, where the household credit market is smaller than in advanced economies and most of the credit allocated during booms goes to the corporate sector (including real estate developers). In such cases, bad booms can develop without displaying any excessive household credit expansion, and monitoring construction activity can be a more robust signal for policymakers.

The pace of construction activity during the boom phase is a better predictor of the economic costs associated with bad booms than other signals. The worst booms—that is, the costliest among bad booms, based on the severity of the ensuing recession—are associated with higher growth in the construction sector during the boom phase. On average, annual real GDP growth in the three-year period following bad credit booms with a construction boom is –3.3 percent, compared with –1.9 percent for bad credit booms without a construction boom—a difference of almost 1½ percentage points. Construction sector activity is a better predictor than household debt: the difference between the costs of bad booms with high versus low household credit growth is much less pronounced. (The annual real GDP growth is lower by ¾ percentage point in the high-household-credit growth case than in the low-household-credit growth case.)

Finally, while the negative growth effects of bad booms seem to be mostly transitory, good booms may have a positive, long-lasting impact on the economy. One percentage point higher value-added growth in the construction sector during a bad boom predicts a 0.1 percentage point drop in annual output growth during the three-year period after the boom. This negative impact disappears over a six-year period. In contrast, higher construction sector growth during a good boom predicts 0.3 percentage point higher annual output growth over both horizons. This underscores an important trade-off: policy action to curb a boom may spare the economy a recession or a systemic crisis—which could have negative, persistent real effects of its own (Cerra and Saxena 2008; Abiad and others 2009). But such policy action may conversely reduce average long-term growth. Hence policymakers may face a mean-volatility trade-off, with different net growth effects depending on country circumstances (Rancière, Tornell, and Westermann 2008).

Our findings have two important implications. First, our results highlight potential new channels through which some booms may lead to subsequent economic underperformance.[3] Construction is traditionally not a sector characterized by high total factor productivity (TFP) growth. Hence, the observed excessive growth of construction activity during bad booms suggests that rapid credit growth may end up badly because of misallocation of resources (labor and capital, as well as credit) in the economy.[4] This in turn leads to lower TFP and GDP growth and may increase the economy's vulnerability to adverse shocks (Reis 2013; Benigno and Fornaro 2014; Dias, Marques, and Richmond 2016; Ebrahimy, forthcoming).

Notably, the experience of emerging markets suggests misallocation effects beyond the well-documented link between rising household debt and a subsequent slowdown in growth (IMF 2017). This can result from the negative impact of indebtedness on aggregate demand, since households might cut consumption to pay off debt (Mian, Sufi, and Verner 2017). However, the small contribution of household debt to total credit in most emerging markets suggests that other channels—such as resource misallocation—are at work in establishing a link between credit booms and subsequent growth in these economies.

Second, as part of a broader early warning system, monitoring the real sector during a boom at a disaggregated level can help policymakers flag bad credit booms and anticipate their economic costs more accurately. Such information could tilt the trade-off associated with policy interventions aiming to curb booms. When the sectoral composition of the expansion is particularly lopsided, policy tightening may be warranted. Increasing the frequency and accuracy of data at the sectoral level would benefit this effort.

[3] The earlier literature has emphasized collateral effects that amplify shocks, strategic decisions creating excessive leverage or risk taking because of externalities, limited liability and/or competitive pressures, capacity constraints, or behavioral biases (Kiyotaki and Moore 1997; Brunnermeier and Sannikov 2014; Lorenzoni 2008; Dell'Ariccia and Marquez 2006; Bordalo, Gennaioli, and Shleifer 2018).

[4] Technically, misallocation depends on marginal products of inputs, which are not necessarily lower in low-TFP-growth sectors (Nishida, Petrin, and Polanec 2014; Kwon, Narita, and Narita 2015). If, say, the marginal product of labor is higher in construction, employment growth in this sector would not represent misallocation of labor.

The rest of this note is organized as follows. Section II documents patterns and stylized facts on what happens to different sectors during and after credit booms. Section III compares the heterogeneity in sectoral performance between good and bad booms. Section IV focuses on the role of the construction sector in helping to detect bad booms ahead of time. Section V summarizes and discusses our key findings. Section VI concludes.

II. CREDIT BOOMS AND THE REAL SECTOR

Studies using aggregate data have shown that real activity tends to pick up during episodes of rapid credit growth and lose steam when the boom comes to an end. But do we observe the same pattern for all sectors of the economy? Using industry-level data on output and employment for 55 countries between 1970 and 2014, we first identify the sectors that are most sensitive to the credit cycle.[5] We then explore more formally which characteristics make a sector more likely to benefit (suffer) during a boom (bust).[6] Finally, we explore whether credit cycles have longer-term implications in terms of the sectoral composition of economic activity.

A. Which Sectors Benefit, Which Suffer?

Almost all sectors expand faster during booms than during tranquil times, both in terms of output and employment. However, there is significant heterogeneity across sectors (Figure 1, panel A). Construction and finance (a distant second) gain the most during booms.[7] Agriculture and services are at the opposite end of the spectrum. Information, mining, trade, and manufacturing lie somewhere

[5] Data are available for 33 industries. For the sake of tractability and clarity, we aggregate them into 11 sectors: agriculture, construction, finance, information, manufacturing, mining, real estate, trade, utilities, other services, and public services. Details, including how the industries are aggregated into broader ones, are presented in Appendix Table 1. In this note, we use the terms "industry" and "sector" interchangeably to refer to the 11 aggregated categories we use in the analysis.

[6] Booms are defined as episodes during which the relationship between credit developments and economic activity exhibits "extraordinary" positive deviations. We follow Dell'Ariccia, Igan, and Laeven (2016) to define what constitutes extraordinary deviations and apply a mix of country-specific, path-dependent thresholds and absolute numerical thresholds to deviations of the credit-to-GDP ratio from its backward-looking rolling trend. This allows us to account for differences across countries as well as changes over time within the same country, and it avoids the risk of missing episodes due to an overfitting trend. We refer the reader to Dell'Ariccia, Igan, and Laeven (2016) for more details on this approach, its pros and cons, and comparison with other methodologies. Appendix I provides technical details on (1) the methodology used to identify booms, busts, and normal times; and (2) the empirical framework to estimate the relative sensitivity of the various sectors during booms and busts. A full list of the booms identified in the sample is in Appendix Table 2.

[7] The growth rates are adjusted to purge out country and sector fixed effects to allow comparability across countries and sectors.

in the middle.[8] As for real estate,[9] employment increases dramatically during booms, but value added appears relatively acyclical.

Value-added growth in construction during booms is strong, exceeding growth in tranquil times by 5 percentage points on an annual average basis. Employment growth is also strong, 3.6 percentage points above its annual average growth rate in tranquil periods. These differences are economically meaningful, corresponding to roughly a 0.6 standard deviation of construction sector value-added and employment growth. Taken from another perspective, construction value added and employment grow almost twice as fast as finance—which ranks second.

An interesting question is whether relatively stronger employment growth during booms is associated with faster productivity growth. The answer seems to be no, as TFP growth in construction typically lags that in other sectors not only during booms but in tranquil times as well (Table 1).[10] Yet the dramatic growth in employment during booms more than compensates for the slow TFP growth the construction sector typically displays and places construction at the top in terms of value-added growth.

Table 1. Productivity Growth

	Tranquil times	Booms	Busts
Construction	-0.32	0.52	-0.89
All except construction	-0.24	0.62	0.15

Sources: EU and World KLEMS, Haver Analytics, IMF *International Financial Statistics*; IMF staff calculations.
Note: Productivity growth is computed as the residuals from regressing total factor productivity growth on country-sector dummies. Annual averages are calculated separately for tranquil times, booms, and busts (see Appendix I for definition of booms and busts). The "all except construction" category reports the median across sectors excluding construction.

On the flip side, no sector is immune to the bust. All of them contract during this phase, but there is again significant variation across sectors (Figure 1, panel B). Construction and finance again top the chart during busts (with finance again a distant second, especially when it comes to employment growth), making them the most procyclical sectors. The real estate sector shows a strong decline in employment but a much smaller decline in terms of value added (confirming the picture from the boom phase). Trade, information, and manufacturing also show procyclicality, but primarily in terms of value added rather than employment.

Overall, we find that the sectors that benefit the most during booms also experience the most severe downturn during busts (Figure 2). This negative correlation between performance during a boom and

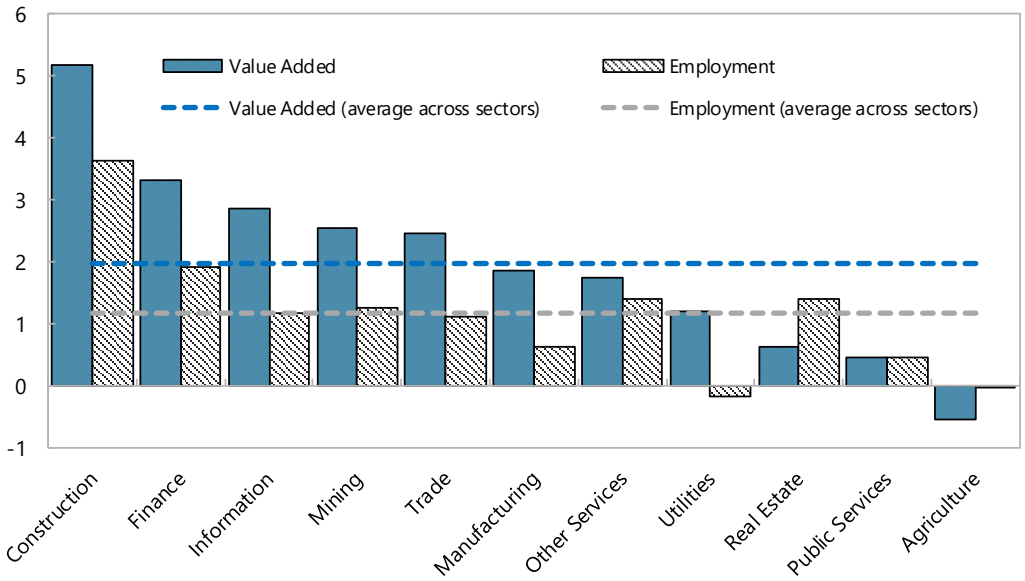
[8] Other services include transport and storage, accommodation and food services, and a range of other activities (professional, scientific, technical, and administrative support as well as entertainment and recreation).

[9] The activities covered in this sector encompass a range of services relating to the provision of property; that is, buying, selling, and renting of commercial and residential properties or land. This sector also includes the activities of real estate agents intermediating in buying, selling, leasing, or managing real estate. We keep it separate from the construction sector as the kind of frictions we discuss later are less likely to apply to these activities.

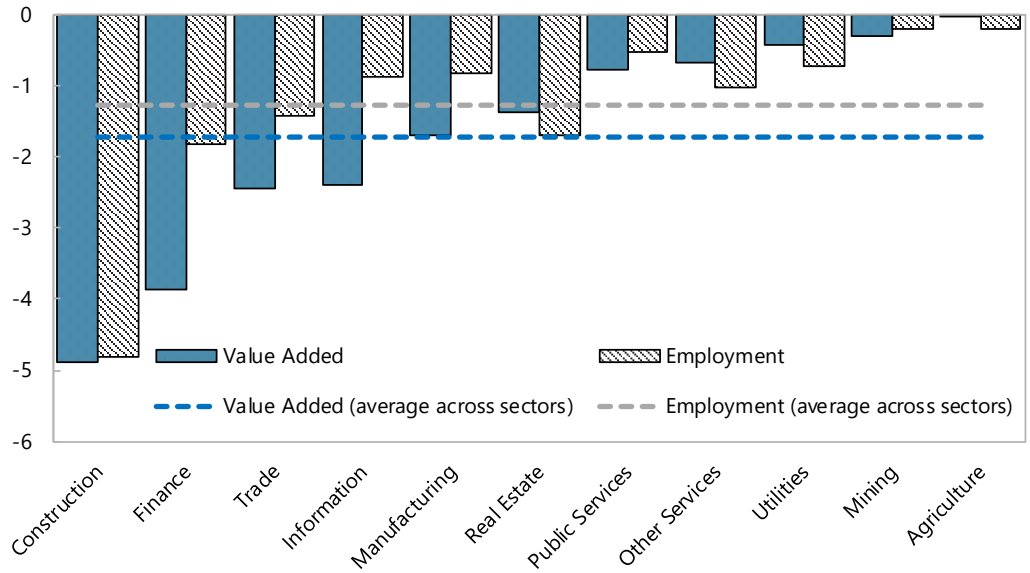
[10] Systematic data on labor productivity growth are not available. The coverage of TFP growth series also has significant gaps (especially for emerging market economies), so these findings should be taken with a grain of salt. It is also worth noting that the numbers reported in Table 1 are obtained after purging out country-industry averages and should not be interpreted as productivity growth in tranquil times being negative. The unadjusted TFP growth series has an average (median) of 0.34 (0.25) for all industries at all times and of 0.09 (0.13) in tranquil times.

Figure 1. Sectoral Activity during Booms and Busts

Panel A. Activity during booms (annual average change relative to tranquil times, percent)



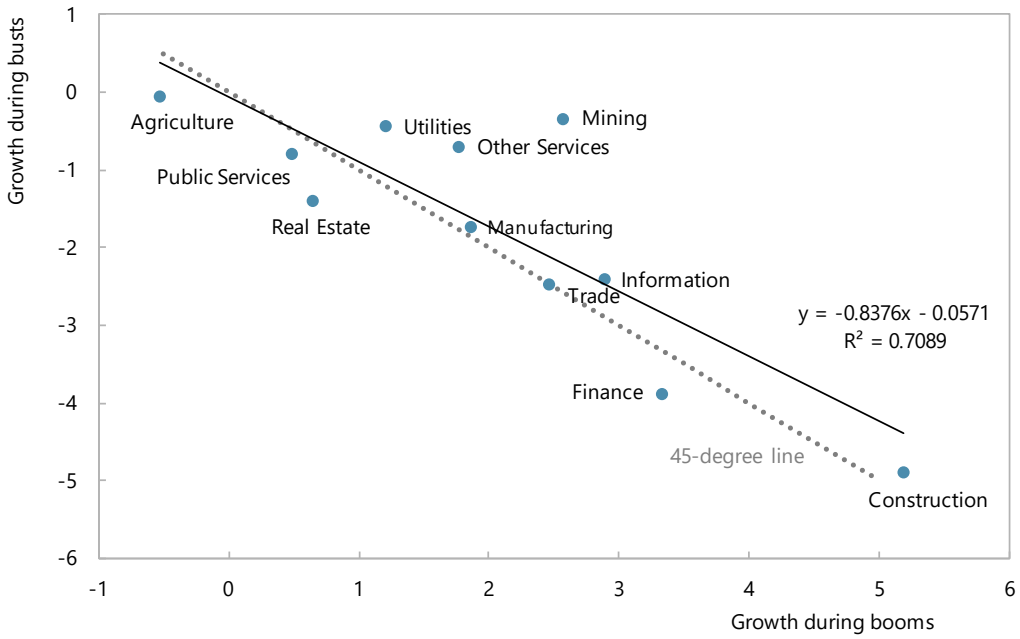
Panel B. Activity during busts (annual average change relative to tranquil times, percent)



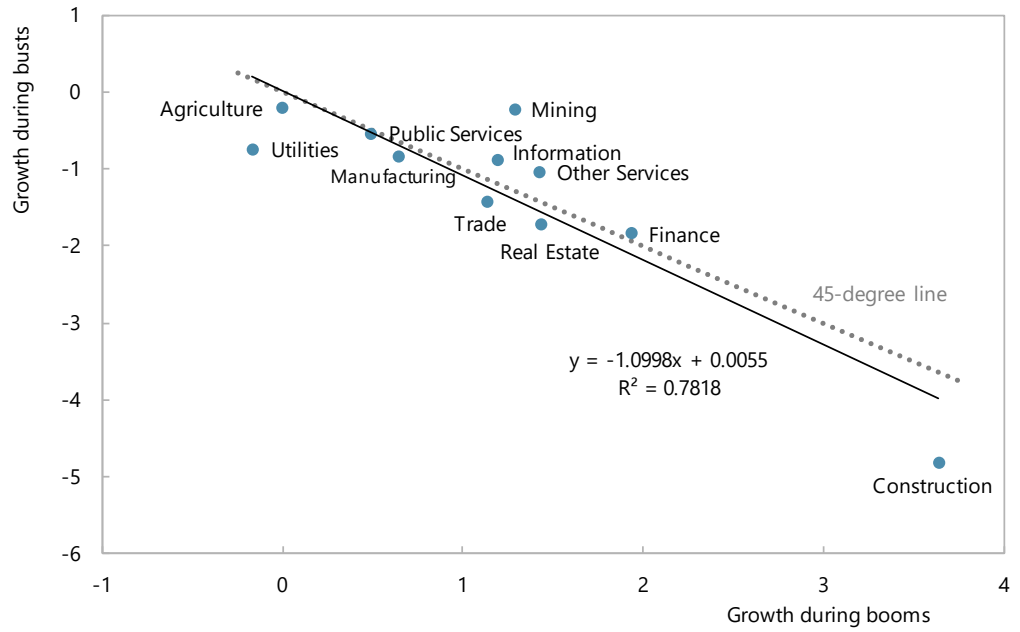
Sources: EU and World KLEMS, Haver Analytics, IMF *International Financial Statistics*.
Note: This figure depicts average annual sectoral value added and employment growth rates during boom and bust episodes. The growth rates are first computed at the country and sector levels and then regressed on a country-sector dummy to purge out country and sector fixed effects. The adjusted growth rates are calculated as the residuals from these regressions. Panel A shows the cross-country average of these adjusted growth rates during all booms relative to tranquil times for each sector. Panel B shows the cross-country average of these adjusted growth rates during all busts relative to tranquil times for each sector. Tranquil times are defined based on the following two criteria: (1) periods in which a country is not in a boom, pre-boom, or bust episode, and (2) when credit-to-GDP growth is above zero. For more information boom-bust identification and on sectoral composition, see Appendix I.

Figure 2. Correlation of Sectoral Activity during Booms vs. Busts

Panel A. Average annual **value-added** growth during busts vs. booms (in percent)



Panel B. Average annual **employment** growth during busts vs. booms (in percent)



Sources: EU and World KLEMS, Haver Analytics, IMF *International Financial Statistics*; IMF staff calculations.

Note: This figure plots the correlation of the adjusted sectoral value added and employment growth rates in boom versus bust episodes. The growth rates are first computed at the country and sector levels and then regressed on a country-sector dummy to purge out country and sector fixed effects. The adjusted growth rates are calculated as the residuals from these regressions. For more information on boom-bust identification and on sectoral composition, see Appendix I.

its subsequent bust is consistent with the notion that credit booms represent episodes of extraordinary activity that cannot be sustained and is subject to reversal at some point.[11] Indeed, over the medium term, credit booms do not appear to be associated with a shift in the sectoral composition of economic activity (see the analysis and discussion in Section II.C).

These stylized facts are generally confirmed in regressions that control for time, country, and sector fixed effects.[12] On average, value added (employment) expands by roughly 1.2 percentage points (0.8 percentage point) more in all sectors during booms, compared with normal times. However, they also contract by almost the same amount during the bust phase (Table 2).

Table 2. Sectoral Activity

	Value-added growth	Employment growth
$Size_{t-1}$	-0.093***	-0.030*
	(0.019)	(0.016)
Boom	**1.222*** **	**0.746** **
	(0.364)	(0.287)
Bust	**-1.231*** **	**-0.638***
	(0.419)	(0.332)
Observations	15,578	11,735
R-squared	0.111	0.111

Source: IMF staff estimates.
Note: This table shows regression results where the dependent variable is value added / employment growth at the sector level and the independent variables are the sector's lagged share of value added / employment and boom and bust dummies. Sector, country, and year fixed effects are included. Robust standard errors are clustered at the country level and displayed in parentheses. Statistical significance at the 10, 5, and 1 percent level is denoted by *, **, and ***, respectively. Coefficients of interest shown in **bold**.

We also confirm the strong procyclicality of some sectors, over and beyond this average effect (Figure 3).[13] We estimate that value added and employment in the construction sector grow by almost 4 percentage points more than in other sectors during booms (on average on an annual basis). However, they contract by almost the same amount during the bust phase. Similarly, finance value added contracts during busts after expanding in booms, although the magnitude of the cycle is significantly smaller than in the construction sector.[14] Further, the

[11] Mining appears to be an outlier in terms of this reversal pattern. Although it grows at the average rate across sectors during the boom, it does not shrink as much during the bust. Mining also ranks toward the top in Figure 1, panel A, but toward the bottom in Figure 1, panel B. This raises the question of whether booms have a permanent positive effect on the mining sector. However, neither the boom nor the bust effect on mining is significant once we control for country and time fixed effects (see Appendix Table 3).

[12] We run the following specification:

$$PerformanceMeasure_{i,c,t} = \beta_1 Size_{i,c,t-1} + \beta_2 Boom_{c,t} + \beta_3 Bust_{c,t} + \beta_4 FixedEffects + \varepsilon_{i,c,t}$$

$PerformanceMeasure_{i,c,t}$ is value-added / employment growth for sector i in country c in year t. $Size_{i,c,t-1}$ is the share of sector i in country c total value added or employment in year t-1, and $Boom_{c,t}$ ($Bust_{c,t}$) is an indicator equal to 1 if country c is experiencing a boom (bust) episode in year t. $FixedEffects$ include the full set of time, country, and sector fixed effects. Results are reported in Table 2.

[13] Specifically, we estimate the following regression:

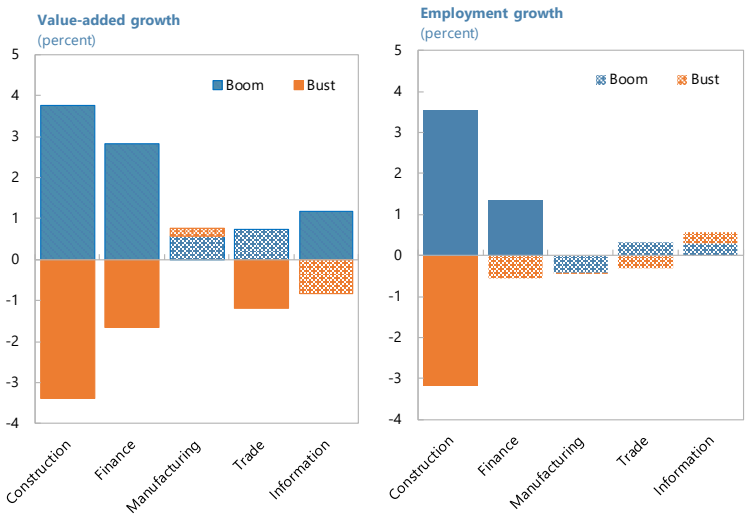
$$\begin{aligned} PerformanceMeasure_{i,c,t} &= \beta_1 Size_{i,c,t-1} + \beta_2 (Boom_{c,t} \times SectorDummy_i) \\ &+ \beta_3 (Bust_{c,t} \times SectorDummy_i) + \beta_4 GDPgrowth_{c,t} + \beta_5 (GDPgrowth_{c,t} \times SectorDummy_i) \\ &+ \beta_6 FixedEffects + \varepsilon_{i,c,t} \end{aligned}$$

For the sake of brevity, Figure 3 reports only coefficients of interest (β_2 and β_3) for the sectors that show a consistent pattern during booms versus busts, based on Figure 1. For further details and the full set of results showing all sectors, see Appendix Table 3. Note that, since we include interactions of boom/bust with all 11 sectors, we cannot include the boom/bust dummies separately in this specification.

[14] These figures relate to the specification in which we include the interactions of industry indicators with boom/bust dummies and GDP growth. In the specification in which we also include the interactions of industry indicators with GDP growth, the coefficients for construction are somewhat smaller but still significant, while the coefficient on the GDP growth interaction is significant and larger in magnitude than for all other industries (see Appendix Table 3). The

procyclicality of the construction sector is largely robust to the exclusion of the global financial crisis period. But this is not the case for the finance sector (see Appendix Table 3). The differences between boom and bust periods for the remaining sectors tend not to be statistically significant.

Figure 3. Differential Dynamics of Sectoral Activity



Sources: EU and World KLEMS, Haver Analytics, IMF *International Financial Statistics*; IMF staff estimates. Note: This figure shows the coefficients obtained on the interaction of the respective sector dummy (construction, finance, manufacturing, trade, or information) and the boom / bust indicator when value added / employment growth at the sector level is regressed on these dummy variables; the sector's lagged share of value added / employment; and sector, country, and year fixed effects. Shaded bars indicate that the coefficient is not statistically significant at conventional levels. See Appendix II for more information on the specification and the full set of regression results.

While not as significant or robust, a couple of other findings are notable. First, the manufacturing sector is not a "winner" during booms. In fact, we estimate that employment in manufacturing grows 1 percentage point less, on average, relative to other sectors during booms. This suggests that, at least in the short term, fast-expanding sectors—such as construction—may draw workers away from the manufacturing sector. Second, we observe that trade value added contracts significantly in a bust, although it does not grow significantly more during the boom phase. This suggests that trade may suffer from negative spillovers, perhaps due to a general tightening in credit conditions or a drop in aggregate demand as highly indebted agents start deleveraging.

B. Which Characteristics Make Some Sectors More Procyclical than Others?

In order to shed light on the broad characteristics that make a sector behave more procyclically during credit boom-bust cycles, we examine the indicators that are commonly used in the literature: tradability, factor intensity, and external finance dependence.[15] We find that industries that are (i) less

latter could be considered a "direct" channel linking construction activity to credit boom and bust patterns (that is, through procyclicality of both construction and credit), and the former could be seen as an "indirect" channel in which both real (for example, resource misallocation) and financial (for example, leverage and default) factors may play a role (see Section III for a more in-depth discussion of such mechanisms). The strong comovement of construction with the business cycle reflects its close integration with many other industries, most notably finance (see Sun, Mitra, and Simone 2013 for stylized facts and overshooting/undershooting patterns of the construction sector in Europe around the time of the global financial crisis).

[15] The regressions we run are similar to those in Section II.A but replace the sector dummy with a sector characteristic dummy (which can be the same for different sectors):

$$PerformanceMeasure_{i,c,t} = \beta_1 Size_{i,c,t-1} + \beta_2\left(Boom_{c,t} \times SectorCharacteristic_i\right) + \beta_3\left(Bust_{c,t} \times SectorCharacteristic_i\right) + \beta_4 GDPgrowth_{c,t} + \beta_5\left(GDPgrowth_{c,t} \times SectorCharacteristic_i\right) + \beta_6 FixedEffects + \varepsilon_{i,c,t}.$$

tradable, (ii) more labor-intensive, and (iii) more reliant on external finance tend to be more sensitive to the credit cycle, both in terms of value added and employment growth (Table 3).

Table 3. Sector Characteristics and Activity during Booms and Busts

	Value-Added Growth		Employment Growth	
	(1)	(2)	(3)	(4)
$Size_{t-1}$	-0.075***	-0.078***	-0.001	0.005
	(0.011)	(0.011)	(0.005)	(0.005)
Boom	-1.320**	0.0304	-1.090*	-0.567
	(0.543)	(0.499)	(0.618)	(0.650)
Bust	1.212**	0.359	-0.013	-0.296
	(0.511)	(0.483)	(0.635)	(0.583)
Tradability	-1.550***	-2.151***	-3.168***	-2.783***
	(0.241)	(0.296)	(0.285)	(0.378)
Boom x Tradability	**-0.927****	**-1.400*****	**-0.792***	-0.449
	(0.458)	(0.462)	(0.408)	(0.494)
Bust x Tradability	**0.820***	**1.122****	0.877	0.690
	(0.488)	(0.493)	(0.608)	(0.544)
Labor Intensity	0.646**	-1.310**	-0.414	-1.291***
	(0.319)	(0.565)	(0.350)	(0.433)
Boom x Labor Intensity	**2.703*****	1.094	**1.849****	1.119
	(0.742)	(0.823)	(0.806)	(0.784)
Bust x Labor Intensity	**-2.566*****	**-1.563****	-0.481	-0.091
	(0.760)	(0.667)	(0.666)	(0.672)
External Finance Dependence	-1.534***	-3.162***	0.012	-0.941**
	(0.359)	(0.491)	(0.324)	(0.422)
Boom x External Finance Dependence	**1.518****	0.260	**1.875*****	**1.010***
	(0.589)	(0.580)	(0.609)	(0.558)
Bust x External Finance Dependence	**-1.251***	-0.445	**-1.368****	-0.911
	(0.668)	(0.687)	(0.668)	(0.574)
GDP Growth	0.789***	0.192**	0.454***	0.240**
	(0.093)	(0.095)	(0.060)	(0.110)
GDP Growth x Tradability		0.209***		-0.144
		(0.050)		(0.096)
GDP Growth x Labor Intensity		0.696***		0.296**
		(0.200)		(0.135)
GDP Growth x External Finance Dependence		0.556***		0.356***
		(0.164)		(0.107)
Observations	15,468	15,468	11,625	11,625
R-squared	0.180	0.192	0.122	0.128

Source: IMF staff estimates.

Note: The dependent variable is *Value-Added Growth* in columns (1)-(2) and *Employment Growth* in columns (3)-(4). The independent variables are $Size_{t-1}$, *Boom, Bust,* and sector characteristics (*Tradability*, *Labor Intensity*, and *External Finance Dependence*) along with their interactions with *Boom* and *Bust*, and real GDP growth. *Value Added (Employment) Growth* is the log change in real value added (employment) for each sector in a country for a given year. $Size_{t-1}$ is the sectoral share of real value added or employment over the country-year total of the respective variable in the previous year. *Boom* and *Bust* are dummy variables which take the value of 1 when a country is in a credit boom or bust episode, respectively, and 0 otherwise. *Tradability* is a dummy that takes the value of 1 if the sector is Agriculture, Manufacturing, or Mining, and 0 otherwise. *Labor Intensity* is computed as the cross-sector share of labor compensation over total value added for the United States; a sample average is used for each sector, giving a country- and time-invariant sector characteristic (see Appendix Figure 1 for sector values). *External Finance Dependence* is calculated following Rajan and Zingales (1998) as the median across all US firms in a given industry of the ratio of total capital expenditures minus current cash flow to total capital expenditures and aggregated to the sector level using value added shares as weights (see Appendix I for aggregation of industries into sectors). All specifications include country and year fixed effects. Robust standard errors are clustered at the country level and displayed in parentheses. Statistical significance at the 10, 5, and 1 percent level is denoted by *, **, and ***, respectively. Coefficients of interest shown in **bold**.

These findings are generally consistent with other empirical studies that have emphasized the strong reaction of the nontradable sector during booms (Mendoza and Terrones 2014; Kalantzis 2015) and the cyclicality of industries that rely on external funding (Braun and Larrain 2005; Abiad, Dell'Ariccia, and Li 2011). For instance, more tradable sectors such as manufacturing expand roughly 1¼ percentage points less than nontradable sectors during booms (Table 3, columns 1 and 2). However, tradables outperform nontradables by roughly the same margin during the bust phase. Interestingly, labor-intensive sectors exhibit faster employment growth during booms, but the contraction during busts in this case is not statistically significant (Table 3, column 3). This could be an indication of the unwillingness of firms with relatively higher demand for labor to fire workers.

Intuitively, these three industry characteristics capture potential transmission and amplification mechanisms.

- External-finance-dependent industries enjoy a more pronounced relaxation in the constraints they face once a credit boom takes hold. Hence, they mobilize the newly available external funds and expand faster than others.

- Labor-intensive sectors tend to depend more heavily on the local areas where they operate and may benefit from a feedback effect: as they grow fast, they hire more workers, and these new hires become new consumers. Labor intensity may also be a proxy for how mobile and tradable these sectors are.

- Nontradables could be more prone to cyclical movements in domestic credit because their revenues depend mostly, if not entirely, on domestic demand. If the boom in question is driven by capital inflows, real exchange rate appreciation could hurt exporters but would have less impact on domestically oriented, nontradable sectors. Without the dampening impact of currency movements, the nontradable sectors would then enjoy the boost from the credit boom more but also contract more during the bust phase.

An additional insight relates to the dynamics between internal and external balances. Credit booms boost domestic demand and, hence, tend to be associated with a deterioration in the current account balance. It then follows that curbing rapid credit growth to avoid overheating and to restore internal balances would lower (raise) the current account deficit (surplus). However, by favoring sectors that are inherently nontradable, credit booms may affect the current account in ways other than just their impact on demand. Specifically, reallocation of capital and labor to the booming nontradable sectors may lead to a deterioration in export competitiveness. Further, improved availability of credit could reduce precautionary savings. These forces would amplify the worsening of the current account balance.

This insight is in line with findings from the literature showing that—consistent with increased cross-border financial flows and the rise of services at the expense of manufacturing—the correlation between credit booms and current account imbalances has grown much tighter in recent decades (Jordà, Schularick, and Taylor 2011); that sudden stops tend to be followed by a collapse in the price and output of the nontradable sectors (for example, Mendoza and Terrones 2014; Magud and

Vesperoni 2015 and references therein); and that current account surplus reversals tend to be followed by an increase in the size of the nontradable sectors as a share of GDP and a reduction in private savings (Abiad, Leigh, and Terrones 2010). Overall, these results can explain, to some extent, why construction benefits the most during booms and suffers more during busts: out of all industries, construction is the only one to rank high in all three dimensions.[16]

C. How Do Sectoral Composition and Credit Booms Relate to Each Other?

A natural follow-up question is whether the cyclical patterns documented in the previous section have any bearing on the industrial structure of the economy in the long run. Since credit booms disproportionately benefit certain sectors, one might expect these sectors to become more prominent in countries that experience more frequent or extreme credit booms.

To explore such longer-term implications, we plot measures of a country's credit-boom experience over our sample period (*x*-axis) against measures of changes in its industrial structure (*y*-axis). We compute the fraction of years spent in a boom over the sample period or, alternatively, the cumulative growth in the credit-to-GDP ratio achieved over all the booms for the former. The change in the share of construction and, alternatively, the change in the concentration of industries are used for the latter. These changes are calculated over the longest horizon possible given the length of time series for a given country. We focus on the sample period up to 2002 to exclude the global financial crisis but also repeat the exercise with 2012 and 2016 as the end years.

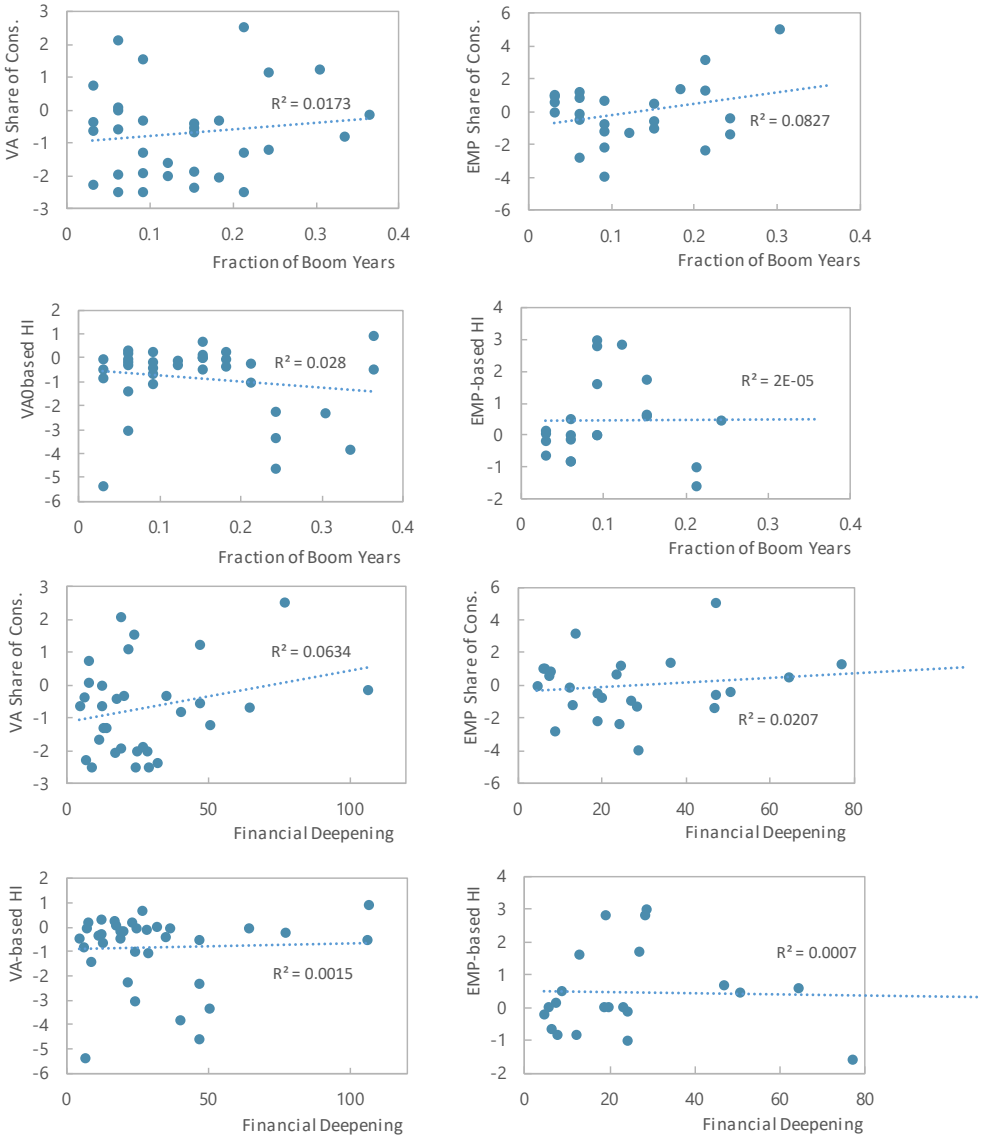
We do not detect any significant, robust relationship between credit boom experience and changes in industrial structure (Figure 4).[17] Hence, the effects of credit booms on different sectors appear to be temporary, with busts contributing to undo any long-term effect on the economic structure. The lack of a long-term relationship between credit booms and the structure of the economy is consistent with the results reported in Section II.A stating that the coefficients on the boom-sector interaction terms are very close to those on the bust-sector interaction terms.

We also explore the other side of the coin: do certain industrial structures drive the propensity of a country to experience credit booms? For instance, if a country already has a relatively large construction sector at the beginning of the sample period, does it end up experiencing more or larger booms? We conduct a similar exercise as in Figure 4 and plot the size of the construction sector at the beginning of the sample period (*x*-axis) against the credit boom experience (*y*-axis). We find no significant, robust relationship between the initial value added or employment share of the construction sector and the frequency of or the financial deepening achieved during the subsequent credit booms (these plots are not included for the sake of brevity but are available on request).

[16] Construction is a nontradable industry. And it ranks first and second in labor intensity and external finance dependence, respectively (see Appendix Figure 1).

[17] Note that we drop the outliers in our calculations (the results are similar when they are included). We also confirm the robustness of the results by looking at the changes in the share of sectors other than construction.

Figure 4. Credit Booms and Industrial Structure

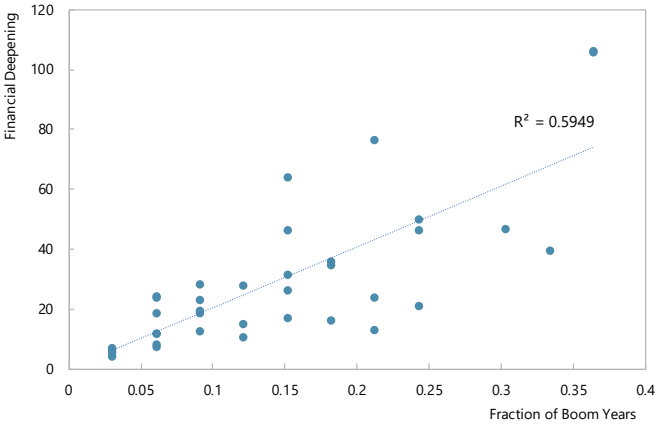


Sources: EU KLEMS, IMF *International Financial Statistics*, IMF *World Economic Outlook*, Haver Analytics.

Note: VA = value added; EMP = employment; HI = Herfindahl Index. The figure shows the correlations between metrics aiming to capture the prevalence of credit booms in a country in the sample period and metrics aiming to capture the long-term change in the industrial structure of an economy. For the first metric, we use either the fraction of years spent in booms ("fraction of boom years") or the cumulative growth in the credit-to-GDP ratio achieved during booms ("financial deepening"). For the second metric, we use either the change in the value added (employment) share of construction in total value added (employment) or the change in the value added (employment) based HI. HI is calculated as the sum of the squared sector value added (employment) shares over the country-year totals; a value of 10,000 (100^2) represents a fully concentrated economy, but we divide by 1,000 to adjust the scale. Changes in the share or HI are computed by taking the first year for which observations are available as the start year and by taking 2002 as the end year. The choice of 2002 as the end year ensures that the results are not affected by the GFC period and the boom episodes just before the global financial crisis. The patterns are similar when we use the latest year for which data are available. Outliers are excluded in this figure. For more information on the identification of boom episodes, see Appendix I.

This lack of a significant long-term relationship with the structure of the economy does not imply that there are no long-term consequences to credit booms. Admittedly, the failure to find significant relationships between booms and the industrial structure (or the changes therein) may be driven by the limited coverage of our sample as well as significant variation across booms. That said, there is a significant (not necessarily causal) relationship between credit boom experience and financial deepening: countries that go through more or longer booms tend to reach higher credit-to-GDP ratios (Figure 5). There is also a significant—and nonlinear—relationship between credit boom experience and long-term economic growth: countries that have booms grow faster, but this growth benefit seems to taper off when a country spends more than five years in a boom (Table 4).

Figure 5. Credit Booms and Financial Deepening in the Longer Run



Sources: IMF *International Financial Statistics*; IMF staff calculations.
Note: The x-axis shows the fraction of years spent in booms ("fraction of boom years"). The y-axis shows the cumulative growth in the credit-to-GDP ratio achieved during booms ("financial deepening"). We restrict the sample period to end in 2002. Choosing 2002 as the end year ensures that the results are not affected by the GFC period and the boom episodes just before the global financial crisis. For more information on the identification of boom episodes, see Appendix I.

Table 4. Credit Booms and Real Activity in the Longer Run

	Value added growth		GDP per capita growth	
Years spent in a credit boom	Annual average	Cumulative	Annual average	Cumulative
0	2.2	29.0	1.7	22.5
1-5	3.1	40.8	2.5	32.6
>5	3.1	39.7	3.0	39.3

Source: IMF staff estimates.
Note: This table shows the annual average as well as cumulative growth (in percent) of real total value added and real GDP per capita for country groups based on their boom experience. We report the mean for each group (the median paints a similar picture, so the patterns are not driven by outliers). We restrict the sample period to end in 2002. Choosing 2002 as the end year ensures that the results are not affected by the global financial crisis period and the boom episodes just before the crisis. For more information on the identification of boom episodes, see Appendix I.

Evidence so far indicates that certain sectors temporarily benefit from credit booms and then suffer during credit busts. In the next section, we explore whether variation in sectors' performance across booms can help us distinguish between *bad* booms that end in crises and periods of subpar growth and *good* ones that do not.

II. CREDIT BOOMS AND THE REAL SECTOR: THE GOOD AND THE BAD

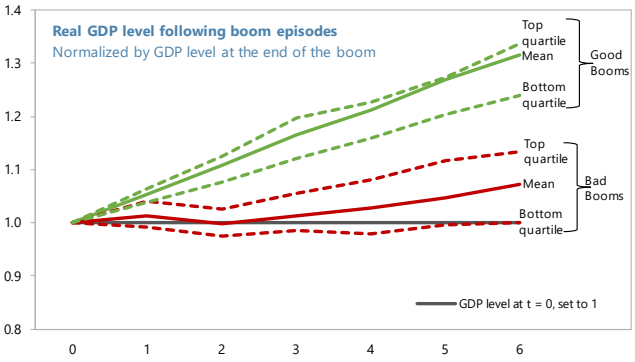
A. Defining Good and Bad Booms

A bad boom is one that is followed by subpar economic performance or a systemic financial crisis.[18] A sizeable fraction of credit booms ends up badly: of the 59 credit booms we identify, roughly two-thirds can be classified as bad booms. To compare the dynamics of output between good and bad booms, we plot the (average) level of real GDP and the credit-to-GDP ratio in the years that follow

[18] The exact methodology used to classify booms as good and bad is explained in detail in Appendix I.

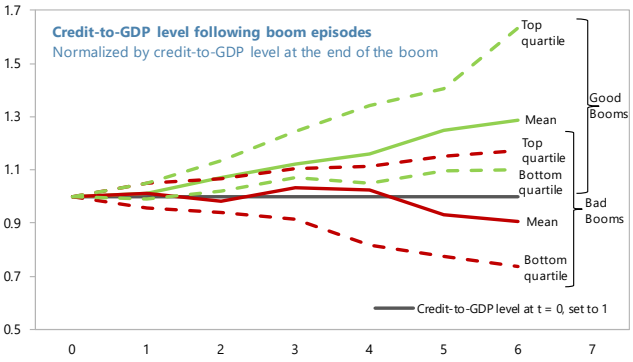
each type of boom. By definition, growth after bad booms is significantly worse than after good booms (Figure 6a). Consistent with the real sector performance, the credit-to-GDP ratio continues to rise after good booms but is stagnant after bad booms, although the difference is not as significant (Figure 6b).

Figure 6a. Economic Performance Following Bad and Good Booms



Sources: EU and World KLEMS, Haver Analytics, IMF *World Economic Outlook*.
Note: This figure plots the average and interquartile range of real GDP levels following good and bad booms across countries over *t*, where *t* = [0; 6]. *t=0* denotes the end of the boom episode. This level is normalized by the GDP level at the end of the boom. For more information on boom classification, see Appendix I.

Figure 6b. Financial Performance Following Bad and Good Booms



Sources: EU and World KLEMS, Haver Analytics, IMF *World Economic Outlook*.
Note: This figure plots the average and interquartile range of credit-to-GDP levels following good and bad booms across countries over *t*, where *t* = [0; 6]. *t=0* denotes the end of the boom episode. This level is normalized by the credit-to-GDP level at the end of the boom. For more information on boom classification, see Appendix I.

A typical good boom lasts about three years, with credit-to-GDP ratio growing by 15 percent annually. Real GDP expands at an annual rate that is 1½ percentage points faster than trend. Recent empirical studies have established that bad booms tend to be longer and larger (for example, Dell'Ariccia, Igan, and Laeven 2016). Indeed, in our sample, a typical bad boom lasts four years as the annual credit-to-GDP growth rate reaches 17 percent. Real GDP grows more than in good booms, exceeding trend growth by 1¾ percentage points. This difference, however, is not statistically significant. In other words, in our sample, both good and bad booms seem to come with similar growth benefits—at least at the aggregate level.

Can the composition of real activity—and in particular sectoral activity—during a boom tell us anything about the likelihood of experiencing a period of subpar economic performance or financial instability down the road? Building on the same empirical framework we use in Section II, we first address this question by exploring whether some sectors expand faster during bad booms than during good ones.

B. Sectoral Activity during Good and Bad Booms

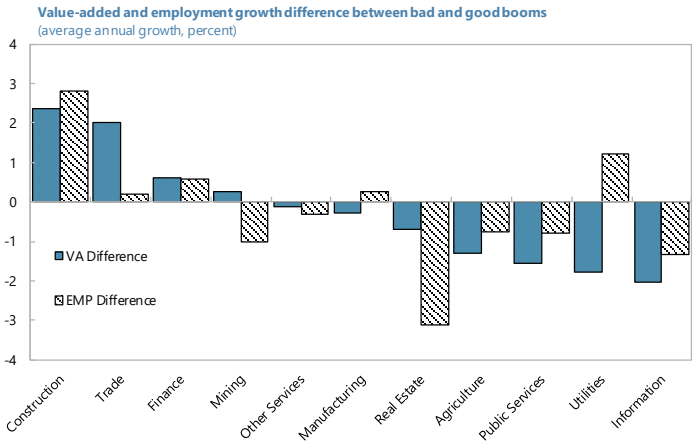
When good and bad booms are looked at separately, the overall composition of activity is not too different. Specifically, when we rank sectors by their growth rates, three sectors top the chart in both good and bad booms: construction, finance, and information (Appendix Figure 2). Granted, the exact ordering is different: information ranks first in good booms and third in bad ones.[19] In general,

[19] Fast growth in the information sector may be an indication of a surge in productivity-enhancing investments that pay off later, hence increasing the chances of a good boom.

however, sectors that perform better than others in good booms also perform better than others in bad ones. The average industry performance is also close for the two types of booms.

One sector seems to behave systematically differently between good and bad booms: construction (Figure 7). Finance, again, is a distant second. Trade also shows strong asymmetry, but only when it comes to growth in value added. The remaining sectors display marginal differences or mixed signs.[20] Overall, construction displays the starkest asymmetry across good and bad booms: value added and employment in the construction sector grow between 2 and 3 percentage points more in bad booms than in good ones, respectively.

Figure 7. Sectoral Activity in Bad and Good Booms



Sources: EU and World KLEMS, Haver Analytics, IMF *International Financial Statistics*, IMF *World Economic Outlook*.

Note: VA = value added, EMP = employment. This figure depicts the difference between average sectoral value-added and employment growth rates during good and bad boom episodes. The growth rates are first computed at the country and sector levels and then regressed on a country, sector, and year dummy conditional on being in a boom episode. The adjusted growth rates are calculated as the residuals from these regressions. The figure shows the cross-country average of these adjusted value-added and employment growth rates during all bad booms minus the adjusted value-added and employment growth rates during all good booms. For more information on sectoral composition, see Appendix I.

Once again, these stylized facts are generally confirmed in a formal regression framework.[21] We find that construction is the only sector that behaves consistently differently between good and bad booms, both in terms of value-added and employment growth (see Appendix Table 4). On average, we estimate that value added (employment) in the construction sector expands by 2.8 percentage points (3.3 percentage points) more in bad booms than in good ones (compared with the other sectors). In line with Figure 7, we also identify asymmetric behavior for the (retail and wholesale) trade sector, but this is limited to value-added growth.

Importantly, the peculiarity of the construction sector is broadly robust to the exclusion of the global financial crisis period and of advanced economies from our sample. Table 5 reports the coefficient associated with the interaction of the bad boom dummy and the construction sector dummy using

[20] Some of these, notably real estate services, display underperformance during bad booms. As we show below, this observation does not survive in a regression setup.

[21] We run the following specification:

$$PerformanceMeasure_{i,c,t} = \beta_1 Size_{i,c,t-1} + \beta_2 Bad_{c,t} + \beta_3\left(Bad_{c,t} \times SectorDummy_i\right) + \beta_4 GDPgrowth_{c,t} + \beta_5 FixedEffects + \varepsilon_{i,c,t}$$

where $PerformanceMeasure_{i,c,t}$ is either value-added growth or employment growth for sector i in country c in year t. $Size_{i,c,t-1}$ is the share of sector i in country c total value added or employment in year t-1, and $Bad_{c,t}$ is an indicator equal to 1 if country c is experiencing a bad boom in year t. $FixedEffects$ is the vector of time, country, and sector fixed effects. The interaction with a sector dummy is introduced one sector at a time. Differently from the specifications in Section II, we are interested in whether a given sector behaves differently from the typical sector, as captured by the bad boom dummy. Table 5 reports only the coefficient of interest (β_3) for key sectors. See Appendix II.B for a more detailed description of the empirical framework and the full set of results.

different subsamples of the data (in bold). We find that construction growth (in value-added terms) is still significantly higher in bad booms, even without the global financial crisis observations (column 3). Moreover, the coefficient on either value-added or employment growth remains significant when looking at advanced economies or emerging markets only (columns 6 and 7). This suggests that the uniqueness of the construction sector goes beyond the latest housing boom-bust cycle that took place in some advanced economies (for example, Ireland, Spain, United States).[22,23]

Table 5. Sectoral Activity during Bad vs. Good Booms: Uniqueness of Construction

	Whole Sample		No GFC		Advanced Economies		Emerging Economies	
	Value-Added Growth	Employment Growth	Value-Added Growth	Employment Growth	Value-Added Growth	Employment Growth	Value-Added Growth	Employment Growth
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Size_{t-1}$	-0.080**	-0.041	-0.090	-0.059	-0.135	-0.117**	-0.104**	0.022
	(0.035)	(0.041)	(0.057)	(0.056)	(0.078)	(0.053)	(0.041)	(0.031)
Bad Boom	-1.949**	-1.701	2.420	1.734	0.251	0.359	-2.942***	-3.515***
	(0.765)	(1.041)	(1.716)	(1.414)	(1.092)	(0.627)	(1.029)	(0.641)
Bad Boom x Construction	**2.817****	**3.308****	**2.332****	1.473	2.038	**3.615*****	**3.181****	0.879
	(1.057)	(1.302)	(1.105)	(1.247)	(1.400)	(0.869)	(1.155)	(1.547)
Observations	2,165	1,610	1,058	735	959	921	1,206	689
R-squared	0.198	0.156	0.172	0.147	0.178	0.168	0.205	0.176

Source: IMF staff estimates.

Note: This table shows regression results conditional on the existence of a boom episode, where the dependent variables are *Value-Added Growth* in columns (1), (3), (5), and (7), and *Employment Growth* in columns (2), (4), (6), and (8). Columns (1) and (2) show the baseline results, also summarized in Table 4. Specifications (3) and (4) exclude the post-2001 period; specifications (5) and (6) include only advanced economies; specifications (7) and (8) include only emerging markets. The independent variables are *Size* $_{t-1}$, *Bad Boom* , *Construction,* and its interaction with *Bad Boom* . *Value-Added Growth* is the log change in real value added for each sector in a country for a given year. *Employment Growth* is the log change in employment for each sector in a country for a given year. *Size* $_{t-1}$ is the sectoral share of real value added or employment over the country-year total of the respective variable in the previous year. *Bad Boom* is a dummy variable that takes the value of 1 when a country is in a credit boom that is followed by a recession or subpar GDP growth, and 0 otherwise. *Construction* takes a value of 1 for the construction sector and 0 otherwise. All specifications include country, sector, and year fixed effects. Robust standard errors are clustered at the country level and displayed in parentheses. Statistical significance at the 10, 5, and 1 percent level is denoted by *, **, and ***, respectively. Coefficients of interest are shown in **bold**. The sample covers 11 sectors in 55 countries over 1970-2014 at annual frequency. See Appendix I for more information on the identification of bad boom episodes and Appendix II for the results for sectors other than construction. GFC = global financial crisis.

A final question is whether the overperformance of construction during bad booms is simply a byproduct of other macro-financial factors. House prices, in particular, closely interact with the credit and business cycles and have been shown to be quite reliable early warning signals (for example, Cerutti, Dagher, and Dell'Ariccia 2017; IMF 2017 and references therein). Given the very nature of construction, it is plausible that the patterns we have documented simply reflect the house-price amplification channel.

[22] The pattern is different for advanced economies and emerging markets: overperformance manifests in employment growth in the former group but shows up in value-added growth in the latter group. The magnitude of the coefficient is also larger when looking at construction employment growth in advanced economy bad booms than when looking at construction value-added growth in emerging markets. This could reflect productivity differences across these groups or differences in institutions (for example, labor market flexibility or the extent of informality). Also notable is the negative significant coefficient on the bad boom dummy, driven by emerging markets. This may be an indication of relatively slower average sector growth during bad booms compared with tranquil times and good booms as a result of resource misallocation.

[23] Also noteworthy is the coefficient on the bad boom dummy. The negative significant coefficient indicates that the average industry value-added and employment growth during good booms is higher than in bad ones in the full sample, but this growth uptick loses significance and switches sign in the subsample preceding the global financial crisis and in advanced economies. This reinforces our previous point that the industry performance on average is similar in good and bad booms.

This does not seem to be the case. Broadly speaking, construction continues to overperform in bad booms relative to good booms even after we control for the growth of house prices (or financial asset prices) over the boom phase (Table 6). We find that construction growth in value-added terms is still higher in bad booms, although it is no longer statistically significant (columns 2 and 3). However, this is mainly because of the limited coverage of house or asset price data for the whole sample, which implies a substantial loss in the number of observations (almost 40 percent for house prices and roughly 25 percent for asset prices). This is confirmed when we run the main specification—that is, without including house or asset prices and their interactions—in the reduced sample where house prices are not missing (column 1). The shrinkage in sample size is less severe for employment growth (about 30 and 10 percent, respectively, for house prices and asset prices), and the results remain significant even when using a smaller sample (columns 5 and 6).

Table 6. Sectoral Activity during Bad vs. Good Booms: Predictive Power of Construction Activity

	Value-Added Growth			Employment Growth		
	(1)	(2)	(3)	(4)	(5)	(6)
$Size_{t-1}$	-0.074	-0.074	-0.112*	-0.071	-0.071	-0.011
	(0.059)	(0.059)	(0.060)	(0.052)	(0.052)	(0.034)
Bad Boom	-1.355***	-1.142**	-1.411***	-1.236***	-1.235	-1.776
	(0.472)	(0.519)	(0.440)	(0.440)	(0.818)	(1.147)
Bad Boom x Construction	1.489	1.489	2.158	**3.805*** **	**3.805*** **	**3.054***
	(1.838)	(1.839)	(1.452)	(1.228)	(1.229)	(1.566)
House Price $Growth_{t-1}$		0.019			-0.030	
		(0.025)			(0.050)	
Bad Boom x House Price $Growth_{t-1}$		0.015			-0.050	
		(0.038)			(0.042)	
Asset Price $Growth_{t-1}$			0.004			-0.022
			(0.008)			(0.016)
Bad Boom x Asset Price $Growth_{t-1}$			-0.010			0.024
			(0.009)			(0.017)
GDP Growth	0.820***	0.797***	0.930***	0.720***	0.759***	0.621***
	(0.084)	(0.079)	(0.103)	(0.100)	(0.059)	(0.131)
Observations	1,232	1,232	1,592	1,083	1,083	1,413
R-squared	0.240	0.241	0.219	0.211	0.215	0.139

Source: IMF staff estimates.

Note: This table shows regression results conditional on the existence of a boom episode. The dependent variable is *Value-Added Growth* (*Employment Growth*) and the independent variables are *Size* $_{t-1}$, *Bad Boom*, *House Price Growth* $_{t-1}$ (*Asset Price Growth* $_{t-1}$) and a construction dummy with its interactions with *Bad Boom*. *Value-Added Growth* (*Employment Growth*) is the log change in real value added (employment) for each sector in a country for a given year. *Size* $_{t-1}$ is the sectoral share of real value added (employment) over total country-year value added (employment) in the previous year. *Bad Boom* is a dummy variable that takes the value of 1 when a country is in a credit boom that is followed by a recession or subpar GDP growth, and 0 otherwise. *Construction* takes the value of 1 for the construction sector and 0 otherwise. *House Price Growth* $_{t-1}$ (*Asset Price Growth* $_{t-1}$) is the lagged annual log change in house prices (asset prices) for each country during each boom episode. Columns (1) and (4) re-run the baseline specification in Table 5, columns (1) and (2) with the subsample where house price data are not missing so that we can see to what extent the findings are driven by differences in the sample. All specifications include country, sector, and year fixed effects. Robust standard errors are clustered at the country level and displayed in parentheses. Statistical significance at the 10, 5, and 1 percent level is denoted by *, **, and ***, respectively. Coefficients of interest are shown in **bold**. The sample covers 11 sectors in 55 countries over 1970-2014 at annual frequency. See Appendix I for more information on the identification of booms.

The unique status of the construction sector in differentiating between good and bad booms may stem from multiple factors.

First, certain intrinsic characteristics of the construction sector could generate an acute resource misallocation problem. Construction produces highly tangible assets that can be pledged as collateral

in loans, which in turn helps to raise more funds and increase investment. However, construction does not have the growth potential of many industries that fall under the broad umbrella of the manufacturing sector. Hence, too much investment in construction due to its high asset tangibility may result in lower TFP and output (Reis 2013; Ebrahimy, forthcoming). This type of misallocation of real resources could also make the economy vulnerable to adverse shocks such as a house price drop.

Overinvestment may also occur within the corporate sector and by firms in other industries, which may depress productivity growth in their core line of business (Shi, forthcoming). For instance, a rapid increase in house prices could drive up the return in real estate investment, pushing firms with abundant cash to invest in real estate. When profitability is very high, investment in real estate can crowd out a firm's managerial resources, resulting in fewer productivity-enhancing activities and lower TFP growth. In these scenarios, higher construction growth during a boom may be a sign of misallocation of resources. Disproportionately allocating credit, capital, and labor to construction (as well as to the rest of the nontradable sector) can lead to low TFP and output growth in subsequent years and an economy more vulnerable to adverse shocks.

Second, there may be additional distortions related to the high labor intensity of construction and the relatively low level of skills needed. Exceptional growth in construction employment during booms can generate adverse incentives or mask existing structural problems in the labor market; for example, job losses in manufacturing (Charles, Hurst, and Notowidigdo 2016). In the former case, temporarily higher wages in a booming construction sector may discourage some workers from investing in their education and skills. This may have long-lasting effects on output and employment after the boom ends. In the latter case, policy attempts to slow the credit boom would deprive the economy of the temporary boost in employment and expose deeper-seated problems in labor force absorption. This, combined with the social value attached to housing, may make it politically difficult to curb credit booms via macroprudential and other policy measures (Herrera, Ordoñez, and Trebesch 2018). Without an appropriate policy response, excessive risk taking and overinvestment ensue.

Third, unusually high growth in the construction sector during a boom tends to make an assessment of economic fundamentals more difficult. This is because, relative to manufacturing, measuring the underlying drivers of growth, such as productivity, can be intrinsically more difficult in the construction sector. This can create adverse incentives for governments by obscuring the connection between policy measures taken during the boom and economic performance after the boom (Fernandez-Villaverde, Garicano, and Santos 2013). For example, necessary prudential measures or structural reforms may be delayed during the boom, raising the likelihood of a downturn and exacerbating the economic costs during the bust.

Finally, leverage may play an important role. Construction projects have large up-front financing needs, and final consumers of the product (either residential or commercial real estate) also tend to use external financing for their purchases. Moreover, credit booms disproportionately benefit industries that have high external finance dependence (Table 3). As a result, and compared with tranquil times, aggregate leverage may increase significantly more during booms led by industries such as construction. This increase in leverage, combined with nominal (for example, wages) or real rigidities (for example, firing costs), could exacerbate the subsequent bust. These rigidities make the

bust more costly—especially if banks evergreen bad loans (Caballero, Hoshi, and Kashyap 2008; Kwon, Narita, and Narita 2015). A longer and bigger boom makes the necessary adjustment more painful.

The possibility of fire sales may exacerbate these dynamics (Kiyotaki and Moore 1997; Brunnermeier and Sannikov 2014). Sales of assets such as real estate as a result of mortgage defaults or foreclosures during a downturn can depress prices even further (Campbell, Giglio, and Pathak 2011). Price declines, in turn, put greater pressure on the balance sheets of banks and households that borrowed to invest in real estate, thereby forcing them to cut their lending or consumption expenditures even further. These problems may be particularly acute for construction, given the extent of investment indivisibility and, hence, higher susceptibility to fire sales.

Similar to construction sector activity, rapid growth in household debt has been shown to predict future growth slowdowns (Mian, Sufi, and Verner 2017). Whether a construction boom tells us anything beyond known predictors of bad booms, including household debt, is a question we tackle in the next section.[24]

III. IS CONSTRUCTION ACTIVITY THE CANARY IN THE COAL MINE?

So far, we have documented that construction is special. It grows much faster than other sectors during booms, suffers more during busts, and is the only sector that consistently displays significant asymmetry between good and bad booms. But in practice, is the construction sector's performance telling us anything more than other warning signals, such the size or duration of the boom (Dell'Ariccia and others 2016), or the rise of household debt (Mian, Sufi, and Verner 2017), or rapidly increasing house prices (Cerutti, Dagher, and Dell'Ariccia 2017)?

The rest of this section explores the ability of construction activity during booms to predict whether a boom will end up badly or not. We find that the performance of the construction sector during booms helps predict both the likelihood of experiencing—and the economic costs associated with—bad booms. Importantly, this predictive power survives even after controlling for the other established warning signals, such as size and duration of the boom and the rise of household debt or an increase in house prices. This suggests that monitoring the construction sector brings additional benefits to policymaking.

A. Predicting Bad Booms

Our first observation is that fast construction growth helps flag bad booms, over and above the information provided by the duration of credit booms. In our sample, roughly two-thirds of booms are bad (Table 7). The frequency of bad booms rises to 74 percent when conditioning on booms being

[24] The coverage of the household credit data is too narrow (at only 50 percent of the original sample) to test the robustness of the results in Table 5 using the same empirical framework.

long (that is, lasting more than 3¾ years—the average duration of booms). Further conditioning on the construction growth observed during the boom dramatically increases the frequency of bad booms: long credit booms that also featured rapid growth of the construction sector never ended well in our sample.[25] In contrast, the frequency of long booms that featured low construction growth and ended badly is 50 percent.[26]

Table 7. Probability of a Bad Boom
(conditional on the presence of a boom)

Full Sample	0.64
Long Booms	0.74
High Construction Growth	1.00
Low Construction Growth	0.50

Source: IMF staff estimates.
Note: This table shows the share of bad booms over the total number of booms, conditioned on different characteristics. Long (short) booms are those that exceed (fall short of) the average duration of a boom. High (low) construction growth is defined as above-(below-) average construction value-added growth during a boom. Given large differences across country groups, average construction growth is calculated separately for advanced economies and emerging markets.

The same picture emerges when taking household credit into account: the construction sector's growth is an informative signal even when conditioning on household credit growth, especially in countries other than advanced economies. For instance, we find that a significant number of bad booms in emerging markets did not feature any rapid increase in household debt (this may be partly due to the fact that household credit markets are relatively undeveloped in these countries). However, almost all the bad booms were accompanied by strong expansion of the construction sector.[27] Such a disconnect between household credit growth and construction almost never happened during bad booms in advanced economies, where households have access to deep mortgage markets to finance housing purchases.[28] This attests to the strong feedback loops between mortgage credit and construction activity in advanced economies. In emerging markets, similar loops likely also exist, but they involve credit to construction firms rather than mortgage credit to households.

Regression analyses generally confirm the predictive power of construction sector growth (Appendix Table 5a). In these regressions, we assess whether the probability of a boom being bad can be explained by the performance of the construction sector during booms and compare it with other key variables, such as duration of the boom or the average growth of household credit during booms. Construction growth, in both value-added and employment terms, raises the odds of the boom being bad, even after controlling for duration. Employment growth in construction remains significant in predicting bad booms even after controlling for the duration of the boom, initial credit to GDP, and the growth rate of credit to GDP during the boom. A 1 percentage point increase in value-added or employment growth in the construction sector raises the probability of a bad boom by

[25] In our sample, there are 11 cases that fit this description. When conditioning solely on being in a high-construction growth boom, there are cases of false positives: nine boom episodes featured high construction growth but did not end up badly. So construction activity alone is not a perfect sign but performs very well together with duration.

[26] Although the rapid growth of a few other sectors, such as trade or finance, also helps flag (long) bad booms, construction discriminates better than any other sector (see Appendix Figure 4). Growth is considered high if it is above the average growth rate of any given sector across countries during booms.

[27] For instance, average household credit growth in Malaysia between 1995 and 1997 was 4 percent, and only 1 percent in the Slovak Republic between 1996 and 1997—well below the average growth of household credit in emerging markets in our sample. In contrast, construction expanded on average by 15 percent in both cases, roughly twice as much as the sample average construction growth in emerging markets.

[28] For international evidence on the gap between advanced economies and emerging markets in terms of household access to finance, see, for instance, Badarinza, Balasubramaniam, and Ramadorai (2016, 2018).

(approximately) 2 and 5 percentage points, respectively, after controlling for the duration of the boom or its size.

Consistent with Table 7, regression analyses also show that long booms are more likely to end badly when they come with fast construction value-added growth. Finally, we find that the performance of construction—in particular employment growth—remains a significant predictor of bad booms even after controlling for household credit growth, house price growth, and asset price growth during the boom phase (Appendix Tables 5b, 5c, and 5d).[29] Interestingly, in our sample, household credit growth, house price growth, and asset price growth are not helpful on their own in flagging bad booms (that is, they are not statistically significant).

B. Costs of Bad Booms

The expansion of the construction sector not only helps flag bad booms but is also a good predictor of their economic costs. In line with our definition of bad booms, we measure the costs of a bad boom by looking at the average (detrended) growth of GDP or sectoral value added over the three- or six-year period following a boom. The lower the growth after the boom, the higher the costs.

On average, we find that the worst booms—that is, the costliest among bad booms in terms of subsequent growth (the lack of thereof)—are associated with higher growth in the construction sector during the boom phase. A recession following a bad boom that features fast construction growth is more than 1.4 percentage points worse than one following a bad boom with low construction growth (Table 8).

Table 8. Growth after a Bad Boom: Summary Statistics

	Real GDP growth after bad booms	
	High	Low
Duration	-3.6	-2.0
Household Credit Growth	-2.9	-2.2
Construction Value-Added Growth	-3.3	-1.9
With Long Booms	-5.0	-2.1
With High Household Credit Growth	-4.1	-2.1

Sources: EU and World KLEMS; IMF staff calculations.
Note: This table shows the average annual real GDP growth over the three years after the end of a bad boom. Each row is a different characteristic of the preceding bad boom episode. High (low) is defined as above-(below-) average growth of the relevant row characteristic over the bad boom duration. Two-sample t-tests with unequal variances show that the differences between high and low subsamples are statistically significant at conventional levels for duration, construction value-added growth, and the combination of long duration and fast construction value-added growth, whereas they are not for household credit growth.

This asymmetry is much less pronounced when comparing bad booms with high and low household credit growth. This suggests that in our sample construction sector growth is more informative about the costs of bad booms than household credit. In fact, the performance of the construction sector is also a good predictor of the depth of bad booms even after controlling for the growth in household credit or duration of the boom. Conditioning on the experience of a long boom (or a boom with high household credit growth), fast construction growth during the boom phase makes the ensuing recession significantly worse (roughly between two and two and a half times more severe).

Once again, our results for construction sector growth are generally confirmed using regressions (Table 9). Unlike in previous sections, we use a cross-sectional specification in which the dependent

[29] Asset price growth is measured using share prices from the Organization for Economic Co-operation and Development (OECD) and using the main stock price index in the country for non-OECD countries.

variable is the average sector growth over three or six years after the boom.[30] Explanatory variables, including construction growth, are all averages over the boom phase.

Table 9. Value-Added Growth after Booms

	Three Years after a Boom			Six Years after a Boom		
	(1)	(2)	(3)	(4)	(5)	(6)
Growth During	-0.147**	-0.154**	-0.148**	-0.212***	-0.208***	-0.219***
	(0.064)	(0.063)	(0.064)	(0.049)	(0.049)	(0.050)
Size During	-0.043	-0.042	-0.042	-0.013	-0.010	-0.011
	(0.037)	(0.037)	(0.037)	(0.029)	(0.029)	(0.029)
Bad	-0.958	-1.207	-0.684	-0.980	-0.861	-0.761
	(0.789)	(0.901)	(0.937)	(0.612)	(0.698)	(0.726)
Construction Growth	**0.363****		0.308	**0.378*****		**0.301****
	(0.157)		(0.188)	(0.122)		(0.146)
Construction Growth x Bad	**-0.466*****		**-0.409****	**-0.365*****		**-0.294***
	(0.168)		(0.198)	(0.131)		(0.154)
Household Credit Growth		0.058*	0.021		0.065**	0.031
		(0.033)	(0.040)		(0.026)	(0.031)
Household Credit Growth x Bad		-0.070*	-0.025		-0.049	-0.015
		(0.042)	(0.048)		(0.033)	(0.037)
Observations	386	386	386	386	386	386
R-squared	0.081	0.069	0.081	0.107	0.101	0.111

Source: IMF staff estimates.

Note: This table shows regression results for post-boom economic growth, conditional on being in a boom. The dependent variable is real *Value-Added Growth* three years after the end of the boom in columns (1)-(3), and six years after the end of the boom in columns (4)-(6). The independent variables are *Growth During* , *Size During* , *Bad, Construction Growth* and its interaction with *Bad,* and *Household Credit Growth* and its interaction with *Bad. Value Added- Growth* is the 3-year average annual value-added growth rate following a boom episode, calculated for each sector in a given country. *Growth During* is the average annual value-added growth rate during a boom episode, calculated for each sector in a given country. *Size During* is the average sectoral share of total value added during a boom episode. *Bad* is a dummy variable that takes the value of 1 when a boom is followed by a recession or subpar GDP growth, and 0 otherwise. *Construction Growth* is the average annual construction value-added growth during a boom episode. *Household Credit Growth* is the average annual household credit growth during a boom episode. The sample is smaller because *Household Credit Growth* is not available for all boom episodes. All variables are detrended. Given that the unit of observation is "boom," the specifications include no fixed effects. Statistical significance at the 10, 5, and 1 percent level is denoted by *, **, and ***, respectively. Coefficients of interest are shown in **bold**.

Higher construction sector performance predicts worse outcomes for the three-year period after the end of bad booms (column 1).[31] In contrast, higher construction sector growth always predicts better outcomes after good booms. Moreover, while higher household credit growth also predicts lower growth three years after a bad boom, it loses predictive power when we control for the output growth in the construction sector (columns 2 and 3). We estimate that 1 additional percentage point of construction value-added growth during a bad boom implies more than a 0.1 percent decline in

[30] We run the following specification:

$$VA\_Growth\_Post\_Boom_{i,c} = \beta_1 Size_{i,c} + \beta_2 Bad_c + \beta_3 (Bad_c \times Construction\_Growth_c) + \beta_4 Construction\_Growth_c + \varepsilon_{i,c,t}$$

where $VA\_Growth\_Post\_Boom_{i,c}$ is value-added growth (using detrended data) for sector i in country c over the 3- or 6-year period after a boom. $Construction\_Growth_c$ is the average growth of construction value added during the boom. $Size_{i,c}$ is the share of sector i in country c total value added at the beginning of the boom, and Bad_c is an indicator equal to 1 if the boom is bad. In additional specifications, we also add household credit growth along with its interaction with Bad_c. Note that, unlike in previous specifications, boom is the unit of observation. Running these regressions at the sector-country level allows us make inferences based on a larger number of observations, but we also confirm the negative association between construction activity and subsequent GDP growth at the country level—alluded to in Table 8, conditional on having a bad boom—in a regression setup (see Appendix Table 6).

[31] The sum of coefficients for average construction growth (0.36), and its interaction with the bad dummy (–0.47) in column 1 is negative and significant (–0.11).

average sector growth over the three-year period after the boom.[32] Our estimate is not very sensitive to the inclusion or exclusion of household credit growth in the regression (column 1 versus column 3). This may result from imperfect correlation between household credit and construction sector activities since construction booms can be financed by corporate credit.

For the six-year period, the net effects of construction during bad booms become negligible or insignificant (column 6), suggesting that the effects we are capturing are, at least on average, temporary.[33] Put differently, higher construction growth during a good boom helps the rest of the economy grow faster even after the boom ends, but these positive spillovers are fully wiped out during bad booms, which constitute about two-thirds of the cases in our sample. This points to a trade-off between achieving higher average growth rates and exposing the economy to a higher risk of a crash—which could result in significant and persistent real effects.[34]

IV. DISCUSSION AND POLICY IMPLICATIONS

A. Trade-off between Good and Bad Booms

Credit booms can be good: the economy continues to grow after recording above-trend growth during the boom. Conditional on a good boom, even higher construction growth during a boom implies higher growth of value added for other sectors after the boom (Table 9). Given the ex ante uncertainty about the nature of the boom, how should policy actions during the boom phase treat the trade-off between preventing the danger of a bad boom and forgoing the benefits of a good one? In other words, is it worth risking a bad boom to enjoy the growth uptick?

Several observations are in order. First, credit booms have a high chance of turning bad. In our sample, bad booms are twice as likely as good booms. Second, bad booms do not seem to come with significantly better performance than good ones during the boom phase. In contrast, the (potential) costs of the boom turning bad seem to dwarf the (potential) benefits of the boom being good. For instance, looking at the tails of the distribution of post-boom performance shows that the worst quartile of bad booms features annual average GDP growth of –3.8 percent—almost twice in absolute value as the best quartile of good booms (+2.1 percent). In other words, credit booms seem to expose

[32] This is given by the sum of coefficients for average construction growth and its interaction with the bad dummy in Table 9, column 3. These coefficients are 0.30 (insignificant) and –0.41, respectively, whose sum is approximately –0.1.

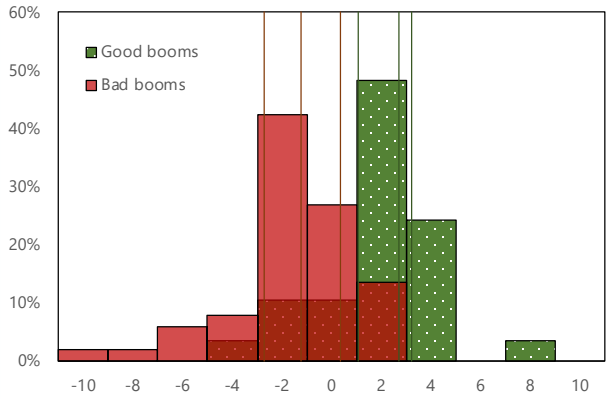
[33] The sum of coefficients for average construction growth (0.30) and its interaction with the bad dummy (–0.29) in column 6 is close to zero (0.01).

[34] This trade-off is consistent with the tapering of benefits from booms, shown in Table 4. Such tapering is more likely to be observed in emerging markets than in advanced economies, in line with Rancière, Tornell, and Westermann (2008) and suggesting that the trade-off between higher average growth and greater risk of a bad boom may depend on country circumstances. These statistics are not reported results for the sake of brevity.

an economy's future growth distribution to negative fat tails that are not compensated by similarly fat positive ones (Figure 8; see also Appendix Figure 3).

Taken together, the evidence seems to suggest that (i) credit booms generally carry high risk but offer relatively lower rewards and (ii) a construction boom along with a credit boom makes a favorable outcome even less likely.

Figure 8. Distribution of Post-Boom Growth Outcomes

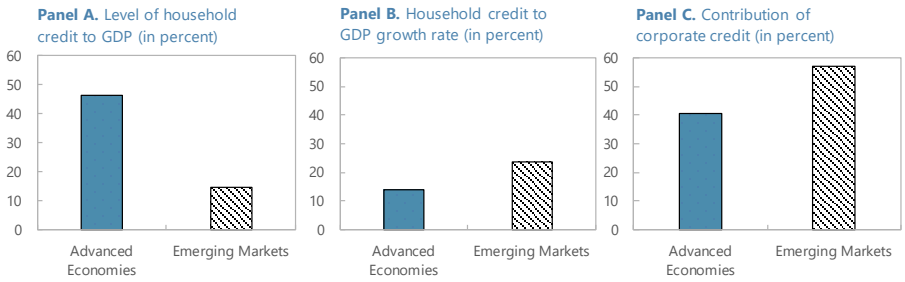


Sources: Haver Analytics, IMF *International Financial Statistics*, IMF *World Economic Outlook*; IMF staff calculations.
Note: This figure shows the distribution of average annual real GDP growth rates over the three-year period following good and bad booms.

B. The Role of Construction

The robust and persistent association of the construction sector with the severity of bad booms, above and beyond household credit growth, suggests that the two may point to different vulnerabilities. On the one hand, high household leverage can exacerbate the bust through its negative impact on aggregate demand (Mian, Sufi, and Verner 2017). A fast-growing construction sector, on the other hand, may be associated with significant misallocation of capital and labor, which can negatively affect TFP and output growth during the bust and is also consistent with a corporate sector overexposed to real estate risk. The distinct implications of construction sector growth are especially relevant in emerging market economies, where household credit markets are small and thus less likely to be the main channel for booms to affect the real economy. In fact, even when household credit grows fast in emerging markets, we find that most of the credit allocated during booms goes through the corporate sector (Figure 9; see also Appendix Figures 5 and 6). [35] Taken together, these findings imply that, at least for emerging markets, construction activity may be a more robust signal than household credit for policymaking.

Figure 9. Composition of Credit during Booms



Sources: EU and World KLEMS, IMF *International Financial Statistics*, Bank for International Settlements.
Note: This figure shows the composition of credit across advanced economies and emerging markets over all boom episodes. Panel A shows the average level of household credit to GDP over all boom episodes. Panel B shows the average annual detrended growth rate of the ratio of household credit to GDP during all boom episodes. Panel C shows the average contribution of corporate credit growth to total credit growth during all boom episodes, calculated as the ratio of corporate credit growth to total credit growth over the boom duration. For more information on boom identification and sample coverage, see Appendix I.

[35] An interesting question to explore in this context is whether the results reported in Table 9 survive inclusion of nonfinancial corporate credit growth instead of household credit growth. In results unreported because of space considerations, we confirm this to be the case.

C. Policy Discussion

There are two important caveats when it comes to the policy implications of our findings. First, the definition of good and bad booms is intrinsically after the fact. That is, we look at how economies performed following a boom episode. An ideal definition would compare an economy's performance during and after a boom with a counterfactual in which the boom (and bust) did not occur. This, however, would require the development of a credible calibrated structural model that our cross-country setup makes very difficult if not impossible.

Second, the association between construction activity during booms and subsequent economic developments does not necessarily indicate causality. Although simultaneity bias is less of a concern—as it is unlikely that agents increase their focus on the construction sector in anticipation of a boom turning bad—construction may be capturing the effect of omitted factors. For instance, a lack of other investment opportunities or saving vehicles may lead to overinvestment in construction and, at the same time, to worse economic outcomes. Or technological changes favoring intangible asset accumulation in firms could lead banks to reallocate their portfolios away from business loans toward mortgages (as documented in Dell'Ariccia and others 2017), not only enabling a construction boom but also increasing uncertainty in growth outcomes—at least temporarily. Nonetheless, from a predictive standpoint this is not relevant. The empirical regularities documented in this note can still be useful for policymakers in their efforts to discern good from bad credit booms and act accordingly.

Keeping these caveats in mind, our findings suggest that if policymakers observe a rapid expansion in the construction sector during a credit boom, they should give consideration to tightening the macroeconomic policy stance and/or activating macroprudential tools. In some cases, activation of these tools will be triggered by other indicators, such as house price surges or rapid growth in mortgage loan markets. However, sometimes these other indicators may not sound the alarm (for example, because the construction boom is financed by the corporate sector or by foreigners), yet risks accumulate (for example, overinvestment in real estate projects and excessive reallocation of labor into the sector). In such cases, real activity metrics—possibly together with other indicators such as rising exposure of banks to specific borrowers—could give a signal that may require action beyond credit speed limits or tighter lending standards. For instance, limits on banks' exposure to real estate developers and other construction firms could be tightened.

Moreover, given the relative difficulty of measuring the underlying fundamentals in the construction sector, a call for better indicators of construction sector performance (for example, productivity) is warranted. More broadly, composing better measures of economic growth that are not contaminated by real estate bubbles, unsustainable credit market dynamics, or unusually rapid growth of construction could be explored.[36]

Another takeaway from the prominent role nontradable sectors such as construction play in credit cycles is that the dynamics of restoring internal and external balances may be different if a country is

[36] This relates to the work on output gap measures adjusted for macro-financial factors. See, for instance, Chen, Ganum, and Rabanal (2017) and the references therein.

experiencing a credit boom. In a country experiencing an excessive current account deficit, credit booms could worsen the trade balance even more as they favor nontradable sectors. In this case, curbing the credit boom to restore internal balances would go in the direction of restoring external balance. If the country has an excessive current account surplus, however, curbing the credit boom may end up raising the surplus as it may trigger a (possibly desired) reallocation of resources from nontradable sectors to tradable sectors.

V. CONCLUSION

Credit booms have been shown to be a harbinger of financial distress and subpar economic performance. Less often, they are associated with financial deepening and sustainable growth bursts. Distinguishing good from bad booms has proved difficult, especially when solely based on aggregate data. We take a first step toward showing how sectoral activity can help in this task.

We show that the construction sector seems to play a unique role. First, it displays the strongest acceleration (deceleration) in both value-added and employment growth during booms (busts). Second, among all sectors, construction is the only one that consistently overperforms during bad booms. Finally, the pace of construction activity during the boom phase is a better predictor of the economic costs associated with bad booms than other variables identified in previous studies.

Our findings have two important implications. First, they highlight potentially new channels through which some booms might lead to subsequent economic underperformance. Since construction is not a high-TFP-growth sector, booms may result in misallocation of resources in the economy. Alternatively, the role of real estate as collateral may generate amplification mechanisms and credit booms and—by increasing leverage—add to the strength of these mechanisms. Second, monitoring construction activity during a boom can provide a litmus test for policy action. In addition to sectoral value added and employment information, which are often available with a few months' lag, more high-frequency indicators such as construction permit applications could act as valuable signals.

Ongoing and future research should continue to expand in the direction of using more granular data to improve our understanding of macro-financial dynamics. A straightforward application could be the introduction of construction sector indicators in the growth-at-risk framework, which links current macro-financial conditions to the distribution of future growth (Adrian and others, forthcoming). Further, effectiveness and possible side effects of policy options to curb excessive developments in the construction sector should be explored. Finally, as longer time series become available, whether the trade-off faced during booms changes in longer horizons should be assessed.

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