Box 1.2. Credit Boom-Bust Cycles: Their Triggers and Policy Implications

Credit has been growing rapidly in a number of emerging market economies, raising concern in some quarters. Although there can be good reasons for credit to grow rapidly—cyclical upturns, financial deepening, and improved medium-term prospects—in some circumstances credit expansion can be excessive and can be followed by financial turbulence, as shown by the recent global financial crisis and the Asian crisis of the mid-1990s. Such credit expansion is often called a "credit boom."
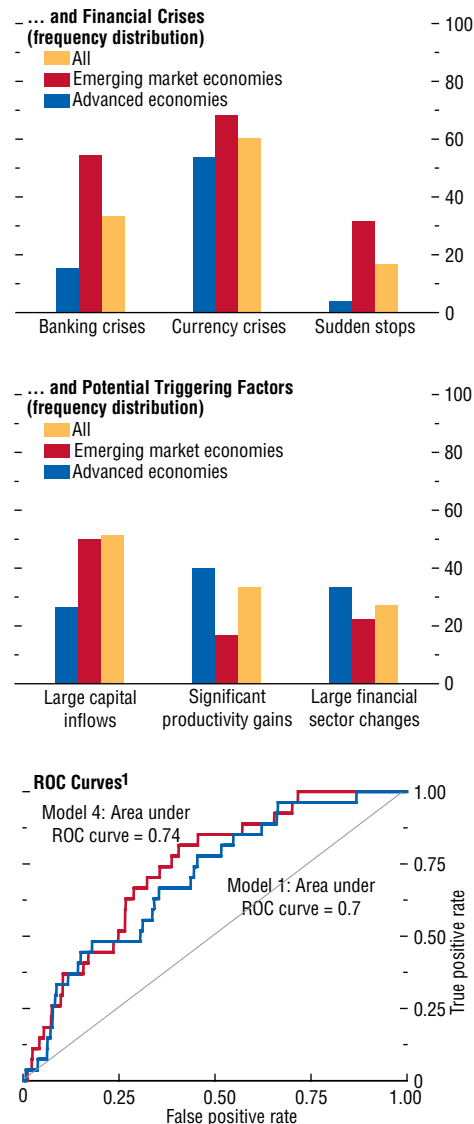
What is a credit boom? It is an episode during which real credit to the private sector expands significantly more than during typical economic expansions.[1] During the upswing of a credit boom, economic activity expands strongly, housing and equity prices rise rapidly, leverage increases sharply, the real exchange rate appreciates, and current account deficits widen. The opposite is observed during the downswing of a boom: activity contracts sharply, housing and equity prices drop, leverage falls, the real exchange rate depreciates, and current account deficits narrow. Financial vulnerabilities heighten as a result of these large swings in macroeconomic and financial variables. In fact, there is a strong association between credit booms and currency crises, banking crises, and sudden stops (Figure 1.2.1, top panel).

Given the strong association between such credit boom-bust cycles and financial crises, it is important to understand what drives them. This box studies credit booms in 47 economies—19 advanced and 28 emerging market economies—during 1960–2010. We find that capital inflows are good predictors of credit booms and merit close monitoring not only because of their impact on competitiveness but also because of other implications for financial stability.

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[1]Credit booms are defined as extreme episodes during which the cyclical component of credit is larger than 1.75 times its standard deviation—see Mendoza and Terrones (2008) for more details and an analysis of these episodes for advanced and emerging market economies. The focus on the cyclical component of credit assumes that the trend captures mostly healthy financial deepening.

Figure 1.2.1. Credit Booms

Sources: Mendoza and Terrones (2008); and IMF staff calculations.
[1]ROC = receiver operating characteristic. The ROC for a coin toss is indicated by the 45-degree line.

What Triggers a Credit Boom?

Credit booms can be driven by many factors. Three in particular garner considerable attention and are indeed strongly associated with credit booms:

Box 1.2 *(continued)*

surges in capital inflows, financial sector reforms, and productivity gains. In particular, credit booms in emerging market economies seem to be associated mostly with large capital inflows, whereas those in advanced economies often coincide with productivity gains (Figure 1.2.1, middle panel). Although this observation is useful, it does not indicate whether these factors can help predict credit boom-busts and which among these is most relevant. To address this issue, we use a simple probabilistic model of credit booms and the following factors:

- Past capital inflows: A surge in net private capital inflows typically leads to a rapid increase in loanable funds. Banks, in an attempt to allocate these funds, often lower their lending standards and extend credit to firms and households previously without access to financial markets. This can lead to an overly rapid expansion of credit.[2]

- Past financial sector reforms: In an attempt to improve their growth performance, countries around the world have implemented measures to eliminate financial repression and develop their financial sectors, which has frequently spurred credit growth. But the process of financial sector development—that is, the emergence of financial instruments, institutions, and markets—can involve risks, particularly when such development is not accompanied by adequate evolution of the regulatory and supervisory frameworks.

- Past productivity gains: Technological progress and innovation are often financed with external resources. Indeed, there is evidence that credit plays an important role in the process of technological innovation. Optimism about rapid technological progress and about future increases in the value of collateral assets often accompanies strong credit growth.[3]

Excessive credit expansion results in part from propagation mechanisms associated with financial market imperfections. One such mechanism is the financial accelerator (Bernanke, Gertler, and

Gilchrist, 1999; and Kiyotaki and Moore, 1997): shocks to asset prices and relative prices are amplified through balance sheet effects. This propagation process can be exacerbated by inadequate regulatory and supervisory frameworks, including implicit government guarantees, and herd behavior by banks.

Main Findings

The econometric results confirm that net capital inflows, financial sector reform, and total factor productivity are good predictors of a credit boom.[4] Net capital inflows appear to have an important predictive edge over the other two factors.

The main econometric results are summarized in Table 1.2.1. This table shows the alternative specifications of a logit regression, with the dependent variable an episode dummy that takes the value of 1 if country i is experiencing a credit boom in year t, and zero otherwise. The estimated coefficients of the different triggering factors have the appropriate signs and are all statistically significant. We are interested in an assessment of the predictive power of various regression specifications, and for that purpose use the receiver operating characteristic (ROC) curve method.[5] The ROC curve is a plot of the true positive rate (TP) versus the false positive rate (FP). If the number of true positives equals the number of false positives, the three factors have the same predictive value as a coin toss—that is, none at all. Thus, the predictive value of the factors is given by the extent to which the ROC curve lies above the 45-degree line in the bottom panel of Figure 1.2.1. A summary measure of this curve—the so-called area under the curve (AUC) measure—is a useful statistic to rank the predictive performance

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[2]Végh (2011) shows that the macroeconomic consequences of capital inflows are the same regardless of the nature of the shock driving the inflows—that is, push or pull.

[3]Zeira (1999), building on the idea of informational overshooting, shows how increased productivity for an unknown period of time could lead to financial booms and crashes.

[4]In the econometric model, the capital inflow variable is proxied by the five-year average of net capital inflows as a percent of GDP. Financial sector reforms correspond to the five-year average of the yearly changes in the financial reform index compiled by Abiad, Detragiache, and Tressel (2008). The data were extrapolated to 2008. The productivity measure was calculated using standard growth accounting methods (Kose, Prasad, and Terrones, 2009) using data from the Penn World Table 7.0.

[5]Berge and Jordà (2011) offer a detailed discussion of this method and an application to the U.S. business cycle. Jordà, Schularick, and Taylor (2010) use this method to examine the extent to which credit expansions help predict banking crises.

Box 1.2 *(continued)*

Table 1.2.1. What Triggers Credit Booms?
(Logit model; dependent variable—start of a credit boom: 1 if true, zero if false)

Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Lagged Net Capital Inflows (percent of GDP, five-year average of yearly changes)	0.403*** [0.126]			0.379*** [0.121]		0.412*** [0.122]			0.388*** [0.127]	0.406* [0.246]
Lagged Financial Sector Reform (five-year average of yearly changes)		0.694*** [0.259]		0.592** [0.286]		0.686** [0.297]				
Lagged Total Factor Productivity Growth (five-year average)			0.177** [0.074]	0.132** [0.063]	0.118 [0.091]	0.081 [0.072]				
Lagged Total Factor Productivity Growth x Advanced Country Dummy					0.335** [0.148]	0.390** [0.155]				
Lagged Real U.S. Interest Rate (five-year average of yearly changes, 10-year Treasury bill)							−0.375 [0.294]		−0.285 [0.311]	
Lagged VIX (five-year average of yearly changes)								0.069 [0.139]		0.129 [0.153]
Advanced Economy Dummy					0.001 [0.328]	0.233 [0.360]				
Constant	−3.827*** [0.155]	−4.137*** [0.229]	−3.844*** [0.176]	−4.231*** [0.236]	−3.921*** [0.267]	−4.504*** [0.374]	−3.754*** [0.157]	−3.966*** [0.329]	−3.824*** [0.155]	−4.012*** [0.344]
Memorandum										
Number of Observations	1,180	1,180	1,180	1,180	1,180	1,180	1,180	472	1,180	472
Log Likelihood	−124.39	−125.97	−126.77	−121.20	−125.47	−118.92	−128.00	−44.49	−124.03	−43.35
Pseudo R^2	0.03	0.02	0.02	0.06	0.03	0.08	0.01	0.00	0.04	0.03
AUC	0.70	0.58	0.63	0.74	0.67	0.74	0.51	0.56	0.71	0.67

Sources: IMF, *International Financial Statistics;* Haver Analytics; Penn World Table 7.0; World Bank, *World Development Indicators;* and IMF staff calculations.

Note: *,**, and *** denote significance at the 10, 5, and 1 percent level, respectively. Significance is based on robust standard errors, which are in brackets. VIX = Chicago Board Options Exchange Market Volatility Index. AUC refers to the area under the curve. Broadly similar results are obtained when using the probit model.

of alternative specifications. If the ROC curve coincides with the 45-degree line, the AUC measure is 0.5 (half the square in Figure 1.2.1, bottom panel). Thus, an AUC of 0.5 indicates the predictive value of a coin toss. If the AUC is greater than 0.5, the respective factor (or combination of factors) has predictive value.

The results reveal that net capital inflows are the most helpful factor in predicting credit booms. Financial sector reforms and productivity gains also help predict these booms; however, their predictive value is lower. The predictive gains of combining

all these factors into a single model are marginal. The model with net capital inflows as a covariate (Table 1.2.1, column 1) shows that this variable is highly significant and possesses an AUC of 0.7. Past financial sector reforms and productivity gains are also important predictors of a credit boom (Table 1.2.1, columns 2 and 3); however, their significance level, fit, and AUC statistics are not as good as those of capital inflows. The model that includes all these factors simultaneously shows only marginal predictive gains vis-à-vis the model including only past net capital inflows (Table 1.2.1, column 4;

Box 1.2 *(continued)*

Figure 1.2.1, bottom panel). These results do not change materially if interaction terms are considered. The specification that includes an interaction term between productivity gains and the advanced economy dummy suggests that past productivity gains are strong predictors of credit booms in these economies, but not in emerging markets (Table 1.2.1, columns 5 and 6).

To explore the possibility that net capital inflows are capturing the effects of easy international financial conditions on domestic credit booms, we include in the regression analysis proxies for return (the real interest rate) and volatility (Chicago Board Options Exchange Market Volatility Index) in the United States. Although these variables have the expected signs, they are not statistically significant (Table 1.2.1, columns 7 and 8). Moreover, when included with net capital inflows, the predictive power of the volatility variable remains broadly unchanged (Table 1.2.1, columns 9 and 10).

What Are the Policy Implications?

Although net capital inflows have well-known benefits for long-term economic growth, they often raise concern among policymakers because they can undermine an economy's short-term competitiveness. The findings of this box suggest that they are also good predictors of credit booms and merit close monitoring for this reason alone. Given the high costs of credit boom-bust cycles, policymakers should closely monitor the joint behavior of capital inflows and domestic lending.[6] There is also evidence that financial sector reforms are predictors of credit boom-busts. Policymakers must ensure that financial liberalization programs are designed to strengthen financial stability frameworks. Last, there is evidence that large productivity gains increase the risk of a credit boom, particularly in advanced economies, driven perhaps by exuberant optimism in new sectors. Thus, even during particularly good periods for the economy, policymakers must be on the lookout for emerging threats to financial stability stemming from credit booms.

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[6]Policymakers can use a combination of macroeconomic, exchange rate, prudential policy, and capital control measures to mitigate the adverse effects of large capital inflows. Ostry and others (2011) discuss in detail policymakers' diverse policy options for addressing different kinds of capital inflows, which is important in light of evidence that net debt flows are better predictors of credit booms than foreign direct investment flows.