SPECIAL FOCUS 1

Recent Credit Surge in Historical Context

Special Focus 1:
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Benign financing conditions since the global financial crisis and, more recently, rising financing needs have fueled a rapid increase in credit to the nonfinancial private sector, especially to the corporate sector, in emerging markets and developing economies. Credit growth has been most pronounced, and nearing the pace associated with past credit booms, in commodity exporting countries. In contrast, in commodity importers, credit-to-GDP ratios are elevated but have been stable or shrinking over the past few years. That said, in a few, mostly energy exporting, emerging and developing countries, credit to the private sector is now near levels that have in the past been associated with episodes of financial stress.

Introduction

Since the global financial crisis, credit to the nonfinancial private sector has risen rapidly in several emerging markets and developing economies (EMDEs, Figure SF 1.1). This post-crisis credit growth has reflected a rotation in borrowing from households to corporates: in contrast to 2006-10, most of the post-crisis increase in EMDE private sector credit has been to nonfinancial corporates. Credit growth has been accompanied by rapidly rising corporate bond issuance since the crisis, especially for oil and gas companies (until 2014) and metals and mining companies. Some of the most indebted corporates include energy and construction companies.

A large literature has identified credit booms as an early warning indicator of macroeconomic or financial stress (e.g. Dell'Ariccia et al. 2014; Eichengreen and Arteta 2002; Gourinchas and Obstfeld 2012; Schularick and Taylor 2012; Claessens, Kose, and Terrones, 2012; Annex Table 1). In the past, such credit booms have often been accompanied by an accumulation of non-performing bank loans that were revealed once the boom subsided. A typical credit boom raised non-performing loans from 2.5 percent to 10 percent of gross loans (Mendoza and Terrones 2008).[1]

Several factors have encouraged post-crisis private sector credit growth in EMDEs. Exceptionally accommodative monetary policy by major central banks has fostered benign borrowing conditions for EMDEs, notwithstanding bouts of volatility. Rising financing needs have increased demand for borrowing, especially among energy and metals exporters since the sharp decline in metals and oil prices in 2011 and 2014, respectively. Post-crisis credit growth was partly also a continuation of a trend increase in the scale of EMDE corporates' business operations and international reach. As EMDE corporates have become increasingly globally active and expand their international sales, production, and supply chains, borrowing needs have risen with more sophisticated liquidity management, centralized treasury operations and larger working capital needs, including in foreign currency (Acharya et al. 2015).

There is a concern that, once again, financial vulnerabilities may be revealed as borrowing costs rise further. This could be triggered by a sharp increase in domestic or global interest rates or by depreciation, including in the wake of, or in anticipation of, diverging monetary policy decisions in major advanced economies. The debt service burden would rise, especially on unhedged, floating-rate, short-term, or foreign currency denominated debt. Corporates (and households) with stretched balance sheets could struggle to service debt at rising cost. The subsequent deleveraging process would impair growth at a time when EMDEs are already struggling to adjust to a difficult external environment.


Note: This Special Focus was prepared by Franziska Ohnsorge and Shu Yu, with contributions from Lei Sandy Ye.

[1]Similarly Elekdag and Wu (2011) found that the ratio of non-performing loans over total assets exceeds its trend by 2 percentage points during credit booms.

FIGURE SF1.1 Credit growth in EMDEs

Rapid private sector credit growth in emerging markets and developing economies since the global financial crisis has been fueled by benign borrowing conditions and rising financing needs. On average, private sector credit growth is well above historical averages—especially in commodity exporters—and has raised credit-to-GDP ratios above those in the 1990s. Among several commodity importers, credit growth has begun to slow from high levels.
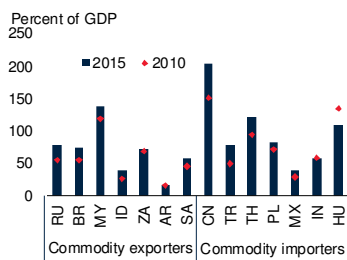
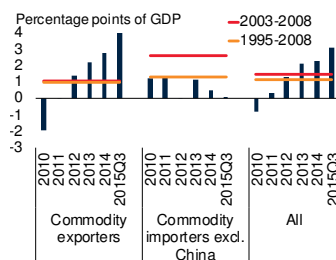**A. Credit to the nonfinancial private sector**
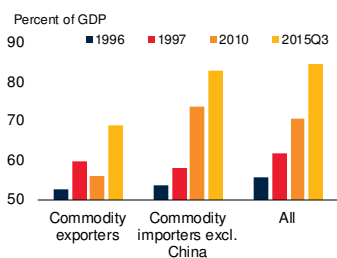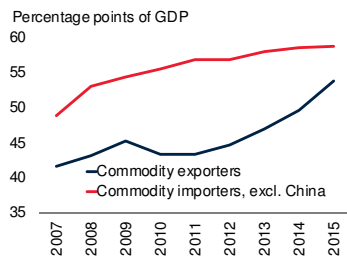
B. Credit to the nonfinancial private sector
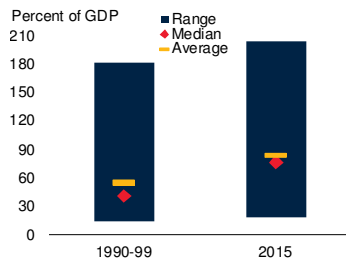
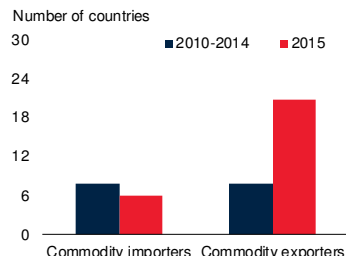**C. Credit to the nonfinancial private sector in 14 EMDEs**

D. Credit growth (broader sample)

E. Credit-to-GDP (broader sample)

F. Number of EMDEs with post-crisis peak in credit (broader sample)

Sources: Bank for International Settlements, International Monetary Fund's International Financial Statistics, World Bank.

A. Unweighted average of claims (from residents and nonresidents) on the nonfinancial private sector in 14 emerging markets and developing economies. Commodity exporters include Argentina, Brazil, Indonesia, Malaysia, Russia, Saudi Arabia, and South Africa. Commodity importers include China, Hungary, India, Mexico, Poland, Thailand, and Turkey.

B. Data availability as in A. Data for Brazil is only available from 1994Q1, Saudi Arabia only from 1993Q1, and for Russia only from 1993Q4. 2015 data are for 2015Q3.

C. 7 commodity exporters (AR = Argentina, BR = Brazil, ID = Indonesia, MY = Malaysia, RU = Russia, SA = Saudi Arabia, and ZA = South Africa) and 7 commodity importers (CN = China, HU = Hungary, IN = India, MX = Mexico, PL = Poland, TH = Thailand, and TR = Turkey).

D. Unweighted averages for broader sample. Credit growth is the average annual change in the credit-to-GDP ratio (in percentage points of GDP). Broader sample includes 55 EMDEs. Please see the main text for a detailed description of the sample and the classification of commodity importers and exporters. Data for 2015 are unavailable for Bahrain, Cote d'Ivoire, Gabon, Nigeria, Peru, Senegal, Sri Lanka, Venezuela, RB, Croatia, Jordan, Mauritius, and Tunisia.

E. Unweighted averages. Data availability as in D.

F. Data availability as in D.

Financing conditions have already begun to tighten. Broadly favorable financing conditions for EMDEs have tightened sharply as capital inflows shrank by 18 percent and bond issuance dropped by 22 percent between 2014 and 2015. This has especially affected oil and gas companies and metals and mining companies, which are struggling to adjust to sharply lower oil and metals prices, and highly cyclical industrial companies such as in the construction industry. For EMDE industrial companies and metals and mining corporates, average bond maturities have shortened by 2½ years between 2014 and 2015, and equity prices have undergone double-digit declines since mid-2014. Pressures may increase with the sharp rise in redemption obligations anticipated for 2017.

Against the current background, this Special Focus essay addresses the following questions:

• How has credit to the nonfinancial private sector—and, specifically, the corporate sector—evolved in EMDEs?

• How does recent credit growth compare with past episodes of credit booms?

• How near are current credit-to-GDP ratios to thresholds identified in the literature as early warning indicators?

Evolution of private sector credit

Database. Credit to the nonfinancial private sector consists of claims—including loans and debt securities—on households and nonfinancial corporates by the domestic financial system as well as external creditors. From 1980, data for this broad definition of credit are available from the Bank for International Settlements for 14 EMDEs, including seven commodity exporters (Argentina, Brazil, Indonesia, Malaysia, the Russian Federation, Saudi Arabia, South Africa) and seven commodity importers (China, Hungary,

India, Mexico, Poland, Thailand, Turkey).[2] These countries account for the bulk of emerging market and developing country debt (McCauley, McGuire and Sushko 2015) and have an established history of international financial market access. Other EMDEs typically access international financial markets to a lesser extent and typically have less developed domestic bond markets. For these countries, credit from the domestic banking system remains the main source of credit. For them, annual data on claims by banks on private sector, provided by the IMF's International Financial Statistics, are used as proxies for missing data for credit to the nonfinancial private sector. This extends the sample by another 41 countries, mainly from 2000 onwards.[3] The combined sample, of 55 countries, consists of 37 commodity exporters and 18 commodity importers.
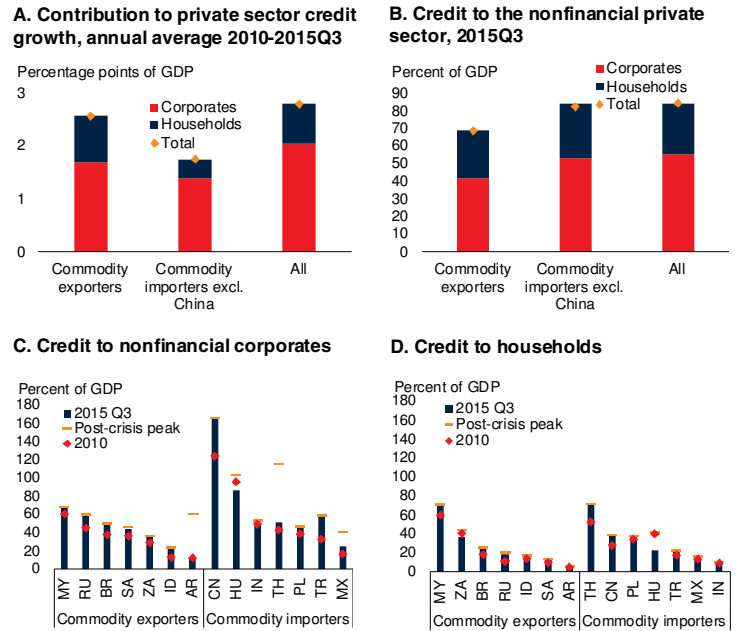
Private sector credit growth. Private sector credit growth is measured as the change in the ratio of credit to the nonfinancial private sector to GDP (in percentage points of GDP). Fueled by low post-crisis borrowing cost and rising financing needs, credit to the nonfinancial private sector increased by 14 percentage points of GDP, to 84.5 percent of GDP, in the five years to the third quarter of 2015 in the 14 EMDEs, for which such comprehensive data are available and in some cases by about 30 percentage points of GDP or more. On average among these countries, credit to the nonfinancial private sector now exceeds levels of the 1990s (Figure SF 1.1). Credit growth was particularly pronounced in commodity exporting economies, where it has been well above the long-term average. As a result, in almost all these EMDEs, credit to the nonfinancial private sector reached post-crisis peaks by 2015.

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[2]Data from Bank for International Settlement is not available for Argentina until 1994, Brazil until 1993, China until 1984, Hungary until 1989, Poland until 1992, Russia until 1995, Saudi Arabia until 1993 and Turkey until 1986.

[3]This includes eleven commodity importers (Bangladesh, Bulgaria, Croatia, Egypt, Georgia, Jordan, Mauritius, Pakistan, Philippines, Serbia, Tunisia) and thirty commodity exporters (Azerbaijan, Bahrain, Bolivia, Botswana, Colombia, Chile, Costa Rica, Cote d'Ivoire, Gabon, Ghana, Guatemala, Honduras, Jamaica, Kazakhstan, Kenya, Kuwait, Mongolia, Namibia, Nigeria, Oman, Panama, Paraguay, Peru, Qatar, Senegal, Sri Lanka, Ukraine, Uruguay, República Bolivariana de Venezuela, Zambia).

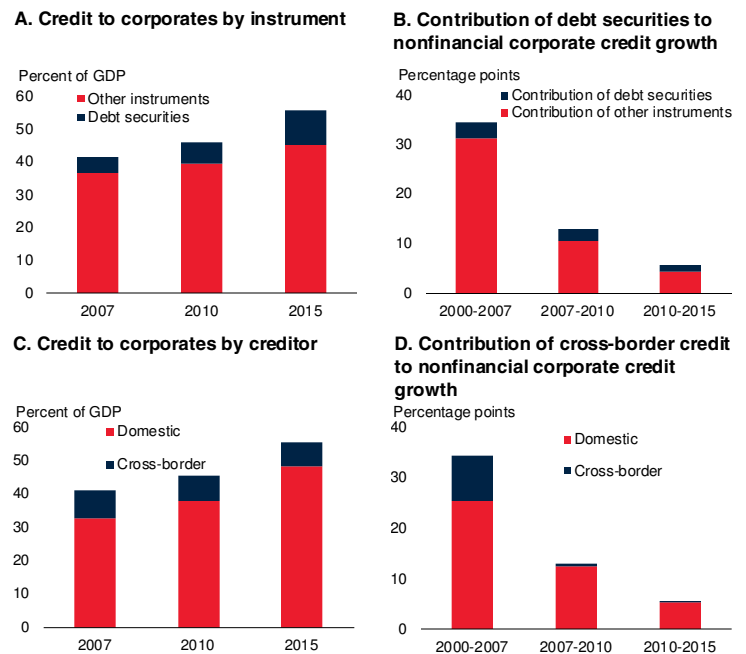**FIGURE SF1.2 Credit to corporates and households**

Two thirds or more of private sector credit growth since 2010 has been to corporates. Credit to corporates now accounts for almost two-thirds of credit to the nonfinancial private sector.

A. Contribution to private sector credit growth, annual average 2010-2015Q3

B. Credit to the nonfinancial private sector, 2015Q3

C. Credit to nonfinancial corporates

D. Credit to households

Source: Bank for International Settlements.
Note: Unweighted average credit (from residents and nonresidents) to nonfinancial corporates and households in 7 commodity exporters (AR = Argentina, BR = Brazil, ID = Indonesia, MY = Malaysia, RU = Russia, SA = Saudi Arabia, and ZA = South Africa) and 7 commodity importers (CN = China, HU = Hungary, IN = India, MX = Mexico, PL = Poland, TH = Thailand, and TR = Turkey).

FIGURE SF1.3 Composition of credit to corporates

Despite a post-crisis rise, debt securities and cross-border credit remain a modest fraction of credit to EMDE corporates.

A. Credit to corporates by instrument

B. Contribution of debt securities to nonfinancial corporate credit growth

C. Credit to corporates by creditor

D. Contribution of cross-border credit to nonfinancial corporate credit growth

Sources: Bank for International Settlements, World Bank.
Notes: Same sample as in Figure SF 1.2. Unweighted averages.
B. D. Contributions to average annual corporate sector credit growth.
C. D. Data are not unavailable for China, India, Indonesia in 2000 and South Africa before 2010.

FIGURE SF1.4 Corporate bond and equity markets

Emerging markets corporate bond spreads surged during the second half of 2015, especially in the metals and mining sector, but started to ease in the beginning of 2016. While corporate bond issuance started to drop from 2013, redemptions are estimated to surge in 2017 and stay at historically high levels through 2020. About two-thirds of bond issuance was placed in international debt markets, almost entirely in foreign currency denominations.
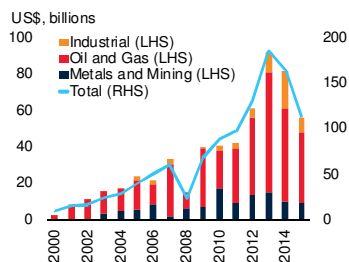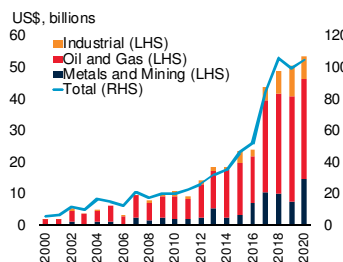
A. Corporate bond spreads
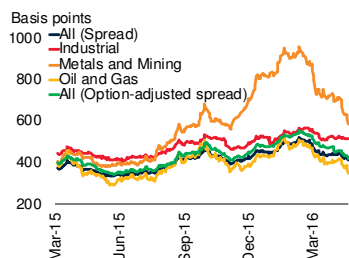
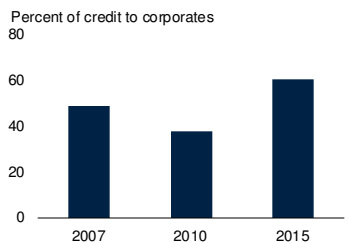**B. Contributions to cumulative equity market change since end-June 2014**
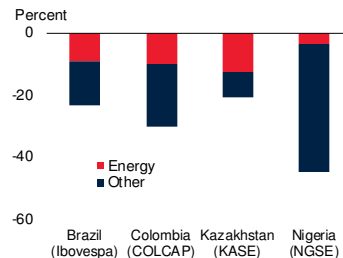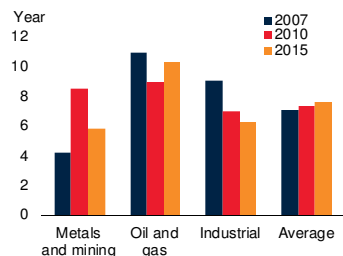
C. Corporate bond issuance

D. Corporate bond redemption

E. Corporate bond in the international market

F. Average corporate bond maturity

Sources: Bloomberg, Institute of International Finance, Bank for International Settlements.
Note: Figures A, C, D, E and F refer to bond in the international market.
A. Option-adjusted spread (OAS) is the spread relative to a risk-free interest rate that equates the theoretical present value of a series of uncertain cash flows of an instrument to its current market price. Due to the limited amount of data on credit default swaps (CDS) for corporate debt, OAS is used as a model-based proxy for credit risk among corporates.
E. Date are available for Argentina, Brazil, China, Hungary, Indonesia, Malaysia, Mexico, Poland, Russia, South Africa, Thailand, and Turkey. Unweighted averages.

Similar private sector credit growth is evident in a broader sample of 55 EMDEs. Among these EMDEs, credit to the nonfinancial private sector increased by about 10 percentage points since 2010, to 60 percent of GDP in the third quarter

of 2015. The divergence between commodity exporters and importers is even more pronounced among this group. By the third quarter of 2015, as financing needs expanded following the sharp oil price decline since mid-2014, credit to the nonfinancial private sector rose by more than 20 percentage points in some oil exporters. In other countries, credit to the nonfinancial private sector has begun to ease from 2013-14 peaks, especially in oil and metals exporters adjusting to lower commodity prices and in commodity importers tightening policies after the Taper Tantrum of 2013. At the firm level, this build-up of debt has also been reflected in deteriorating firm solvency (Alfaro et al. 2016).

Increase in credit to corporates. Since 2010, most of the increase in credit to the nonfinancial private sector has reflected credit to corporates, as corporates in both commodity exporters and importers have taken advantage of low financing costs. Credit to corporates has accounted for more than three quarters of the increase in credit to the nonfinancial private sector since 2010 in commodity-exporting EMDEs, where financing needs have risen sharply, and more than half in commodity-importing EMDEs (Figure SF 1.2). As a result, credit to the corporate sector now accounts for about two-thirds of credit to the nonfinancial private sector, and somewhat more in commodity-exporting EMDEs. While, on average, credit to corporates rose at a similar pace in commodity importers and exporters alike, the pace of credit growth to households in commodity importers (excluding China) was less than half the pace in commodity exporters. This more muted rise in credit to households in commodity importers may reflect the anemic post-crisis recovery in some countries or policy tightening in others.

Shifting composition of credit to EMDE corporates. The composition of credit to EMDE corporates has gradually shifted (Financial Stability Board 2015, Figure SF 1.3).

Foreign currency. In contrast to sovereign (and aggregate) debt, which is gradually shifting towards local currency, the share of foreign

currency-denominated credit in credit to non-financial corporates has increased (McCauley, McGuire and Sushko 2015; Chui, Kuruc and Turner 2016). Foreign currency-denominated debt raises exchange rate risk. In addition, nonresident portfolio asset funds holding correlated portfolios amplify any impact of exchange rates on corporate balance sheets (Miyajima and Shin 2014). That said, in most countries, and on average, the share of credit (loans or securities) denominated in foreign currency remains moderate around 20 percent, and the bulk of the corporate credit growth is accounted for by domestic currency denominated credit.[4]

Bond issuance. Since 2004, credit to nonfinancial corporates has shifted from bank loans to bond issuance (Chui, Fender, and Sushko 2014; Cortina, Didier, and Schmukler forthcoming; Feyen et al. 2015; Ayala, Nedeljkovic, and Saborowski 2015). Although bond maturities may shorten, bond market activity has been less procyclical and more resilient during the global financial crisis than bank lending (Cortina, Didier, and Schmukler forthcoming; Contessi, Li, and Russ 2013; Adrian, Colla, and Chin 2013, Figure SF1.4). However, despite strong corporate bond issuance since 2010, the bulk of corporate credit growth continued to be contributed by non-securities credit. Debt securities accounted for only 19 percent of credit to the corporate sector in 2015 (compared with 16 percent in 2007). The predominance of bank lending may reflect limited access for smaller EMDE corporates to bond markets. For EMDE corporates, access to bond markets tends to be restricted to a few large corporates that have been able to shift towards bond finance, often at longer maturities and lower cost (Didier, Levine, and Schmukler forthcoming).

Cross-border credit. Cross-border credit from a foreign bank could be considerably more volatile than credit from a domestic bank if the foreign

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[4]Turkey, Poland, and Hungary are exceptions among the 14 EMDEs in the sample, with foreign currency-denominated credit accounting for more than 25 percent of credit from domestic banks.

FIGURE SF1.5 Characteristics of credit booms

During a typical credit boom, credit to the nonfinancial private sector grows by more than 6 percentage points of GDP. On average, credit booms last less than two years and about one-third are followed by at least mild, deleveraging over the next three years. On average, recent private sector credit growth has been nearing levels associated with past credit booms in commodity exporters. In commodity importers, credit-to-GDP ratios have been considerably higher than in past credit booms but have been stagnant or declining.
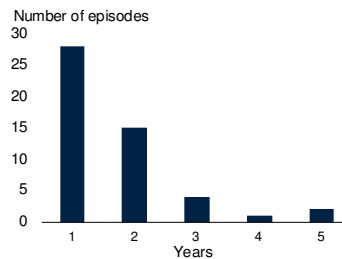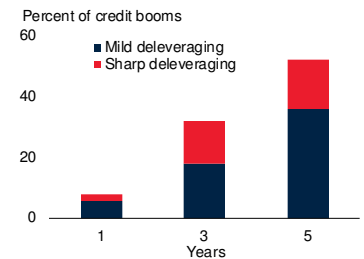
A. Evolution of credit
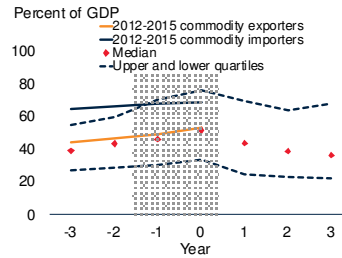
B. Evolution of credit growth
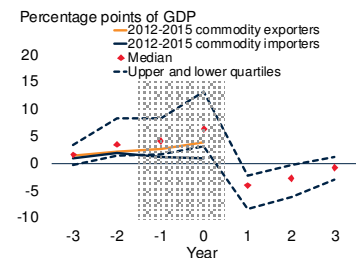
C. Duration of credit booms

D. Deleveraging after credit booms

Sources: Bank for International Settlements, Haver Analytics, International Monetary Fund International Financial Statistics and World Economic Outlook.
Notes: A credit boom is defined as an episode during which the cyclical component of the nonfinancial private sector credit-to-GDP ratio (derived using a Hodrick-Prescott filter) is larger than 1.65 times its standard deviation in at least one year. The episode starts when the cyclical component exceeds one standard deviation and ends in a peak year when the nonfinancial private sector credit-to-GDP ratio declines in the following year. "0" is the peak of the credit boom event. To address the end-point problem of a Hodrick-Prescott filter, the dataset is expanded by setting the data for 2016-18 to be equal to the data in 2015. Figures show the medians of credit to the nonfinancial private sector and of its change (red diamond) and their corresponding upper and lower quartiles during a boom episode (dashed blue line). The solid orange (commodity exporters) and blue (for commodity importers) lines for 2012-15 show the sample means for t=0 at 2015Q3. For 2012-15, the sample is restricted to countries where the data are available in 2015. Data are not available in 2015 for Bahrain, Cote d'Ivoire, Croatia, Gabon, Jordan, Mauritius, Nigeria, Peru, Senegal, Sri Lanka, Tunisia, Venezuela, RB. Data are not available for Argentina until 1994, Brazil until 1993, China until 1984, Hungary until 1989, Poland until 1992, Russia until 1995, Saudi Arabia until 1993 and Turkey until 1986. Please see the main text for a detailed description of the sample.
A. Credit to the private non-financial sector in percent of GDP.
B. The annual change in credit to the nonfinancial private sector as a percent of GDP.
C. Blue bars denote the number of credit boom episodes that lasted for 1-5 years. Events that are still developing in 2015 are dropped.
D. The (cumulative) percent of credit boom episodes followed by mild deleveraging (defined as private sector credit-to-GDP ratio falling 1 standard deviation below the HP-filtered trend) or sharp deleveraging (defined as private sector credit-to-GDP ratio falling 1.65 standard deviations below trend) over 1, 3, and 5 years. The horizontal axis shows the number of years after a credit boom. Events that are still developing in 2015 are dropped.

bank does not consider the EMDE a core market with long-established lending relationships (de Haas and van Lelyveld 2012; Cetorelli and Goldberg 2009 and 2012; de Haas and van Horen 2012; Claessens and van Horen 2012). Despite a modest increase since 2010, the share of cross-

FIGURE SF1.6 Macroeconomic developments during credit booms

Credit booms in the EMDEs were accompanied by widening current account deficits and faster real GDP growth.
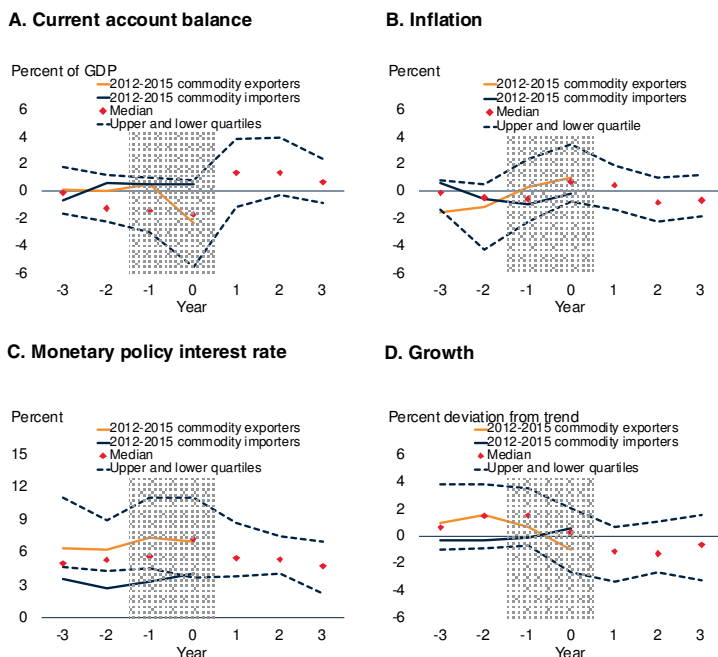
A. Current account balance

B. Inflation

C. Monetary policy interest rate

D. Growth

Sources: Bank for International Settlements, Haver Analytics, International Monetary Fund International Financial Statistics and World Economic Outlook.
Notes: See note in Figure SF 1.5 for the definition of credit booms. Data availability as in Figure SF 1.5.
A. The cyclical component of the current account in percent of GDP (derived using a Hodrick-Prescott filter). Data not available for China until 1997.
B. The cyclical component of the inflation rate (derived using a Hodrick-Prescott filter). Hyper-inflation episodes are dropped. Data are not available for Argentina until 1991, Mexico until 1987, Russia until 1996, Thailand until 1984, and Turkey until 1995.
C. Data are available for Bahrain (2007), Brazil (1999), Georgia (2008), Guatemala (2005), Honduras (2005), Indonesia (1990), Jordan (2004), Kazakhstan (2005), Kenya (2006), Malaysia (2004), Mauritius (2006), Mexico (2008), Mongolia (2007), Paraguay (2011), Peru (2003), Philippines (2001), Qatar (2002), Russia (2011), Saudi Arabia (1999), South Africa (1980), Thailand (2000), Turkey (1999), and Uruguay (2008).
D. The cyclical component of real GDP (in millions of U.S. dollars) in percent of its trend (derived using a Hodrick-Prescott filter).

border credit remains modest at less than 20 percent in the third quarter 2015, well below the 2000-07 average. Since 2010, credit from the domestic banking system has continued to be the main source of corporate credit growth.

Lending to commodity companies. Corporate borrowing has been fastest in the oil and gas sector and mining sector (Didier et al forthcoming; Domanski et al. 2015), and cyclical industries (e.g. construction; IMF 2015a). Since 2006, the outstanding syndicated loans and debt securities of state-owned energy corporates grew at double-digit average annual rates and the stock of debt of oil and gas firms has more than tripled (Domanski et al. 2015).

The shifting composition of credit to the corporate sector may have reduced vulnerabilities to bank funding shocks and to foreign bank funding shocks through cross-border credit but has increased vulnerabilities to exchange rate risk and liquidity risk in capital markets. Notwithstanding these gradual shifts, the bulk of credit to EMDE corporates remains from the domestic banking system (more than 80 percent) and, on average, denominated in domestic currency (80 percent). Similarly, the bulk of the credit growth has been accounted for by credit from the domestic banking system and in domestic currency.

Recent credit growth in light of past episodes

Event study. A rich literature has documented that credit booms are sometimes followed by sharp deleveraging episodes in subsequent years (e.g. Barajas et al. 2010; Elekdag and Wu 2011). Both the credit booms and the subsequent sharp or gradual deleveraging cycles have been accompanied by considerable macroeconomic volatility. To illustrate the developments during credit cycles in EMDEs, an event-study is used. As in Mendoza and Terrones (2008 and 2012), a credit boom is defined as an episode during which the private sector credit-to-GDP ratio is more than 1.65 standard deviations above its Hodrick-Prescott filtered trend (i.e. outside the 90 percent confidence interval) in at least one year. An episode starts when the deviation exceeds one standard deviation and ends when the credit-to-GDP ratio begins to fall. Conversely, a deleveraging episode is defined as an episode during which the private sector credit-to-GDP ratio is more than 1.65 standard deviations below trend in at least one year. The deleveraging episode starts when the ratio falls more than one standard deviation below trend and ends when the credit-to-GDP ratio begins to climb.[5] Credit booms and deleveraging episodes are studied

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[5]The results are robust to using thresholds of 1.75 or 1.55 standard deviations.

within a 7-year event window that covers their peak or trough years (t=0), the three prior years, and the three following years. Since 1980 (2000 for the broader sample), there have been 56 credit booms and 28 deleveraging episodes in EMDEs.[6]

Characteristics of credit booms. In a credit boom, private sector credit grows, on average, by more than 6 percentage points of GDP per annum and private sector credit peaked at 52 percent of GDP, on average (Figure SF 1.5).[7] The average credit boom lasted 1.7 years, with the longest episode lasting five years.[8] Until the credit boom peaked, current account deficits rose by almost 2 percentage points of GDP above their long-run trend but subsequently narrowed sharply (Figure SF 1.6). Real GDP rose by 1-2 percent above trend in the two years before the credit boom peaked but, within two years, fell below trend.[9]

Characteristics of deleveraging episodes. Within three years of the end of the credit boom, about one-third of booms were followed by at least a mild deleveraging episode (in which the private sector credit-to-GDP ratio fell more than 1 standard deviation below trend). During a deleveraging episode, private sector credit contracted by almost 2 percentage points of GDP per year and private sector credit fell to 35 percent

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[6]The event study uses the broader sample that covers the 14 EMDEs, for which comprehensive data on credit to the nonfinancial private sector are available from Bank of International Settlements, and another 41 EMDEs where data on claims on the private sector is available from IMF's International Financial Statistics. The resulting frequency of credit boom (5 percent), as defined as the average number of booms per country per year. It is somewhat higher than previous studies partially because the sample has been expanded to cover recent credit booms. Using a looser boom identification strategy, Elekdag and Wu (2011) found the ratio to be about 3 percent. Arena et al. (2015), Dell' Ariccia et al. (2014), and Mendoza and Terrones (2008) found the frequency of credit booms to be about 2 percent.

[7]Annex SF1.1 discusses statistically significant differences between event and non-event years .

[8]This is within the range found by other authors. Using growth in real claims on the private sector and different thresholds to identifying boom episodes, Elekdag and Wu (2011) show that the typical boom lasts about two years. Mendoza and Terrones (2008) find a considerably longer duration (about 7 years) using more smoothed data and a lower threshold for the starting and ending points for a boom.

[9]Mendoza and Terrones (2008), Elekdag and Wu (2011), and Arena et al. (2015), also found that growth tends to rise before booms and decline towards the end of it. Jorda et al. (2013) further suggest that faster credit growth tends to be followed by deeper recessions and slower recoveries.
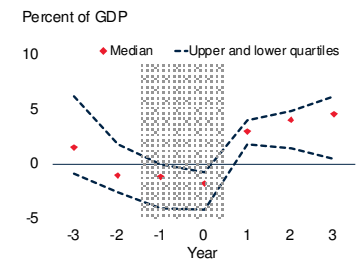

FIGURE SF1.7 Characteristics of deleveraging episodes

Deleveraging episodes are associated with a period of mild declines in private debt. On average, deleveraging episodes last about 1.5 years. About one-third of deleveraging episodes are preceded by credit booms in the preceding three years.
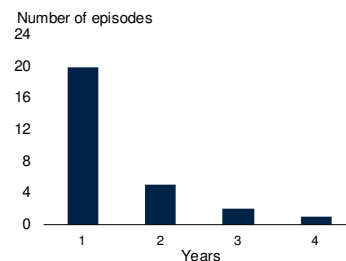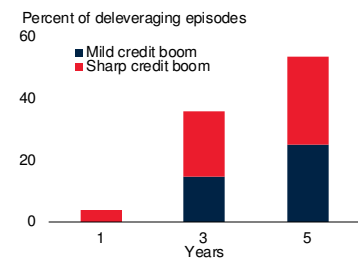

A. Evolution of credit
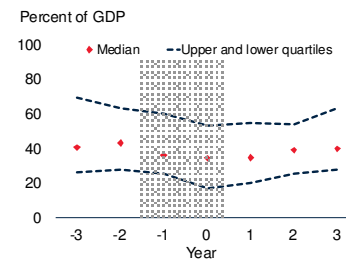
B. Evolution of credit growth

C. Duration of deleveraging episodes

D. Credit booms before deleveraging episodes

Sources: Bank for International Settlements, Haver Analytics, International Monetary Fund International Financial Statistics and World Economic Outlook.
Notes: A deleveraging episode is defined as an episode during which the nonfinancial private sector credit-to-GDP ratio (derived using a Hodrick-Prescott filter) is more than 1.65 standard deviations below its Hodrick-Prescott-filtered trend in at least one year. The episode starts when the ratio falls more than 1 standard deviation below trend and ends in a trough year when the private sector credit-to-GDP ratio starts to rise in the following year. "0" is the end (trough) year of the deleveraging episode. To address the end-point problem of a Hodrick-Prescott filter, the dataset is expanded by setting the data for 2016-18 to be equal to the data in 2015. Figures show the medians of credit-to-GDP ratio and of its increase (red diamonds) and their upper and lower quartiles (dashed blue lines) during a deleveraging episode. The solid orange (commodity exporters) and blue (for commodity importers) lines for 2012-15 show the sample means for t=0 at 2015Q3. For 2012-2015, the sample is restricted to countries where the data are available in 2015. Data are not available in 2015 for Bahrain, Cote d'Ivoire, Croatia, Gabon, Jordan, Mauritius, Nigeria, Peru, Senegal, Sri Lanka, Tunisia, Venezuela RB. Data are not available for Argentina until 1994, Brazil until 1993, China until 1984, Hungary until 1989, Poland until 1992, Russia until 1995, Saudi Arabia until 1993 and Turkey until 1986. Please see the main text for a detailed description of the sample.
A. Credit to the nonfinancial private sector as a percent of GDP.
B. The annual change in credit to the nonfinancial private sector as a percent of GDP.
C. Blue bars denote the number of deleveraging episodes that lasted for 1-3 years. Events that are still developing in 2015 are dropped.
D. The (cumulative) percent of deleveraging episodes preceded by mild credit booms (defined as private credit-to-GDP ratio more than 1 standard deviation above the Hodrick-Prescott-filtered trend) or sharp credit booms (defined as private credit-to-GDP ratios rising more than 1.65 standard deviations above the trend) over 1, 3, and 5 years. The horizontal axis shows the number of years before the deleveraging event. Events that are still developing in 2015 are dropped.

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of GDP, on average (Figure SF 1.7). The average deleveraging episode lasted over 1.4 years, with the longest episode lasting four years.[10] Only one-third of deleveraging episodes were preceded by, at least mild, credit booms in the previous three years. Deleveraging episodes were associated with

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[10]This is broadly in line with findings of other authors (Barajas et al. 2010).
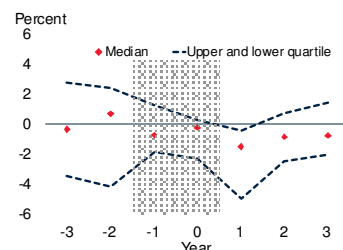
FIGURE SF1.8 Macroeconomic developments during deleveraging episodes

Deleveraging episodes were associated with improved current accounts but, weaker growth. As deleveraging episodes ended, inflation began to ease.
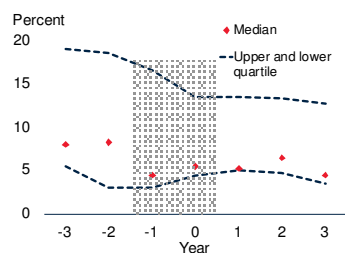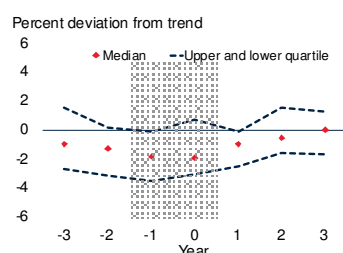
A. Current account balance
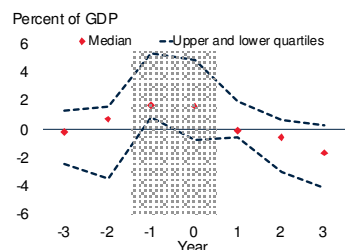
B. Inflation

C. Monetary policy interest rate

D. Growth

Sources: Bank for International Settlements, Haver Analytics, International Monetary Fund International Financial Statistics and World Economic Outlook.
Notes: See note in Figure SF 1.7 for the definition of deleveraging episodes. Data availability as in Figure SF 1.7.
A. The cyclical component of the current account in percent of GDP (derived using a Hodrick-Prescott filter). Data not available for China until 1997.
B. The cyclical component of the inflation rate (derived using a Hodrick-Prescott filter). Hyper-inflation episodes are dropped. Data are not available for Argentina until 1991, Mexico until 1987, Russia until 1996, Thailand until 1984, and Turkey until 1995.
C. See Note C of Figure SF 1.6 for data availability.
D. The cyclical component of real GDP (in millions of U.S. dollars) in percent of its trend (derived using a Hodrick-Prescott filter).

considerable current account improvements (about 2 percentage points of GDP, Figure SF 1.8). Real GDP fell, on average, by almost 2 percent below trend during the deleveraging episode.

Recent developments in historical comparison. Since 2012, levels of credit in *commodity-importing* EMDEs have been considerably higher than during previous credit booms but credit growth has been well below levels associated with past booms. In contrast, *commodity-exporting* countries' credit and credit growth have been near levels associated with past credit booms (Figure SF 1.5).

By the third quarter of 2015, private sector credit exceeded levels associated with past booms in only a few countries.

Current credit levels: Warning signs?

Early warning indicators. A large literature examines potential thresholds for private sector credit growth that may be an early warning indicator of impending macroeconomic and financial stress. For example, credit to the private sector was typically about 10 percentage points of GDP above its long-run trend before a financial crisis (Drehman 2013). In Central and Eastern European EMDEs, most past banking crises were preceded by about 9 percentage points of GDP deviation of credit to the private sector from its long-term trend (Gourinchas and Obstfeld 2012). When applied to 1996 or 1997 data, these early warning indicators correctly highlighted heightened vulnerabilities in Indonesia, Thailand, and Malaysia (Figure SF 1.9).

Most EMDEs are still some distance away from the thresholds identified by these studies (Figure SF 1.9). The few EMDEs where private sector credit exceeded these thresholds in in the third quarter of 2015, were mostly energy exporting countries. Microdata for EMDE corporates suggest similarly that median firm leverage in many EMDEs is near or above levels that preceded the 1997-98 crisis in some East Asian countries (Alfaro et al. 2016).

Long-term debt overhang. Even if a credit boom does not end in a crisis, a debt overhang can weigh on long-term growth as the necessary balance sheets repair proceeds gradually (Lo and Rogoff 2015, Buttiglione et al. 2014). Private sector credit above 80-100 percent of GDP has been found to be no longer growth-enhancing (Arcand et al. 2012; Cecchetti, Mohanty, and Zampolli 2011). Again, credit-to-GDP ratios in most EMDEs are still well below these thresholds, with few exceptions in which credit to the private, or corporate, sector exceeds 80 percent of GDP.

Conclusion

The main findings of this Special Focus are as follows.

• How has credit to the private sector—and, specifically, the corporate sector—evolved in EMDEs? Credit to the nonfinancial private sector and, especially, the corporates has grown rapidly since the global financial crisis, fueled by benign borrowing conditions and, in commodity exporters, by rising financing needs. Credit growth was most rapid in commodity exporting EMDEs, although from a starting point of modest credit-to -GDP levels. In contrast, in commodity importing EMDEs, average credit-to-GDP ratios are considerably higher than in commodity exporting countries but are now stagnant or shrinking. On average, private sector credit-to-GDP ratios have risen above 1990s averages.

• How does credit growth compare with past episodes of credit booms? Since 2012, credit to the nonfinancial private sector in commodity-importing EMDEs has been considerably higher (in percent of GDP) than in previous credit booms but its growth has been subdued. In contrast, credit growth in commodity-exporting EMDE has been rapid, near the pace and levels of
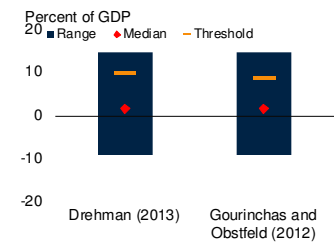
FIGURE SF1.9 Comparison: Credit and early warning indicators

In most EMDEs, private sector credit is still some distance away from the thresholds identified by previous studies as being associated with financial stress.

A. Credit to the private sector compared to thresholds, 1997
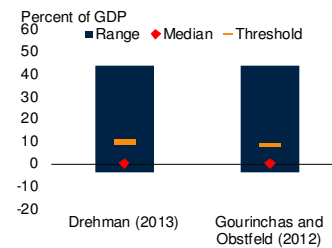
B. Credit to the private sector compared to thresholds, 2015Q3

Sources: Bank for International Settlements, Haver Analytics, International Monetary Fund International Financial Statistics and World Economic Outlook.
Notes: Orange lines show the thresholds identified by previous studies for deviation of the private sector credit-to-GDP ratio from its trend (derived using a Hodrick-Prescott filter, Drehman 2013, Gourinchas and Obstfeld 2012). Blue bars indicate the ranges of these measures; red diamonds show medians.
A. Data are available for 14 EMDEs (Argentina, Brazil, Indonesia, Malaysia, Russia, Saudi Arabia, and South Africa, China, Hungary, India, Mexico, Poland, Thailand, and Turkey).
B. Broader sample (55 EMDEs) is used here. Data are not available for Bahrain, Côte d'Ivoire, Croatia, Gabon, Jordan, Mauritius, Nigeria, Peru, Senegal, Sri Lanka, Tunisia, Venezuela.

credit-to-GDP ratios associated with past credit booms.

• How near are current credit-to-GDP ratios to thresholds identified in the literature as early warning indicators? Most EMDEs are still some distance away from the thresholds identified by these studies.

FIGURE SF1.10 Risks

Private debt stress, perhaps triggered by a sharp increase in borrowing costs, can eventually result in banking sector losses which, in turn, could require fiscal support to banks as it happened in some previous episodes. In several emerging markets, credit to nonfinancial private sector has risen rapidly at the same time as fiscal buffers have eroded and as government debt has been set on or neared unsustainable paths.

A. Government borrowing cost
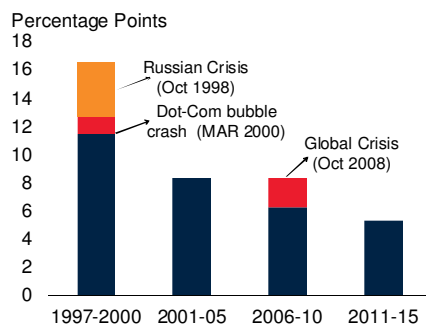
B. Government debt during crises
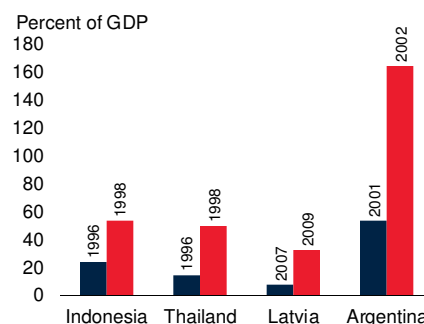
C. Emerging market bond redemption profile
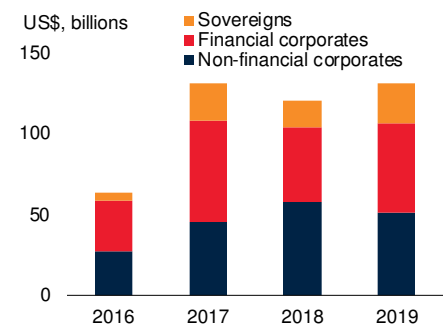
Sources: Bloomberg, Bank for International Settlements, Haver Analytics, International Monetary Fund International Financial Statistics and World Economic Outlook.
C. Data are available for Argentina, Brazil, China, Hungary, India, Indonesia, Malaysia, Mexico, Poland, Russia, Saudi Arabia, South Africa, Thailand, and Turkey.

In general, policy buffers to respond to financial stress are considerably higher than in the 1990s. On average in EMDEs, reserves (in percent of GDP) are now more than 60 percent higher than in the 1990s; government debt is 10 percentage points of GDP and external debt is 16 percentage points of GDP below 1990s levels.

These buffers notwithstanding, fiscal risks could compound a growth slowdown that would accompany a post-boom deleveraging. Deteriorating corporate balance sheets may weaken the balance sheets of exposed domestic banks. In a tail risk scenario, large private sector losses could require governments to provide substantial financial support. In past episodes of financial stress, such outlays markedly increased public debt above and beyond the increases attributable to the fiscal deficit (Laeven and Valencia 2012; Claessens et al. 2014; Bova et al. 2016; World Bank 2015b). As in previous episodes, fiscal space can shrink rapidly and borrowing cost can rise steeply during periods of elevated financial stress (Figure SF 1.10). This could force governments to tighten fiscal policy in the midst of a growth slowdown.

Various policy options could help contain risks from rapid credit growth while maintaining a broadly accommodative monetary policy stance (World Bank 2011, 2013, 2014; Arteta et al. 2015). Measures commonly considered to slow household credit growth include tighter ceilings on debt service-to-income ratios of lower-income households; more pronounced risk-based pricing of household lending; and differential loan-to-value ceilings on first and second mortgages. Other measures can help contain risks from the corporate credit growth, for example, increased stress testing of listed corporates' balance sheets; and pre-emptive legislative and regulatory steps to facilitate restructuring of nonperforming loans and corporate resolution. Measures to contain foreign currency risks in lending to corporates include more intensive stress tests; more intrusive monitoring of liquidity ratios in foreign currencies; and additional hedging requirements.

ANNEX SF1.1 Robustness exercises

This technical annex presents a detailed analysis of the difference between event and non-event episodes discussed in the main text of the Special Focus.

A credit boom is defined as an episode during which the cyclical component of the private sector credit-to-GDP ratio (derived using a Hodrick-Prescott filter) is larger than 1.65 times its standard deviation (i.e. outside the 90 percent confidence interval). The episode starts when the cyclical component of private sector credit-to-GDP exceeds one standard deviation and it ends in a peak year when the credit-to-GDP ratio begins to fall. "0" is the peak year of the credit boom. To address the end-point problem in estimating a Hodrick-Prescott filter, the dataset is expanded by setting the data for 2016-18 to be equal to the data in 2015.

An ordinary least squares regression is estimated for the private sector credit-to-GDP ratio (in percent of GDP), real GDP, current account balances (in percent of GDP), the monetary policy rate, and inflation on dummy variables for each of the 3 years before the peak of a boom or trough of a deleveraging episode, the peak or trough year, and each of the 3 years after the peak or trough. All variables except monetary policy rates are expressed as deviations from their long-term trend. Country fixed effects are included to control for other country-specific factors.

The coefficient estimates for each of the dummy variables (red diamonds in Annex Figures SF 1.1–SF1.2) indicate the deviation in each of these variables during an event from a non-event. The 95 percent confidence intervals are shown in dotted blue lines.

During a credit boom, credit-to-GDP ratios are statistically significantly, and about 25-30 percentage points of GDP, higher; current account deficits are about 3 percentage points of GDP wider; and inflation is about 5 percentage points more elevated than during non-event years. In the run-up to the peak of the boom, real GDP growth is statistically significantly (2-3 percentage
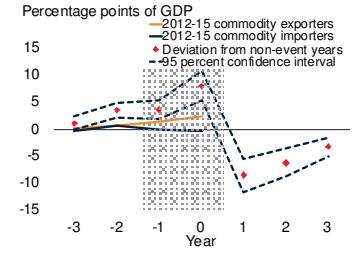
ANNEX FIGURE SF1.1 Developments during credit booms

During credit booms, credit-to-GDP ratios rise significantly above non-events. Current account balances widen, inflation rises, and growth increases significantly more than in non-events.
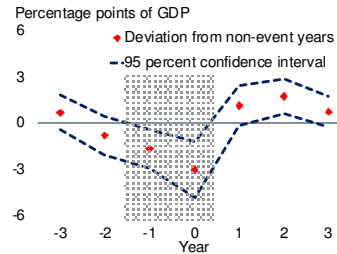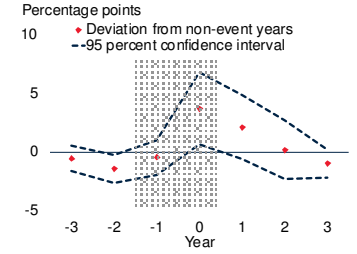

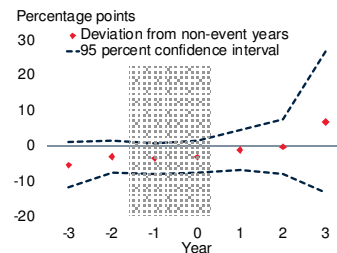A. Evolution of credit
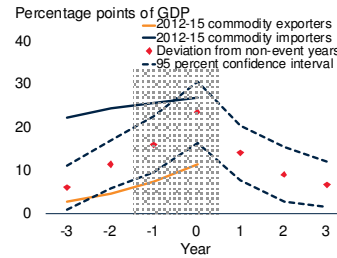
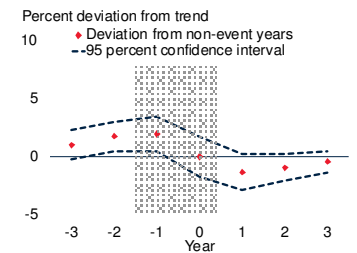B. Evolution of credit growth

C. Current account balance

D. Inflation

E. Monetary policy interest rate

F. Growth

Sources: World Bank, IMF International Financial Statistics, Bank for International Settlements.
Notes: Credit booms and their peak years are defined as the same as in Figure SF 1.5. "0" is the peak year of a credit boom. Data availability as in Figure SF1.5. Figures show the estimated deviation (red diamond) of each variable (their cyclical components derived using a Hodrick-Prescott filter except monetary policy interest rate) and its corresponding 95 percent confidence intervals (blue dotted line) from non-event years during the event window (three years before the peak, the peak year, and the three years after the peak).
A. Credit to the nonfinancial private sector in percent of GDP. The solid orange (commodity exporters) and blue (for commodity importers) lines for 2012-15 show the differences between the sample means for t=0 at 2015Q3 and those during non-event years.
B. The annual change in credit to the nonfinancial private sector in percentage points of GDP. The solid orange (commodity exporters) and blue (for commodity importers) lines for 2012-15 show the differences between the sample means for t=0 at 2015Q3 and those during non-event years.
C. The cyclical component of the current account in percent of GDP (derived using a Hodrick-Prescott filter). Data are not available for China until 1997.
D. The cyclical component of the inflation rate (derived using a Hodrick-Prescott filter). Hyper-inflation episodes are dropped. Data are not available for Argentina until 1991, Mexico until 1987, Russia until 1996, Thailand until 1984, and Turkey until 1995.
E. Data are available for Bahrain (2007), Brazil (1999), Georgia (2008), Guatemala (2005), Honduras (2005), Indonesia (1990), Jordan (2004), Kazakhstan (2005), Kenya (2006), Malaysia (2004), Mauritius (2006), Mexico (2008), Mongolia (2007), Paraguay (2011), Peru (2003), Philippines (2001), Qatar (2002), Russia (2011), Saudi Arabia (1999), South Africa (1980), Thailand (2000), Turkey (1999), and Uruguay (2008).
F. The cyclical component of real GDP (in millions of USD dollars) in percent of its trend (derived using a Hodrick-Prescott filter).

ANNEX FIGURE SF1.2 Developments during deleveraging episodes

During deleveraging episodes, the credit contractions, narrowing of current account deficits and growth slowdowns are statistically significantly larger than during non-events.

A. Evolution of credit
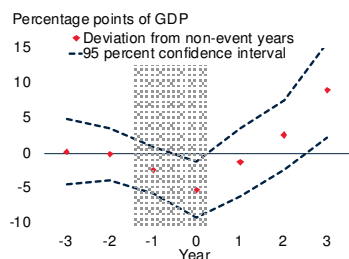
B. Evolution of credit growth

C. Current account balance

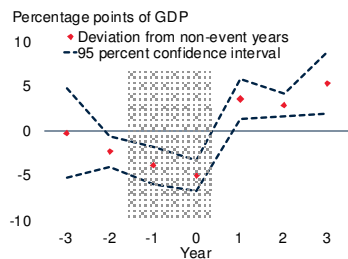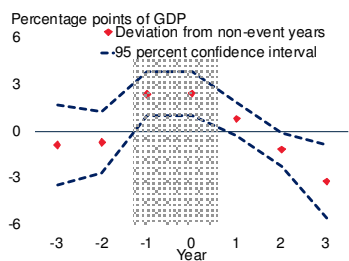**D. Inflation**
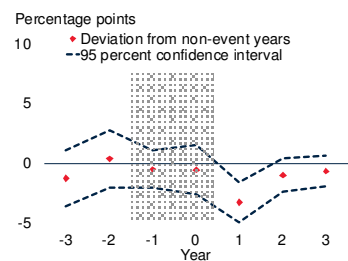
E. Monetary policy rate
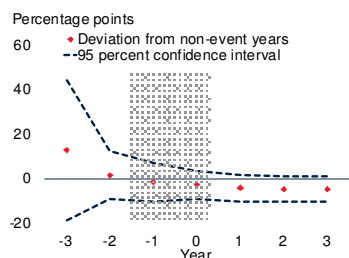
F. Growth
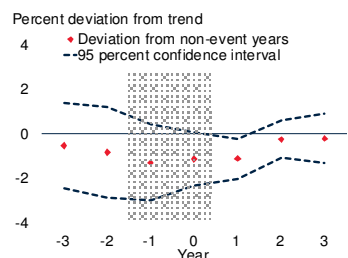
Sources: Bank for International Settlements, Haver Analytics, International Monetary Fund International Financial Statistics and World Economic Outlook.
Notes: Deleveraging episodes and their trough years are defined as the same as in Figure SF 1.7. "0" is the trough year of a credit deleveraging episode. Data availability as in Figure SF1.7. Figures show the estimated deviation (red diamond) of each variable (their cyclical components derived using a Hodrick-Prescott filter except monetary policy interest rate) and its corresponding 95 percent confidence intervals (blue dotted line) during the event window (three years before the trough, the trough year, and the three years after the trough) from non-event years.

A. Credit to the private nonfinancial sector as a percent of GDP.
B. The annual change in credit to the nonfinancial sector as a percent of GDP.
C. The cyclical component of the current account in percent of GDP (derived using a Hodrick-Prescott filter). Data are not available for China until 1997.
D. The cyclical component of the inflation rate (derived using a Hodrick-Prescott filter). Hyper-inflation episodes are dropped. Data are not available for Argentina until 1991, Mexico until 1987, Russia until 1996, Thailand until 1984, and Turkey until 1995.
E. Data are available for Bahrain (2007), Brazil (1999), Georgia (2008), Guatemala (2005), Honduras (2005), Indonesia (1990), Jordan (2004), Kazakhstan (2005), Kenya (2006), Malaysia (2004), Mauritius (2006), Mexico (2008), Mongolia (2007), Paraguay (2011), Peru (2003), Philippines (2001), Qatar (2002), Russia (2011), Saudi Arabia (1999), South Africa (1980), Thailand (2000), Turkey (1999), and Uruguay (2008).
F. The cyclical component of real GDP (in millions of U.S. dollars) in percent of its trend (derived using a Hodrick-Prescott filter).

points) higher than during non-events. However, at the very peak of the credit boom, growth slows towards the pace during non-event years.

In contrast, during deleveraging episodes, private sector credit falls statistically significantly (by over 5 percentage points of GDP) below that in non-events. Current account deficits turn into surpluses and growth falls statistically significantly (although only at the 10 percent confidence level) below growth in non-events.

ANNEX TABLE SF1.1 **Review of selected literature: Vulnerabilities arising from credit surges**

Authors	Data Coverage	Methodology	Results
Abiad et al. (2011)	23 OECD countries and 25 EM, 1970-2009	Panel data analysis, probit analysis and difference-in-difference method	Creditless recoveries—defined as episodes where real credit growth is negative in the first three years following a recession—follow about one in five recessions. While they seem to be more common in developing countries and emerging markets, they also occur in advanced economies. On average, income growth during credit-less recoveries is about 3.9 percent, as opposed to 4.3 percent for recoveries with credit.
Adrian et al. (2013)	U.S. corporations, 1998-2010	Descriptive analyses and DSGE	While loans show the typical procyclical pattern of rising during a boom and contracting sharply in a downturn, bond financing surges during downturns. During the 2007-09 crisis, the total amount of new issuances of loans and bonds decreased by 50 percent. Loans decreased 75 percent, but bond issuance rose two-fold. The cost of both types of financing increase steeply (four-fold increase for new loans, and threefold increase for bonds).
Alfaro et al. (2016)	21 EM, 1992-1997 and 2009-2014	Descriptive statistics	While corporate vulnerability levels are not as severe as the run-up to the East Asian crisis, corporates in a broader spectrum of emerging markets display weaker liquidity and solvency indicators after 2008-2009.
Amri et al. (2014)	31 EM and 5 troubled eurozone economies, 1981-2010	Descriptive statistics	Two methods identify credit booms: (1) 1.75 standard deviations away from the country specific trend in real credit-to-population; and 2) 1.55 standard deviations away from the country specific trend in log real credit. The unconditional probabilities that a credit boom is preceded by a capital flow surge range from 40 to 71 percent. Meanwhile, the unconditional probabilities that a capital flow surge will be followed by a credit boom range from 11 to 38 percent.
Arcand et al. (2012)	108 countries, 1970-2000	Cross-country and panel analysis	Finance starts having a negative effect on output growth when credit to the private sector reaches 100 percent of GDP. The true relationship between financial depth and economic growth is non-monotone. Findings are not driven by output volatility, banking crises, low institutional quality, or by differences in bank regulation and supervision.
Arena et al. (2015)	135 developing countries, 1960-2011	Descriptive analysis, stylized facts	Credit booms in developing countries, defined as episodes when the cyclical component of real credit is larger than 1.65 times its standard deviation, are similar in their duration and magnitude but differ in their macro-economic implications. Surges in capital inflows precede credit booms, especially in middle-income countries. Credit booms followed by banking crises are associated with depreciations (by 2 percent on average), drops in investment, consumption, and GDP (by 10 percent, 3-4 percent, and 3 percent, respectively, on average) and current account surpluses (by 1.5 percentage points of GDP, on average).
Ayala et al. (2015)	47 EM, 2000-2013	Censored panel regressions with fixed effects	Institutions and macro fundamentals (e.g. current account ratio) create an enabling environment for bond market development. During the recent boom, however, global cyclical factors accounted for most of the variation of bond shares in total corporate debt. The sensitivity to global factors varies with relative bond market size rather than local fundamentals. Foreign bank linkages help explain why bond markets increasingly substituted for banks in providing liquidity to EMs.
Barajas et al. (2010)	18 MENA economies, 1983-2008	Panel data analysis	Credit booms defined by a country-year in which the credit-to-GDP ratio exceeds its trend by 1.5 times the country-specific historical standard deviation, or an absolute increase of 5 percentage points of GDP. Credit slowdowns are often preceded by credit booms. Credit booms account for 3.5 percent of the sample, (country-year pairs). Factors driving lower credit growth are bank funding position deterioration, lending capacity and loan quality tightening; and poor macroeconomic conditions. Expansionary monetary policy helps cushion these negative effects.

ANNEX TABLE SF1.1   **Review of selected literature** *(continued)*

Authors	Data Coverage	Methodology	Results
Bech et al. (2012)	24 AE, 1960-2016	Panel data analysis	Deleveraging during financial crisis-led recessions is associated with stronger subsequent recoveries. A decline in private debt by 10 percentage points of GDP during the recession is associated with a 0.6 percentage point increase in average output growth during the recovery phase.
Cecchetti, Mohanty, and Zampolli (2011)	18 OECD economies, 1980-2010	Panel data analysis	Government, corporate, and household debt above 85 percent, 90 percent, and 85 percent of GDP, respectively, reduces growth. Higher financial fragility and higher probability of credit booms and busts are potential channels.
Cetorelli and Goldberg (2009)	U.S. Banks, 2000-2008	Descriptive analysis	Global banks played a significant role in the transmission of the current crisis to emerging-market economies. Adverse liquidity shocks to developed-country banking, such as those that occurred in the United States in 2007-08, have reduced lending in local markets through contractions in cross-border lending to banks and private agents and also through contractions in parent banks' support of foreign affiliates.
Cetorelli and Goldberg (2012)	50 U.S. banks with foreign affiliates, 2006Q1-2010Q1	Panel regression	During the 2008-09 crisis, U.S. banks experiencing funding shocks reduced their internal funding more to peripheral than to core (i.e. large) foreign affiliates.
Chen et al. (2015)	12 EM and 24 AE, 1960-2013	Descriptive analysis; OLS analysis	A decline in the private sector leverage ratio by 10 percentage points over the 5 years of the typical deleveraging episode is associated with an increase in annual growth of about 0.4 percentage points over the subsequent 5 years. Deleveraging episodes tend to last about five years, during which debt falls by about 15 percentage points of GDP. An annual decline in private sector debt ratio by one percentage point during the deleveraging episode is associated with higher annual average real growth rate in the next 5 years by 13-24 basis points.
Claessens, Kose and Terrones (2012)	44 countries, 1960Q1-2010Q4	Descriptive statistics; Duration analysis	By analyzing the interactions between business and financial cycles, it is found that there are strong linkages between the different phases of business and financial cycles. In particular, recessions associated with financial disruptions, notably house and equity price busts, tend to be longer and deeper than other recessions. Conversely, while recoveries following asset price busts tend to be weaker, recoveries associated with rapid credit growth and house prices are stronger.
Claessens and van Horen (2012)	Bank balance sheets in 129 countries, 1995-2009	Descriptive statistics	Bank loans behaved in a markedly procyclical manner (with a lag) during the recent financial crisis, while bond markets did not.
Contessi, Li, and Russ (2013)	U.S., 1952Q1-2013Q1	Descriptive statistics	Bank loans behaved in a markedly procyclical manner (with a lag) during the recent financial crisis, while bond markets did not.
De Haas et al. (2012)	1294 banks, 1999-2009	Panel regression	During the 2008-09 crisis, both domestic and foreign banks cut lending but banks participating in the Vienna Initiative were more stable lenders.
De Haas and van Horen (2013)	Individual syndicated loans, 2000-09	Panel regression	International banks cut cross-border lending sharply during the 2008-09 crisis. However, they continued to lend more to countries in which they maintained close relations with borrower (e.g. because they operated a local subsidiary, they were geographically close, or they had built up more lending experience).

ANNEX TABLE SF1.1 **Review of selected literature** *(continued)*

Authors	Data Coverage	Methodology	Results
De Haas and van Lelyveld (2014)	48 international banks and 2,020 domestic banks, 1992-2009	Panel regression	During the 2008-09 crisis, multinational bank subsidiaries had to slow lending almost three times as fast as domestic banks.
Dell'Ariccia et al. (2014)	170 economies, 1960-2010	Panel data analysis	Bank credit booms are episodes when the credit-to-GDP ratio is more than 1.5 times its standard deviation above its trend and the annual average credit growth exceeds 10 percentage points of GDP; or when the annual growth rate of the credit-to-GDP ratio exceeds 20 percent. During boom years, in comparison to non-boom years, growth improves by two percentage points, current account deteriorates by one percentage points and investment growth is 100 percent higher. About 60 percent of credit booms are followed by economic underperformance. About one-third of credit booms are followed by banking crises.
Demirguc-Kunt and Detragiache (2005)	N/A	Literature/ methodology survey	Credit growth (defined as the rate of growth of real domestic credit to the private sector) is a statistically significant determinant of banking crises in a multinomial logit approach. Estimated banking crisis probabilities from the multivariate logit approach are higher than those derived from professional forecasts by 2-12 percentage points.
Didier et al. (forthcoming)	Firm-level data for EM, 2008-2015	Descriptive analysis.	Leverage increased more in energy sector firms than in other firms.
Drehmann (2013)	39 EM and AE, 1970-2010	Descriptive analysis.	The credit-to-GDP gap is defined as the difference between the credit-to-GDP ratio and its long-term trend. Compared to the bank credit-to-GDP gap, using the total credit-to-GDP gap (including securitized credits held by the non-bank financial sector and cross-border lending), increases the prediction precision on incidence of banking crises by 5-30 percent.
Edison (2000)	20 EM and AE, 1970-2009	Signals approach; Case study	In an extension of the basic signals approach used to predict crises, vulnerability to crisis is signaled when one or more "indicator variables" (on current account, capital account, real sector and financial sector) deviate significantly (more than 2.5 standard deviations) from their behavior during non-crisis periods. Short-term debt to reserve ratio is found to be the best predictor while the change in domestic credit to GDP ratio is one of the best predictors of financial crises in Asia. Measures such as declines in reserves by more than 50 percent were moderately successful in predicting financial crises in Mexico.
Elekdag and Wu (2011)	21 AE and 43 EM, 1960-2010	Descriptive analysis, stylized facts	Credit booms, defined as episodes when the cyclical component of real credit is larger than 1.55 times its standard deviation, are associated with worsening bank and corporate balance sheets. While corporates' leverage ratio increases by 7-16 percent, banks' credit to total assets ratio and non-performing loan ratios grow by about 5 percentage points. Credit boom are also associated with higher capital inflows (by 1-6 percent), current account deficits (about 2-4 percent of GDP), higher asset prices (by 7-10 percent) and stronger domestic demand (about 2-7 percent). Booms typically last for three years.
Financial Stability Board(2015)	15 AE and 12 EM, 1999-2014	Descriptive analysis	Against the backdrop of ample global liquidity and prolonged low global interest rates, nonfinancial corporate bond issuance in major EMDEs has risen sharply.

ANNEX TABLE SF1.1 **Review of selected literature** *(continued)*

Authors	Data Coverage	Methodology	Results
Feyen et al. (2015)	71 emerging and developing countries and 7 industrial sectors, 2000-2014	Panel regression	Global factors are important drivers of emerging and developing economies bond issuance. A decrease in U.S. expected equity market (or interest rate) volatility, U.S. corporate credit spreads, and U.S. interbank funding costs and an increase in the Federal Reserve's balance sheet (1) raise the odds that the monthly issuance volume of a country-industry is above its historical average; (2) decrease individual bond yields and spreads; and (3) raise bond maturities, after controlling for country pull factors, bond characteristics.
Gourinchas and Obstfeld (2012)	22 AEs and 57 Ems, 1973-2010	Discrete panel data analysis	For EM, domestic credit growth and real currency appreciation are the most effective predictors of financial crises. A 9 percentage point increase in the credit to GDP ratio increases the probability of banking crisis in the next three years by 6.4 percent. For emerging markets, a 4 percentage point increase in the reserves to GDP ratio are associated with a lower likelihood of banking crisis by 5.2 percent.
IMF (2015a)	40 EM, 2004-13	Descriptive and panel data analysis	Global factors, such as the inverse of the U.S. shadow rate and the global oil prices, have become more important drivers of EM corporate leverage, as opposed to domestic and firm-specific factors. The share of variation in leverage explained by global factors increased from 6 percentage points in 2007 to 45 percentage points in 2011 (30 percentage points in 2013).
IMF (2015b)	China, 2007-14	Descriptive and panel data analysis	The post-global-financial-crisis credit boom in China resulted in a large credit gap that is around 15 percent of GDP. Corporate debt, the main driver for the credit boom, has risen from 78.9 percent of GDP in 2007 to 111.5 percent of GDP in 2014. The rise in corporate debt has been driven by SOEs, real estate firms, and sectors with overcapacity.
IMF (2015c)	128 countries, 1980-2013	Panel data analysis	The effect of financial development on economic growth is bell-shaped: it weakens at higher levels of financial development (between 0.4 and 0.7 with 1 being the maximum). When financial development proceeds too fast, deepening financial institutions can encourage greater risk-raking and high leverage, which leads to economic and financial instability.
Jassaud and Kang (2015)	Italy, 2007-14	Descriptive analysis	The buildup of nonperforming loans (NPLs) in Italy since the global financial crisis reflects both the prolonged recession as well as structural factors that have held back NPL write-offs by banks. The impediments to NPL resolution in Italy and fostering a market for restructuring distressed assets could support corporate and financial restructuring.
Jorda, Schularisk, and Taylor (2013)	14 advanced countries, 1870-2008	Local projection method	Financial-crisis recessions are more painful than normal recessions, and the credit intensity of the expansion phase is closely associated with the severity of the recession phase for both types of recessions. After five years, the financial-crisis recession path of real GDP per capita is about 5 percent lower than the normal-recession path.
Kaminsky, Lizondo, and Reinhart (1998)	5 industrial, 15 developing economies, 1970-95	Signals approach, OLS analysis	A "signals" approach helps predict currency crises. Among all, the real exchange rate serves as the most effective predictor of currency crises: 57 percent of crises were signaled. For credit growth (defined as the change in the ratio of domestic credit to GDP), the average lead time for the domestic credit to GDP ratio to signal a crisis is 12 months.
Lo and Rogoff (2015)	Canada, Japan, UK, U.S., and Euro Area, 2000-15	OLS analysis	Literature survey on persistently slow growth across advanced economies six years after the onset of the financial crisis.

ANNEX TABLE SF1.1 Review of selected literature *(continued)*

Authors	Data Coverage	Methodology	Results
Mendoza and Terrones (2008)	27 AEs and 22 Ems, 1960-2006	Trend decomposition, Panel data analysis	Credit booms, as defined by 1.75 times the standard deviations from the trend (1 standard deviation for starting and ending dates), are associated with economic expansion (2-4 percent), increasing housing (15 percent) and equity prices (10-30 percent), real appreciation (about 9 percent above trend), and larger current account deficits (around 2 percentage point of GDP); and vice versa for credit contractions. Credit booms tend to last about 6-7 years.
Mendoza and Terrones (2012)	61 emerging and industrial countries, 1960-2010	Trend decomposition, Panel data analyses	Credit booms, as defined by 1.65 times the standard deviations from the trend (1 standard deviation for starting and ending dates), often lasts for 4-5 years. Credit booms show three similarities in industrial and emerging economies: (1) booms are similar in duration and magnitude; (2) banking crises, currency crises or sudden stops often follow credit booms (at similar frequencies in industrial and emerging economies); and (3) credit booms often follow surges in capital inflows, TFP gains, and financial reforms, and are far more common with managed exchange rates.
Milesi-Ferretti and Tille (2010)	75 countries	Panel regression	During the 2008-09 crisis, international banking activity contracted both in terms of cross-border lending and operations through foreign affiliates, with magnitude being more pronounced for cross-border operations.
Reinhart, Reinhart, and Rogoff (2012)	14 AEs 1800-2011	Descriptive analysis	The major public debt overhang episodes in the advanced economies since the early 1800s, characterized by public debt to GDP levels exceeding 90% for at least five years, are associated with growth over one percent lower than during other periods. The growth effects are significant even in the many episodes where debtor countries were able to secure continual access to capital markets at relatively low real interest rates.
Schularick and Taylor (2012)	14 AEs 1870-2008	Panel data analysis	In the pre-war era (1870-1939), credit and money growth are tightly linked. Both the credit-to-GDP ratio and the money-to-GDP ratios are about 0.5. During the post-war era (1945-2008), credit growth was not backed by monetary growth. While the credit-to-GDP ratio is around 1, the money-to-GDP ratio stays below 0.65. High credit growth serve as an early warning indicator of financial crises: an increase in average real loan growth over 5 years by one standard deviation (7 percent) increases the probability of crisis by 2.45-2.8 percentage points.
Shin (2014)	NA	Descriptive analysis	Global bank financing has increasingly given way to asset managers and other "buy side" investors who have global reach.

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