**BANCO DE MÉXICO**

# Financial System Report

November 2015

**NOTICE**


*Unless otherwise specified, this document has been drafted using information as of October 31, 2015. Figures are preliminary and may be revised.*

# CONTENT

# 1.   Introduction

The objective of the *Financial System Report* is to present the analysis of risks that, from Banco de México's standpoint, may represent threats to the domestic financial system.[1] Hence, more than describing the events that occurred during the twelve months prior to its publication, the *Report* focuses on the status of risks and their potential impact, were they to materialize. The conclusions stemming from the hereby presented analysis shall not be interpreted as a forecast of the future performance of economic variables. Rather, the aim of the analysis is to present a balance of possibilities and prospects, were certain risks to materialize. This is because it is always preferable to address all scenarios in a timely manner, especially the less positive ones, so as to undertake preemptive measures or, failing this, to properly tackle such scenarios. The Mexican economy currently faces a particularly adverse and complex international environment, caused by the global economic slowdown and the fall in oil prices, a generalized appreciation of the US dollar and increased volatility in international financial markets.

The impact of the oil price fall on Mexican public finances, together with the reduction of oil output and the economic slowdown, has heightened macro-financial risks in the domestic economy, especially in the face of the expected normalization process of the monetary policy by the Fed as well as other possible contagion effects from emerging economies. In this context, the timely announcement of the public expenditure adjustment, aiming at offsetting the decline in oil prices, mitigated economic agents' concerns over the potential impact on financial markets of an increase in public debt –given the expectation of the US monetary policy normalization. Undoubtedly, the risk of contagion among emerging economies has increased over the last months, owing to a number of factors: uncertainty over the starting date of the said process, the economic slowdown in emerging countries, problems in Chinese financial markets and certain geopolitical tensions.

No matter what the trigger of the contagion process in emerging economies could be, the materialization of such event could lead to a revision of international investors' portfolios and a reduction of capital flows towards those economies. Therefore, such possibility poses an additional risk to domestic financial stability. The outlook described before might give way to a scenario characterized by a higher demand for foreign financial resources in a context of shrinking supply of external funds.

It follows that Mexico should use its economic policy to keep setting itself aside from other emerging economies –as has already been taking place in the fiscal, monetary and regulatory domains.

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[1]   For the purpose of this report, financial system refers to the group of intermediaries and markets that enable savings mobilization, its channeling for investment and the sharing of risks in the economy, including institutions, organizations and activities that contribute to or facilitate those functions.

Notwithstanding the foregoing, Mexico should keep strengthening its macroeconomic fundamentals to face up to the adverse environment. This includes consolidating the measures recently adopted in the fiscal field, in order to stabilize and ultimately lower the public sector's financial requirements, as well as to adjust monetary policy whenever necessary, and continue with the swift implementation of structural reforms.

As for the financial system, although Mexican Banks have sufficient liquidity and capital to carry on operations even under extreme circumstances, some smaller institutions must undertake additional efforts to be in a better position to properly face adverse scenarios, particularly those affecting their liquidity.

In addition, it is advisable that non-financial private companies that have issued significant amounts of foreign currency denominated debt keep on striving to accurately identify the risks to which they are exposed, and thus, take measures to mitigate them. These firms must adapt their financial strategies to changing circumstances in a timely manner.

This report consists of three sections. In section 2, we analyze the main risks and vulnerabilities for the financial system that stem from the economic environment. Firstly, we analyze risks related to the decline in oil prices and the diminishment of oil production. Then, we explain the risks that derive from the US Fed monetary policy normalization process. And finally, we analyze the risks related to a possible contagion from emerging economies and an economic slowdown. In section 3, we present the analysis of the potential effects that the above mentioned risks could have on financial institutions and non-financial companies, together with the results of Banco de México's yearly stress tests for banks. Last, section 4 presents conclusions and recommendations derived from the previous analyses.

## 2.    Main Risks and Vulnerabilities

The Mexican economy and its financial system face an adverse and complex environment, resulting from a global economic slowdown, a persistent fall in oil prices and the expectations linked to the onset of the US monetary policy normalization process. The latter has driven a generalized US dollar appreciation along with higher interest rates and has heightened the risk of a capital flow reversal from emerging countries. Further, Mexico could be affected by a possible contagion effect from other emerging markets –the Chinese economy being a major contributor to this effect.

This section analyzes the main risks to the stability of the financial system. The first risk is posed by the fall in oil prices along with the downtrend in production capacity, which may lead to further deterioration of public finances (subsection 2.1). The second risk is a significant outflow of foreign investors' funds (subsection 2.2) as a result of a disorderly adjustment in financial markets, due to the onset of the monetary policy normalization in the US. The third risk is the materialization of a contagion effect from emerging economies (subsection 2.3). Last, the fourth risk is an eventual slowdown of the domestic economy (subsection 2.4).

Figure 1 illustrates both the risks and the transmission channels through which such risks could directly or indirectly have an impact on financial institutions and non-financial companies. First, the global slowdown and a further decline in oil prices and production may lead into a domestic slowdown. Inevitably, lower growth directly lowers the income of banks, brokerage firms, investment funds, other financial entities and non-financial companies. At the same time, lower growth also increases the default rates of credit institutions.

Second, a domestic slowdown in conjunction with a plunge in oil prices and production, might indirectly impact financial institutions and non-financial companies via adjustments in domestic financial markets, and this situation may worsen under geopolitical or international tensions. On the one hand, lower growth might hinder tax income, and this undermines public finances. On the other hand, the decrease in oil prices and production would accentuate the disadvantageous effects of lower economic growth on public finances. Furthermore, the deterioration in public finances might exert an upward pressure on interest rates denominated in domestic currency, thereby shrinking intermediaries' financial margin.

**Figure 1**
**Financial Stability Map**

| External Shocks | Main Risks | Transmission Channels | Impact Analysis |
|---|---|---|---|

Global Economic Slowdown → Lower Economic Growth

Fall in Oil Prices and Reduction in Oil Production

US Monetary Policy Normalization

Deterioration of Public Finances

Foreign Capital Outflows

Contagion Among Emerging Economies

Increases in Peso Denominated Interest Rates

Lower liquidity and market size

Peso Depreciation

Higher Cost of Funds in US Dollars

Banks and Brokerage Firms

Investment Funds

Other Financial Entities

Non-Financial Companies

Last, in a context of low growth and deteriorated public finances, the normalization of US monetary policy and the worsening of the economic situation in the emerging world, especially in China, may trigger significant outflows of foreign capital. In this scenario, financing costs in Mexican pesos and US dollars would increase, and the peso would further depreciate. All these shocks could have an impact on the balances of financial intermediaries and non-financial companies.

# Banco de México

## 2.1.   Risks Related to the Fall in Oil Prices and Production

As of the end of June 2014, oil prices started to decline, reaching levels, during the first quarter of 2015, similar to the ones observed in the wake of the 2008-2009 crisis (graph 1a). A moderate world demand resulting from the economic slowdown in major emerging economies certainly contributed to this; nevertheless, the downtrend in oil prices can be mainly explained by a significant increase in world oil supply (graph 1b).

**Graph 1**
**World Crude Oil Market**

a) Spot Price

US dollars per barrel

b) Annual Change in Oil Production

Million barrels per day

c) WTI Futures Price Curve

US dollars per barrel

Figures as of November 13, 2015
Source: Bloomberg

Figures as of October 15, 2015
Source: Short-term Outlook, US Energy Information Administration

Figures as of November 13, 2015
Source: Bloomberg

1/ Forecast by US Energy Information Administration.

Several factors have contributed to reinforcing expectations that the crude oil price may remain at relatively low levels for a long period of time. In particular, it is expected that large fixed costs and advanced sales in the futures market by less efficient producers may lead a number of companies to remain in the market in the short-term, and thus, delay the contraction of world supply. In the meantime, an uptrend in oil inventories along with the saturation of storage capacity has been observed.[2] In addition, the crude oil price could also remain at low levels, if OPEC members refuse once again to curtail production in order to set off future increases in crude oil world supply. Indeed, one of the major reasons that explains the recent drop in oil prices is that, unlike what was done in the past, Saudi Arabia has not cut back its own supply to offset the increase in world supply stemming from the higher American and Canadian production.

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[2]   Both the accumulation of inventories and the saturation of storage capacity can be attributable to the generalized strategy of storing crude oil and making futures sales to gain profits from contagion. For this situation to exist, it is necessary that the oil sale price in the futures market be higher than the sum of expected spot prices (graph 1c) and storage costs.

The reduced price of the Mexican oil mix (graph 2a) together with the reduction of production (graph 2b) could further hamper public revenues (graph 3a) and impact public finances (graph 3b).

**Graph 2**
**Mexican Oil Industry**

a) Price of the Mexican Mix
US dollars per barrel

b) Mexican Production of Crude Oil
Thousand barrels per day

Figures as of October 2015
Source: Petróleos Mexicanos

Figures as of October 2015
Source: Petróleos Mexicanos
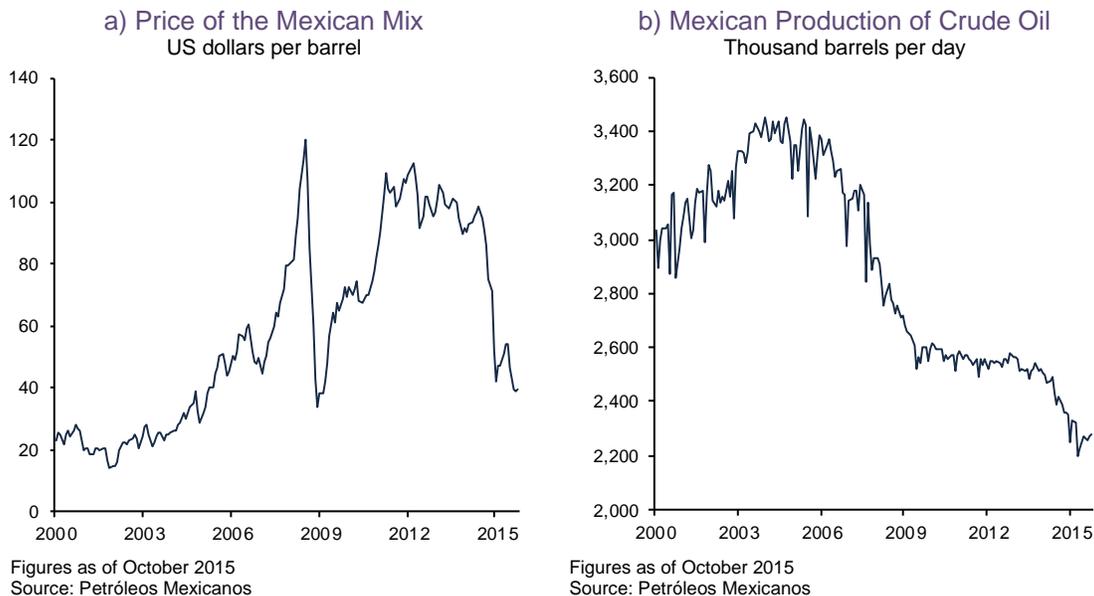
The impact of lower oil income on public finances has been mitigated by a higher tax income obtained from the fiscal reform that entered into force in 2014, as well as by the improved tax collection relating to the special tax on production and services (IEPS in Spanish) applicable to fuel and diesel. Further, the decline in oil prices has also been set off by oil price hedges. These hedges offer coverage to the government's oil income when oil price declines.[3] Additionally, under an outlook of lower oil income, Mexican authorities have set in motion a permanent adjustment to the public expenditure.

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[3] The hedge strategy adopted in 2015 completely covered the price of 79 USD per barrel stipulated in the Federal Income Law for this year. For that matter, put options were purchased at an average price of 76.4 USD per barrel for the Mexican mix; a subaccount of 7,944 million pesos was thus created as part of the Budget Revenue Stabilization Fund (FEIP) to cover the gap.

**Graph 3**
**Fiscal Indicators for Mexico**

a) Public Budget Revenue[1]
Percentage of GDP

b) Gross Public Debt[2]
Percentage of GDP
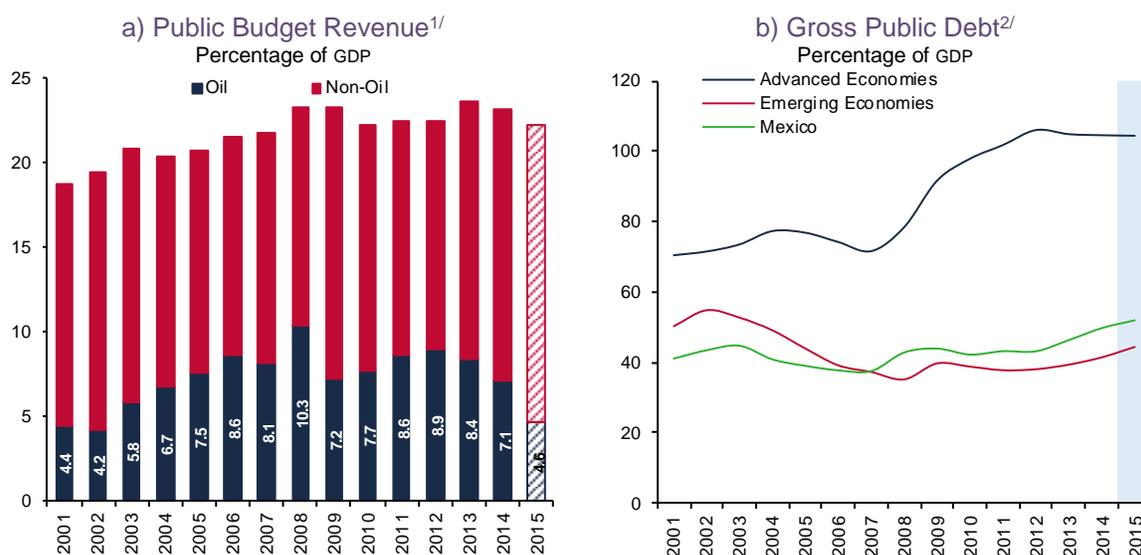


Figures as of October 2015
Source: SHCP and CGPE

Figures as of October 2015
Source: IMF World Economic Outlook

1/ 2015 figures are SHCP forecasts included in the Economic Policy General Criteria for the fiscal year 2016.
2/ The shaded area corresponds to the IMF forecast (World Economic Outlook, October 2015).

There are other risks relating to changes in the oil trade balance in recent years; specifically, these changes may increase Mexican needs for foreign funds. In particular, the oil trade balance has been dropping over the last years and is expected to be negative in 2015 for the first time ever since this data is available (graph 4a). This negative sign implies moving from a situation where the sector provided a net supply of foreign currency denominated funds to one where the sector becomes a net receiver of funds. This could lead to a higher current account deficit in 2015 *vis-à-vis* the end of the previous year. Recently, foreign investment inflows have not completely covered the current account deficit although they continue to finance around 80 percent thereof (graph 4b). A further deterioration of public finances or the current account might heighten the country risk perception and lead to a greater adjustment of foreign investors' portfolios. These issues might mix with the impact of the US monetary policy normalization process or the intensified risk aversion caused by the worsening of the situation in China.

**Graph 4**
**Trade Balance, Current Account and Foreign Direct Investment in Mexico**

a) Trade Balance and Current Account Excluding Oil[1]

b) Ratio of Foreign Direct Investment to Current Account Deficit

Percentage of GDP

Percent
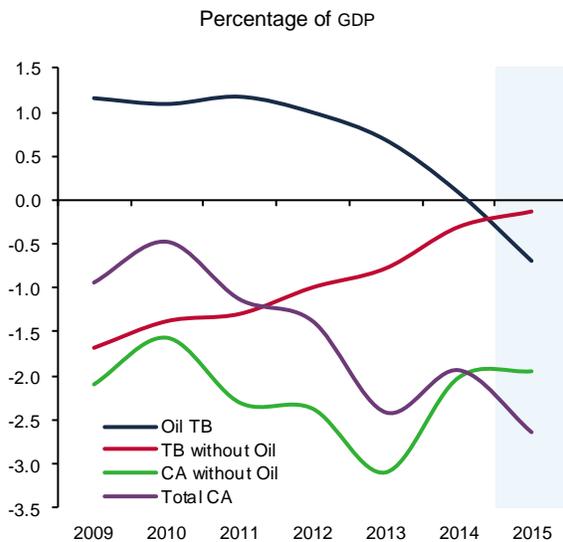


Figures as of November 20, 2015
Source: Bloomberg
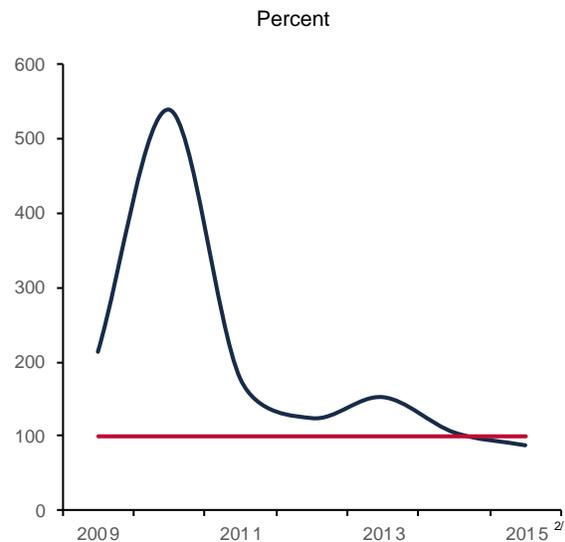
Figures as of November 27, 2015
Source: Banco de México

1/ The shaded area corresponds to Banco de México's estimates for the end of 2015.
2/ 2015 figures correspond to the third quarter of the year.

Considering the outlook described, an econometric exercise was performed to estimate the effect that a deterioration of public finances and the current account might have on the international perception of country risk for Mexico (see box 1). The results of the analysis suggest that a one percent increase in the fiscal deficit, measured as a percentage of GDP, would push the *EMBI Global* index up by more than 24 points, whereas a one percent hike in the current account deficit as a percentage of GDP, would increase the index by 34 points. These results confirm that it is of utmost importance to implement the announced adjustments to public expenditure, in order to meet the federal government's forecasts for public balance and current account, and hence control the country risk perception, especially under the adverse international economic conjuncture.

## Box 1

### Country Risk Model for Mexico

One way of measuring investors' perception of country risk is through the spread of interest rates in the country's USD denominated debt *vis-à-vis* US Treasury bond rates. The *Emerging Market Bond Index Global* (*EMBIG*)[1] is built on the basis of such spreads for various emerging countries (see graph). The *EMBIG* has subindices for some countries, such as Mexico. Hence, the *EMBIG* for Mexico (*EMBIG-MX*) provides a country risk measure.

**EMBI *Global***
Basis points



2007 2008 2009 2010 2011 2012 2013 2014 2015
Figures as of November 12, 2015
Source: Bloomberg

In order to understand the effect that some macro variables and a deterioration of public finances could have on investors' perception of country risk for Mexico, an econometric exercise was performed relating the *EMBIG-MX* to the main variables associated with the domestic default rate, which have therefore an impact on country risk perception.[2]

The following equation was estimated:

$$EMBIG\text{-}MX_t = \beta_{0} + \beta_1 \Delta PIB_{t-1} + \beta_2 \Delta TC_t + \beta_3\, Inf_t + \beta_4 BF_t + \beta_5 CC_t + \beta_6\, ln\,(RI_t) + \beta_7 VIX_{t-1} + \varepsilon_t\,,$$

where the level of *EMBIG-MX* is a function of the lagged real GDP growth ($\Delta PIB_{t-1}$), the nominal depreciation of the exchange rate ($\Delta TC_t$), the level of quarterly inflation ($Inf_t$), the fiscal balance to GDP ratio ($BF_t$), the current account balance to GDP ratio ($CC_t$) and the natural logarithm of international reserves ($ln\,(RI_t)$). In addition, a global indicator for short-term expected volatility in the stock market was included as a control variable ($VIX_{t-1}$). The main estimation results are shown in the table below. All the explanatory variables were significant at least at the 5 percent level, except for the growth of lagged GDP which was significant at 10 percent. Following the sign of the respective coefficients, the *EMBIG-MX* would increase if the fiscal deficit, the current account deficit, the inflation, the peso

depreciation and global uncertainty (measured as the $VIX_{t-1}$) were to grow. Conversely, increases in the growth rate of the domestic economy and the level of international reserves would reduce the *EMBIG-MX*.

**Estimation Results**

| EMBI *Global* Mexico | |
|---|---|
| Variables | Coefficients |
| Current account balance (%PIB) | -33.87*** (7.85) |
| Fiscal balance (%PIB) | -24.64*** (5.77) |
| Inflation (quarterly) | 24.23** (12.09) |
| GDP growth (quarterly, lagged) | -12.57* (7.39) |
| *VIX* index (lagged) | 3.63*** (0.87) |
| Nominal exchange rate (depreciation) | 5.30*** (1.82) |
| International reserves (logarithm) | -133.57*** (19.97) |

Observations: 72, R$^2$ = 0.7512, includes constant
Robuts standard errors in parentheses
*** p<0.01, ** p<0.05, *p <0.10

In order to illustrate the magnitude of these results, the coefficients of certain fundamental variables should be interpreted individually. Hence, a one percent increase in the current account deficit as a percentage of GDP would imply an increase of 33.9 percentage points in the *EMBIG-MX*. Likewise, a one percent increase in the fiscal deficit as a percentage of GDP would translate into a 24.6 percent hike in the *EMBIG-MX*. In contrast, a one percent increase in GDP would make the *EMBIG-MX* decrease by 12.57 points, whereas an increase of one billion dollars in international reserves would entail a nearly one point fall in the *EMBIG-MX*.

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[1] The *EMBI Global* is an index computed by JP Morgan Chase reflecting the returns of every country's or group of countries' debt portfolio, as the case may be, e.g. Latin American countries or emerging countries as a whole. Debt includes Eurobonds, Brady bonds and local debt and loans with an outstanding face value of at least 500 million dollars and a maturity term of 1 to 2.5 years. This indicator is an average for every period and its reduction implies a decline in country risk, as perceived by investors. It is measured in basis points and corresponds to the spread of returns *vis-à-vis* the US Treasury bond with same duration as the debt in question.

[2] This specification is based on a model that, using a group of several emerging economies, concludes that the *EMBI Global* level for every country is positively related to inflation, the fiscal deficit and the current account deficit. Conversely, it is negatively related to international reserves, economic growth and the exchange rate appreciation. See M. Ramos-Francia and G. Rangel: "Revisiting the effects of country specific fundamentals on sovereign default risk," *Economics Bulletin*, vol. 32, (2012).

The low oil prices would also represent an indirect risk for the Mexican financial system, because they can affect the risk perception of other emerging oil exporting economies, and this may lead to a full deterioration in the credit quality of emerging countries' assets as a whole.[4] Indeed, low oil prices may further undermine fiscal soundness and depreciate the local currencies of oil producers, including certain large emerging economies. This event could in turn lead to an upward revision of credit risk for emerging economies as a whole, thereby affecting the price of domestic financial assets. In fact, countries whose sovereign debt largely contributes to the construction of sovereign margin indices are generally oil net exporters.[5] Furthermore, contagion effects could magnify if the increasing financial vulnerabilities of emerging economies led global asset managers, particularly those of large crossover funds, to simultaneously withdraw from those economies.[6]

Last, a scenario of protracted low oil prices also poses an indirect risk for macroeconomic and financial stability in Mexico due to its possible impact on the global energy sector. A sustained decline in the price of oil might hamper oil producers' liquidity, which could, in turn, hinder their capacity to refinance their debt. Due to the importance of oil for the global economy, an eventual chain of defaults triggered by the incapacity to pay obligations could unleash large contagion effects on the global financial system and indirectly impair the Mexican system. Nonetheless, since global banks' exposure to the energy sector is low, the likelihood of external contagion is not high.

## 2.2. Risks Stemming from the Normalization Process of the US Federal Reserve Monetary Policy

Over the last seven years, advanced economies have maintained unprecedented expansionary monetary stances. The stimuli began in 2008 with noteworthy and sustained declines in reference rates (graph 5a) in order to mitigate the effects of the international financial crisis on economic activity.

In a second stage, the stimuli continued via purchases of diverse financial assets, which led to significant increases in central banks' balances (graph 5b) and encouraged long-term interest rates to follow a downtrend for several years (graph 5c).

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[4] In contrast, institutions such as the International Monetary Fund have suggested that a fall in oil prices would have a positive effect on the global economy.

[5] Sovereign margin indicators, such as the index family of emerging market bonds produced by JP Morgan (EMBI), are built upon the spread between the interest rates paid by USD denominated sovereign bonds of emerging economies and the rates paid by US Treasury bonds. That is why this indices are used as a measure of investors' risk perception of a given country or region.

[6] Crossover funds invest in both equity and venture capital. Financial institutions such as Templeton, BlackRock and Pimco manage this type of funds, and have been increasing exposure to emerging markets in search for higher returns since the financial crisis of 2008-2009. Unlike debt funds of emerging economies, crossover funds are not obliged to keep their investments in such markets and may settle their positions at any time.

**Graph 5**
**Monetary Conditions in Advanced Economies**

a) Central Banks' Reference
Rates
Percent
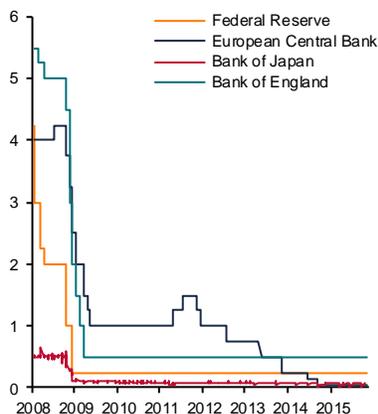
b) Assets in Central Banks'
Balances
Percentage of GDP

c) 10-year Sovereign Bond
Yields
Percent

Figures as of November 13, 2015
Source: Bloomberg
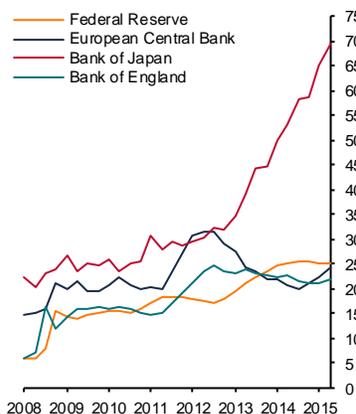
Figures as of the second quarter of 2015
Source: Bank of Japan, European
Central Bank, Bank of England, Federal
Reserve, Haver Analytics
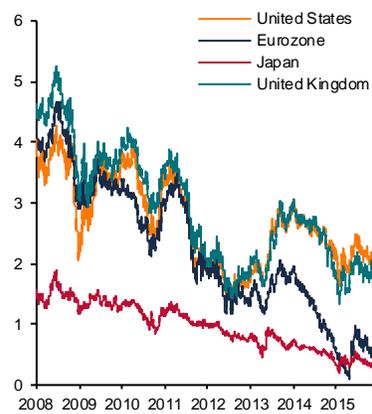
Figures as of November 13, 2015
Source: Bloomberg

Nevertheless, the recovery of economic activity and employment in certain advanced countries over the last months, particularly in the US and the UK, triggered expectations that the normalization of the monetary policy stance in those countries would begin sooner than in other developed countries –the latter case is exemplified by the Eurozone and Japan, where the monetary stimulus is expected to be stepped up for a long period of time. The expected gap between advanced countries' monetary stances generated relevant changes in international financial markets. Particularly, since mid-2014, the US dollar has registered substantial appreciation *vis-à-vis* a broad currency basket (graph 6a). The generalized strength of the US dollar persists, even in periods when financial markets put off the estimated start-up date of the monetary policy normalization (graph 6b) and despite expectations of more gradual than expected increases in rates (graph 6c).

**Graph 6**
**US Monetary Policy**

a) US Real Effective Exchange Rate[1]

Índex (2010=100)

b) Expected Date of the First Rise in the US Reference Rate

Percentage of respondents that expect the rise at the date in question[2]

c) Fed Funds Futures Curve
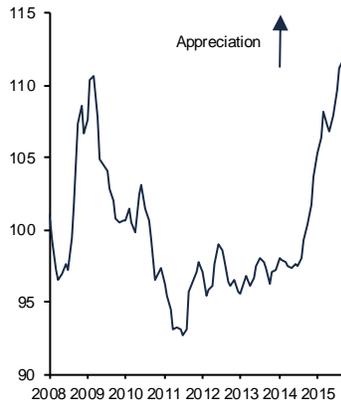
Percent

Monthly figures as of October 2015
Source: JP Morgan, Haver Analytics
1/ *Vis-à-vis* 59 currencies, weights according to trade volume.
2/ Dates on the horizontal axis correspond to meetings of the Federal Open Market Committee throughout 2015.
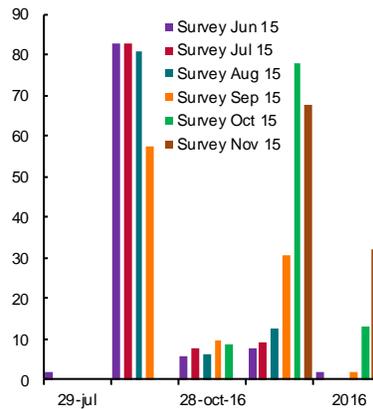
Figures as of November 10, 2015
Source: Blue Chip Publications
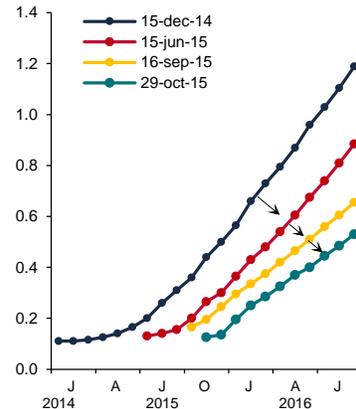
Figures as of October 29, 2015
Source: Bloomberg

The expansionary monetary policies implemented in advanced economies gave rise to a substantial increase in capital flows towards emerging economies. Although capital inflows allowed local governments and companies to tap funds under highly favorable circumstances, they also increased macro-financial vulnerabilities. This is chiefly attributable to the possibility of foreign investor runs during the normalization process of the US monetary policy that may translate into a disorderly adjustment in financial markets.

In fact, certain changes in capital flows towards emerging economies have been registered; these started to fall again starting mid-2014 (graph 7a). When analyzing the most recent monthly data, we observe that although some small-sized inflows to fixed income markets have been registered (graph 7b), inflows toward equity markets narrowed significantly during August and September, mainly because of capital outflows from Asia and Latin America (graph 7c).

Due to uncertainty about when and how the normalization process of the US monetary policy will take place, the risk of new volatility bouts persists. This is evident, as the high level of global financial integration has increased the correlation between different countries' capital flows, and also their dependence on monetary conditions of advanced countries.

**Graph 7**
**Capital Flows to Emerging Economies**

a) Cumulative Flows to Emerging Economies[1/]
Left axis: billions of dollars
Right axis: percent

b) Bond Flows
Billions of dollars

c) Equity Flows
Billions of dollars
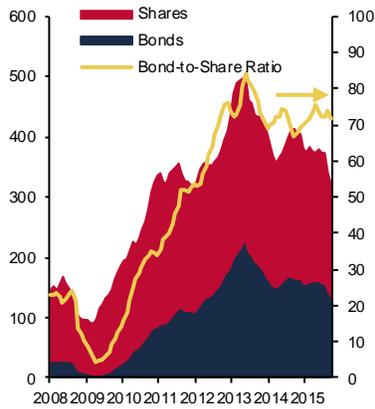
Monthly figures as of September 2015
Source: EPFR Global
1/ Cumulative flows as of November 2003.

Figures as of October 2015
Source: Institute of International Finance
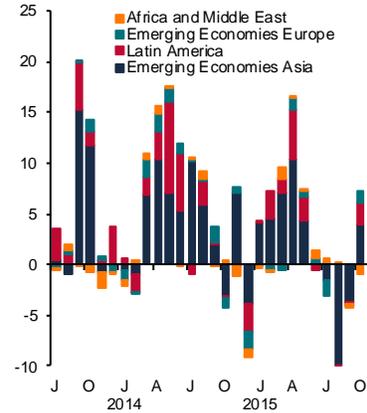
Figures as of October 2015
Source: Institute of International Finance

On top of the situation described before, there are additional effects from the international reallocation of capital and businesses carried out by large global financial intermediaries as a result of the implementation of higher capital and liquidity requirements. This situation, which is independent from monetary policy decisions in advanced countries, accentuates movements in capital flows, especially in economies perceived as bearing higher risk for having a relatively weaker macroeconomic framework or more severe structural problems.

As the onset of the normalization of the US monetary policy approaches, long-term interest rates in the US have spiked, although they dropped since July 2015 onwards (graph 8a). This, together with the fall in prices of oil and basic commodities, and fears over the Chinese slowdown have heightened volatility in emerging financial markets. For instance, the exchange market's volatility in Russia and Brazil reached an all-time high (graph 8b) in December 2014 and August 2015, and the same happened in the stock markets of Russia, Brazil and China (graph 8c).

**Graph 8**
**US Interest Rates and Volatility in Emerging Markets**

a) US 10-year Treasury Bond Yield
Percent
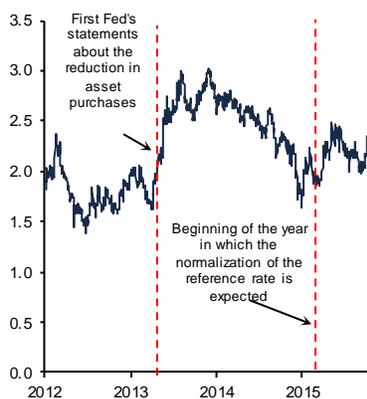
b) Volatility in the Exchange Rate *vis-à-vis* the US Dollar
30-day Implied volatility without units
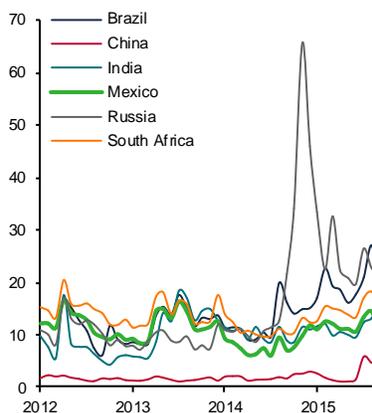
c) Volatility of Stock Indices
30-day Implied volatility without units

Figures as of November 13, 2015
Source: Bloomberg

Figures as of November 13, 2015
Source: Bloomberg
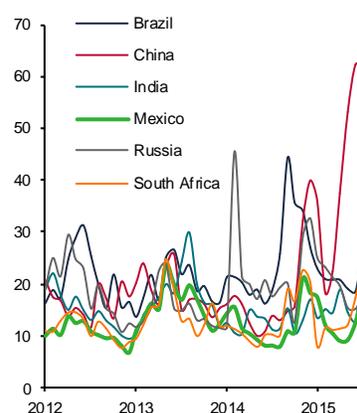
Figures as of November 13, 2015
Source: Bloomberg

To put the risk derived from the reversal of capital flows towards emerging economies into perspective, we must take into consideration that the flows composition has substantially changed over the last years. Indeed, the share of fixed income instruments is now far higher than that available before the financial crisis,[7] while the funds managed by non-banking institutions have also increased. As for the latter subject, the likelihood of severe volatility bouts is highlighted by the higher concentration and importance gained by the global asset management industry in international fund intermediation, especially in emerging markets.[8]

The global asset manager's portfolio recomposition may have significant impacts on emerging economies due to four key factors. First, due to the large size of funds relative to the size of the underlying asset market; second, since the performance of global funds is measured as a function of relative returns that are compared between them, there are incentives to sell assets right when other global funds are selling them too. Third, because the potential of contagion across different asset classes has increased due to the increasing importance of investment in asset portfolios from emerging countries, such as the ETFs.[9] And fourth, due to managers'

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[7] An estimate of the fixed income to equity securities ratio of accumulated capital flows to emerging economies shows that it has more than tripled since the last international financial crisis. (Graph 7a shows an estimation of this ratio, which went from 21.4 percent in September 2008 to 72.4 percent in July 2015).

[8] By the end of 2014, the five largest global asset managers administered 18.5 percent of total assets managed by the major 500 companies, whereas the 20 largest administered 41.6 percent thereof (78.1 trillion dollars in total). By the end of 2013, the corresponding figures were 18.3 and 41.0 percent (76.4 trillion dollars in total). Source: Towers Watson (2015): *The World's 500 Largest Asset Managers (Year end 2014)*.

[9] When selling a contributable fund, its manager is obliged to sell different investment assets that are part of their portfolio.

incentives to settle their positions before greater falls in prices take place, and investors' incentives to exit their positions before they are no longer able to do so (especially under extreme circumstances when the amount of liquid assets would be depleted). It is important to bear in mind that, in scenarios of rising interest rates, leverage funds always face higher pressure to be sold in a timely manner.

Other risk factors to financial stability in emerging economies have gained importance in recent years; namely, the higher proportion of local currency denominated government bonds in hands of foreign investors and the increase in foreign currency denominated debt issued by local non-financial companies. About the former factor, the International Monetary Fund has pointed out that the depreciation of local currencies *vis-à-vis* the US dollar might lift refinancing risks for countries where the foreigners share in the local currency denominated debt market is substantial and the base of local investors is insufficient to absorb such funds.[10]

About the second factor, the total amount of non-financial companies' corporate bonds in emerging economies had an approximate fivefold increase from 2008 to 2014. As a result, the amount of debt of the non-financial corporate sector in such economies went, on average, from 49 to 74 percent of GDP in the referred period. Furthermore, since nearly a third of bond issuances is denominated in US dollars, the higher interest rates in such currency and the generalized appreciation of the US dollar may make it difficult for some issuing companies to serve and refinance their debt.[11]

To summarize, the large amount of capital flows that entered emerging economies, along with the higher relative share of domestic public and foreign private debt, the concentration and the increasing share of global asset managers in the intermediation of funds towards emerging economies and the higher share of foreign investors in local currency denominated debt markets, have increased the vulnerabilities of the financial systems in emerging economies, especially in the face of possible changes in US dollar interest rates. All these factors could magnify the effects of increases in US interest rates on the price of assets from emerging economies, particularly on both the exchange rate and interest rates. This could also affect the financial positions of governments, financial intermediaries and non-financial companies that during the period of low foreign interest rates increased their leverage and their exposure to market, exchange and liquidity risks.

The broad liquidity that prevailed in international financial markets allowed both the private and public sectors in Mexico to tap foreign funds under highly favorable circumstances. The same happened in other emerging economies. Nevertheless, as mentioned before,

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[10]  See International Monetary Fund, *Global Financial Stability Report,* April 2015 (p. 43).

[11]  See International Monetary Fund, *Global Financial Stability Report,* October 2015 (p. 83).

these capital flows have also increased the vulnerabilities of the domestic economy to possible foreign shocks.

It is worth mentioning that, in recent years, a high correlation has been observed between capital inflows and the cyclical component of financing to the non-financial private sector.[12] This suggests that such financing could be widely influenced by changes in the availability of foreign financial funds. According to results from Granger causality tests, causality has moved from net capital flows to the cyclical component of total financing to the non-financial private sector (graph 9).[13] This is why a reversal of capital flows may entail the shrinkage of financing to the private sector and hence hamper economic activity.

**Graph 9**
**Net Capital Flows and Financial Cycle in Mexico**
Millions of dollars
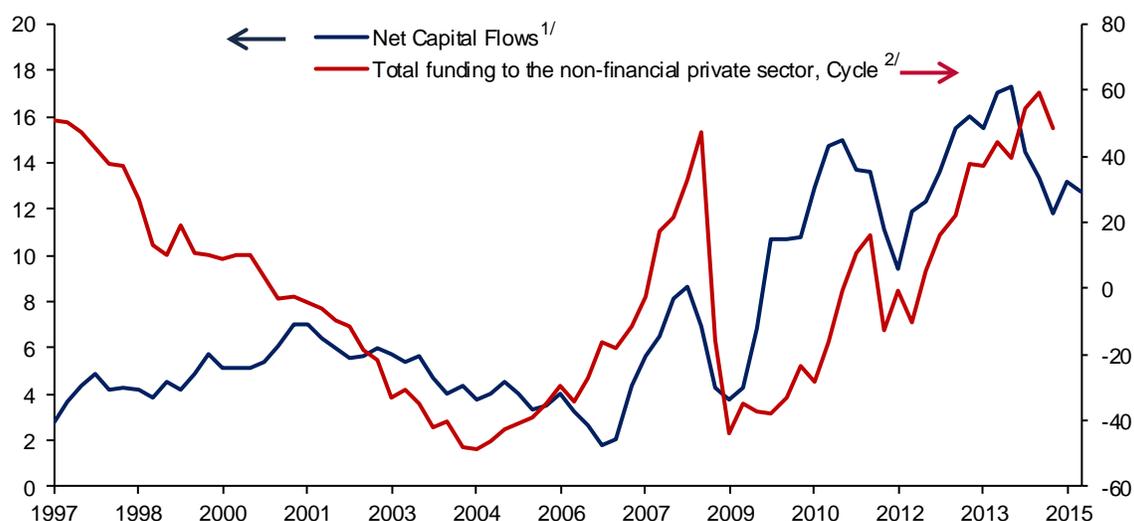


Original figures as of the second quarter of 2015
Source: Banco de México and own calculations
1/ Net capital flows were deseasonalized using a centered moving average of order 4 (quarterly data).
2/ The cyclical component of loans was obtained by applying a two-tailed HP filter. A signal-to-noise ratio equal to 400 000 was used, as traditionally advised for quarterly disaggregated financial variables.

As mentioned before, the normalization process of the Fed's monetary policy could lead global investors to adjust their portfolios. Should this process occur in a disorderly manner, it would have a significant impact on the exchange rate and USD and MXN interest rates, and thus, in financing conditions for the domestic public and

[12] Total financing to the non-financial private sector includes foreign and domestic financing, both via financial intermediaries and debt markets.

[13] Under the null hypothesis of Granger causality tests, there is an absence of temporary causality between variables, which does not necessarily rules out other causality concepts. In particular, in such tests, the concept of causality is defined in statistical terms, that is, a variable A causes a variable B if variations in A are a meaningful source of information to forecast future movements in variable B.

private sectors. In fact, during the past years, international events of different type have triggered periods of higher stress in Mexican financial markets with the above mentioned features (graph 10).

**Graph 10**
**Mexican Stress Index**

**Financial Markets Stress Index (FMSI) and its components[1]**
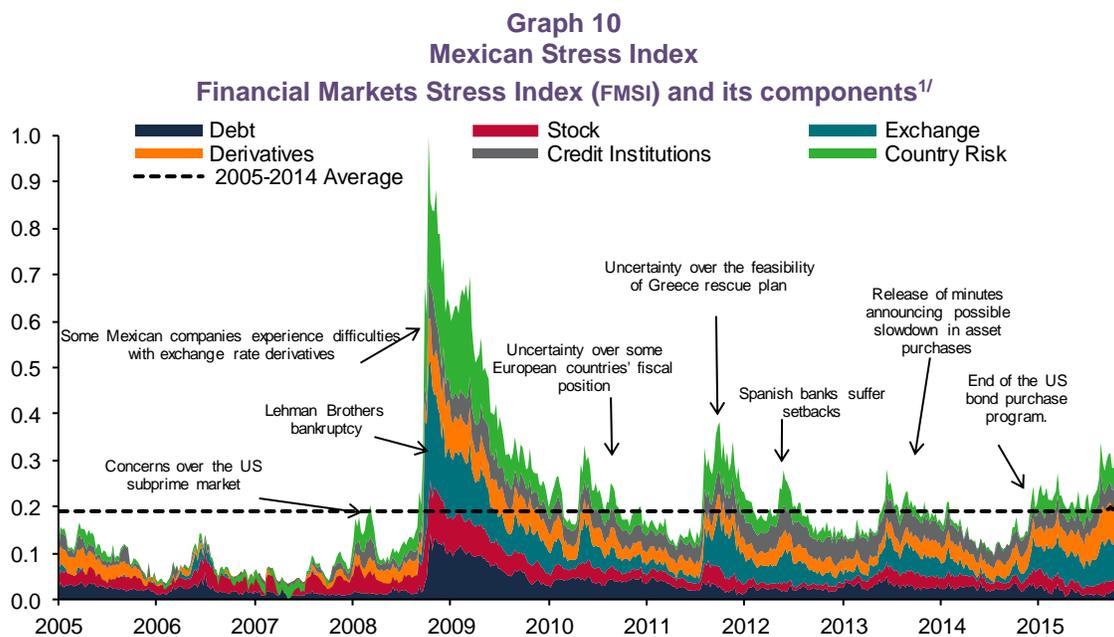


Figures as of November 12, 2015
Source: Banco de México
1/ The sum of components results in the [0,1] scaled FMSI. Even though the components are not independent from each other, they were categorized on the basis of the main factor affecting them. The index was computed using the principal component methodology explained in box 2 in the *Financial System Report September 2013*.

In order to weigh the impact on the public sector of a potential volatility hike in international financial markets, its increasing dependence on foreign financing (both in US dollars and in Mexican pesos) should be considered (graph 11). Although large benefits for domestic public finances have stemmed from the broadening and diversification of the investor base, under the current international environment, the swift increase in foreign investors' share might heighten the financial system's vulnerabilities. In any case, it is worth mentioning that the foreigners' share has remained relatively constant over the last years, despite the presence of volatility in international financial markets.

**Graph 11**
**Indicators for Non-Residents' Share in Public Debt**

a) Gross External Debt of the Federal Public Sector

b) Local Currency Denominated Debt in Hands of Non-Residents[1]

c) Holdings of Local Currency Denominated Government Securities by Non-Residents

Percentage of GDP

Percentage of GDP

Percentage of total outstanding amount
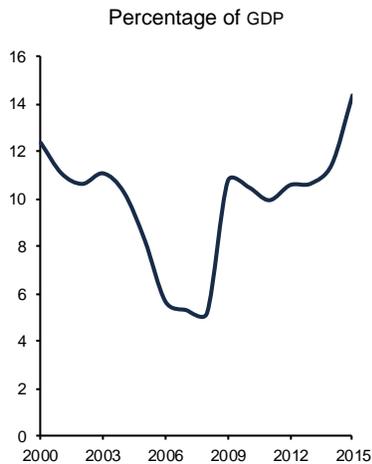


The figure for 2015 corresponds to the debt balance as of September
Source: SHCP and INEGI
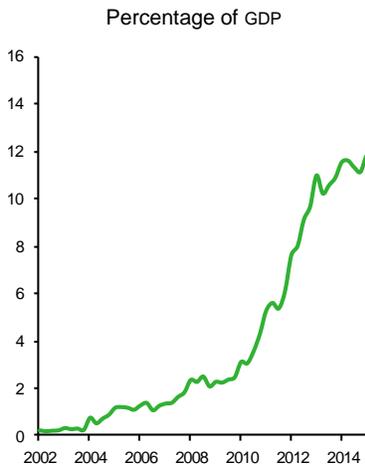
Figures as of the second quarter of 2015
Source: Banco de México (Balance of payments) e INEGI

Figures as of October 21, 2015
Source: Banco de México

1/ Corresponds to non-residents' holdings of Federal Treasury certificates (cetes), federal development bonds (bondes), fedederal development bonds with a fixed rate (bonos), federal development bonds denominated in investment units (udibonos), monetary regulation bonds (brems), and savings protection bonds (BPA y BPAT).

The aforementioned vulnerabilities provide a rationale for analyzing the factors that may have a significant impact on foreign capital outflows; thus, the objective of the analysis is to weigh the likelihood of capital outflow occurrence and asses the relative importance of the factors that may explain it. In order to comply with this objective, an econometric exercise was carried out with the dual purpose of identifying significant explanatory factors of foreign capital outflows (box 2) and estimating the likelihood of its occurrence.

The exercise suggests that the estimated outflow probability seems to be a good predictor for ex post registered flows (graph 12). The results also indicate that the most influential factor in such probability is the 10-year US interest rate (graph 13). Other factors that may influence the outflow probability are the exchange rate implied volatility and the *VIX*[14]; in contrast, increases in the Mexican oil mix lower such probability.

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[14]  The *VIX* is an index that measures market expectations of expected volatility for the S&P 500 over the next 30 days. The index is computed and published by the Chicago Board Options Exchange (CBOE) and is based on implied volatilities available from option quotes of the S&P 500.

**Graph 12**

**Probability of Capital Outflow in the Subsequent Week and Ex Post Registered Flow**

Left axis: millions of dollars

Right axis: percent
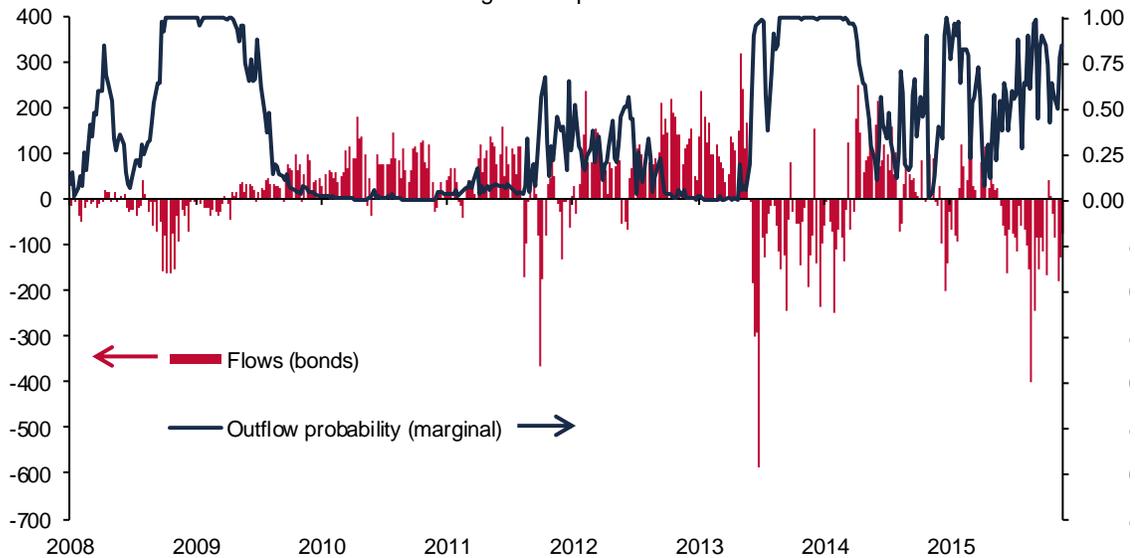


Figures as of November 25, 2015

Source: Banco de México, EPFR Global and Bloomberg

**Graph 13**

**Contribution of Different Variables to Capital Outflow Probability**

Percent
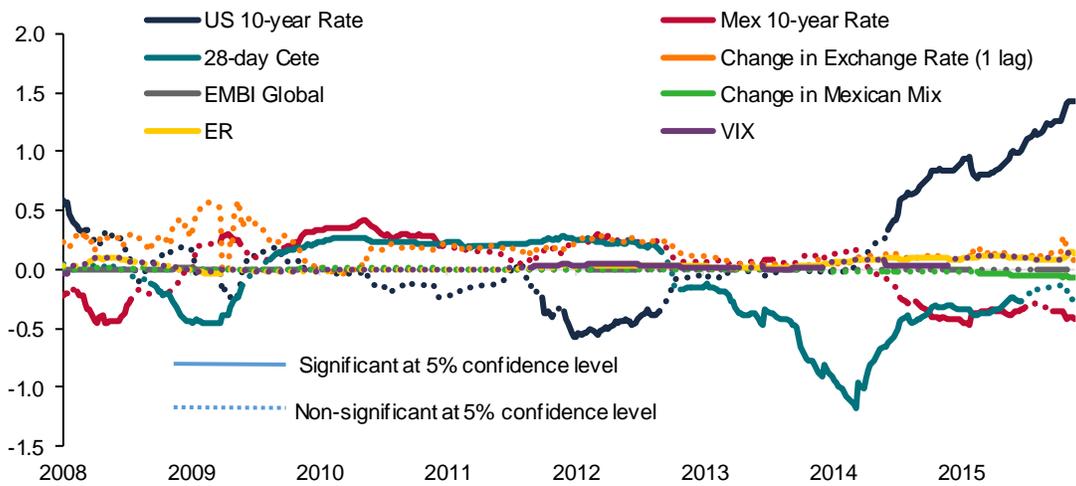


Figures as of November 25, 2015

Source: Banco de México, EPFR Global and Bloomberg

Last, some components of the new international regulation could also be curbing financial intermediaries' risk taking. In Mexico, there has been a decline in holdings of government securities for trading purposes, especially by subsidiaries of foreign banks. The average amount per transaction of government securities has also declined.

**Box 2**

### Probability Model for Capital Outflows

High liquidity in international financial markets and very low interest rates are some of the effects of monetary policy decisions taken by central banks in advanced countries. Under these circumstances, savers have looked for investment alternatives such as instruments with higher expected returns, which were available in emerging markets.

For the emerging markets that have become the target of such investments, a capital exodus might potentially generate adverse effects, especially if such outflows occur in an abrupt and unexpected way. In this context, it is useful to have an indicator that measures the probability of capital outflows.

From a qualitative perspective, capital outflows can be considered as the result of a binary event (occurring or not occurring).This naturally leads to select a discrete choice model to estimate the probability of a capital outflow.[1] These models are used when the dependent variable (response variable) is a random variable that may accept a finite number of values (2 in this case), and the objective is to explain the probability of response when the explanatory variables take different values.

In other words, we attempt to explain $p(x) = P(y = 1/x) = P(y=1/x_1, x_2, ...x_k)$, where $x_1, x_2, ...x_k$ are the explanatory variables and $y$ is the response variable, which in this case takes the value of 1 if there is a capital outflow and 0 otherwise.

A common strategy to model this kind of responses is to assume that there is a latent unobservable variable $y^*$, which is a linear function of explanatory variables plus a random variable that follows a standard normal distribution, and has a direct relationship with the response variable. That is, when the latent variable is positive, the response variable is equal to 1, and when it is negative, the response variable is 0:

$P(y=1/x) = P(y^*>0) = P(x\beta+\varepsilon > 0) = 1 - \Phi(-x\beta) = \Phi(x\beta)$,

where $\Phi$ is the standard normal distribution function. This is a *probit* model.

A probit model was used to estimate the probability of a capital outflow, for which the capital outflow event was defined as 1 and the capital inflow event as 0. Data publicly available from capital flows published by EPFR Global were used to define this dichotomous outcome.

It is important to clarify that the model allows the estimation of the capital outflow probability but not its amount. Hence, the following model was used to estimate the probability that an exit of foreign investors in Mexican debt would occur in the subsequent week:

$$P(y_{t+1} = 1/x) = \Phi(x_t\beta_t),$$

with:

$$x\beta = \beta_0 + \beta_1 BonMX10y + \beta_2 BonUS10y + \beta_3 R_{MX}1M + \beta_4 VIX + \beta_5 VolImpTC + \beta_6 \Delta Prec.Petróleo + \beta_7 \Delta TC_{-1}.$$

where $\Phi$ is the standard normal distribution function and the variables used in the analysis are: 10-year bond yields in Mexico and the US (*BonMX10y* and *BonUS10y*), the one-month rate in Mexico ($R_{MX}1M$), the VIX (*VIX*), the implied volatility of the MXN/USD (*VolImpTC*), the change in the Mexican oil mix price ($\Delta Prec.Petróleo$) and the weekly change in the lagged exchange rate ($\Delta TC_{-1}$).

The model was estimated with weekly data in 4-year windows (208 weeks), with a view to taking into account changes in the state of the economy. The highest pseudo-$R^2$ of the model was 0.48 in 2015, and the area under the ROC curve of the same model was 0.92.

If we were to analyze the marginal effect of each variable, it is worth clarifying that in the probit model, coefficients do not have a direct interpretation (just as in linear regression models, for instance). This is because the coefficients reflect a latent variable's dependence on explanatory variables; hence, they should be interpreted via partial effects. Partial effects are calculated as the change in probability when a variable changes. For example, when the variable $x_i$ changes, the partial effect would be:

$$Partial\ Effect = \delta \Phi(x\beta)/\delta x_i = \beta_i \phi(x\beta).$$

where $\phi$ is the density function of the standard normal distribution.

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[1] For instance, see Jeffrey M. Wooldridge: *Econometric Analysis of Cross Section and Panel Data*, Cambridge, Mass: MIT Press (2002).

### 2.3. Risks Related to Contagion from Other Emerging Economies

Contagion from other emerging economies represents another external risk for Mexico. Contagion among economies during financial crises has been a recurrent phenomenon in the last decades. Contagion can take place when a shock is transmitted from one country to another, even when there are no explicit links such as direct trade, bank loans or other investment flows. During this type of contagion, the extreme joint movement of financial variables does not depend on macro fundamentals but on investors' behavior.

When a country is struck by a shock, liquidity restrictions may force investors to withdraw funds from other countries. The growing importance of global asset managers exacerbates the probability of contagion. Global asset managers represent an agency problem, because the financial transactions that they repeatedly undertake are carried out to minimize losses and not necessarily to maximize the returns of the investors, who are the funds' owners (principals).[15] Managers in charge of taking portfolio decisions have been delegated to do so by capital owners. This problem is partially solved by comparing the performance of said investors. As it is in nobody's interest to be ranked in the bottom, given the corresponding costs, their decision-making tends to follow a gregarious pattern. Hence, in case portfolio reconfigurations exert a significant impact on interest rates, then their behavior could magnify the problem. A recent study by Banco de México gives evidence that suggests that capital inflows and outflows in emerging economies may register gregarious patterns.[16]

The size of these events could also depend on the financial features of the analyzed economy. Another factor that may influence and increase the probability of contagion is that Mexican financial markets could be increasingly used to hedge inherent risks related to other emerging markets.

With the purpose of assessing the risk of contagion from other emerging economies, we present below the results of a statistical analysis to evaluate the likelihood of an adverse scenario simultaneously affecting Mexico and other emerging economies. In other words, we analyze a situation where market participants are not able to distinguish among emerging economies, or where any given shock could trigger contagion between them.[17]

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[15] Agency problems or principal-agent problems have been widely studied in economic literature. They occur when the owner of an asset (principal) delegates some tasks to a manager (agent) and their incentives are not aligned. In such case, results tend to be inefficient as the agent does not necessarily obtain the results which are most beneficial to the principal.

[16] See Manuel Ramos-Francia and Santiago García-Verdú: "Is Trouble Brewing for EMEs?", *Banco de México*, April 2015, Research Paper No. 2015-08.

[17] See Kristin Forbes: "The 'Big C': Identifying Contagion", *National Bureau of Economic Research*, 2012, Working Paper No. 18465.

Although this statistical exercise does not allow to establish a causal relationship between the occurrence of extreme events in different countries, it turns out to be helpful to assess the probability of simultaneous occurrence of a one-tailed event affecting Mexico and another emerging economy. For that purpose, an indicator capable of measuring tail dependence between two variables was used. As explained in box 3, the probability of contagion is computed by an indicator that measures asymptotic dependence. This is because the extreme values of two variables may simultaneously occur only when two variables are asymptotically dependent. Additionally, a tail-dependence indicator is more adequate to measure the probability of contagion than a correlation coefficient. The reason for this is that the latter only measures average linear dependence, and hence is not capable of adequately measuring extreme simultaneous events that typically occur in times of crisis or high volatility.

This distinction is relevant as the correlation coefficient has already been used in the past to try to measure contagion across economies. Yet, when volatility hikes in the financial variables of any given country are registered, then the correlation with other countries may increase, without contagion changes being necessarily intensified.[18] Therefore, it was deemed appropriate to use the multivariate theory of extreme values to explore whether extreme changes in financial variables were tail correlated.

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[18] See Forbes, Kristin J. and Roberto Rigobon: "No Contagion, Only Interdependence: Measuring Stock Market Comovements," *Journal of Finance*, 2002, v57(5,Oct), 2223-2261 (2001).

<div align="center">**Box 3**</div>

<div align="center">**Another Form of Financial Contagion Among Emerging Countries**</div>

Financial crises are characterized by extreme events simultaneously materializing, such as substantial changes in investment returns, stock market crashes, large losses in intermediaries' balances due to simultaneous defaults or price plunges of risky assets. Extreme or atypical events in the financial field appear in the tail of the probability distribution and have a direct impact on the magnitude of all statistical moments.

The analysis of tail dependence of a joint distribution is a tool that may provide relevant information about the level of systemic risk. This type of dependence take the form of extreme simultaneous observations, as is the case under financial stress conditions. This analysis is also useful to estimate the probability of contagion between asset prices, among financial institutions or even across countries.

In essence, the study of tail-dependence via the correlation of extreme events provides information about the probability of occurrence of these events in a joint manner. This technique is particularly useful because of the fact that traditional correlation measures, such as the Pearson correlation coefficient, have severe limitations. In particular, since this coefficient exclusively measures linear dependence, it is usually dominated by observations around the mean, and it may fully measure adequately the dependence relation only in the case of a multivariate Gaussian distribution.

The basic dependence structure between two variables can be classified in four types: independence, asymptotic independence, perfect dependence and asymptotic dependence.[1] Variables with a positive relationship and asymptotic dependence will have simultaneous extreme observations more frequently than if they were independent. Hence, for any pair of variables, when the first tends to its upper limit, then the probability that the second also reaches its upper limit tends to zero will happen only when the two variables are asymptotically independent. In contrast, the variable will tend to a limit other than zero when the two variables are asymptotically dependent. As a consequence, extreme values may simultaneously occur only when the variables are asymptotically dependent.

For the purposes of studying multivariate dependence, it is convenient to transform data to a common marginal distribution that exclusively captures aspects related to the dependence structure. Thus, for any pair of time series, the Fréchet marginals $(X, Y) \rightarrow (S, T)$[2] may be employed:

$$S = -1 / \log F_x(X) \quad \text{y} \quad T = -1 / \log F_y(Y),$$

where $F_X$ and $F_Y$ are the marginal distributions of $X$ and $Y$, respectively. It is noteworthy that $S$ and $T$ have the same dependence structure as $X$ and $Y$. Hence, $S$ and $T$ are asymptotically independent if $P(q)$ tends to zero when $q$ tends to 1. If the limit is not zero, it is then said that $S$ and $T$ are asymptotically dependent, where $P(q)$ is:

$$x = \lim_{q \to 1} P(q)$$
$$= \lim_{s \to \infty} Pr(T > s \, / \, S > s)$$
$$= \lim_{s \to \infty} \frac{Pr(T > s \, , \, S > s)}{Pr(S > s)}.$$

Further, $S$ and $T$ will be asymptotically dependent if $x > 0$ and perfectly dependent if $x = 1$. As a consequence, if $x > 0$, then $S$ and $T$ will be asymptotically independent. A supplementary indicator that may be used to measure the degree of extreme dependence for asymptotically independent variables is: [3]

$$\bar{x} = \lim_{s \to \infty} \frac{2 \log Pr(S > s)}{\log Pr(S > s, T > s)} - 1,$$

where $-1 < \bar{x} < 1$. The variable $\bar{x}$ is the ratio at which $Pr(T > s / S > s)$ approaches zero. With perfect dependence, $Pr(T > s / S > s) = Pr(S > s)$ and $\bar{x} = 1$. With independence, $Pr(T > s / S > s) = Pr(S > s)^2$ and $\bar{x} = 0$. It is possible to estimate this value non-parametrically.

Using these results, it is possible to estimate the likelihood of joint occurrence of tail events for any given pair of financial series with sufficient historical information. Also, it is possible to determine whether this occurrence is statistically significant. For the specific case of countries, this indicator allows to determine the probability of contagion in the face of extreme events either in the stock market or other financial markets, or even in the country risk perception.

Similarly, this methodology also enables the measurement, with a certain degree of statistical confidence, of the extent of differentiation between economies in light of external extreme events or even a crisis: the economies that display asymptotic dependence have a higher probability of being simultaneously affected by the same events than those that do not present such dependence.

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[1] See Ser-Huang Poon et al: "Extreme Value Dependence in financial markets: Diagnostics, models and financial implications." *The Review of Financial Studies*, 17-2, pp 581-610 (2004).
[2] This transformation eliminates the influence of marginal distributions on the estimator calculation and, since it is monotonically increasing, it does not have an impact on data order and neither on the dependence estimator. The features of this transformation and the Sklar theorem ensure that the tail dependence relationship will be preserved.
[3] See Ledford, A. and J.A. Twan: "Statistics for Near Independence in Multivariate Extreme Values," *Biometrika*, 83, pp 197-215 (1996).

Two main results were obtained from the contagion analysis. First, with price information of credit default swaps (CDS)[19] during the months following the international financial crisis, the spreads between the probability of occurrence of extreme events (degree of asymptotic dependence) in Mexico and advanced economies as a group and that between Mexico and the emerging economies group have been increasing throughout time. Nevertheless, since 2013, a decline in the probability of simultaneous adverse effects in Mexico and the emerging economies group has been observed. This probability has remained relatively low and is not statistically significant for the case of advanced economies (graph 14).

**Graph 14**
**Tail Dependence for Sovereign Risk Market Indicators between Mexico and Emerging and Developed Countries[1/]**
Percent
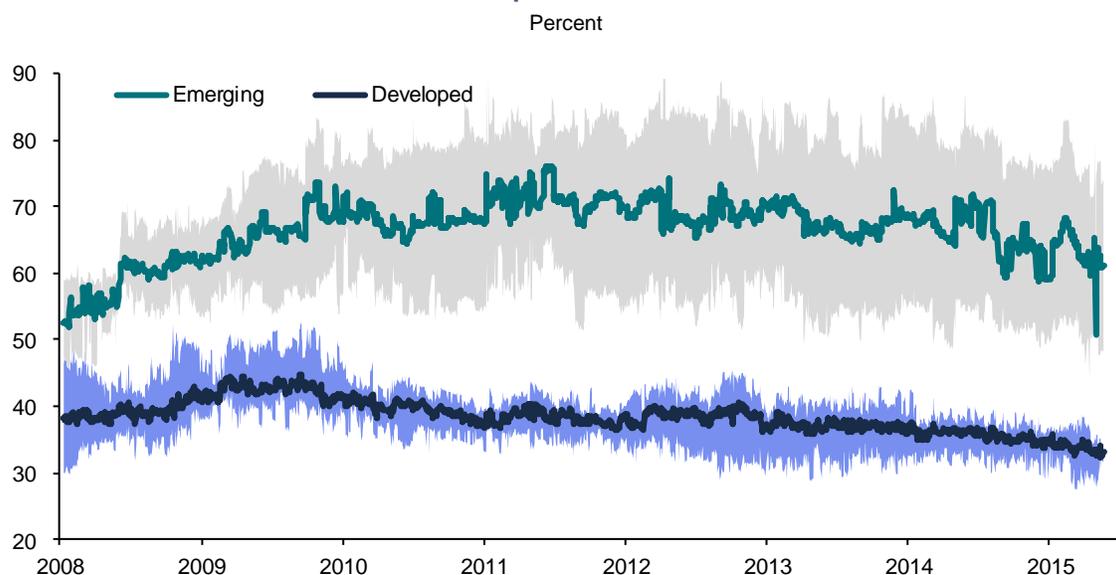


Figures as of October 20, 2015
Source: Own estimates with Markit figures
1/ Emerging countries: Brazil, Russia, Turkey and Colombia. Developed countries: Germany, Spain, Italy, Portugal and the US.

Second, an asymptotic dependence analysis between a stress index for Mexico[20] and other countries revealed that dependence has become statistically significant for Brazil and Indonesia. In addition, this dependence is statistically significant over a long period for Mexico and Chile, Peru and Turkey. The dependence relationship between Mexico and Russia ceased to be significant until very recently (graph 15). For the cases of Thailand, Poland and Colombia, no asymptotic dependence with Mexico was found.

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[19]  The Credit Default Swaps (CDS) market provides an alternative to hedge specific credit risks. It also offers the possibility to speculate with reference entities credit quality. This market has gained importance in recent years; as of June 2015, its notional current value was 14.6 trillion dollars. The price of CDS includes the seller's potential default.

[20]  See *Financial System Report 2014*. The version employed for this exercise is an abridged version of the IESF; see also Cyn-Young Park and Rogelio V. Mercado: "Determinants of financial stress in emerging market economies," *Journal of Banking & Finance*, Elsevier, vol. 45(C), pages 199-224 (2014).

**Graph 15**
**Stress Index Asymptotic Dependence[1]**
**Probability of a Simultaneous Extreme Event in Mexico and Selected Countries**
Percent
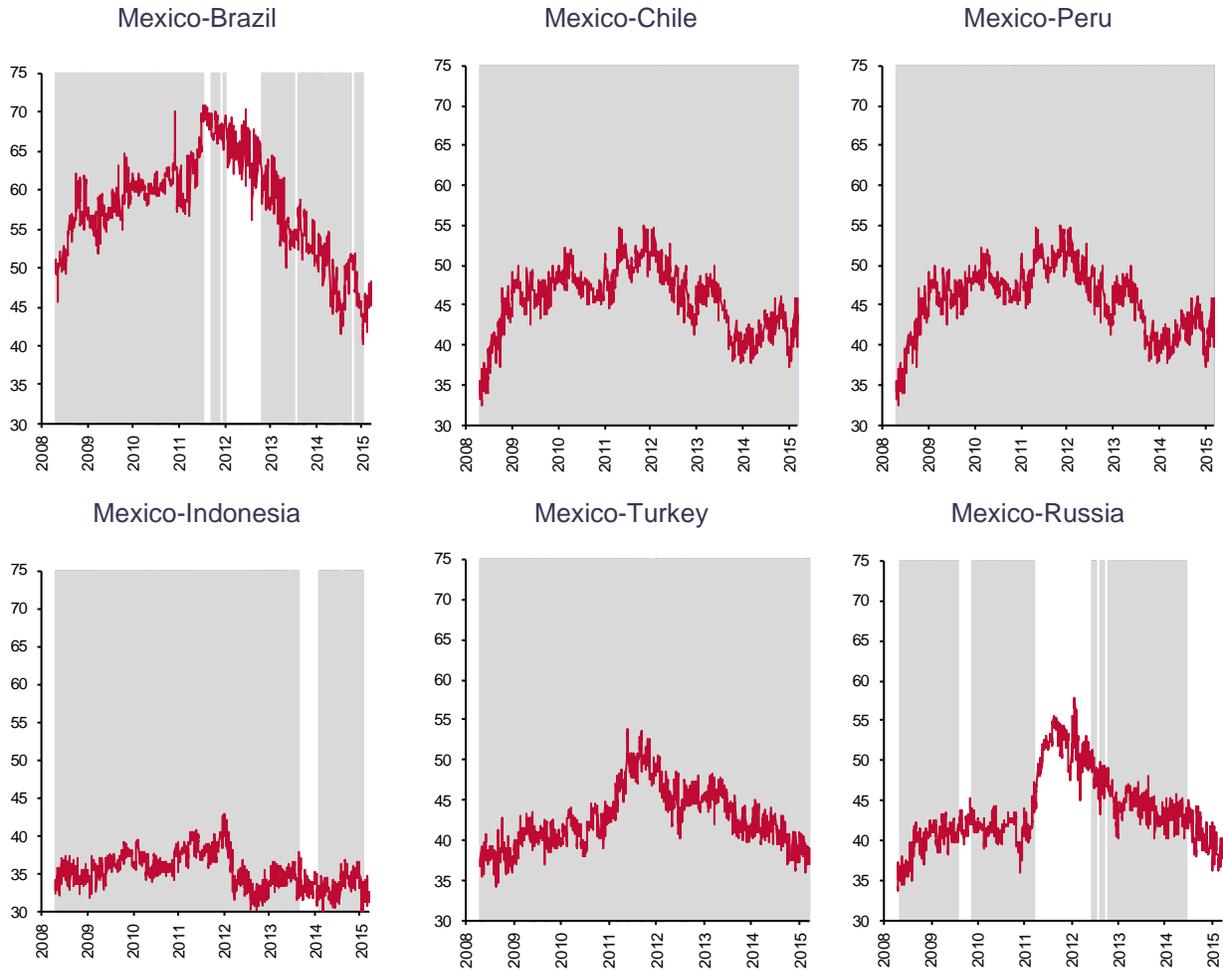


Figures as of October 22, 2015
Source: Own calculations with Markit and Bloomberg figures
1/ Asymptotic dependence was calculated using the spread between stress indices as input. The shaded area indicates that the
probability is statistically significant.

This contagion analysis is also useful to highlight that Mexico should maintain its ability to stand out under stress circumstances in the emerging world. In order to assess this ability and its evolution in recent years, a comparative analysis of macro-financial variables between emerging economies was carried out. Some of these variables are used as vulnerability indicators for early warning exercises. The variables can be classified into four groups: economic, public finance, external sector and international financial indicators. The nine emerging economies that have accumulated the highest capital inflow levels since 2009 were included in the analysis along with Colombia which occupies the thirteenth position (table 1).[21]

**Table 1**
**Cumulative Capital Flows Towards Selected Emerging Economies[1]**
Millions of dollars

| | Country[2] | Shares | Bonds | Total |
|---|---|---|---|---|
| 1 | South Korea | 23,336 | 7,843 | 31,179 |
| 2 | India | 21,883 | 8,008 | 29,890 |
| 3 | Brazil | 12,427 | 4,888 | 17,316 |
| 4 | South Africa | 9,466 | 6,962 | 16,429 |
| 5 | Russia | 4,342 | 10,492 | 14,833 |
| 6 | Indonesia | 4,550 | 9,592 | 14,143 |
| 7 | **Mexico** | **-2,033** | **15,943** | **13,911** |
| 8 | Turkey | 3,115 | 5,430 | 8,545 |
| 9 | Poland | -965 | 8,946 | 7,981 |
| 13 | Colombia | 847 | 4,732 | 5,579 |
| | United States | -171,833 | 858,288 | 686,455 |

Monthly figures as of August 31, 2015
Source: EPFR Global
1/ Accumulated since January 1, 2009
2/ The US were included at the end as a reference.

In terms of basic economic indicators, Mexico continues to differentiate itself from other emerging economies. Despite the strengthening of the US dollar and the ensuing depreciation of most emerging currencies, Mexico stands out for keeping its inflation low and stable (graph 16a). Further, in spite of global economic weakness, Mexico has achieved positive economic growth, unlike some of the major emerging economies (graph 16b). Regarding the real effective exchange rate (weighed by trade level), the adjustment of the Mexican peso has been lower than that of the currencies of commodity exporting economies (energy, metal and agricultural products; graph 16c).

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[21] Due to its geographical proximity with Mexico and its relative similarity with the Mexican economy (oil exports), Colombia was included instead of Thailand, China and Malaysia which occupy the tenth, eleventh and twelfth positions in the above mentioned list, which along these lines was obtained from the IMF list of 24 countries considered as emerging economies.

**Graph 16**
**Economic Indicators**

a) Average Annual Inflation Rate[1/]

Annual percent change

b) Real GDP Growth Rate [1/]

Annual percent change

c) Real Effective Exchange Rate

Index (2010=100)



Figures as of October 2015
Source: IMF

Figures as of October 2015
Source: IMF

Figures as of October 2015
Source: JP Morgan, Haver Analytics

1/ Shaded areas correspond to *World Economic Outlook* forecasts, October 2015.
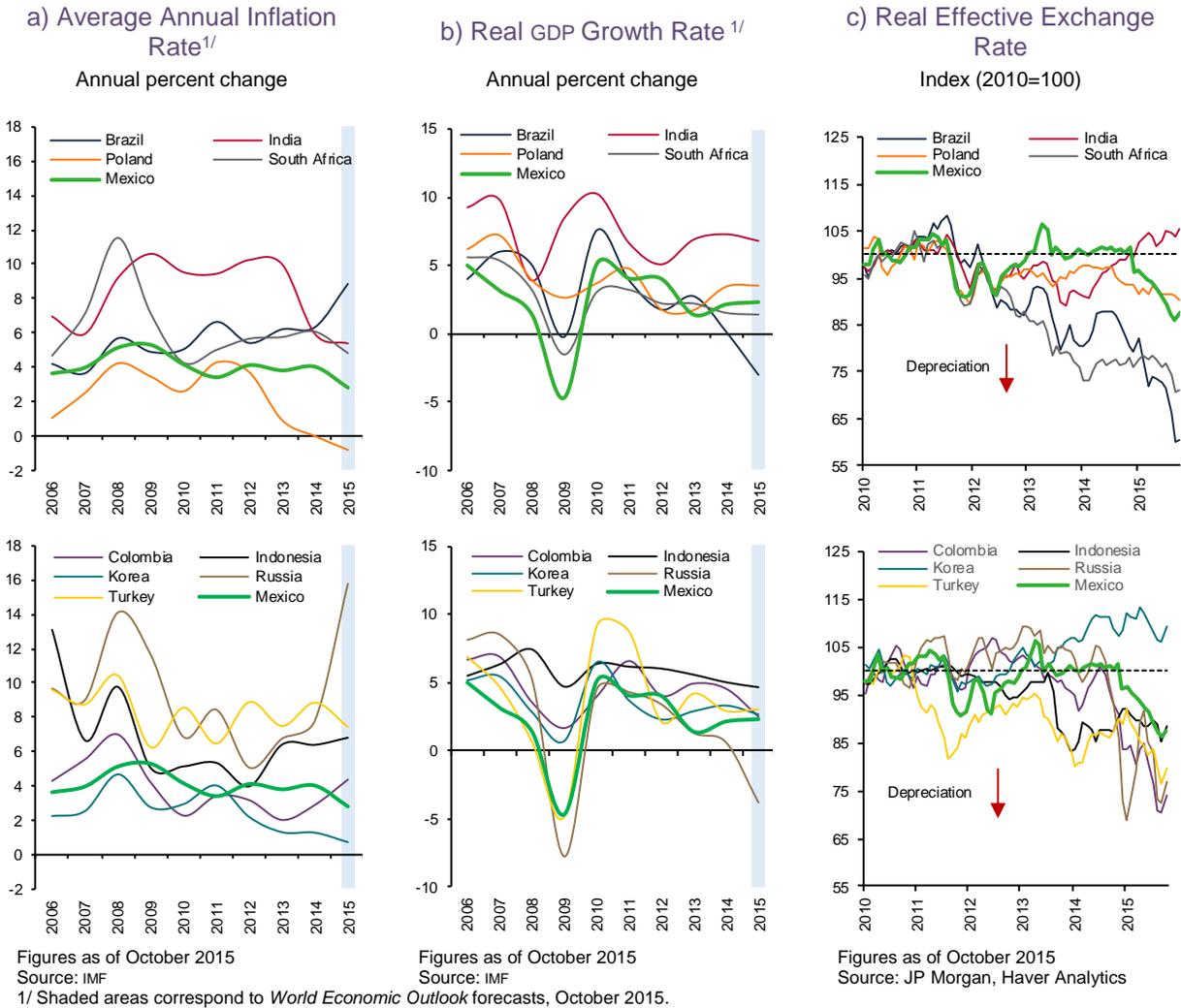
Public finance indicators, on their part, displayed a highly common pattern in emerging economies during the international financial crisis: there was a deterioration in the public balance of all countries (graph 17a) and nearly all saw their public debt grow in the aftermath of the crisis (graph 17b).[22] The Mexican public deficit and public debt followed a similar trend. Yet, unlike the majority of emerging countries, Mexico is expected to show a public balance improvement by the end of 2015. Further, although the public debt is expected to slightly grow by the end of the year, it is also expected to stabilize and remain at a manageable level in 2016. These public finance figures have made the Mexican long-term sovereign bond yield remain relatively low (graph 17c).

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[22]  India represents an exception thanks to their economic momentum. In particular, their initially high public debt-to-GDP ratio downtrended in the wake of the crisis, despite their relatively high public deficit. Turkey is another case where the public debt-to-GDP ratio also downtrended, but in this case it was mainly due to primary surpluses.

**Graph 17**
**Public Finance Indicators[1/]**

a) Public Balance

Percentage of GDP

b) Public Debt

Percentage of GDP

c) 10-year Sovereign Bond Yield

Percent



Figures as of October 2015
Source: IMF

Figures as of October 2015
Source: IMF

Figures as of November 30, 2015
Source: Bloomberg

1/ Shaded areas correspond to *World Economic Outlook* forecasts, October 2015.
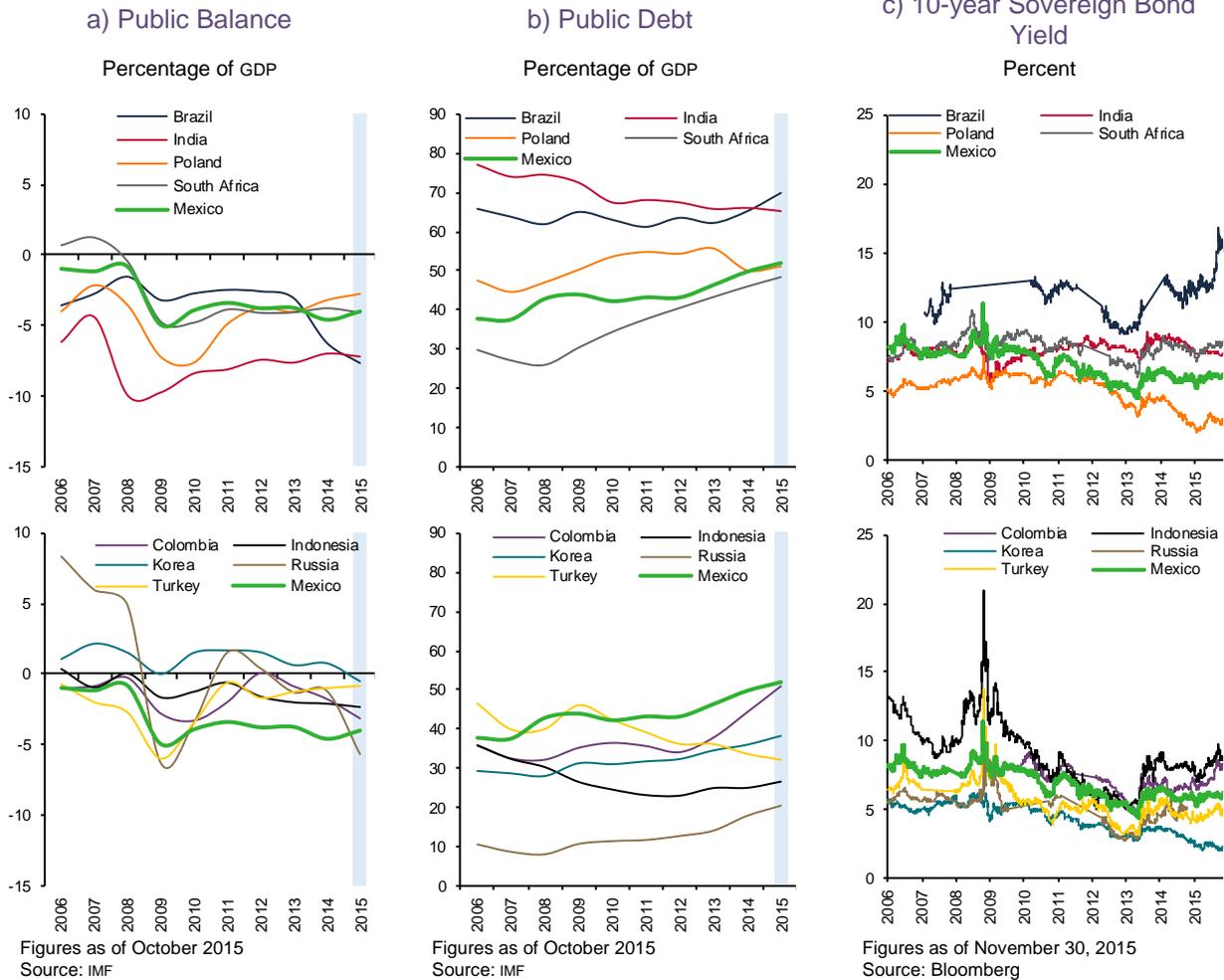
With regard to the external sector indicators, even though the Mexican current account deficit moderately grew during the period of analysis, when compared with other emerging economies, its level is still very low (graph 18a). The same can be said of the ratio of external debt to exports of goods and services, which despite a slight increase, is one of the lowest among the sample of analyzed countries (graph 18b).

Last, the international reserve coverage indicator for Mexico started to uptrend starting 2013, and its current amount doubles the sum of short-term external debt and current account deficit (graph 18c).

**Graph 18**
**External Sector Indicators**

a) Current account[1/]

Percentage of GDP

b) External Debt[2/]

Percentage of exports

c) Reserve Coverage[3/ 4/]

Percent



Figures as of October 2015
Source: IMF

Figures as of October 2015
Source: Own estimations with World Bank and IMF data.

Figures as of June 2015
Source: Own estimations with World Bank and IMF data.
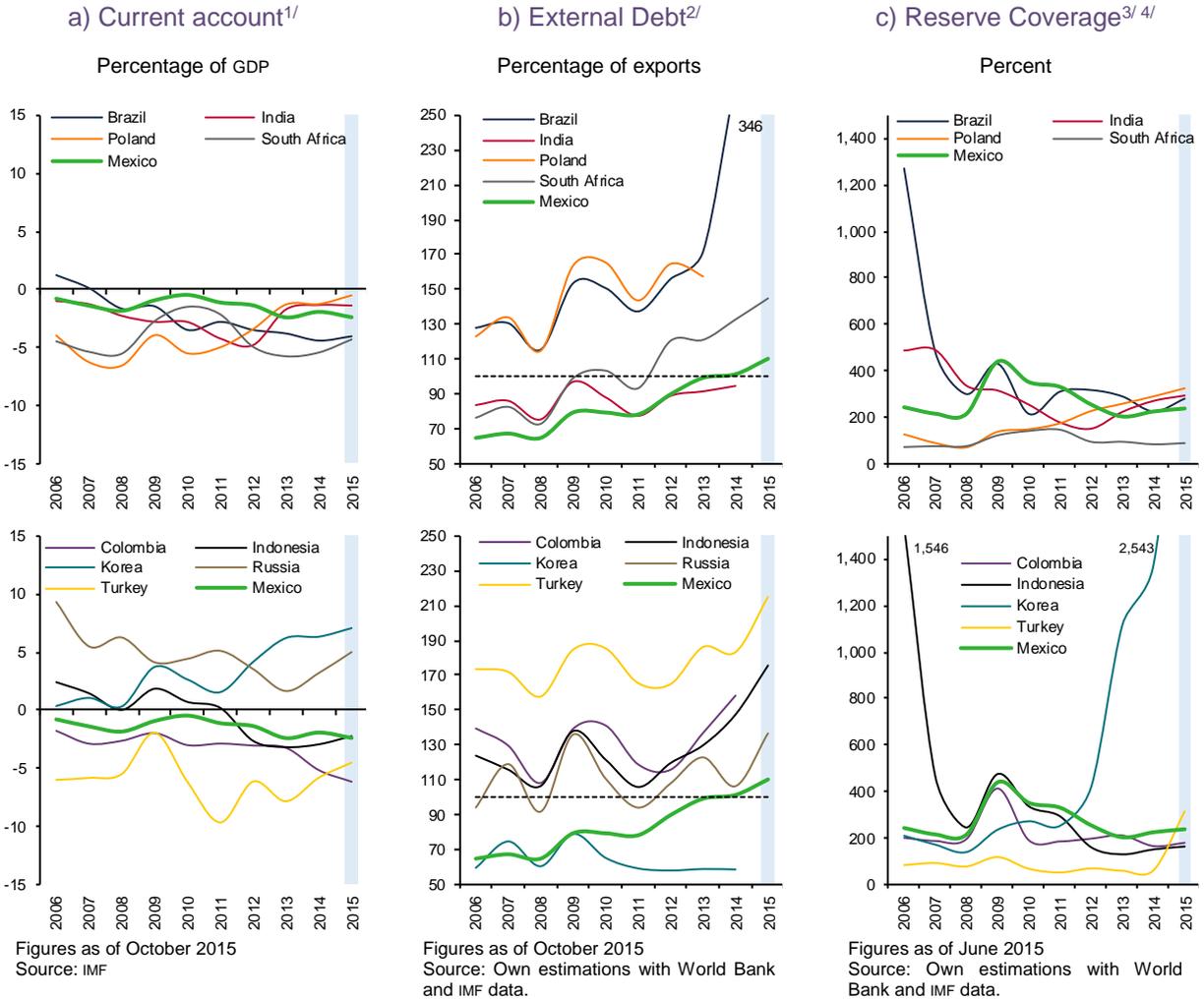
1/ Shaded areas correspond to *World Economic Outlook* forecasts, October 2015.
2/ Shaded areas correspond to the debt balance as of the second quarter of 2015, except for Russia whose figures correspond to the first quarter. Figures of *Exports of goods and services* are annualized and correspond to the first quarter of 2015.
3/ The *Reserve Coverage Indicator* is calculated as the value of international reserve assets (including the IMF flexible credit line) divided by short term debt minus the current account balance.
4/ The shaded areas correspond to the second quarter of 2015, except for India and Turkey whose figures correspond to the first quarter. In Russia, the current account surplus exceeds short term external debt. Hence, there is no amount to be covered by international reserves, according to the definition we are using.

As for international financial indicators, those related to capital flows suggest that after tapping significant funds for several years, emerging economies are experiencing a partial flow reversal since 2013 (graph 19a). The reversal took place during the volatility episode in international markets that resulted from the Fed announcement about the then near slowdown in the purchase of financial assets, which was part of their quantitative easing policy – which along these lines is being implemented to date in most countries.

Country risk indicators (graph 19b) and market indicators measuring sovereign default risk (graph 19c) registered an uptrend, although more moderate in Mexico. Even though the Mexican economy has recorded a partial reversal of the capital flows, as well as a slight uptrend in the country risk indicator and the sovereign default risk implied in financial asset prices, the levels of these two indicators are more favorable than those of most emerging economies.

**Graph 19**
**International Financial Indicators**

a) Cumulative Capital Flows

Millions of dollars
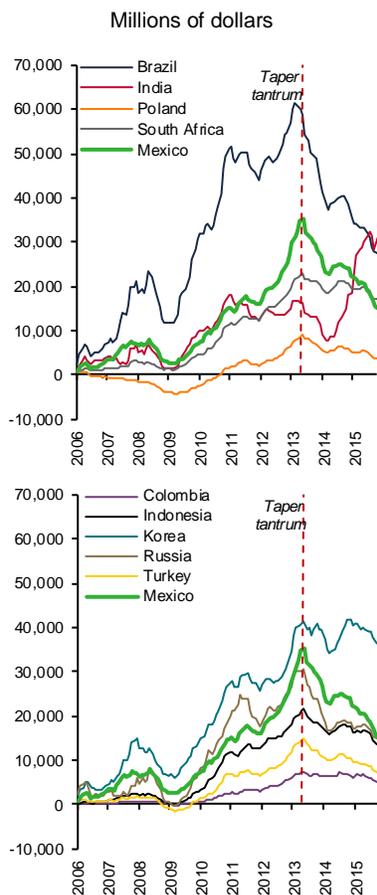
b) Sovereign Margin
(EMBI Global)

Basis points
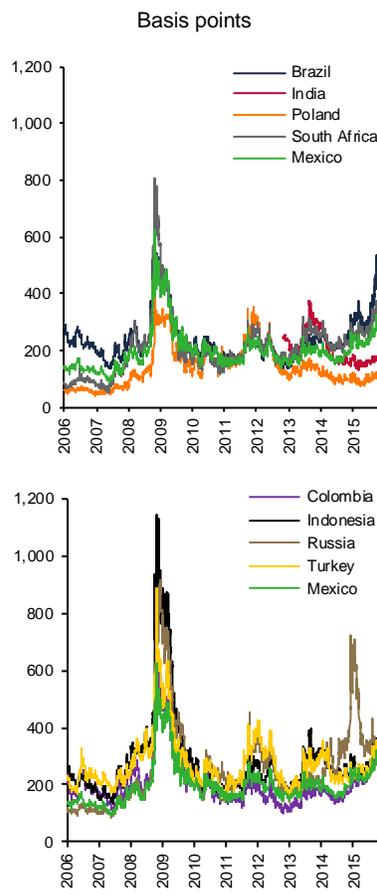
c) Sovereign Risk Market
Indicators
(5-year CDS)
Basis points



Figures as of October 2015
Source: Bloomberg

Figures as of November 27, 2015
Source: Bloomberg
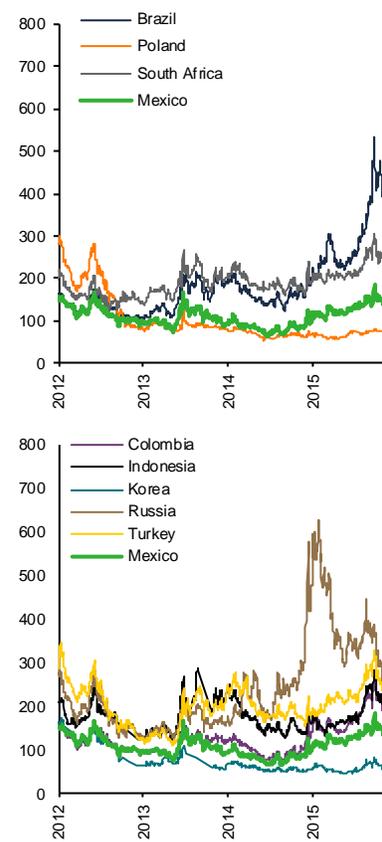
Figures as of November 30, 2015
Source: Bloomberg

It is worth stressing the particular importance of any given country's credit rating for investors' and global financial intermediaries' investment and business decisions. Indeed, the use of these ratings has potentialized their influence on the allocation of funds between countries. Nowadays, credit ratings have a direct impact on capital flows and financing costs for governments and private companies, and also determine the structure of regulatory costs of financial intermediaries. The latter, due to the sensitivity of regulation to risk perception and, above all, to assessment by specialized agencies. In

that sense, given their sound macroeconomic performance, South Korea, Poland and Mexico have stood out among the emerging economies that received greater capital flows in the wake of the global financial crisis. As a result, they have preserved their investment grade and, in certain cases, improved their rating, even in the face of an adverse international environment (graph 20).[23]

**Graph 20**
**Latest Changes in Standard & Poor's Sovereign Ratings[1/]**
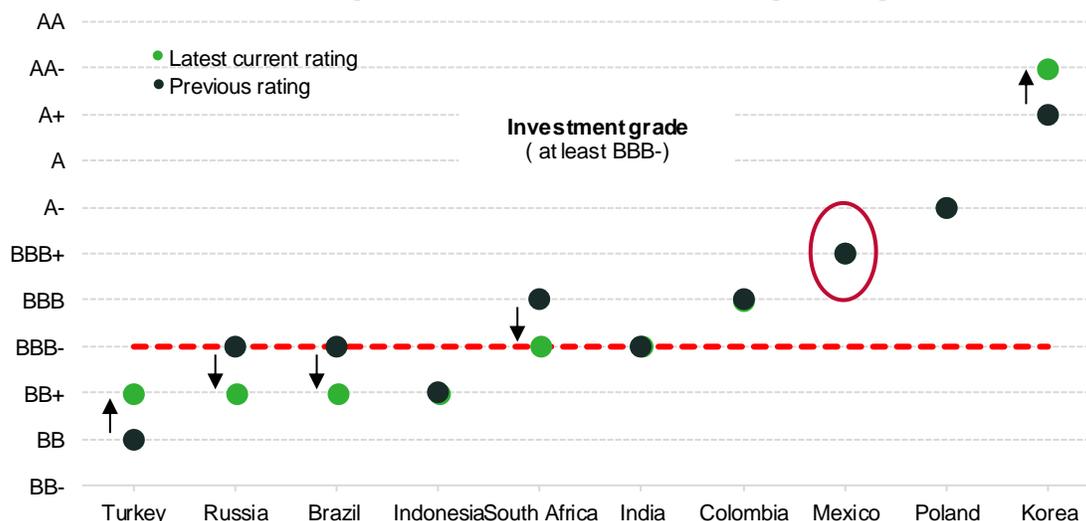


Fuente: Bloomberg
1/ The latest ratings were valid as of October 26, 2015.

Keeping −and even improving− the credit rating to maintain the investment grade status is important to Mexico. In particular, it provides access to better financing conditions, a broader investor base and, to the extent it is a benchmark for international regulation, a better asset treatment on domestic and foreign financial institutions. This is especially important because there is a number of foreign financial institutions that operate in the country.

It is noteworthy that the most relevant variables that determine credit ratings and the investment grade for any given country are the levels of external and internal debt as a share of GDP, the current account balance as a share of GDP, GDP growth, political risk, the level of financial depth and an economic development indicator, among others.[24]

Furthermore, despite the presence of strong volatility bouts in financial markets over the last years, Mexican financial markets have

---

[23]  According to Standard & Poor's, as of October 21, 2015, six out of ten of the emerging economies included in the sample had an investment grade rating status: Korea (AA-, stable), Poland (A-, stable), Mexico (BBB+, stable), Colombia (BBB, stable), India (BBB-, stable) and South Africa (BBB-, stable). The rest had a rating lower than BBB-, and therefore, a non-investment grade: Indonesia (BB+, positive), Brazil (BB+, negative), Russia (BB+, negative) and Turkey (BB+, negative).

[24]  For instance, see L. Jaramillo: Determinants of Investment Grade Status in Emerging Markets. *IMF. Working Paper* WP/10/117, (2010). A. Alfonso, P. Gomes. y P. Rother: "Short-and long-run determinants of sovereign debt credit ratings". *International Journal of Finance & Economics*,16(1), 1-15 (2011) o E. Missoondoyal-Bheenick: "An analysis of the determinants of sovereign ratings". *Global Finance Journal*, 15(3), 251-280, (2005).

displayed a satisfactory performance. For instance, the global trading volume of Mexican pesos in exchange markets has grown faster than that of any other emerging market currency. As a consequence, in 2013, the Mexican peso became the most traded emerging currency (graph 21). In addition, the Mexican stock market, albeit with a lower volume than others, has registered a far lower volatility level. Finally, as already mentioned, the governments of emerging economies profited from the ample liquidity that prevailed in financial markets to issue local currency denominated debt with non-resident investors. In this regard, the amount of securities issued by the Mexican government has shown a positive and stable trend in spite of volatility episodes.

Capital flows and country risk indicators have a connection with the aforementioned economic, public finance and external sector indicators. Such variables suggest that countries with solid economic fundamentals, or those that have shown some improvements, are also the ones that have registered lower capital outflows (or even inflows) during stress periods and whose sovereign debt has maintained a good credit rating.

Although Mexico has stood out from other emerging economies, it is essential to keep on working to maintain and improve this distinction. For that purpose, and with a view to boosting sustained growth, it is imperative that Mexico maintains price stability, strengthens public finances and continues to timely implement structural reforms. All this will not only make Mexico differentiate itself from other emerging countries, but also be ready to face possible global episodes of financial volatility in the future.

**Graph 21**
**Financial Market Trading Volume**

a) Global Exchange Market
Trading Volume

Billions of dollars, daily average



b) Stock Market Trading
Volume

Millions of dollars



c) Government Securities
Denominated in Local
Currency

Billions of dollars



Figures as of 2013
Source: Bank of International
Settlements Triennial Suvey 2013

Figures as of October 21, 2015
Source: Bloomberg

Figures as of the last quarter of 2014
Source: IMF Sovereign Investor Base
Dataset for Emerging Markets

## 2.4. Risks Related to the Economic Slowdown

Global economic growth has been weak for a prolonged period of time (graph 22a). While advanced economies continue to pick up at a moderate pace (graph 22b), emerging economies continue to slow down (graph 22c). Further, there remain wide differences not only between both country groups, but also within each of them.

Within the bloc of advanced economies, the US and the UK have grown faster than the rest. Particularly, the Eurozone and Japan are growing at a more moderate pace. On the other hand, some oil exporting advanced economies, such as Canada and Norway, have experienced a slowdown resulting from the fall in hydrocarbon prices. Moreover, there have already been early signs of an adverse effect of the emerging economies slowdown on advanced economies, which has translated into downward revisions of global growth.

**Graph 22**
**Global Economy**

a) Global GDP

Annual percent change



Figures as of October 2015
Source: IMF *World Economic Outlook*

b) Advanced Economies' GDP

Annual percent change



Figures as of October 2015
Source: IMF *World Economic Outlook*

c) Emerging Economies' GDP

Annual percent change



Figures as of October 2015
Source: IMF *World Economic Outlook*
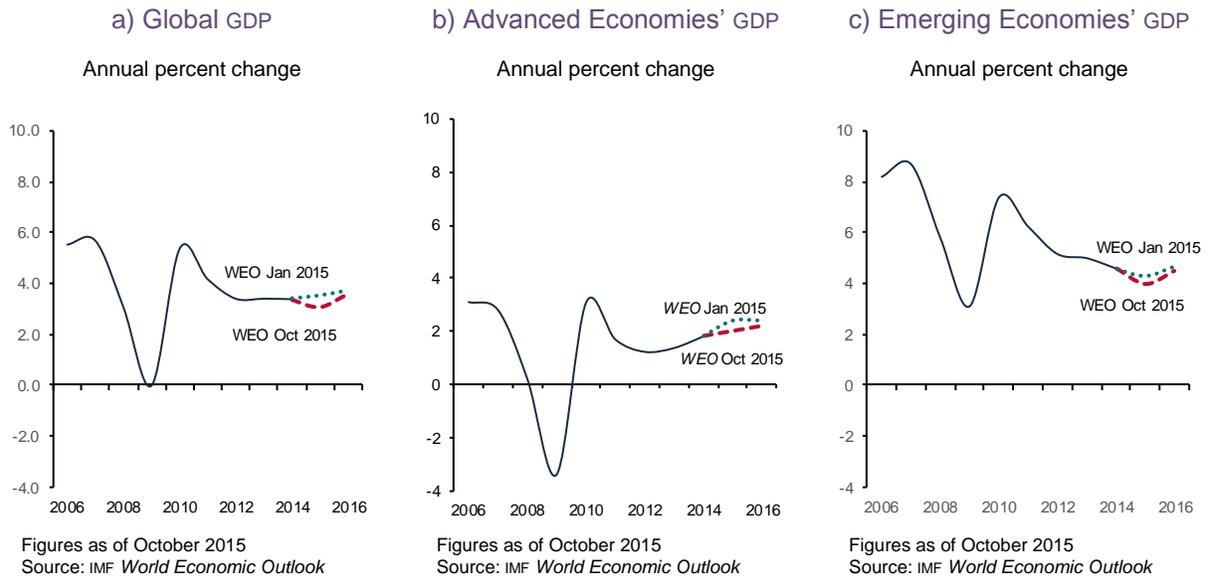
The recent economic slowdown in the emerging world can be largely explained by two major reasons: the Chinese economic slowdown and its effects on global commodity prices. For some time, the Chinese economy has been undergoing a transformation process, as it moved from one economic model based on investment to another based on consumption. Even though this strategy aims at fostering self-sustained economic growth, it may take a long period of time to bear fruit. Meanwhile, its economic slowdown has had significant global repercussions, both directly via international trade and indirectly via the effects on commodity prices. China remains one of the major global commodity consumers, and hence, its economic slowdown has brought such demand down, especially for industrial metals and energy. This is the reason why the price of such commodities has registered a downtrend (graphs 23a and 23b). Similarly, food prices have followed suit (graph 23c).

**Graph 23**
**Commodity Prices**

a) Energy Price Index

January 2, 1970 = 100
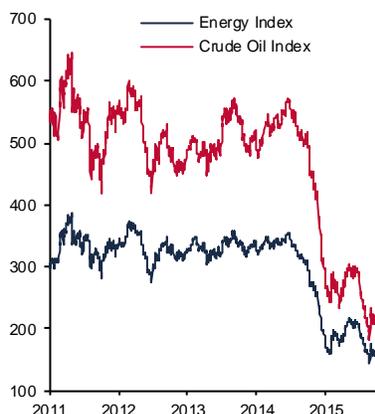


Figures as of November 13, 2015
Source: Bloomberg

b) Industrial Metals Price Index

January 2, 1970 = 100
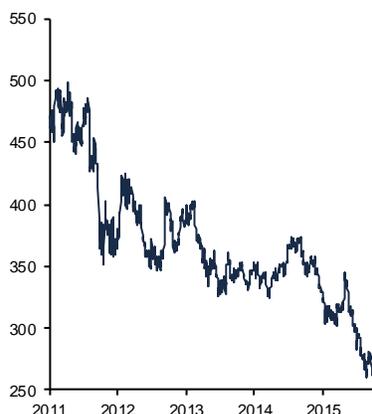


Figures as of November 13, 2015
Source: Bloomberg

c) Food Price Index

January 2, 1970 = 100
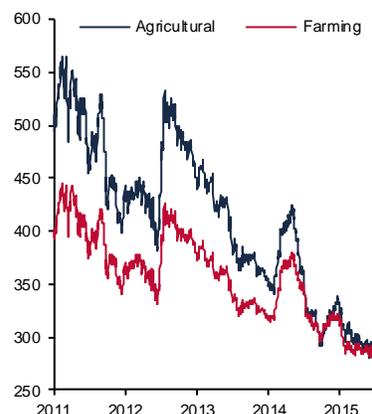


Figures as of November 13, 2015
Source: Bloomberg

The decline in commodity prices has weakened economic activity, and thus, hindered growth in exporting emerging countries.

As explained in section 2.1, the decline in oil prices is mainly due to a supply expansion, although a demand contraction had also an influence thereon. In any case, this has negatively affected economic activity in oil exporting emerging economies. This effect, along with geopolitical and idiosyncratic issues, explains the economic slowdown expected to occur during the current year, and to a lesser extent, in 2016, in countries like Russia and Brazil. All this, together with the Chinese situation, has deteriorated the economic outlook for the emerging world.

The US economy is expected to grow at a moderate pace during this and the following year, slightly above its long-term trend (graph 24a). The main driver will be a robust expansion in household consumption, which has thrived thanks to gradual –albeit continuous– improvements in labor market conditions (graph 24b) and a decline in goods prices, particularly in the price of fuel. For its part, US manufacturing production, which directly relates to US exports, continues to be weak, as a result of the generalized strength of the US dollar and a sluggish foreign demand (graph 24c).

**Graph 24**
**US Economy**

a) US Real GDP (forecast by Blue Chip Economic Indicators)

Quarterly percent change
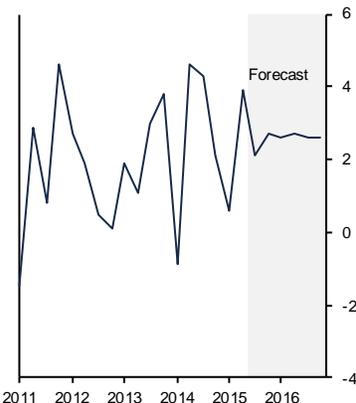


Figures as of the second half of 2015
Forecasts as of the last quarter of 2016
Source: Bureau of Economic Analysis, Blue Chip

b) Unemployment Rate and Non-Farm Jobs in the US

Left axis: percent
Right axis: thousands
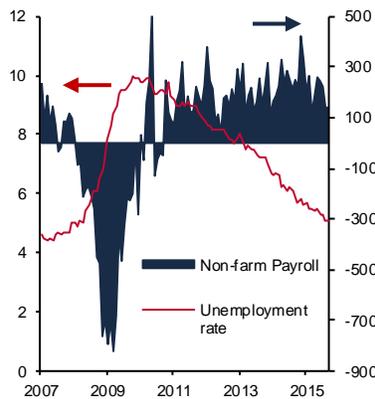


Figures as of October 2015
Source: Bureau of Labor Statistics

c) US Manufacturing Production

Quarterly percent change of 3-month moving mean
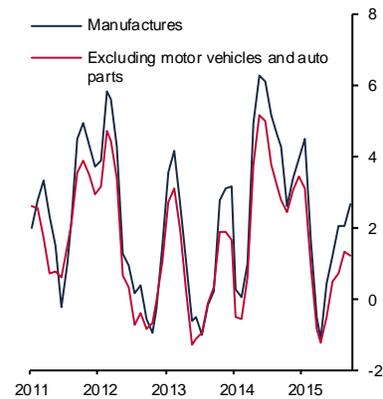


Figures as of October 2015
Source: Federal Reserve

As for Mexico, economic activity has continued to grow at a moderate pace in recent years (graph 25a); and, across the board, growth expectations for 2015 and 2016 have been revised downwards.[25] Lower than expected economic growth in 2015 can be largely explained by two factors. First, the decline in oil production, which in turn hampered mining production. Second, the manufacturing sector has also exhibited a moderate slowdown. These two events have led to lower industrial growth as a whole (graph 25b). It is worth stressing that the performance of manufacturing production largely reflects the recent decline in manufacturing exports (graph 25c), which is in turn a result of US industrial production and the lack of demand from countries other than the US.

It is noteworthy, however, that, given the level of integration between the US and Mexican economies, the fact that the US has grown at a relatively higher pace than other industrial economies, might be alleviating the effects of a global economic slowdown on Mexico.

Among domestic expenditure components, investment and –most importantly– consumption exhibit higher growth than in previous years. Further, private consumption is the aggregate demand component with the highest contribution to growth in recent months.

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[25] See Banco de México: *Quarterly Report, October-December 2014* (p. 55); *Quarterly Report, January--March 2015* (p. 58); *Quarterly Report, April-June 2015* (p. 50) and *Quarterly Report, July-September 2015* (p. 52).

The global economic slowdown could continue crippling domestic economic growth, mainly via a reduction in the external demand for Mexican goods. Although this effect could materialize through various channels, the main avenue would be that the global economic slowdown together with the generalized strength of the US dollar continued weakening US exports. This would translate into lower industrial production in the US and, since Mexico is one of the major suppliers of the American industry, the weakened US exports would directly impact Mexican manufacturing exports.

**Graph 25**
**Domestic Economy**

a) Real GDP, Seasonally Adjusted Real Annual and Quarterly Percent Change

b) Industrial Production Index[1/]

c) Manufacturing Exports[2/]

Percent

2008 = 100

2008 = 100
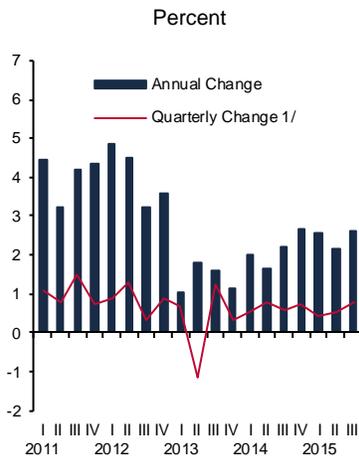


Figure as of the third quarter of 2015
Source: INEGI

Figures as of September 2015
Source: INEGI

Figures as of September 2015
Source: INEGI

1/ From unseasoned figures.
2/ The dotted line corresponds to the trend-cycle.
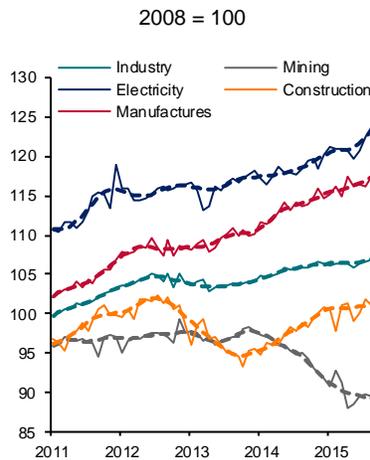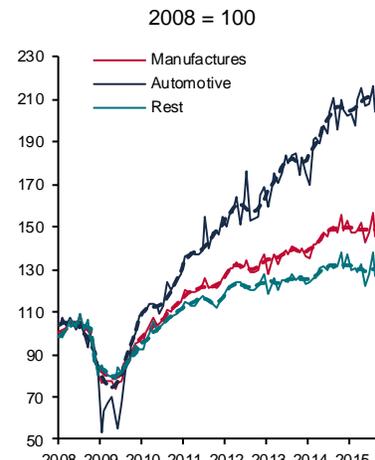
Lower than expected economic growth and, above all, the continuation of the domestic economic slowdown, whether for domestic or external reasons, pose a risk to the financial system. Firstly, because such macroeconomic situation has a direct impact on financial institutions' balances, both reducing their profits and increasing losses as a result of credit portfolio deterioration.

The latter can be particularly observed when unanticipated economic plunges occur, as the one that took place at the onset of the global 2008-2009 crisis. Throughout that period, the economic slowdown brought credit institutions' profitability down to a minimum –measured in terms of capital returns (graph 26a) –, at a time when, along these lines, the financial system was suffering from the deterioration in the credit card portfolio registered the previous year. This lower profitability was due to a reduction in banks' major revenues stemming from interest collection (graph 26b), and to a substantial rebound in loan delinquency (graph 26c). As explained in section 3.1.1, even if banks as a whole record high capitalization levels that

enable them to adequately face a similar situation, some institutions may be more vulnerable to such an event. Consequently, an unforeseen economic slowdown may represent a risk.

**Graph 26**

**Economic Activity, Banks' Profitability and Delinquency Rate**

a) Annual Change in IGAE and Return on Equity (ROE)

Percent
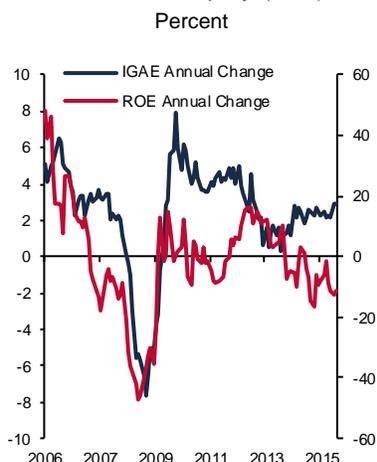
b) Annual Change in IGAE and Interest Income

Percent
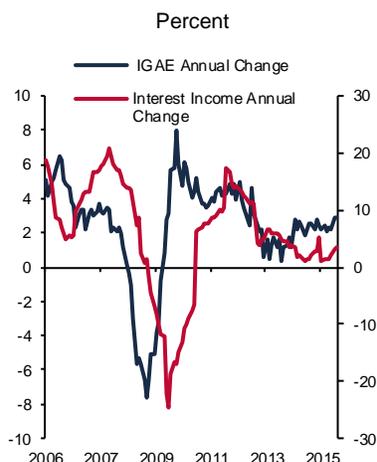
c) Annual Change in IGAE and Adjusted Delinquency Rate

Percent

Figures as of September 2015
Source: Banco de México and CNBV

Figures as of September 2015
Source: Banco de México and CNBV
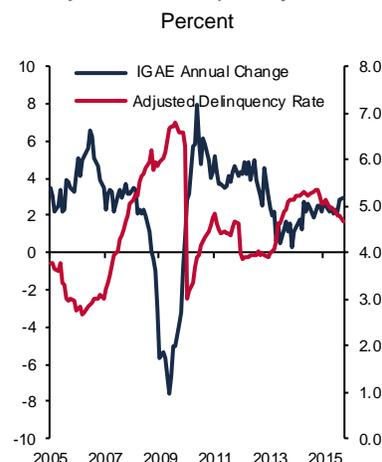
Figures as of September 2015
Source: Banco de México and CNBV

Furthermore, lower than expected economic growth and the continuation of the domestic economic slowdown could represent and indirect risk to the stability of the financial system. This situation could magnify risks derived from the economic shocks analyzed in the previous subsections. Particularly, lower than expected growth may deteriorate public finances further, thereby increasing the public deficit and inhibiting the reduction in the debt-to-GDP ratio foreseen in the 2016 General Criteria for Economic Policy. As a result, this situation may narrow the gap between Mexico and other emerging economies, thus increasing country risk.

Finally, the more sluggish the economic activity and the longer it takes to pick up, the greater the probability of contagion from other emerging economies. In consequence, the Mexican economy and its financial system would be more vulnerable to various shocks.

# 3. Impact Analysis and Stress Tests

As explained in the previous section, an abrupt reversal of capital flows could lead to a significant change in financing conditions for the Mexican economy. In particular, the ensuing interest rate hikes and further depreciation of the exchange rate would have an impact on financial institutions' risk positions and non-financial companies issuing debt in foreign currencies.

Although those shocks are not expected to compromise the stability of the financial system, this section shows the results of an impact study on the financial system as of the publication date of this report, including an assessment of the situation of development banks. Finally, we show the results of stress tests for commercial banks that Banco de México performs every year with the purpose of assessing their ability to face extreme adverse situations. These stress tests not only analyze credit risk but also concentration risk.

## 3.1. Impact Analysis

### 3.1.1. Financial Intermediaries

### Credit Risk

As mentioned in the previous section, lower economic growth could lead to a deterioration of commercial bank loan portfolios. Credit risks take months to materialize. Their impact on delinquency rates depends on both the severity of the shock and whether this is accompanied by interest rate movements. Yet, thanks to commercial banks' high capital adequacy levels, the stress tests performed by Banco de México suggest that, under extreme circumstances, very few institutions' solvency levels would fall below the regulatory minimum.

The commercial bank loan portfolio's value at risk ($VaR$), measured as a proportion of their capital, remained stable throughout most 2014, with a slight spike during the second quarter of 2015 (graphs 27a and 27b).[26] This spike can be explained by an increase in the amount of the loan portfolio, an increase of corporate loans' share in loans portfolio and an increase in the default rate, particularly that of small-sized companies and natural persons with entrepreneurial activities (graph 29a). All these factors meant that within the

---

[26] The credit $VaR$ is calculated using a capital adequacy and credit risk model. The main elements in the model are the probability of default for every loan, the structure of variances and covariances for potential defaults, and the structure and concentration level of loans that form part of the portfolio. Further explanations of the model can be found in Banco de México´s *Financial System Report 2006* and J. Márquez Diez-Canedo: *Una nueva visión del riesgo de crédito (A New Vision for Credit Risk)*, Limusa (2006). $VaR$ is the percentile attached to a specific confidence level from a probability loss distribution related to a portfolio of assets subject to credit risk. This measure does not provide information about the expected value of losses when they exceed the value at risk (VaR), Therefore, the conditional value at risk enables the analysis of the tail of the distribution, since it represents the expected value of losses when they exceed the value at risk (VaR).

commercial bank portfolio, the corporate portfolio increased its contribution to risk (graph 27c).

**Graph 27**
**Credit Risk Indicators for Commercial Banks**

a) Loan Portfolio's Annual Value at Risk and Conditional Value at Risk
Percentage of net capital

b) Annual Conditional Value at Risk by Type of Loan
Percentage of current loans
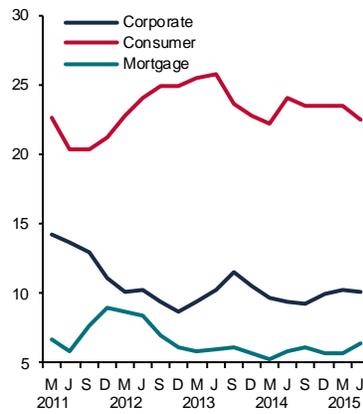
c) Contribution to Risk by Type of Loan
Percentage of CVaR



Figures as of June 2015
Source: Banco de México

Figures as of June 2015
Source: Banco de México
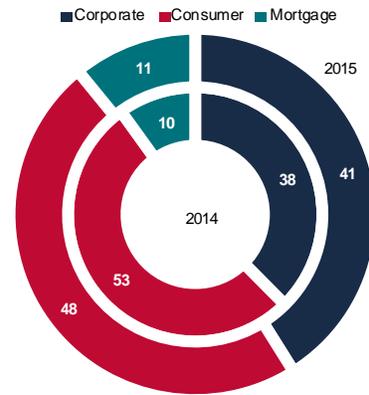
Figures as of June 2015
Source: Banco de México

As for the probability of default of the consumer portfolio, it improved over the last year, as shown by its adjusted delinquency rate. The delinquency decline for the consumer portfolio partially responded to the swift growth thereof; nonetheless, the credit quality of new debtors remains unknown (graph 28).

**Graph 28**
**Credit Risk Indicators for Commercial Banks**

a) Annual Probability of Default

Percent

b) Portfolio Concentration

HHI[1/]

c) Adjusted Delinquency Rate

Percent



Figures as of June 2015
Source: Banco de México

Figures as of June 2015
Source: Banco de México

Figures as of June 2015
Source: Banco de México and CNBV
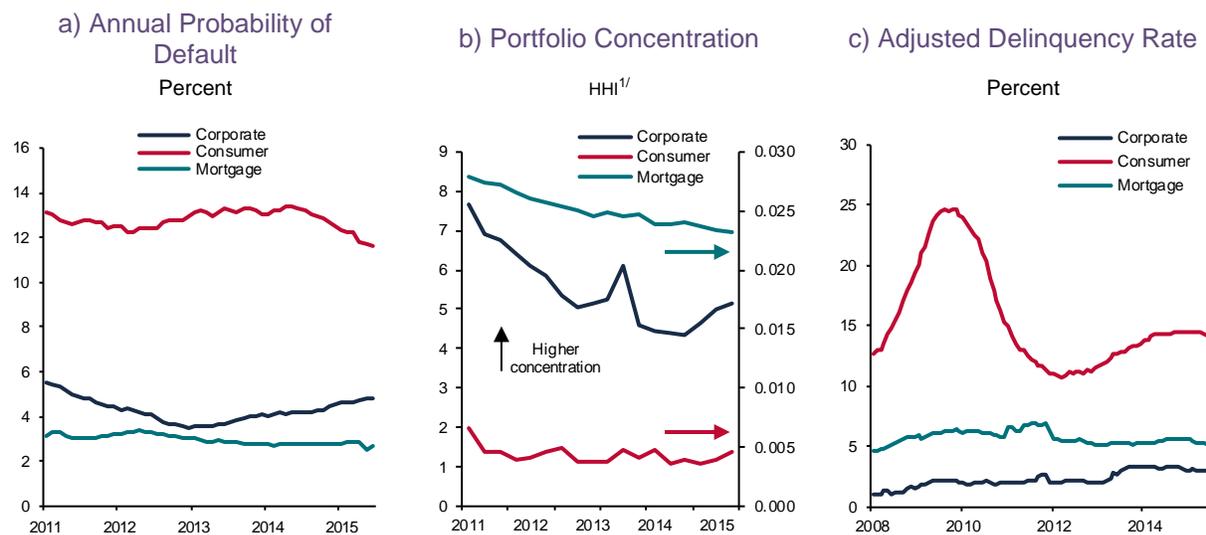
1/ The Herfindahl Hirschman Index (HHI) consists of the sum of the squares of every loan's share in total portfolio. This index may take values between zero and ten thousand. The bigger the indicator, the greater the market concentration.

The higher concentration levels for the corporate portfolio as of the second half of 2014 can be explained by the higher participation of large companies, which usually require higher funding amounts (graph 28b). On the other hand, graph 29c illustrates the increase in large companies' as a share of the total portfolio that was observed in the past months. The higher share in financing from domestic banks is attributable to the fact that, owing to the prevailing volatility in international financial markets, large companies have engaged in bank financing to reduce their external foreign currency denominated debt.

Some bank portfolios show very high concentration levels. Banks in that situation are exposed to significant losses in relation to their capital, especially in the case that a small number of debtors default (graph 30).

**Graph 29**
**Credit Risk Indicators for Commercial Bank Loans**

a) Annual Probability of Default by Company Size[1]

Percent
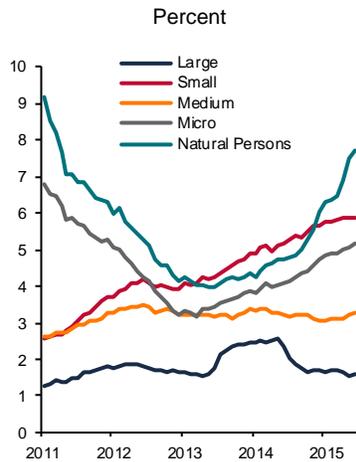


Figures as of June 2015
Source: Banco de México

b) Delinquency Rate by Company Size

Percent
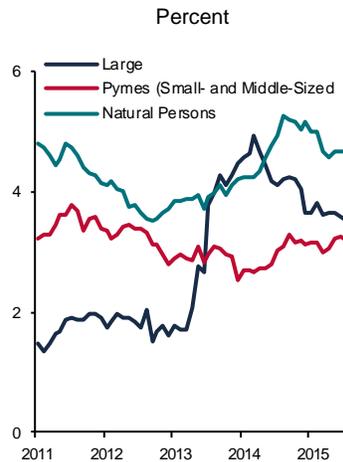


Figures as of June 2015
Source: Banco de México

c) Large Companies' Share[2] in Commercial Loans to the Non-Financial Private Sector

Percent



Figures as of June 2015
Source: Banco de México

1/ This probability is estimated from every type of loan's observed default rate, and calculated as the proportion of debtors or credits that are no longer paid during certain period of time with respect to current loans during the previous period.
2/ Large companies are listed companies that form part of the 500 largest companies in the country or with current loans larger than 1 billion pesos.

**Graph 30**
**Concentration Risk Indicators for Bank Commercial Loans[1]**

a) 20 Largest Debtors in the System

Billions of pesos

| Debtor | |
|---|---|
| Debtor 1 | 90,474 |
| Debtor 2 | 75,740 |
| Debtor 3 | 28,839 |
| Debtor 4 | 28,219 |
| Debtor 5 | 27,245 |
| Debtor 6 | 22,918 |
| Debtor 7 | 20,750 |
| Debtor 8 | 17,381 |
| Debtor 9 | 15,796 |
| Debtor 10 | 15,489 |
| Debtor 11 | 15,357 |
| Debtor 12 | 13,271 |
| Debtor 13 | 10,573 |
| Debtor 14 | 9,197 |
| Debtor 15 | 8,661 |
| Debtor 16 | 7,850 |
| Debtor 17 | 7,090 |
| Debtor 18 | 6,665 |
| Debtor 19 | 6,455 |
| Debtor 20 | 6,349 |
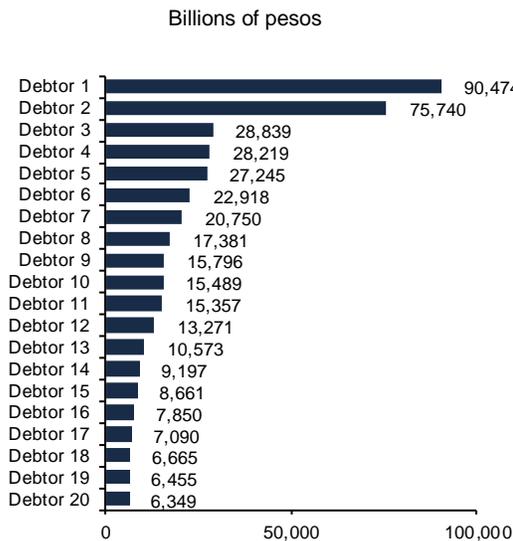


Figures as of June 2015
Source: Banco de México

b) Number of Past-Due Debtors Required to Bring the CAR Down to 10.5 and 8 percent

Vertical axis: Number of debtors
Horizontal axis: Banks identified with a number
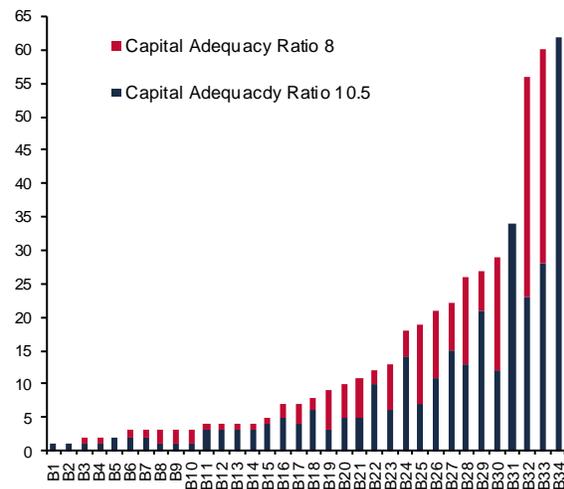


Figures as of June 2015
Source: Banco de México

1/ Commercial loans include loans to public and private companies, states and municipalities.

The deterioration of the consumer loan portfolio observed in recent years started to moderate in the first half of 2015, in particular the payroll loan portfolio (graph 31b). Regarding personal loans, the decline in the delinquency rate is due to the higher amount granted by banks as of the second quarter of 2015. Even though there seems to be no signs of looser origination standards, it is convenient to monitor its performance (graph 31c).

**Graph 31**
**Consumer Credit**

a) Profitability Indicator and Consumer Credit Growth[1]

Percent

b) Adjusted Delinquency Rate by Type of Loan

Percent
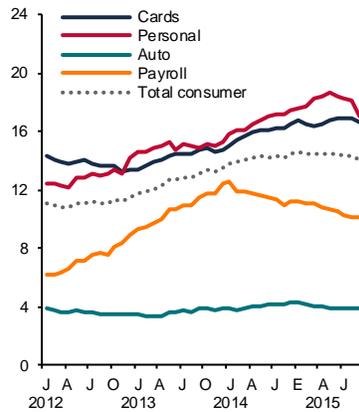
c) Personal Loan Vintages

Vertical axis: delinquency (percent)
Horizontal axis: months elapsed

Figures as of June 2015
Source: Banco de México

Figures as of June 2015
Source: Banco de México and CNBV

Figures as of June 2015
Source: Banco de México

1/ The profitability indicator is calculated by subtracting charge-offs and the amount of reserves that exceed charge-offs from interest income. The 12-month accumulated figure was divided by the average loan portfolio of the last twelve months, and then the TIIE (using it as a funding rate) was subtracted.
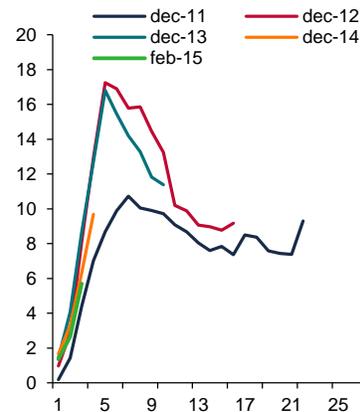
With regard to mortgage loans, the increase in housing prices is noteworthy, particularly in upper income residential housing.[27] According to price indicators collected by specialized housing monitoring companies, this increase is concentrated in the Mexico City metropolitan area. Both origination standards and the Loan-To-Value (LTV) and Payment-To-Income ratios have remained stable for all types of housing (graphs 32b and 32c). This means that, although banks have gradually increased the loan amount granted, the down payment and income required have been maintained. In synthesis, the stability of such indicators has made mortgage loan delinquency remain stable in recent years (graph 32).

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[27] Upper income residential housing are houses worth more than three million pesos; that is, houses for the upper income population segment.

**Graph 32**
**Mortgage Loans**

a) Price per Square Meter by
Type of House

Index (2008=100)
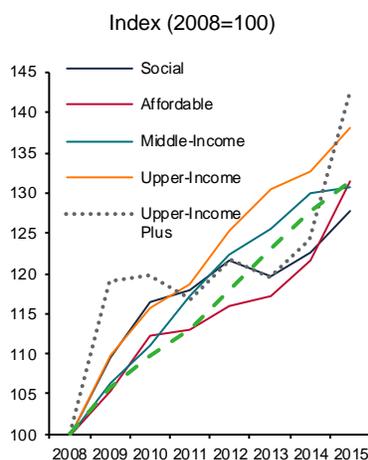


Figures as of June 2015
Source: Softec

b) Loan-To-Value (LTV) and
Payment-To-Income (PTI)
Ratios by Type of House

Percent
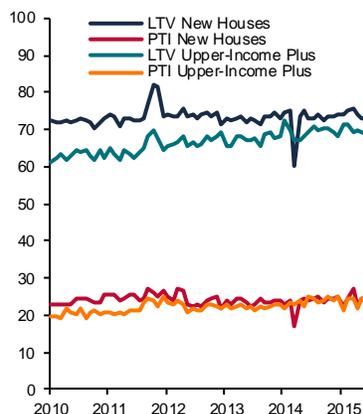


Figures as of June 2015
Source: Banco de México y CNBV

c) Distributions of Amounts
Funded by Commercial
Banks

Millions of pesos
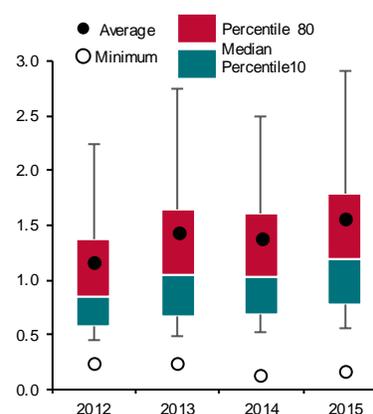


Figures as of June 2015
Source: Banco de México

### Interest Rate Risk

The sensitivity level of financial intermediaries' positions in securities was analized with a view to assess the impact of an increase in local currency denominated interest rates. Losses from a 300-basis-point parallel shift in the yield curve turned out to be moderate for banks. In contrast, the impact on siefores and insurance companies were larger. In both cases, the size of the losses *vis-á-vis* their portfolio value arises from the long term nature of their investment horizons due to the characteristics of their liabilities. In fact, if their assets and liabilities were jointly marked-to-market, then the net impact of the above mentioned increase in the rates would be lower.[28]

With regard to surcharge risk,[29] the price sensitivity of financial instruments is higher to increases in the surcharge. In fact, the value change in these instruments from an increase of one basis point in surcharges may be ten times larger than the one they would experience in the face of an identical increase in rates.[30]

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[28] Although liability losses could offset the impact of asset valuation, it is important to consider that assets include debt instruments whose quote is available in the market; hence, their mark-to-market is natural. In contrast, liabilities include contract obligations entered into with customers, and thus, there is usually no availability of mark-to-market processes and reference prices for them.

[29] A surcharge is an additional return on the interest rate used to discount a bond's expected flows, so that its present value equals the bond's market value. In the Mexican market, bondes D and bonds issued by the IPAB (BPAG28, BPAG91 and BPA182) are valued at surcharge. For further information, see Banco de México's website (www.banxico.org.mx), Financial System Section, Reference material, Auctions, Placement of Securities.

[30] The valuation of bondes D and bonds issued by the IPAB includes the surcharge.

Since brokerage firms, development institutions and commercial banks hold a higher proportion of securities with surcharge risk in their portfolios, they would be the hardest-hit entities (table 2).

**Table 2**

**Losses and Gains in the Securities Portfolio Given a Parallel Change in Interest Rates and Surcharge**

Percentage of the securities position value

| Type of Holder | Interest Rate | | | Surcharge | | |
|---|---|---|---|---|---|---|
| | 300 Basis Point Change | | | 100 Basis Point Change | | |
| | jun-14 | jun-15 | sep-15 | jun-14 | jun-15 | sep-15 |
| Commercial Banks | 6.1 | 4.5 | 3.8 | 0.9 | 1.3 | 1.3 |
| Development Banks | 5.5 | 4.0 | 2.2 | 2.2 | 1.7 | 2.0 |
| Brokerage Firms | 4.4 | 3.1 | 1.9 | 1.3 | 1.9 | 1.9 |
| Insurance Companies | 22.9 | 17.6 | 16.0 | 0.1 | 0.0 | 0.1 |
| Siefores | 20.1 | 17.1 | 16.1 | 0.2 | 0.1 | 0.1 |
| Investment Funds | 4.8 | 3.3 | 2.6 | 1.0 | 1.0 | 1.0 |
| **Weighted Average** | **9.4** | **7.8** | **6.3** | **0.9** | **1.0** | **1.1** |

Source: Banco de México

The exchange rate depreciation does not represent a significant direct risk for commercial banks, as current regulation related to foreign currency positions sets limits on USD long and short positions with respect to net capital. These rules have refrained banks from experiencing substantial mismatches in foreign currencies.

Graph 33a presents commercial banks' put and call positons in foreign currencies by type of transaction, whereas graph 33b by type of counterparty. The first graph shows that banks have a relatively high level of liquid assets denominated in foreign currency, while the second indicates that these assets are invested in government securities with high credit quality, central bank deposits or in highly rated foreign banks.

**Graph 33**
**Exchange Risk Indicators**

a) Exchange Risk Position and Main
Components
Billions of dollars



Legend:
- Credit minus Deposits
- Derivatives
- Liquid Assets
- Securities
- Currency Sales andPurchases
- Others
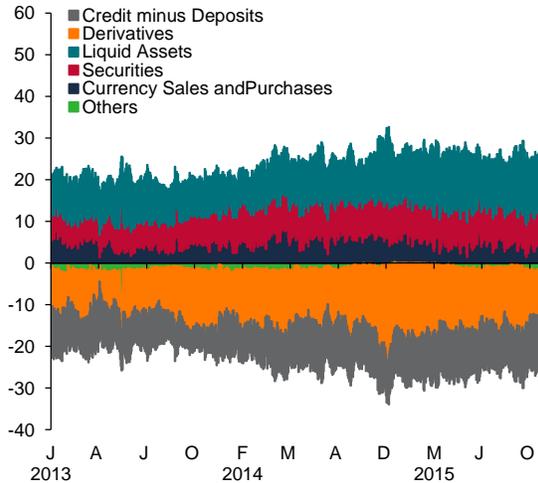
Figures as of June 2015
Source: Banco de México

b) Exchange Risk Position by Type of
Counterparty
Billions of dollars



Legend:
- Sovereigns, Central Banks and Foreign Banks
- Other Domestic Entities
- Development Banks
- Other Foreign Entities
- Foreign Financial Entities
- Domestic Companies and Persons
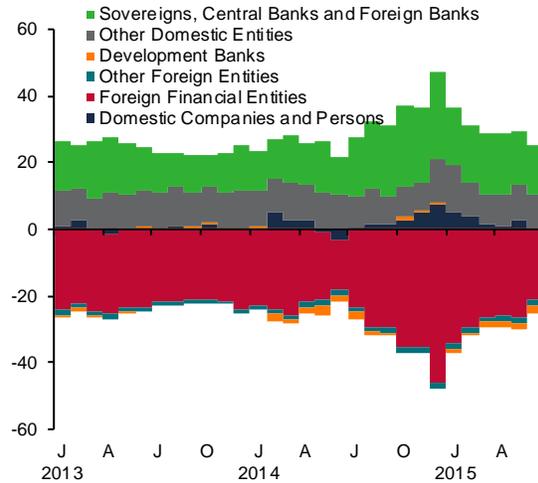
Figures as of June 2015
Source: Banco de México

The Basel Committee on Banking Supervision (BCBS), in its role as an international cooperation organization in the field of banking supervision and oversight, periodically evaluates member countries' level of adoption of international standards. The Mexican banking capital and liquidity regulation was evaluated in 2014, receiving the highest grade.[31]

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[31] The assessment of Mexican regulation was executed between 2014 and 2015, as part of the Regulatory Consistency Assessment Program (RCAP). Results were released on March 13 in two reports: *Assessment of Basel III risk-based capital regulations – Mexico* (available at http://www.bis.org/bcbs/publ/d315.pdf) and *Assessment of Basel III LCR regulations – Mexico* (available at http://www.bis.org/bcbs/publ/d316.pdf).

<div align="center">

**Box 4**

**Financial Charge Borne by Households**

</div>

One out of every three severe global bank crises has been preceded by a credit boom.[1] Yet, it cannot be inferred from this finding that all credit booms are necessarily harmful, especially when they promote a balanced, sustainable economic growth. That is, credit should be regarded as risk free if its expansion is consistent with sustained economic growth. Nonetheless, when credit booms lead to excessive and poorly allocated aggregate expenditure, they may trigger a crisis. Evidence suggests that when a credit boom is due to higher credit demand, the probability of a crisis occurring is lower. On the other hand, when the boom results from excess credit supply, the moral hazard and adverse selection problems worsen, and thus, the probability of a crisis is higher.

In practice, the analytical problem is to identify whether credit growing above its trend is consistent with economic fundamentals. Yet, this is hard to identify accurately, as aggregate credit levels do not reveal the distribution of indebtedness. High levels of debt for both companies and households are usually signs of financial vulnerability, and more often than not, there is a correlation between high indebtedness levels, credit deterioration and the occurrence of financial crises.

As far as companies are concerned, there is consensus as to which are the adequate leverage measures to detect financial vulnerability. Yet, for households, there is no precise and generally accepted definition of what may be considered a leverage level increasing the debtor's financial vulnerability, and hence, creditors' credit risk. In general terms, one of the reasons for this complexity is that indebtedness is a concept with a cumulative dimension (total debt amount) and a flow dimension (debt service or financial charge). Equally, the relevant benchmark to assess the level of indebtedness may be the level of income (the flow), the household's wealth or even the expected value of income. Nevertheless, it is possible to compute financial charge indicators that, under certain assumptions, could be used to understand the dynamics of household credit and its relationship with grantors' credit risk.

For this purpose, we compute an indicator that measures household debt service as a proportion of income, by using a sample of workers that belong to the formal economy. It is worth underscoring that this indicator does not take into account the total level of indebtedness. The sample was obtained from a population of nearly 18 million workers affiliated to the IMSS who were active in the bimonthly in the period between October 2011 and August 2012 and who kept making contributions until May 2015. A simple random sample of one million contributors was crossed with data for credit information bureaus (sic in Spanish). The observations within the sample without credit records were not considered for the analysis; this narrowed the sample down to 414,005 contributors.[2] The financial charge indicator was built as the sum of the amount payable of loans registered at sic divided by the individual's monthly salary.[3]

The analyzed population suggests that workers in higher-income deciles[4,5] have a trend to engage in a greater number of loans (both revolving and mortgage). Also, in the first deciles, we observe the prominent presence of non-bank credit grantors. Further, the profile of non-bank grantors varied according to the level of income. Thus, in higher deciles more loans were granted by department stores. Even though in the first 6 income deciles credit access is relatively ample, credit sources and financial features significantly vary with respect to other deciles.

The level of financial charge in this population has been growing throughout time registering an increase of nearly 26 percent during the last two years, as shown in graph A.

An inverse relationship was also found between the level of income and the level of financial charge, and a proportional relationship between the level of financial charge and delayed payments (graph B).

The financial charge growth observed in the analyzed population may lead to higher credit risk for institutions granting funds to this population. This is why there is a close monitoring of this risk.



**Graph A**
**Financial Charge**
Debt service as a proportion of monthly income



**Graph B**
**Relationship Between Financial Charge and Average Days of Delay**
Horizontal axis: financial charge deciles
Vertical axis: average days of delay per decile
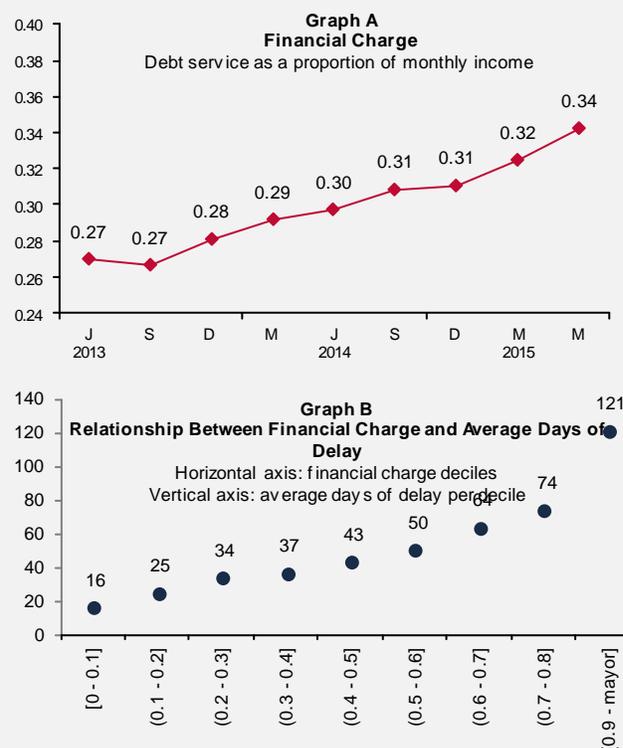
Source: Banco de México

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[1] X. Freixas, L. Laeven and J.L. Peydró: *Systemic Risk, Crises, and Macroprudential Regulation*, Boston, MA: MIT Press, June (2015).
[2] The general representativeness of the financial charge indicator for households relies on the following factors: (1) that credit performance of the population with access to formal credit and with a file at the Credit Bureau be representative in relation to the general population; (2) that the income of contributors affiliated with the IMSS be also representative of the general population. Therefore, we excluded workers in the informal sector, independent workers and government employees who have a record at the Credit Bureau.
[3] These include monthly payments of non-revolving consumer loans such as personal or payroll loans, minimum payment of credit cards and monthly amortization of mortgage loans.
[4] It is important to point out that the sample does not consider revenues other than salaries, because they are not available. In order to avoid greater biases, the sample was cut down and takes only into account people with income lower than 25 salaries (level of salary that caps maximum contribution to the IMSS). In other words, people with higher salaries were excluded from the analysis.
[5] Income deciles are built with the sample and do not correspond to the population's income deciles; yet, the income distribution does not present significant biases.

## Liquidity Risk

At the end of 2014, Banco de México and the CNBV jointly published the regulation for the Liquidity Coverage Ratio for commercial banks. This is pursuant with the guidelines established by the Banking Liquidity Regulation Committee and Basel Standards.[32] The regulation came into effect as of January 2015, with a gradual implementation agenda. These rules are designed to mitigate the probability that a stress scenario may lead a credit institution into liquidity problems. In that sense, in 2015, banks' liquidity, measured by the LCR, shows that institutions meet the minimum requirement of 60 percent, although the vast majority exhibits levels of at least 100 percent (graph 34).

**Graph 34**
**Liquidity Coverage Ratio[1/]**
Percent
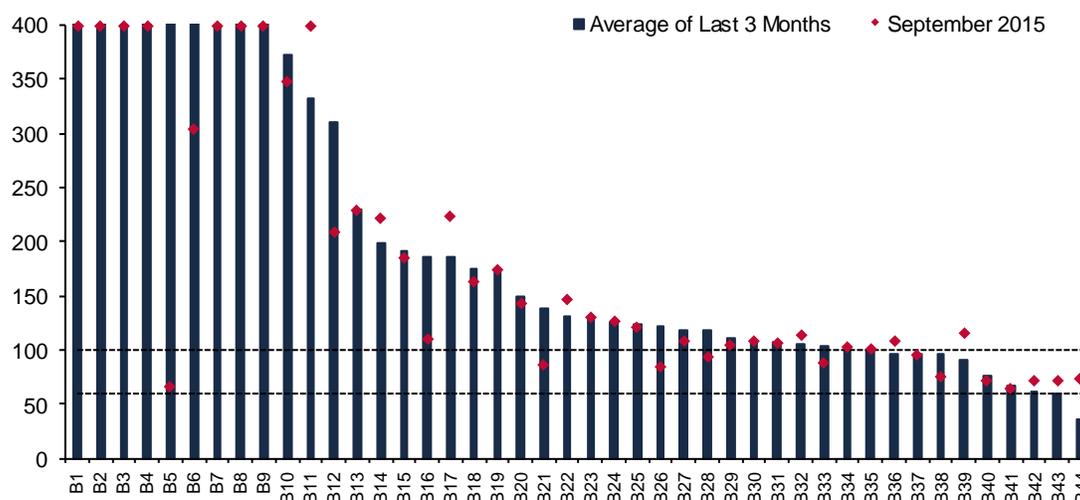


Figures as of September 2015
Source: Banco de México
1/ The average LCR of institutions B1 through B9 is equal or higher than 400 percent.

The gradual implementation agenda stipulated that larger banks were obliged to meet the LCR at 60 percent as of January 2015. For the remaining banks, those which as of January 1, 2015 had been operating for at least 5 years, were subject to reach the minimum as of July 1, 2015; while those which as of January 1, 2015 had been in operation for less than five years, will have to comply with the minimum 60 percent as of January 2016.[33] In addition, banks are obliged to release their average LCR every quarter, as well as several

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[32] According to article 96 bis 1 of the Credit Institutions Law and as part of the financial reform, the Banking Liquidity Regulation Committee's purpose shall be to issue guidelines to establish liquidity requirements by which commercial banks must abide. Such guidelines aim at ensuring that commercial banks are capable of meeting payment obligations in various terms and scenarios, including those characterized by adverse economic conditions.

[33] Large banks are those with loan portfolios greater than 30 billion UDI.

of its components, from their corresponding implementation date onwards.

As of September 2015, all banks met the minimum required LCR of 60 percent. Some banks have made efforts to gradually improve their LCR via the replacement of short-term funding by more stable or longer-term funding or by increasing their holdings of liquid assets.

Despite such progress, liquidity risk management should not be limited to compliance with the minimum regulatory requirements. For proper liquidity management, institutions should take into account diverse indicators, measures and stress analysis for decision purposes, in order to determine the optimal level of liquid assets in line with their business's characteristics. In other words, regulatory compliance should not be mistaken for effective risk management. An additional element that credit institutions should take into account is the volatility in their liquidity ratios that results from their financing and investment strategies. This is noteworthy, because, given a change in market conditions, volatility could bring their ratio below the regulatory minimum.

Aiming at strengthening banks' liquidity positions, in October 2014 the Basel Committee published an additional requirement, known as the Net Stable Funding Ratio. This indicator, which shall come into force in January 2018, is expected to align the maturity structure of liabilities with the maturity structure and liquidity profile of assets, up to a one-year horizon.

Currently, on aggregate, the Mexican banking system is financing its loan portfolio with stable funds (graph 35), although this does not necessarily imply that all institutions currently would meet this additional requirement.

**Graph** 35
**Loan Portfolio Stable Funding**[1/]
Percent
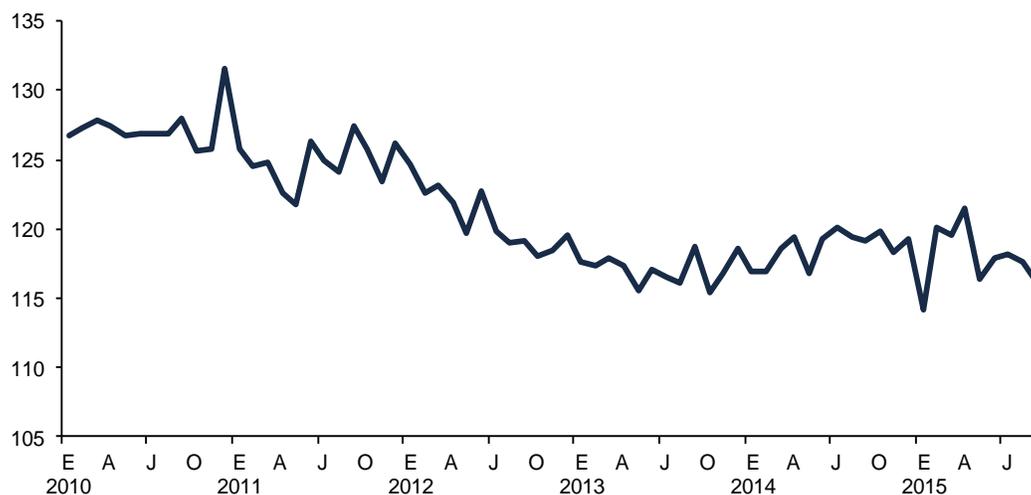


Figures as of September 2015
Source: CNBV and Banco de México
1/ Stable funding is made up of demand deposits and deposits from the general public, funds with terms longer than one year and stockholders' equity.

### 3.1.2. Non-Financial Private Companies Issuing Foreign Currency Denominated Debt

The ample liquidity that prevailed in international financial markets in recent years allowed Mexican companies to contract debt for higher amounts and longer terms than those offered by domestic markets (graph 36c).

Mexican non-financial private companies' total indebtedness grew significantly in recent years, especially in the case of foreign currency denominated debt issued in international financial markets. Consequently, foreign currency denominated debt represents more than half of companies' total indebtedness (graph 36a).[34] Nevertheless, as of 2014, placements started to slow down and in 2015 the amount placed is concentrated in companies with the best credit ratings (graph 36b).

---

[34] As of June 2015, the balance of total funds granted to non-financial private companies was 3,850 billion pesos. Foreign currency denominated debt amounted to 52.5 percent of funds. By type of company, 47.8 percent of total funds corresponds to companies listed on the BMV.

**Graph 36**
**Evolution of Financing and Characteristics of Non-Financial Private Companies' Debt Placements**

a) Total Financing
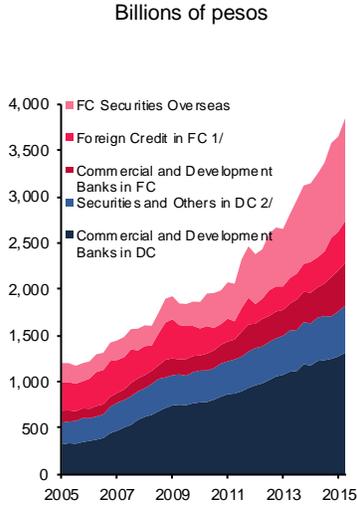
b) Debt Placements Overseas by Issuer's Rating
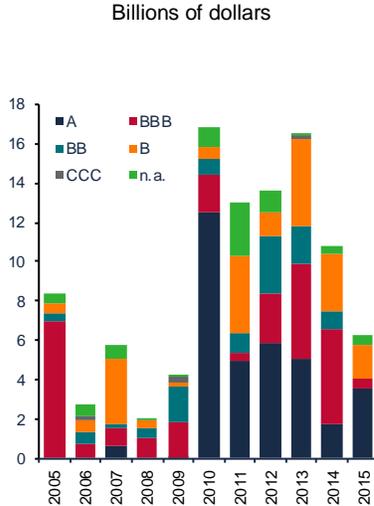
c) Companies Issuing Debt in Mexico and Overseas, 2010-2015[3]

Billions of pesos

Billions of dollars

Vertical axis: average term (years)
Horizontal axis: average amount placed (millions of pesos)

Figures as of June 2015
Source: Banco de México

Figures as of September 2015
Source: Bloomberg
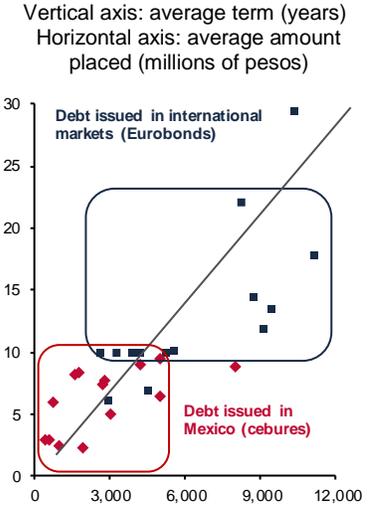
Figures as of September 2015
Source: Banco de México and Bloomberg

1/ Does not include suppliers.
2/ Includes funds granted by non-bank financial entities, excludes supplier credit.
3/ During the period 2010-September 2015, 55 companies issued Eurobonds and 78 senior bonds, 13 of which placed issues in both markets.

While some companies used funds obtained from these issues to replace debt contracted in less favorable conditions, others invested in projects that have not always been reflected in expected income flows due to the global and domestic economic slowdown. The higher indebtedness and the peso depreciation have had across the board a relatively moderate impact on companies' debt service (graph 37a). Nonetheless, there are substantial differences between companies with long-term liabilities −logically bearing a lower debt service charge as a proportion of their revenues− and those with high leverage and short-term maturities (graph 37b).

**Graph 37**

**Leverage and Debt Service of Non-Financial Companies Listed on the BMV**

a) Debt Service Coverage Ratio[1]

Number of times

b) Net Debt[2] to EBITDA and Average Term of Debt

Vertical Axis: net debt to EBITDA (number of times)
Horizontal Axis: average term (years)



Figures as of June 2015
Source: BMV
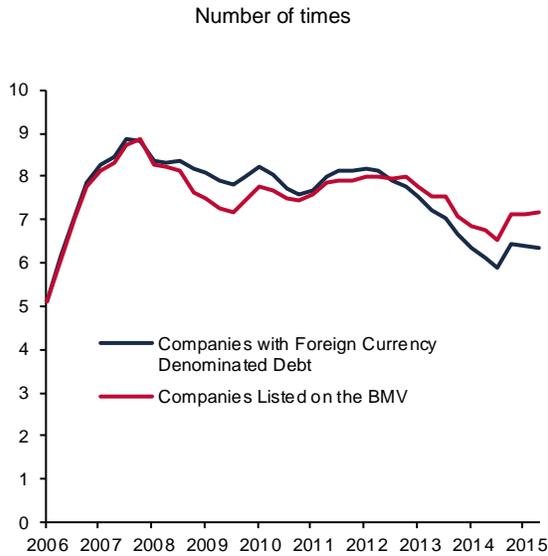
Figures as of June 2015
Source: BMV

1/ The debt service coverage ratio is computed by dividing EBITDA by accrued interest. EBITDA stands for Earnings Before Interest, Taxes, Depreciation and Amortization.
2/ Net debt calculated as the sum of bank liabilities and debt issuances less cash and equivalents.
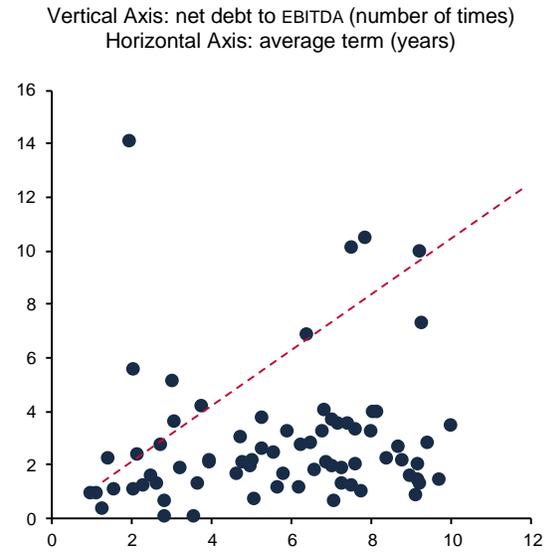
Most new issues overseas were placed at fixed rates; hence, as a whole, leveraged companies do not face a significant interest rate risk (graph 38a). Moreover, for most of such companies, refunding risk is insignificant as the maturities of foreign currency denominated debt securities are not concentrated in the short-term (graph 38b and 38c). The foregoing notwithstanding, for some companies, debt placements overseas increases leverage and exchange rate risks.

**Graph 38**
**Refunding and Interest Rate Risks of Non-Financial Companies Listed on the BMV**

| a) Mexican Companies' Debt Placements Overseas | b) Maturities of Foreign Currency Denominated Debt Securities | c) Foreign Currency Net Interest-Bearing Debt Due Over the Next 12 Months[1/ 2/] |
|---|---|---|
| Billions of dollars | Billions of dollars | Percentage of EBITDA |
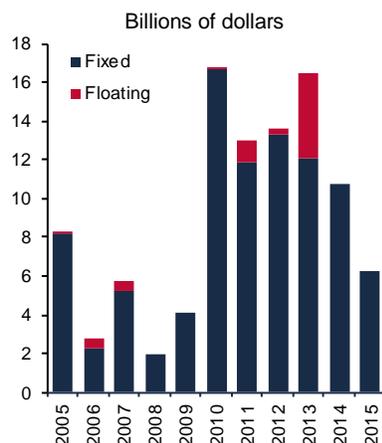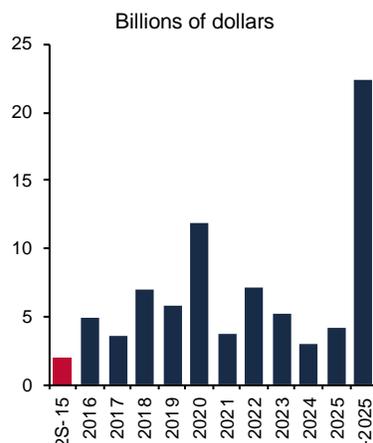
Figures as of June 2015
Source: Bloomberg

Figures as of June 2015
Source: Bloomberg
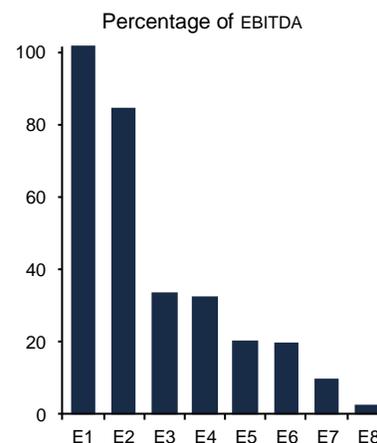
Figures as of June 2015
Source: BMV

1/ Foreign currency net interest-bearing debt includes debt securities and foreign currency denominated bank debt. Outstanding assets denominated in foreign currencies are subtracted therefrom, and then the result is used as a cash estimate in the respective currency.
2/ The horizontal axis shows different companies.

Data pertaining to non-financial companies listed on the Mexican Stock Exchange indicate that the companies whose leverage grew more were those who have liabilities denominated in foreign currencies (graph 39a).[35] Some companies increased their leverage without that strategy hitherto translating into higher operational income. This obviously raises uncertainty as to their ability to service debt and continue growing (graph 39b).[36]

---

[35] One of the indicators mainly used by financial analysts to measure leverage is debt net of cash as a percentage of earnings before interest, taxes, depreciation and amortization (EBITDA). The prospectuses of debt issuances or bank loans typically include covenants that limit such ratio. Hence, when caps are exceeded, companies face difficulties to refund or increase their liabilities.

[36] A total of 94 non-financial companies listed on the BMV as of June 2015 were included in the analysis.

**Graph 39**
**Leverage Performance of Non-Financial Companies Listed on the BMV and Impact of Currency Fluctuations**

| a) Equity Multiplier (Total Assets to Equity Ratio) | b) Net Debt to EBITDA Ratio | c) The Effect of Changes in FX Rates[1] |
|---|---|---|
| Number of times | Number of times | Left axis: percentage of EBITDA<br>Right axis: MXN/USD |



Figures as of June 2015
Source: BMV

Figures as of June 2015
Source: BMV

Figures as of June 2015
Source: BMV

1/ Currency fluctuations reflect exchange rate losses or gains not only from long or short MXN/USD positions, but also from other currencies *vis-à-vis* the Mexican peso.

The depreciation of the Mexican peso *vis-à-vis* the US dollar has contributed to increasing some companies' leverage, given the revaluation of their US dollar denominated debt. Further, the depreciation has had an impact on some companies' net profits (graph 39c). A portion of accounting losses derived from currency fluctuations is due to the revaluation of financial assets and liabilities denominated in foreign currencies, which not always translate into cash flows since debt may have long-term maturities.[37]

Further depreciation of the Mexican peso could have effects on the financial position of companies that increased their foreign currency denominated debt. Some of them lessen this risk by using derivatives hedges, and thanks to the natural coverage that their sales in foreign currencies represent. Although, at an aggregate level, the depreciation impact seems to be null, some companies with significant mismatches would be vulnerable to further depreciation.

In order to mitigate risks, during the last year, certain companies have taken steps and adopted strategies to reduce their leverage levels; namely, by exchanging debt for stocks, refunding US dollar denominated debt (both via liabilities in pesos or by extending maturities), selling assets abroad, repurchasing issues in US dollars, and putting off investment plans that entail expenses in US dollars.

---

[37] There are some companies whose functional currency is the US dollar, but present their financial statements in pesos to the general public. Said conversion *de facto* engenders an exchange effect that, although not representing a mismatch in pesos −just because the US dollar is their operating currency−, is reflected in their stockholders' equity as part of *Other Comprehensive Income* (OCI). OCI does not have an impact on net profits.

According to our studies, the possible materialization of exchange rate and interest rate risks faced by non-financial companies listed on the BMV would have limited effects on domestic commercial banks (graph 40a). This is because most of foreign currency denominated credit contracted by listed companies that could be regarded as most vulnerable are bank loans or debt placements overseas. We also detected that certain non-listed companies have seen their foreign currency denominated liabilities grow in recent years. Nearly half of these companies' debt was contracted abroad, mainly with banks, and, to a lesser extent, via private issues; the remainder has been granted by domestic banks (graph 40b).

**Graph 40**
**Non-Financial Companies' Indebtedness**

| a) Breakdown by Origin of Funds Granted to BMV Listed Companies with Exchange Rate Risk[1] | b) Foreign Currency Denominated Funds | c) Domestic Commercial Bank Loans to Companies by Currency |
|---|---|---|
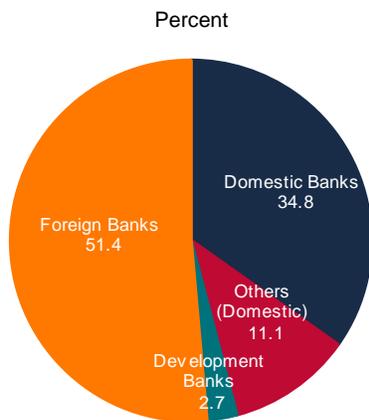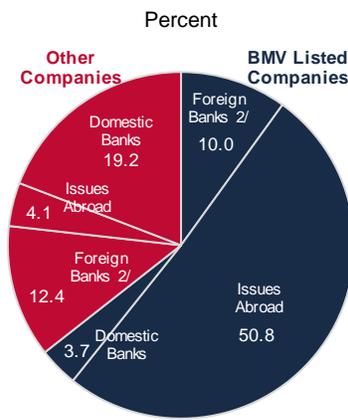
Percent

Percent

Billions of pesos

Domestic Banks 34.8

Foreign Banks 51.4

Others (Domestic) 11.1

Development Banks 2.7

**Other Companies**

**BMV Listed Companies**

Foreign Banks 2/ 10.0

Domestic Banks 19.2

Issues Abroad 4.1

Foreign Banks 2/ 12.4

Domestic Banks 3.7

Issues Abroad 50.8

Figures as of June 2015
Source: BMV

Figures as of June 2015
Source: BMV
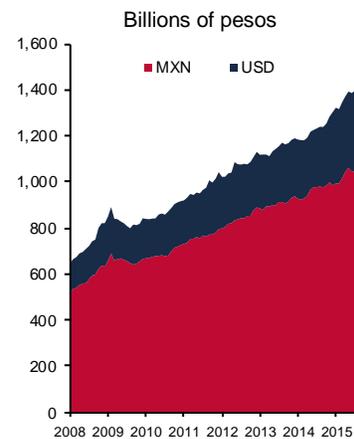
Figures as of June 2015
Source: CNBV

1/ Includes 50 companies listed on the BMV spotted as having greater exchange rate vulnerability during the exchange rate risk analysis described before.
2/ Does not include credit from foreign non-financial suppliers.

As of June 2015, domestic banks' foreign currency denominated loans to companies accounted for 26 percent of total portfolio (graph 40c). As of that date, companies listed on the BMV accounted for 25 percent thereof. Yet, domestic banks are exposed to limited risks, as most loans have been granted to companies with revenues in US dollars that use derivatives to hedge exchange rate risk.

Large companies' access to foreign funds in turn provided funds for bank loans to smaller-sized companies (graphs 41a and 41b). Hence, the greater fund availability diminished the spread between active rates and the interbank equilibrium interest rate (TIIE) (graph 41c). Nevertheless, this trend may start to revert to the extent

conditions in global financial markets worsen, and large companies replace external for domestic funding.

**Graph 41**
**Corporate Bank Loans by Size**

a) Balance of Commercial Loans by Company Size
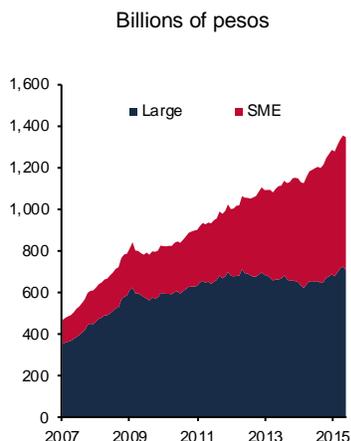
Billions of pesos

b) Real Annual Change

Percent

c) Average spread between the 28-day TIIE and Active Rate as of Grant Date

Basis points



Figures as of June 2015
Source: Banco de México

Figures as of June 2015
Source: Banco de México
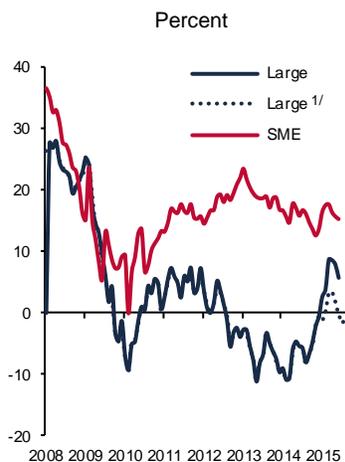
Figures as of June 2015
Source: Banco de México
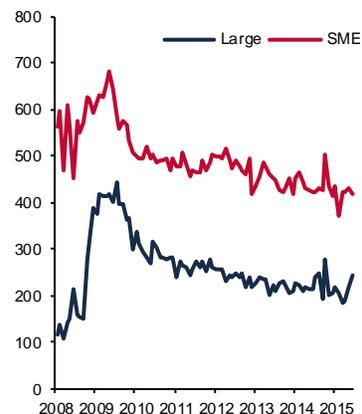
1/ Clean of the exchange rate depreciation effect on the USD loan portfolio.

### 3.1.3. Investment Funds

The international community is increasingly concerned about how investment fund managers could react in a scenario of disorderly adjustments in interest rates, as well as how resilient they may be in the face of a generalized demand for redemptions.

This section presents an analysis of risks faced by domestic fixed income funds in a scenario of disorderly adjustments of interest rates. In particular, we consider potential liquidity risks, similar to those materialized in 2008 and 2009, when redemptions by investors were observed. Specifically, we study the capacity of fixed income funds' to absorb liquidity shocks. Although securities holdings for some funds in operation are diversified (repo and direct), others have concentrated their portfolios in securities whose markets are more vulnerable to liquidity pressure.

**Structure and Trends**

As of September 30, 2015, 559 fixed income and equity funds were operating in Mexico, integrated into 28 fund managers, of which 7 (25 percent) were independent and the remaining 21 (75 percent) belonged to a financial consortium, bank or brokerage firm.

Investment funds' net assets have significantly grown over the last decade. The value of said assets increased from 5 percent of GDP in 2005 up to 11 percent in 2015. Most assets are concentrated in fixed

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income funds, which represented 4 percent of GDP in 2005 and 8 percent in 2015. However, in the second half of 2008 and part of 2009, there was a general contraction triggered by the global financial crisis. In consequence, during the last quarter of 2008, net assets managed by fixed income funds fell by 12.3 percent *vis-à-vis* their balance in the previous quarter.

Price volatility during the 2008 crisis led to substantial redemptions in both fixed income and equity funds. The decrease in the amount of assets managed was mainly attributed to redemptions, rather than losses in the value of the securities that were part of the portfolio (graph 42b).[38] Other episodes of net outflows were observed afterwards, although none of them comparable to what happened in 2008 and 2009.

Historically, direct and repo investments in government securities, including those issued by the IPAB, represent the majority of Mexican holdings in investment funds. At an aggregate level, as of January 2008, they represented 72 percent of debt portfolio; and, as of September 2015, they accounted for 79 percent (graph 43).

**Graph 42**
**Net Asset Value of Fixed Income and Equity Funds**

a) Evolution of Fixed Income Funds Asset Portfolio

b) Net Investor Inflows/Outflows versus Changes in Market Value of Assets
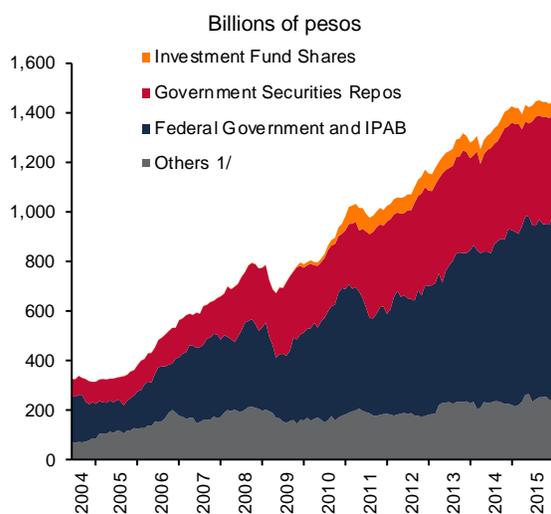


Figures as of September 2015
Source: CNBV
1/ Others: bank securities and non-financial private sector
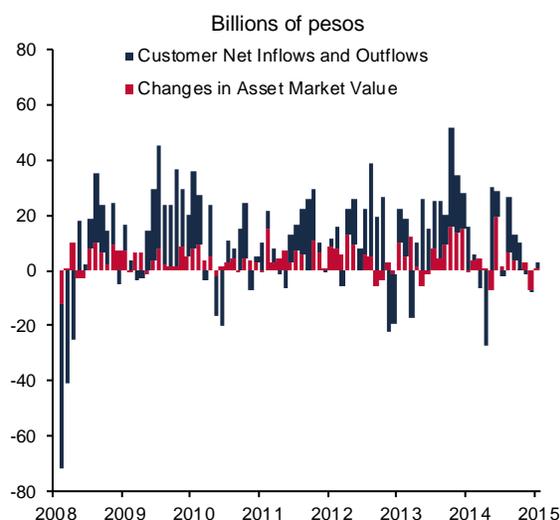
Figures as of September 2015
Source: CNBV

[38] As a result of redemptions registered over that period, investment funds cleared investments in government assets. International investors followed suit. In contrast, institutional investors and other domestic investors increased their holdings in said assets.

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**Graph 43**
**Configuration of Fixed Income Funds Assets**



Others (Public Sector)
5.4

Investment Funds
3.6

Bank
Securities
10.5

Non-Financial Private
Sector
7.0

Cetes, bondes, bonos
and udibonos, direct
31.9

IPAB, repo
9.5

IPAB, direct
14.1

Cetes, bondes, bonos
and udibonos, repo
18.1
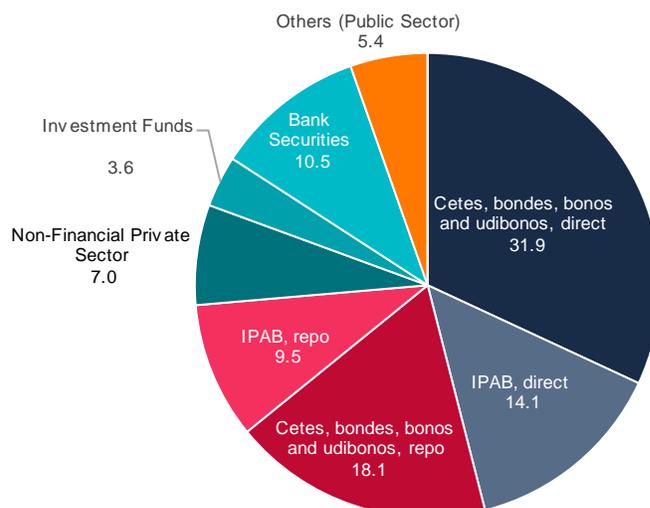
Figures as of September 2015
Source: CNBV

## Regulation and Liquidity Risks

In order to improve investment funds' liquidity management, Mexican financial authorities have issued various regulatory measures. The CNBV issued regulation that stipulated that funds must prepare investment profiles for their customers, so that they receive investment recommendations and financial consulting services that best suit their profile.[39]

In that sense, with a view to tackling liquidity issues, even before the global financial crisis, the Law had already laid down certain preemptive measures, such as the suspension on redemptions and the application of redemptions haircuts for investors seeking to withdraw their investments in times of high volatility. Further, reforms to the Investment Fund Act enacted in January 2014, introduced the options to split a fund during stress periods with no previous authorization during stress periods. In addition, in November 2014, the CNBV issued norms to regulate the above mentioned activities.[40]

There could be, of course, extreme situations with unusually high liquidity demand for investment funds, for example when funds step back from incurring the image and reputational costs that arise from the implementation of the above mentioned measures.

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[39] See articles 4 and 5 of *General Provisions Applicable to Financial Entities and Other Persons Providing Investment Services*, published on the Official Journal of the Federation on January 9, 2015.

[40] See General Provisions Applicable to Investment Funds and the Persons Providing Them with Services, also known as Investment Fund Rules (CUFI in Spanish), published on the Official Journal of the Federation on November 24, 2014.

It is also essential that investment funds reinforce their liquidity risk management practices, and that they use quantitative indicators to determine the sufficiency of the high-quality liquid assets level of sufficiency to cope with stress scenarios.

Investment funds have been generally modifying their portfolios and increasing the proportion of liquid debt securities. In 2008, some funds had liquid assets below their current levels, which made them vulnerable to considerable redemptions by their customers. Currently, the group of funds pursuing aggressive investment strategies is small, and the majority of funds hold enough liquid assets to face high redemption levels similar to the ones observed in recent years.[41] Nevertheless, despite this relative improvement, certain funds do not have enough liquidity yet to cope with the repurchase commitments laid down in their prospectuses, nor with plausible −albeit remote− stringent stress scenarios. For their part, the largest funds on the market are characterized by keeping a high proportion of liquid assets.

Investment funds must evaluate whether the configuration and size of their portfolio of liquid assets are adequate given the characteristics of their operation, their risk profile and their commitments to investors. On the other hand, financial authorities, given the circumstances prevailing in such market, must assess the convenience of making adjustments and imposing new market and regulatory measures that ensure liquidity in periods of stress and high volatility.

### 3.1.4. Other Financial Entities and Activities

In the wake of the global financial crisis, the response of global authorities has led to increased regulatory requirements for the traditional banking sector. This has generated incentives for intermediation to occur via diverse channels other than banks. Thus, financial authorities have decided to monitor inherent risks in financial entities, activities or instruments other than traditional banking. In that sense, the spotlight has centered on maturity mismatches, leverage and the assumption of excessive credit risk.

Therefore, the G20 Financial Stability Board (FSB) developed a methodology to follow up such risks. According to this methodology, financial entities, activities or instruments are classified into five categories depending on their economic functions and respective risks.[42]

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[41] Expected liquidity outflows represent a statistical exercise capturing the observed historical distribution of fund outflows, and considers the average of those outflows above the percentile 95 of said distribution.

[42] The Banco de México *Financial System Report* October 2014 presents the FSB methodology in detail. Said methodology was fine- tuned over the last year: entities which are not classified on the basis of their risks into the five identified categories were excluded from the heading *Other Financial Entities and Activities* (OEAF) described in the 2014 Report.

Table 3 presents said categories and their major inherent risks. Further, all domestic financial entities, activities and instruments classified into those five groups are listed, together with asset amount and growth per category.

**Table 3**
**Other Financial Entities and Activities by Type of Activity and Quasi-Banking Risk[1]**
**(FSB Methodology)**

| Type of Activity or Economic Function | Entity/Instruments/Activity | | Risk Factor: | | | Total Assets | Real Annual Change 2T15-2T14 |
|---|---|---|---|---|---|---|---|
| | | | Maturity Transformation | Leverage | Financial Runs | | |
| | | | Long-Term Assets / Total Assets | Total Assets / Equity | | Billions of pesos | Percent |
| **Management of Clients' Assets** | Debt Funds | | ✓ | | ✓ | 1,446 | 2.0 |
| | Real Estate Investment Trusts (fibras) [4] | | | ✓ | | 248 | 3.2 |
| | Capital Development Certificates (CDC) [4] | | | ✓ | | 89 | 13.2 |
| | Energy and Infrastructure Investment Trusts (fibra E) | | | ✓ | | n.a. | n.a. |
| **Granting of Loans Reliant on Short-Term Funds** | Socaps (Basic Tier) | | ✓ | ✓ | | n.a. | n.a. |
| | Socaps (Tiers 1 through 4) | | ✓ | ✓ | | 93 | 10.7 |
| | Sofipos (Tiers 1 through 4) | | ✓ | ✓ | ✓ | 25 | -11.9 |
| | Credit Unions | | ✓ | ✓ | | 47 | -1.4 |
| | Regulated Sofomes having equity links | Banks | ✓ | ✓ | | 275 | 5.3 |
| | | Financial Groups | ✓ | ✓ | | 61 | -10.3 |
| | | Other fin. entities [2] | ✓ | ✓ | | 0 | n.a. |
| | Regulated Sofomes Issuing Debt | | ✓ | ✓ | ✓ | 0 | n.a. |
| | Unregulated Sofomes | | ✓ | ✓ | | 177 | 1.3 |
| | Deposit Warehouses | | ✓ | ✓ | | 13 | 9.4 |
| | Financial Companies Specialized in Loans, Financial Leasing or Factoring [3] | | ✓ | ✓ | | 30 | 10.7 |
| | Companies Granting Consumer Loans | | ✓ | ✓ | | 82 | 1.4 |
| **Market Intermediation Reliant on Short-Term Funds** | Brokerage Firms | | ✓ | ✓ | ✓ | 540 | 42.9 |
| **Facilitating Credit Creation** | Credit Insurers (financial guarantee) | | ✓ | | | 5 | -6.5 |
| **Intermediation Based on Asset Securitizations** | Public Sector Mortgage-Backed Securities (Infonavit and Fovissste) [4] | | ✓ | ✓ | | 217 | 6.2 |
| | Bank and Sofomes Mortgage-Backed Securities [4] | | ✓ | ✓ | | 67 | -2.8 |

Figures as of June 2015
Source: CNBV, Indeval, Valmer, Banco de México
1/ Red check marks indicate cases where the described behavior could occur or currently occurs only in some of the entities of this specific sector in Mexico. Risk factors in the columns are defined as:
•  Maturity transformation risk: arises from obtaining short-term funds to invest in long-term assets (maturity mismatch).
•  Leverage risk: arises from the use of techniques or strategies in which one borrows funds to subsequently purchase assets, with the purpose of increasing potential investment profits (losses).
2/ Consolidated either with socaps, sofipos or credit unions.
3/ E.g., financial branches of auto makers, non-financial companies undertaking leasing and factoring activities.
4/ Only the outstanding marked-to-market amount issued is considered.

This amendment serves the purpose of providing a more precise measure of such entities and activities not subject to traditional banking regulation which present similar risks to banks.

In Mexico, as of June 2015, the entities that were classified according to their risks into the aforementioned economic functions accounted for 21.5 percent of the financial system and 18.8 percent of GDP. This sector exhibited real annual growth of 7.6 percent as of the same date, mainly driven by debt funds. It is noteworthy that in the US this sector represents 82 percent of GDP.

Debt funds stand out among these intermediaries, as they have received special global attention in recent years, given the possible materialization of their liquidity risk. The assessment of liquidity risk for investment funds was presented in the previous section of this *Report.* We also found that brokerage firms with significant increases in repo and securities investments, as well as equity mutual funds are in the same case. The latter experienced fast growth over the last year, although from a small base.

Such capital investment vehicles do not perform credit intermediation but their investments could generate and magnify financial risks (leverage, transformation of terms and liquidity risks, etc.). These entities take funds by placing instruments with investors −in some cases, only with institutional investors.

In particular, two investment vehicles have experienced substantial growth: capital development certificates (CDCs) and infrastructure and real estate investment trusts (Fibras in Spanish). Although, given their size, these vehicles do not currently represent a risk for the financial system, it is necessary to monitor their growth and the vehicles managers' disclosure of information to investors. Specifically, financial leverage, the acquisition of loan portfolios and the development of other activities may give rise to conflicts of interest and dilute the purpose that led to the creation of those figures, apart from representing unfair competition for other regulated financial activities.

In Mexico, some rules that limit risks are applied to financial entities, activities and operations not subject to banking regulation. Moreover, several of these entities are subject to oversight procedures (table 4). Additionally, new regulation was issued in recent months to create a new investment instrument, fibras E; and soon, new standards will be issued to create the investment projects trust securities (cerpis), whose regulation and inherent risks are commented below.

### Infrastructure and Real Estate Investment Trusts (fibras)[43]

As of June 2015, fibras' assets amounted to 334 billion pesos, which accounted for 2.1 percent of the total financial system's asset

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[43] The *Financial System Report* October 2014 describes the legal and tax framework applicable to fibras.

value.[44] As of mid-2014, fibras' growth had been swift, but diminished over the last year. This reduction can be explained by the economic slowdown[45] and the fact that the foreign investors' fund supply decreased.

**Table 4**
**Regulation Applicable to Entities and Activities Not Subject to Banking Regulation**

| Type of Activity or Economic Function | Entity/Instruments/Activity | Capitalization | Accounting Criteria | Prudential Criteria | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Risk Management | Portfolio Provision | Risk Diversification | Liquidity Require | Information Disclosure | Credit Process |
| | **Commercial Banks** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Managment of Clients' Assets | Debt Funds | | ✓ | ✗ | n.a. | ✓ | ✓ | ✓ | n.a. |
| | Real Estate Investment Trusts (fibras) | | ✓ | ✗ | ✗ | ✗ | ✗ | ✓ | ✗ |
| | Capital Development Certificates (CDC) | | ✓ | ✗ | ✗ | ✗ | ✗ | ✓ | ✗ |
| | Energy and Infrastructure Investment Trusts (fibra E) | ✗ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Granting of Loans Reliant on Short-Term Funds | Socaps | | | | | | | | |
| | Basic Tier | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ |
| | Tier 1 | ✓ | ✓ | ✗ | ✓ | ✓ | ✓ | ✓ | ✗ |
| | Tiers 2 - 4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Sofipos | | | | | | | | |
| | Tier 1 | ✓ | ✓ | ✗ | ✓ | ✓ | ✓ | ✓ | ✗ |
| | Tiers 2 - 4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Credit Unions | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Regulated Sofomes | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ | ✓ |
| | Having Property Links with Banks | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ | ✓ |
| | Having Property Links with Financial Groups | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ | ✓ |
| | Having Property Links with other entities 2/ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ | ✓ |
| | Issuing Debt Securities | ✓ | ✗ | ✗ | ✗ | ✗ | ✗ | ✓ | ✗ |
| | Unregulated Sofomes | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ |
| | Deposit Warehouses | ✗ | ✓ | ✗ | ✗ | ✗ | ✗ | ✓ | ✗ |
| | Financial Companies Specialized in Loans, Financial Leasing or Factoring 3/ | ✗ | ✓ | ✗ | ✗ | ✗ | ✗ | ✓ | ✗ |
| | Companies Granting Consumer Loans | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ |
| Market Intermediation Reliant on Short-Term Funds | Brokerage Firms | ✓ | ✓ | ✓ | n.a. | ✓ | ✓ | ✓ | n.a. |
| Facilitating Credit Creation | Credit Insurers (financial guarantee) | ✓ | ✓ | ✓ | n.a. | ✓ | ✓ | ✓ | n.a. |
| Intermediation Based on Asset Securitizations | Public and Private Sector Securitizations | ✗ | ✓ | ✗ | ✗ | ✗ | ✗ | ✓ | ✗ |

Source: Ley de Instituciones de Crédito, Ley de Protección y Defensa al Usuario de Servicios Financieros, Ley General de Organizaciones y Actividades Auxiliares del Crédito, Ley de Ahorro y Crédito Popular, Ley para Regular las Actividades de las Sociedades Cooperativas de Ahorro y Préstamo and Ley de Uniones de Crédito, together with circulars issued by CNBV for each financial entity.
n.a. not applicable

1/ Their level of indebtedness is capped.
2/ Consolidated either with socaps, sofipos or credit unions
3/E.g., financial branches of auto makers, non-financial companies undertaking leasing and factoring activities.

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[44] This amount excludes assets belonging to the Mortgage Trust (FHipo). Unlike the rest of fibras, which have thus far only invested in real estate, FHipo has invested in a set of mortgage loans in joint partnership with Infonavit. FHipo does not comply with the criteria set forth by the Income Tax Law, and hence, cannot be regarded as fibras. As of June 2015, their assets amounted to nine billion pesos.

[45] A fall in the occupancy rate is one of the major risks faced by fibras, which in turn depends on the level of economic activity.

In 2014 prudential regulation came into effect with the purpose of limiting fibras' leverage and liquidity risks. Yet, some of these instruments might also be subject to foreign exchange risks. Although fibras disclose detailed information about their liabilities denominated in foreign currencies, that is not the case for their revenues, nor the financial derivatives contracted to hedge exchange or interest rate risks. In order to address this situation, it would be convenient that information disclosed by fibras also includes tests of sensitivity to changes in the exchange rate for their balances, revenues and income statements.

### Capital Development Certificates (CDCs)

The capital development certificates sector has kept on growing thanks to new issuances and reopenings. In consequence, as of June 2015, the CDC asset balance was 92 billion pesos, which accounted for 0.6 percent of total assets in the financial system.

Originally, these instruments were designed to obtain capital, rather than debt funds; in a narrow sense, they would not be part of a credit intermediation chain. Nevertheless, some of these vehicles have recently been investing in loan portfolios, which makes them part of that chain. In general terms, CDC investing in debt do not take leverage and, in just few cases, the amount is minimum. Yet, prudential rules have been issued to limit their leverage, especially for those that predominantly destine funds to credits, loans, financing and purchase of debt securities. In addition, the regulation sets forth the obligation to comply with a debt coverage ratio. The measures mentioned before are particularly relevant, as siefores are the major holders of these certificates.

### New Instruments

During the second half of 2015, regulation was issued for a new investment instrument (fibras E) with different features from those already mentioned. The purpose was to count on more flexible investment vehicles in strategic economic sectors, such as the energy and infrastructure sectors.

Fibras E are trusts that shall invest in operating companies' shares that shall in turn invest in the energy or infrastructure sectors. In order to finance such investments, the vehicle shall issue trust securities for investments in the energy and infrastructure sectors. The promoted company shall have, within its total assets, mature and stabilized assets that shall be used in eligible projects or activities, pursuant to the rules set forth to access tax benefits.[46] Thanks to the operation of the promoted company, assets shall generate income flows that shall be passed on to investors via the trust, for the

---

[46] Some projects likely to be included in fibras E are: transportation planning and hydrocarbon processing projects (except for exploration and production projects, and the sale of fuels to the general public); electricity generation, transmission and distribution projects; roads, bridges, prisons, water treatment systems; telecommunications networks, among others. Assets may be acquired or already be part of a previous asset within the entity.

operating entity to generate a taxable income for the year. Like real estate fibras, profits shall be distributed among holders of trust securities, with tax benefits in case the respective criteria are met.

Similarly, work is being done to issue regulation for a second instrument which is a trust that shall issue capital instruments, known as trust securities for investment projects (cerpis). Its purpose shall be to obtain funds and invest in companies and projects from all economic sectors. Access to these instruments shall be limited to domestic or foreign institutional investors, and they shall be placed in a restricted public offering.

The rules applicable to fibras E are contained in the CNBV Circular for Securities Market Issuers. In addition, the Consar has introduced relevant amendments to rules applicable to pension funds (afores) and managed funds in order to establish a prudential framework in line with these new instruments' risk features. It should be considered that corporate and governance structures for these instruments shall have meaningful differences with other instruments previously offered on the market.

With the purpose of preventing potential conflicts of interest in fibras E and cerpis, the responsibility of technical committees has been strengthened, so as to safeguard holders' interests, since the latter have fewer rights within the General Assembly of holders *vis-à-vis* those in the case of CDC or real estate fibras. This formula is intended to provide more swiftness to the vehicle, in order to facilitate investment in projects that, given their scale and specialization, may require the participation of a specialized co-investor with analytical capabilities, who shall therefore play an active role in the investment. Since these specialized participants will also invest their own funds in projects or companies, the incentives to safeguard other investors' interests (e.g., institutional investors) will be duly aligned. Furthermore, compensation criteria are also expected to be self-imposed for managers, who, according to international practices, could be a co-investor's related party or controlled by the latter. [47]

Table 5 shows the main differences relative to corporate governance and incentives for all investment instruments considered by regulation. We highlighted the characteristics that may favor incentives alignment between trust managers and holders or passive investors.

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[47] The vehicle that was the basis for the two previous ones is the *Master Limited Partnership Agreement*, which became quite common in the US and Canada for investments in projects in the energy sector, given the huge scale of investments. It has become common to find −in a self-imposed fashion− that compensations received by the trust manager increase as the project consolidates. This feature contributes to aligning incentives for the manager to safeguard the interests of liability holders.

**Table 5**
**Characteristics of Senior Trust Bonds**

| Type of Policy Tool | Development (CDC) | Real Estate (fibras) | Investment in Energy and Infrastructure Sectors (fibras E) |
|---|---|---|---|
| **Devices to Align Incentives** | | | |
| With limited voting, shall pay preferential distributions | ✗ | ✗ | ✓ |
| Compensation payment to the manager, trustor or related parties shall be subordinated to payment to trust securities holders | ✗ | ✗ | ✓ |
| **Corporate Governance** | | | |
| The Assembly shall approve investments higher than 10 percent of property which represent conflicts of interest. | ✓ | ✓ | ✗ |
| The Assembly shall approve any increase in compensation schemes and management fees or any other concept that favors the manager or member of the technical committee. | ✓ | ✓ | ✗ |
| Holders, who individually or jointly possess a portion of the outstanding amount, shall be entitled to name a member of the technical committee. Further, if stipulated, the trustor, common representative and manager shall be part of the committee. | ✓, 10% | ✓, 10% | ✓, 10% |
| The technical committee shall approve transactions with related persons or parties with conflicts of interest for a value higher or equal to a percentage of trust assets. | ✓, 5% | ✓, 5% | ✓, 10%[1] |
| The technical committee shall be comprised of 21 members at most, a percentage of whom, at least, shall be independent. | ✓, 25% | ✓, 25% | ✓, 50% |
| Members of the Assembly and the Committee with conflicts of interest shall abstain from voting. | ✓ | ✓ | ✓ |
| A conflict of interest transaction shall have the majority of votes from independent members of the committee. | ✗ | ✓ | ✓ |
| The committee shall inform investors whether independent members' opinion is different from determinations. | ✓ | ✓ | ✗ |
| The committee shall announce transactions with related persons as relevant events. | ✗ | ✗ | ✓ |
| **Prudential Measures** | | | |
| Leverage limit | ✓, Assets ≤ 5* Certificates[2] | ✓, Assets ≥ 0.5* Liabilities; Assets ≤ 5* Liabilities[2] | ✓[3] |
| Coverage ratio | ✓, 1.0[2] | ✓, 1.0[2] | ✗ |

Source: Single Circular for Issuers, CNBV
1/ Applied only if the technical committee appoints a committee of conflicts of interest.
2/ In case the issuance funds are mainly devoted (at least 70 percent) to granting loans.
3/ The holders Assembly shall approve of the maximum limit to indebtedness.

### 3.1.5. Development Institutions

In general terms, development institutions have the necessary financial strength to face possible adverse scenarios, both derived from lower economic growth and adjustments in exchange rates and interest rates, related to new volatility bouts in financial markets. Indeed, the development banking system is adequately capitalized, registering as of June 2015 a capital adequacy ratio of 14.51 percent (graph 44). This level provides the necessary financial soundness to cope with diverse stress scenarios.

**Graph 44**
**Capital Adequacy Ratio for the Development Banking System**
Left axis: millions of pesos
Right axis: percent
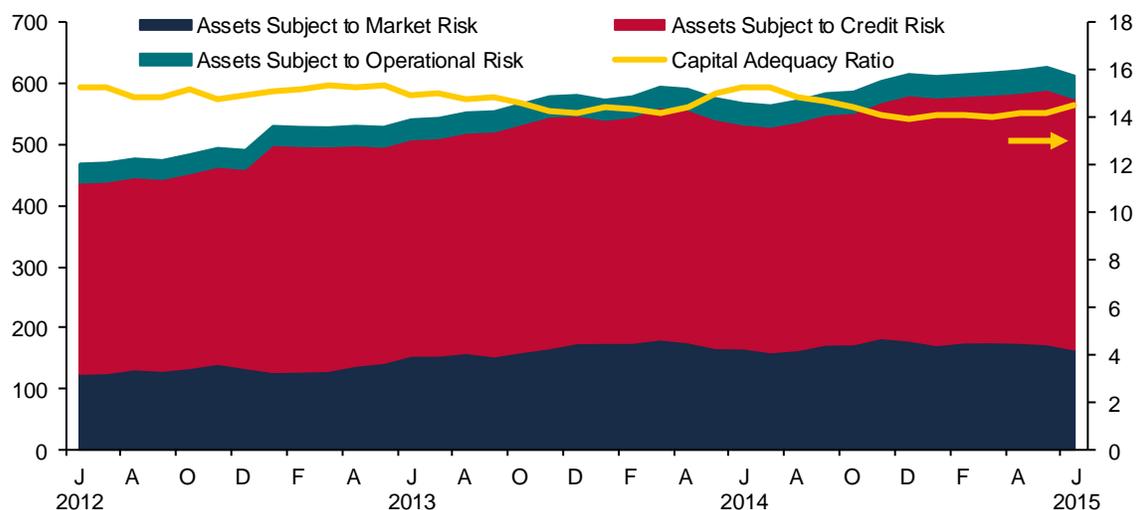


Figures as of June 2015
Source: CNBV and Banco de México

Another element that heightens development banks' resilience to economic shocks is the Ministry of Finance and Public Credit's ability to transfer capital surpluses among institutions (generally via the collection of revenue from a national credit society and their allocation to another national credit society via capitalization). This possibility enables a more efficient and immediate allocation of funds, while mitigating the drying up of credit for any given institution.

Nonetheless, just like other credit institutions, development banks face various risks, inherent to their financial intermediation activities, that should be systematically identified and overseen. Hence, from this Report edition on, we will include a section which will present an assessment of the major risks that, considering the economic environment as of the date of publication, are of greater relevance for development banks.

### Credit Risk

As mentioned in section 2.4, an abrupt domestic economic slowdown is one of the major risks for the domestic financial system. Were this risk to materialize, it would affect a portion of debtors and heighten the probability of default, thereby increasing expected losses for both development bank credit products and guarantees. Yet, the effect on guarantees would be lower for development banks, as most count on state counter-guarantees.

Currently, the development bank portfolio is properly diversified, although given their nature and legal object, some institutions' portfolios are concentrated in one specific economic activity. It is

noteworthy that the poor performance of portfolios received as payment in previous years elevated the vulnerability of the Federal Mortgage Society (SHF in Spanish). On the other hand, although Banobras exhibits the highest capital adequacy ratio in the system, it could be hit by a decline in infrastructure activity (mainly derived from a slowdown in loan granting to projects with their own source of payment).

## Market Risk

In general terms, large credit and financing structures have total or partial coverage for market risks. These hedges lessen the impact on debtors of eventual interest rate hikes, and thus bring down delinquency related to such heading. Market risks to which development banks are exposed derive from their securities positions in both domestic and foreign currencies. There are only three institutions that have substantial securities holdings, which are mainly reported to institutional customers. Among reported instruments, bondes D have shown a sizable income source. A sharp rise in interest rates could lead to losses for this sector through two different channels. First, interest rate hikes, and particularly, increases in the bondes D surcharge, would entail valuation losses affecting institutions' capital adequacy ratio and lending capacity, probably in times of high credit demand. Second, the potential withdrawal of institutional investors financing their positions would make development institutions increase fund gathering or partially get rid of such positions, possibly forcing themselves to take losses.

With regard to exchange rate risks, development banks as a whole do not hold relevant open positions. Yet, Bancomext is a special case, due to the placement of foreign currency denominated loans, which implies plunges in their capital adequacy ratio when their credit risk assets are revalued.

## Liquidity Risk

Liquidity gaps in this sector do not pose considerable risks. Further, in times of liquidity stringency, development banks tend to keep their deposits, thanks to the "flight for safety" effect −their liabilities count on a federal guarantee.

## Direct credit and credit boosted

Amendments introduced by the financial reforms that came into effect in 2014 granted more flexibility to development banks. These institutions have set goals in their own plans that imply growth rates three or four times higher than the GDP growth forecast for the 2013-2018 period. In consequence, development banks have seen their fund placement accelerate, exhibiting high growth rates in recent

years.[48] So far, no risks related to such results have been identified. Yet, monitoring is required to prevent this high financing growth to bring about a shift from commercial to development banks or a possible portfolio deterioration in the medium-term.

**Figure 2**
**Direct Credit and Credit Boosted by Development Institutions**
Millions of pesos

| | |
|---|---|
| **Direct Credit and Credit boosted by Development Institutions** | **$1,221,925** |

| **Direct Credit** | **Net boosted credit** |
|---|---|
| **$808,395**[1/] | **$413,530**[2/] |

| **Credit to Public Sector** | **Credit to Private Sector** | **Credit as Agent of the Federal Government** | **Without Guarantee** | **With Guarantee** (exposure derived from development institutions' guarantees) |
|---|---|---|---|---|
| **$221,459** | **$583,322** | **$3,614** | **$279,926** | **$133,604** |

| Corporate **$261,607** | Housing **$82,068** | Nafin **$53,657** | Banobras **$22,946** |
|---|---|---|---|
| Infrastructure **$100,854** | Agribusiness **$118,984** | Bancomext **$21,813** | FIRA **$6,083** |
| | Consumption[3/] **$19,809** | | SHF[4/] **$29,105** |

Figures as of June 2015
Source: CNBV and Banco de México
1/ Development banks' on-balance credit. First-tier credit: 544.6 billion pesos; second-tier credit: 260 billion pesos. It excludes 1,380 million pesos corresponding to repo transactions relating to derivatives financing and valuation.
2/ "Net induced credit" refers to the total balance of loans granted by private financial intermediaries, partially guaranteed by development banks, FIRA and FN, and without development banks' funding. It excludes securitizations recorded on the SHF's balance
3/ Consumer credit is comprised of loans granted by Banjército to army forces, payroll loans granted by Bansefi, and loans granted to development banks' employees as employment benefits.
4/ Includes guarantees issued by the SHF Mortgage Insurance Division (scv in Spanish).

As of June 2015, the balance of loans granted by development banks, Fideicomisos Instituidos en Relación con la Agricultura (Agricultural Trusts, FIRA) and Financiera Nacional de Desarrollo Agropecuario, Rural, Forestal y Pesquero (National Funds for Farming, Rural, Forestry and Fisheries Development, FN) [49] was 808.8 billion pesos. This accounted for 19 percent of total loans granted by the banking system (both commercial and development

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[48] As of June 2015, the real annual growth of development banks' financing amounted to 16.6 percent, resulting from real annual growth of 17.8 percent in the total portfolio and 14.4 percent in the induced balance.

[49] As of January 10, 2014, as part of the financial reform, Financiera Rural (Rural Funds) turned into Financiera Nacional de Desarrollo Agropecuario, Rural, Forestal y Pesquero (FN, National Funds for Farming, Rural, Forestry and Fisheries Development).

banks) and 4.6 percent of GDP. Additionally, development intermediaries provided guarantees for additional loans ("net induced credit") for an amount of 413.5 billion pesos. Hence, as of the same date, the sum of both concepts amounted to 1,221.9 billion pesos (figure 2), accounting for 28.8 percent of total banking financing.[50]

### 3.2. Stress Tests

The aim of Banco de México's stress tests is to assess commercial banks' ability to absorb losses caused by extreme adverse, albeit feasible, scenarios of macro-financial variables. We must underscore that the hereby analyzed scenarios do not represent a forecast of macroeconomic variables, nor prejudice the probability of their occurrence. This simulation exercise exclusively present extremes situations in order to analytically evaluate the extent to which banking institutions might be affected.

With the purpose of ensuring the availability of enough historical data for model construction and analysis purposes, only banks operating for no less than five years were considered. Similar to what was done in previous years, we used a 3-year prospective horizon and took institutions' balance as of June 2015 as starting point.

The exercise assesses possible results for a set of adverse scenarios. Following the methodological approach of previous years, four thousand scenarios were simulated, so as to capture certain events; e.g., multiple equilibria that may occur even with similar observations of the underlying variables or not very stable financial system equilibria that take place due to nonlinearities -these may cause that relatively small changes in underlying variables lead to completely different results on intermediaries' balances.

The exercise required: (a) the projection of banks' major financial variables, in order to determine its possible effects on their solvency; (b) the paths of capital levels by explicit modeling of credit losses and portfolio performance; and (c) the projection of non-financial income and expenses. Hence, for every scenario and every bank, we ended up at the end of the simulation with a possible path for the main components of balance sheets and income statements, modeled in response to an extreme, albeit feasible, macroeconomic scenario.

Unlike previous years, in this year's exercise we modeled in greater detail the concentration effect of the commercial loan portfolio. In so doing, we came up with a better representation of the possible performance of banks' major financial variables. We considered not only the path of the capital ratio but also that of the leverage ratio.[51]

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[50] Total financing refers to the sum of the loan portfolio and balance induced by granted guarantees. The amount includes guarantees issued by the SHF Mortgage Insurance Division.

[51] With a view to complementing prudential banking regulation, the Basel Committee on Banking Supervision is currently developing a leverage ratio upon which caps shall be imposed. This ratio is calculated by dividing any given bank's

The modeling strategy employed to generate scenarios was flexible enough to take into account different conditions. For instance, it was possible to model scenarios including both an environment of rising interest rates in the US along with a potential effects of a disorderly capital outflow.

Two set of scenarios were simulated for the stress tests exercises. For both, we assumed raises in short- and long-term US interest rates, and adverse shocks on major domestic macroeconomic variables.[52,53] For the first set, we assumed an average impact of 100 basis points on the short-term USD interest rate, and an average increase of 200 basis points in the long-term USD interest rate. We also assumed a two standard deviation plunge in the IGAE growth rate and an unfavorable shock of one standard deviation on the remaining simulated variables.[54,55] For the second set, we assumed an average impact of 200 basis points on the short-term USD interest rate, and a gradual average increase of 400 basis points in the long-term USD interest rate over the first year (table 6). The remaining variables were assumed to behave as in the first set. Each group considered two thousand possible adverse scenarios (graph 45 and 46).

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regulatory capital by its total assets, including off-balance transactions, as well as a special treatment for derivatives transactions. The leverage ratio is expected to form part of minimum capital requirements as of January 2018.

[52]   Scenarios were generated with the vector autoregressive model explained in box 5 of the *Financial System Report 2013*.

[53]   The simulated variables were: the 28-day cete rate, the MXN/USD exchange rate, inflation, unemployment, the Mexican Stock Exchange Price and Quotation Index, the current loan portfolio, the US industrial production index, the Dow Jones index, the oil price and the VIX.

[54]   We used the standard deviation estimated by the model, which corresponds to the historical series' standard deviation as of 1997.

[55]   Our assumption for IGAE's performance is particularly extreme, as it implies a fall in production similar to those observed in 1995 or 2009.

**Graph 45**
**Average Performance of Variables in Different Scenarios**

a) Global Economic Activity
Indicator

Annual percent change



Figures as of June 2015 and 3-year
simulations thereafter
Source: INEGI and Banco de México

b) Unemployment

Percent



Figures as of June 2015 and 3-year
simulations thereafter
Source: INEGI and Banco de México

c) Exchange Rate

Annual percent depreciation



Figures as of June 2015 and 3-year
simulations thereafter
Source: Banco de México
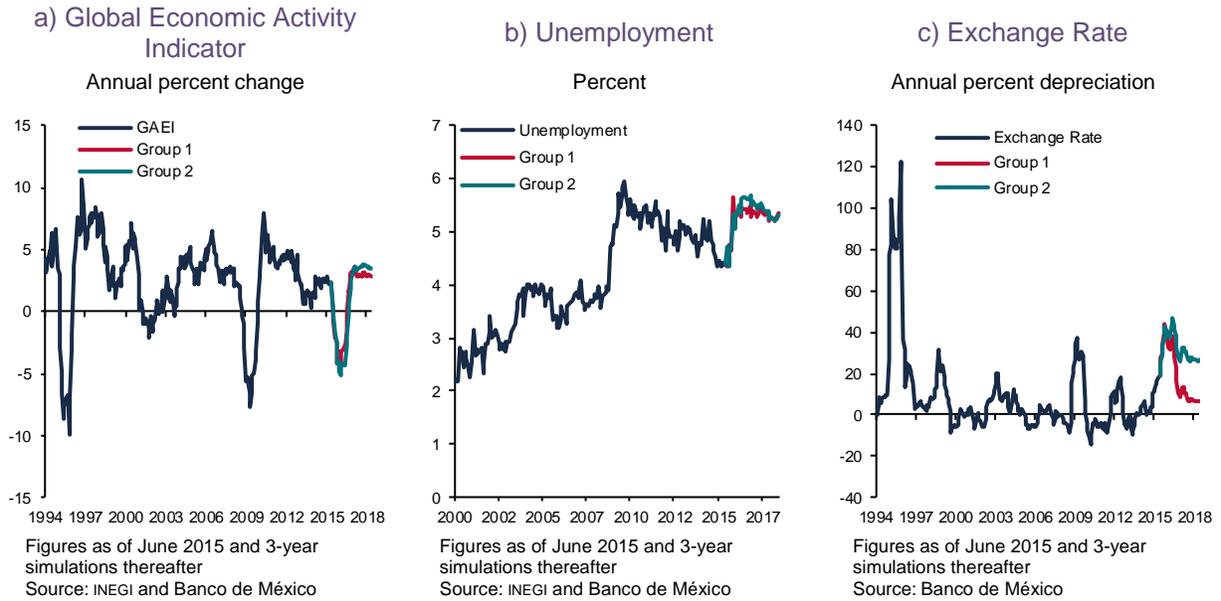
**Graph 46**
**Average Performance of Variables in Different Scenarios**

a) 28-Day Cete Rate

Percent



Figures as of June 2015 and 3-year
simulations thereafter
Source: INEGI and Banco de México

b) 3-Month US Treasury Bond
Rate

Percent



Figures as of June 2015 and 3-year
simulations thereafter
Source: INEGI and Banco de México

c) 10-Year US Treasury Bond
Rate

Percent



Figures as of June 2015 and 3-year
simulations thereafter
Source: INEGI and Banco de México
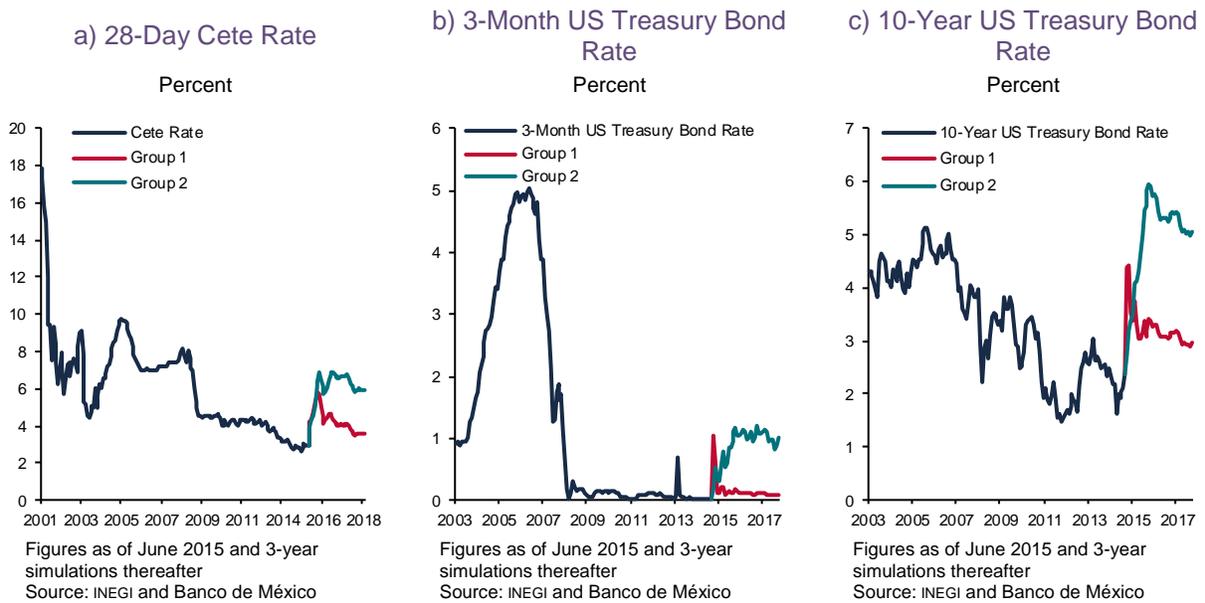
**Table 6**
**12-, 24- and 36-month Shocks on Certain Variables: Group 2**

| | Value as of June 2015 | After 12 Months | | After 24 Months | | After 36 Months | |
|---|---|---|---|---|---|---|---|
| | | Critical Value min or max | Average | Critical Value min or max | Average | Critical Value min or max | Average |
| 28-Day Cete Rate [1/] | 2.96 | 8.37 | 6.06 | 8.40 | 6.65 | 8.34 | 5.91 |
| Exchange Rate [2/] | 15.46 | 25.11 | 22.64 | 30.89 | 27.58 | 33.00 | 29.56 |
| IPC | 45,054 | 31,191 | 48,999 | 44,754 | 56,372 | 53,299 | 66,000 |
| IGAE [3/] | 2.3 | -6.5 | -4.3 | -3.9 | 3.4 | 3.1 | 3.4 |
| Unemployment Rate [1/] | 4.4 | 6.2 | 5.7 | 6.3 | 5.5 | 6.0 | 5.3 |
| 10-Year US Treasury Bond Rate [1/] | 2.36 | 7.50 | 5.84 | 7.59 | 5.32 | 6.84 | 5.06 |
| 3-Month US Treasury Bond Rate [1/] | 0.02 | 1.55 | 1.12 | 1.71 | 1.20 | 1.71 | 1.02 |
| Inflation [1/] | 2.9 | 8.8 | 6.7 | 10.5 | 7.9 | 10.2 | 7.0 |

Figures as of June 2015
Source: Banco de México
1/ Percent.
2/ MSN/USD
3/ Annual percent change

The probability of default was estimated using econometric models that take into account three types of loan portfolios: commercial, consumer and mortgage loans. In these models, the probability of default is a function of macroeconomic variables. In that manner, the effect of adverse macroeconomic scenarios leads to a deterioration of loan portfolios.

Estimations were performed on an individual basis, bank by bank; hence, we obtained a specific effect for every institution, without compromising the consistency of the model. The severity of the loss given default was also estimated for every portfolio and every bank.[56] Thus, the deterioration of every portfolio depends both on probability of default and the severity of the loss given default (graph 47).

We also assumed that the loan portfolio growth depends on each scenario's economic conditions. Therefore, banks' loan granting relies on such conditions, as well as the fact that institutions increase their reserves to completely cover their non-performing portfolio and the increase in the current portfolio's default risk. On the other hand, the portfolio concentration effect was captured by simulating the default of the largest debtors in the system. Finally, for each scenario, interest rate margin is dependent on interest rates and the active and passive interest rate elasticity for every bank. We also ensured that, for all cases, non-financial income and expenses were always proportional to portfolio size.

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[56] As in our previous *Report*, loss given default (LGD) is estimated using the Vasicek model; see Jon Frye: "The simple link from default to LGD", *Risk*, March (2014).

**Graph 47**
**Performance of Default Indicators and Losses**

a) Probability of Default

Percent

| | |
|---|---|
| Commercial | |
| Consumer | |
| Mortgage | |

Figures as of June 2015 and 3-year
simulations thereafter
Source: Banco de México

b) Loss Given Default

Percent

| | |
|---|---|
| Commercial | |
| Consumer | |
| Mortgage | |

Figures as of June 2015 and 3-year
simulations thereafter
Source: Banco de México

c) Delinquency Rate

Percent

| | |
|---|---|
| Commercial | |
| Consumer | |
| Mortgage | |

Figures as of June 2015 and 3-year
simulations thereafter
Source: Banco de México

In addition, we assumed that banks: (i) do not inject capital nor apply changes to their strategies; (ii) financial authorities do not react to the deteriorations of institutions or macroeconomic conditions; and (iii) off-balance positions remain constant throughout the analyzed horizon.

On one hand, the higher probability of default leads to a portfolio with a higher share of past-due loans and provision expenses, while bringing down interest income and credit risk weighted assets for every bank. On the other hand, higher interest rates increase interest income and funding costs. Hence, every bank's final level of leverage and capital ratio depend on their loan portfolio performance, their income and initial capital ratio level. In turn, the portfolio performance depends on every bank's sensitivity to the variables used in the hereby designed scenarios.

The test structure made it possible to identify banks with business models that, under stress circumstances, would experience significant losses, as well as banks with greater risk appetite. Results suggest that, even in adverse scenarios, the system as a whole is solid (graph 48a). Yet, certain institutions would exhibit less strength, as their capital adequacy ratios are below the regulatory minimum. Withal, not all institutions in that situation would exhibit the same weaknesses, and they would all end up with different levels of capital adequacy levels. While in some cases a decline in the capital ratio would result from losses owing to a fall in income, in other cases, a higher delinquency of portfolios would imply a fall in the capital ratio. Finally, for some institutions, the initial capital level was crucial to determine their results.

**Graph 48**
**Stress Test Results: Leverage and Capital Adequacy Ratios**

a) Capital Adequacy Ratio

Percent

b) Leverage and Capital Adequacy Ratios

Percentage of cases in four thousand scenarios

c) Concentration Contribution

Vertical axis: relative frequency
Horizontal axis: capital adequacy ratio decline (percentage points)

Figures as of June 2015 and 2-year simulations thereafter
Source: Banco de México

Simulated figures as of June 2018
Source: Banco de México

Simulated figures as of June 2018
Source: Banco de México

On the other hand, even though in all scenarios the system would end up above the minimum considered for the leverage ratio that will be required by the Basel Committee as of 2018, some institutions would fall below the three percent proposed by the Committee,[57] even when their capital adequacy ratios remained above the regulatory minimum (graph 48b). This latter result underscores the benefit from including a leverage ratio within regulatory measures applied to credit institutions.

Furthermore, although a high concentration in the loan portfolio would have significant negative effects on certain institutions –as it could lead to a decline in the capital ratio of up to 5 percentage points (graph 48c)−, this was not a decisive factor in the stress tests performed for institutions presenting a capital ratio below the minimum.

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[57] The Basel Committee on Banking Supervision proposed to apply a 3 percent minimum for the leverage ratio. Yet, both the proposed level and the concepts that will be part of its calculation could still be revised before its compulsory application in 2018.

# 4. Conclusions

The environment currently faced by the Mexican economy not only implies higher risks for the financial system and imposes severe restrictions on the macroeconomic stance adopted to respond to it, but also hinders the economic recovery. Risks posed by such an environment are associated with global low growth, the fall in oil prices and productive capacity, uncertainty over the normalization process of the US reference rate and possible contagion events stemming from other emerging countries. Further, there is still a threat of new volatility bouts, whose intensity could increase owing to capital reallocation by global financial intermediaries.

The materialization of risks analyzed in this *Report* could occur in a situation characterized by a higher foreign demand for financial funds in parallel with greater constraints to obtain them. In such case, the macroeconomic equilibrium would be necessarily reached through adjustments in the main financial variables, such as the real exchange rate and the interest rate. Under such circumstances, the revival of private expenditure would be hampered and the adjustment may have adverse effects on the stability of the financial system, especially if this adjustment would take place disorderly.

Structural reforms and financial shielding measures adopted to face the situation described before (the strengthening of liquidity and capital rules, the accumulation of international reserves, the arrangement under the IMF Flexible Credit Line, oil price hedge programs and dollar auctions announced by the Exchange Rate Commission) have all played their part in preparing the Mexican economy and its financial system to successfully −and at the lowest possible cost − cope with the aforementioned risks. This resiliency is reflected in the hereby presented stress test results, which suggest that the financial system is currently strong, even under the materialization of adverse scenarios.

Yet, it will be essential to keep on strengthening the macroeconomic framework and promoting prudential measures that help Mexico stand out among other emerging economies. Preserving fiscal and monetary discipline will be fundamental, given the unfavorable environment.

As far as the financial system is concerned, as already mentioned, the banking sector as a whole counts on enough capital and liquidity to deal with extreme situations. Some smaller institutions will have to make additional efforts to withstand liquidity shortfalls. The coming into effect of the new regulation shall create incentives for weak institutions to address their vulnerable situation.

Although the stress tests performed indicate that, even in adverse scenarios, the banking sector is sound, there are some banks whose business models are particularly vulnerable in extreme scenarios.

Some investment funds also present a certain level of vulnerability in the face of a large and disruptive adjustment in interest rates; they will need to keep on taking steps to limit such risk. For their part, some fibras and development capital certificates are assuming significant leverage, refinancing and exchange rate risks. Although this situation does not really pose a threat to the stability of the financial system, it is advisable that managers analyze their risks and increase the quantity and quality of financial information disclosed to the market.

Finally, some non-financial companies are also vulnerable to interest rate hikes and further depreciation of the domestic currency. The assessment of such risks is not simple, given the lack of standardized information. Measures will have to be taken in the future so that listed companies improve information disclosure by releasing tests applied to their balance sheets, sales and income statements in order to assess their sensitivity to changes in the exchange rate. Hence, it is advisable that non-financial companies that have contracted foreign currency denominated debt continue to accurately identify their risks and take proper actions to mitigate them.

To sum up, the growing influence of specialized agencies' credit ratings on investment and business decisions made by global investors and financial intermediaries shoul not be underestimated. Such ratings not only have a direct influence on capital flows and funding costs for governments and companies, but also affect the cost structure of financial intermediaries −banking regulation has become more sensitive to credit ratings. It is imperative that Mexico continues strengthening its macroeconomic framework and implementing, in a timely and adequate manner, structural reforms in order to successfully cope with the complex international environment.

# List of Initials and Acronyms

| | |
|---|---|
| **afores** | Pension Fund Managers |
| **BCBS** | Basel Committee on Banking Supervision |
| **BMV** | Mexican Stock Exchange |
| **bondes D** | Federal Government Development Bonds |
| **bonos** | Federal Government Development Bonds with Fixed Interest Rates |
| **BPA** | Savings Protection Bonds |
| **BPAT** | Savings Protection Bonds with Quarterly Payment of Interest |
| **brems** | Monetary Regulation Bonds |
| **CAR** | Capital Adequacy Ratio |
| **CDC** | Capital Development Certificates |
| **CDS** | Credit Default Swaps |
| **cerpis** | Senior Trust Bonds for Investment Projects |
| **cetes** | Treasury Certificates |
| **CGPE** | Economic Policy General Criteria |
| **CNBV** | National Banking and Securities Commission |
| **Consar** | National Commission for the Pension System |
| **CUFI** | Single Circular for Investment Funds |
| **CVaR** | Conditional Value at Risk |
| **EBITDA** | Earnings Before Interest, Taxes, Depreciation and Amortization |
| **EMBI** | Emerging Market Bond Index |
| **EMBIG** | Emerging Market Bond Index Global |
| **EMBIG-MX** | Emerging Market Bond Index Global-Mexico |
| **ETFS** | Exchange-traded funds |
| **FED** | The Federal Reserve System of the United States of America |
| **FEIP** | Budget Revenue Stabilization Fund |
| **FHipo** | Mortgage Trust |
| **fibras E** | Energy and Infrastructure Investment Trusts |
| **fibras** | Infrastructure and Real Estate Trusts |
| **FIRA** | Agricultural Trusts |
| **FN** | National Funds for Farming, Rural, Forestry and Fisheries Development |
| **FR** | Rural Funds |
| **FSB** | Financial Stability Board |

| | |
|---|---|
| **GDP** | Gross Domestic Product |
| **G20** | Group of 20 industrialized and emerging countries |
| **HHI** | Herfindahl Hirschman Index |
| **IEPS** | Special Tax on Production and Services |
| **IGAE** | Global Activity Economic Indicator |
| **IMF** | International Monetary Fund |
| **IMSS** | Mexican Social Security Institute |
| **INEGI** | National Institute of Statistics and Geography |
| **INPC** | National Consumer Price Index |
| **IPAB** | Institute for the Protection of Bank Savings |
| **IPC** | Price and Quotation Index of the Mexican Stock Exchange |
| **LCR** | Liquidity Coverage Ratio |
| **LGD** | Loss Given Default |
| **LTV** | Loan-to-Value |
| **OCI** | Other Comprehensive Income |
| **OFEA** | Other Financial Entities and Activities |
| **OPEC** | Organization of the Petroleum Exporting Countries |
| **PTI** | Payment-to-Income |
| **RCAP** | Regulatory Consistency Assessment Programme |
| **ROE** | Return on Equity |
| **SHCP** | Ministry of Finance and Public Credit |
| **SHF** | Federal Mortgage Society |
| **SIC** | Credit Information Bureaus |
| **siefores** | Pension Funds |
| **socaps** | Savings and Loan Cooperatives |
| **sofipos** | Popular Finance Corporations |
| **TIIE** | Interbank Equilibrium Interest Rate |
| **UDI** | Investment Units |
| **udibonos** | Federal Development Bonds Denominated in Investment Units |
| **VaR** | Value at Risk |
| **VIX** | Chicago Board Options Exchange Volatility Index |
| **WEO** | World Economic Outlook |
| **WTI** | West Texas Intermediate |