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"It is much more realistic to say that the banks "create credit", that is, that they create deposits in their act of lending, than to say that they lend the deposits that have been entrusted to them."
Joseph Schumpeter

The economic impact of Basel III: applying the BIS analysis to the eurozone

p.3

In November 2016 the Bank for International Settlements (BIS) published an updated economic impact study of Basel III and the ongoing reforms, suggesting the existence of some room for manoeuvre in the creation of additional capital buffers. We demonstrate in this analysis that this room no longer exists in the eurozone, where the dominant role played by banks in financing increases the economic cost of new regulatory requirements and reduces the optimal bank solvency ratio, above which the economic cost exceeds the estimated benefit of tighter regulation.

By Laurent Quignon

Mexico: US anchor called into question

p.21

As the only Latin American country in North America, Mexico plays a special role on the continent. Today it is in the frontline of the new US administration's swerve towards protectionism and anti-immigration policies. Despite relatively solid macroeconomic fundamentals, Mexico's economic growth has been disappointing, and its prospects are eroding. The country has to seize the opportunity offered by Donald Trump's challenge to redefine its economic model, lessen its dependence on the United States and strengthen productivity by further integrating in global value chains.

By Sylvain Bellefontaine & Tarik Rharrab

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BNP PARIBAS

The bank for a changing world

The economic impact of Basel III: applying the BIS analysis to the eurozone

Laurent Quignon

In November 2016 the Bank for International Settlements (BIS) published an updated economic impact study of Basel III and the ongoing reforms, suggesting the existence of some room for manoeuvre in the creation of additional capital buffers. We demonstrate in this analysis that this room no longer exists in the eurozone, where the dominant role played by banks in financing increases the economic cost of new regulatory requirements and reduces the optimal bank solvency ratio, above which the economic cost exceeds the estimated benefit of tighter regulation.

By revealing the deficiencies of the banking system the financial crisis of 2007-2008 highlighted the need for a deep overhaul of prudential regulation of banks. With a mandate from the G20, from 2009 onwards the banking regulators issued a series of recommendations to make the banking system more stable. The consolidation of the prudential framework and the gradual introduction of the two parts (solvency and liquidity) of Basel III have resulted in an unprecedented improvement in the solidity of the European banking system. The question now arises as to whether further strengthening of solvency requirements will provide an economic benefit greater than the economic cost it will incur. The economic impact study published by the BIS in November 2016 (Fender and Lewrick [2016]) suggests that, on the global scale, the optimal solvency ratio remains slightly higher than the ratio required to meet current regulatory requirements that will soon by applicable to all banks. Unfortunately, this 'global' conclusion does not hold true for the eurozone. Our economic impact analysis uses the methodology of the BIS study, adapting certain parameters to the European context. Our results indicate that the average regulatory solvency ratios, and even more the average effective ratios of European banks, are now above their optimal level. Consequently, any increase in regulatory requirements, and notably the concrete application of the measures contained under the unofficial name 'Basel IV', will have an economic cost greater than the expected economic benefit.

An unprecedented regulatory shock

The 'Basel III' framework has two complementary aspects: a solvency part which seeks to strengthen banks' capacity to absorb potential losses, and a liquidity part whose twin goals are the reduction in maturity mismatch and the strengthening of banks' resilience in the face of possible tension in the bank liquidity market.

Strengthening banks' ability to absorb losses

The latest Basel requirements for bank solvency are not limited, indeed far from it, to the increase in the regulatory threshold from 4% (*Core Tier 1* Basel II) to 7% (*Common Equity Tier 1* (CET1) Basel III). On the one hand, the scope of the numerator in this ratio has been virtually limited to common stock (i.e. lower-quality securities that were previously eligible are now excluded) and retained earnings, whilst the deductions included in the calculation of CET1 have been considerably increased. On the other hand, the denominator of the ratio, consisting of risk-weighted assets, has been expanded under the influence of the increased weighting applicable to the trading book ('Basel II.5') in 2011 and the inclusion of counterparty risk on over-the-counter derivative transactions (Basel III) since 2014.

In addition, the largest systemically important banks will see a capital surcharge applied of up to 2.5% of risk-weighted assets in 2016, whilst the introduction of a 3% leverage ratio, – the ratio of Tier 1 capital to

unweighted assets[1] – is planned for 2018. Lastly, heightened leverage requirements are under discussion. The BIS believes that all of these measures equate to a global regulatory threshold of between 8.2% and 8.9% of risk-weighted assets across the banking system. The combination of the increase in the regulatory threshold (from 4% of risk-weighted assets under Basel II to the above-mentioned figure of between 8.2% and 8.9% under Basel III), the tighter definition of the ratio's numerator (substitution of Common Equity Tier 1, consisting mainly of common stock, for Core Tier 1 which had a much broader definition) and the expansion of risk-weighted assets results in an approximately threefold increase between Basel II and Basel III regulatory requirements.

According to figures from the "*Basel III Monitoring Report",* published by the Basel Committee in September 2016, CET1 capital for a sample of 90 major banks rose by 65% between 30 June 2011 and 30 June 2015, with that for a sample of 69 medium-sized banks rising by 59.5%.

The introduction of international liquidity ratios

For the first time, the Basel Committee has introduced two new liquidity standards, where previously banking liquidity requirements had, for lack of agreement, escaped the process of international harmonisation of prudential regulation that began in the 1980s. The finalised version of the Basel Committee's recommendations on the short-term liquidity ratio, or *Liquidity Coverage Ratio* (LCR), was published in January 2013. The LCR relates eligible *high quality liquid assets* (HQLA) – consisting primarily of sovereign debt and reserves held at central banks – to theoretical net cash outflows over thirty days in the event of a severe liquidity shock. Respecting the LCR thus guarantees the bank's ability to withstand a major liquidity shock. Within the European Union, the calendar for the gradual introduction of the LCR, established by the Capital Requirements Regulation (CRR), has been maintained by a delegated act. Initially set at 60%, the minimum coverage of liquidity requirements will gradually rise to 100% in 2018. According to details published by the European Banking Authority (EBA [2016]), the liquid assets of the 171 banks that took part in the exercise rose from approximately EUR 1,330 billion in June 2011 to around EUR 2,520 billion in December 2015, an increase of nearly 90%.

The final recommendation, on long-term liquidity ratio, or Net Stable Funding Ratio (NSFR), was published by the Basel Committee in October 2014. The aim of this long-term liquidity ratio, which can be considered more as a stable resources ratio, is to protect banks from the consequences of a liquidity shock by forbidding the financing of bank assets (loans or securities) with a maturity of more than six months or one year, depending on category, using resources maturing within this period and susceptible to not being renewed. The ratio therefore requires that assets maturing in more than one year (weighted) and certain off-balance sheet items are 100% covered by available stable resources. The ratio reduces transformation risk at the cost of a limitation on banks' ability to transform maturities. A NSFR of 100% will be required within the European Union two years after the effective date of the regulation presented to the Parliament and Council by the European Commission on 23 November 2016, which, among others, modifies the CRR and the Capital Requirements Directive (CRD) adopted in 2013.

European Banking Authority calculations (EBA [2016]) reflect a steady increase in NSFR within the European Union even before this becomes a legal requirement. On average for the major European banks making up Group 1, this rose from 88% in June 2011 to 106% in December 2015, whilst the stable resources deficit for banks with a ratio below 100% has fallen from EUR 1,330 billion to just over a tenth of that figure at EUR 142 billion. These changes have come from the increase in stable banking resources (numerator) and, to a lesser extent, a reduction in the assets requiring stable resources (denominator).

Our re-evaluation based on the latest BIS impact study (November 2016)

Necessary as it is, prudential regulation of banks comes at an economic cost. Obscured for the time being by the extremely accommodating nature of monetary policy, particularly in the eurozone, the higher cost of bank financing will become apparent when monetary policy normalises. The mission given by the BIS to the Long-term Economic Impact Group (LEI [2010]) was precisely to compare the economic benefit (from avoiding banking crises) of the application of the new rules over the very long term to their economic cost (impact of lower financing volumes). The expert group concludes that the economic benefits are greater than the economic costs across a very broad range of solvency ratios, suggesting that the regulator has considerable scope to increase requirements. In order to take into account the additional measures in the Basel III package, whether already introduced (capital surcharge for G-SIB banks since 2016), about to be introduced (leverage ratio in 2018, TLAC[2] for large banks in 2019), or in the process of being calibrated (specific leverage ratio for G-SIBs), Fender and Lewrick (2016) updated an analysis of the economic impact of new regulatory standards published last November by the BIS. Despite the new elements introduced, the conclusion remains the same: notwithstanding the substantial tightening of prudential requirements since the original impact study (LEI [2010]), these remain below the optimal solvency ratio, giving the relevant authorities scope to increase requirements within the framework of the new instruments given to them (countercyclical buffer).

The specific features of the eurozone have nevertheless caused us to revisit this latest impact analysis from the BIS authors. First, economic impacts were tested econometrically through models using different definitions of the solvency ratio, which needed to be harmonised. These diverse definitions were brought to a single definition (TCE/RWA[3] 'Basel II') using a transitional matrix drawn up by the BIS. The TCE/RWA solvency ratios thus obtained were then expressed under the 'fully-loaded' Basel III definition (i.e. assuming full application, rather than the phased-in application set out in the regulatory timetable) by using a conversion factor. For a given Basel II TCE/RWA ratio, the optimal 'Basel III' CET1 ratio rises as the conversion factor rises. It should therefore be noted that this conversion factor increased considerably between the initial LEI analysis in 2010 (x 0.66) and that published by BIS in November 2016 (x 0.78). Our calculations suggest a slightly lower conversion factor for European Union banks (x 0.71).

Finally, and most importantly, the median economic cost of a 1 percentage point increase in the solvency ratio is higher in the eurozone than the central hypothesis adopted by the BIS report for all the economic zones considered. In the central hypothesis taking account of the effects of TLAC, the adaptation of the BIS method implies an optimal fully-loaded Basel III CET1 ratio of 8.4% in the eurozone, compared to the 9.9% in the BIS analysis of November 2016, which is not focused on a particular geographical region. It therefore appears that the average CET1 solvency ratio resulting from the addition of current requirements to those that will become applicable in the near future (minimum requirement, 'universal' leverage ratio, G-SIB specific leverage ratio) calculated by BIS (of between 8.2% and 8.9%) is extremely close to the optimal level for the eurozone. From this level, a tightening of prudential regulations remains technically possible, but the expected economic benefit (avoiding the loss of GDP associated with a banking crisis) is less than the economic cost incurred (reduction in GDP from lower financing volumes).

Review of BIS methodology

The economic analysis of the long-term impact of Basel III (LEI [2010]) compares the economic costs and benefits for the new regulatory framework. The central hypothesis is that the effects are seen only in the level of GDP and not in the long-term growth rate. Lastly, the long-term costs and benefits were not quantified for given variations or ratio levels. These were expressed *in abstracto* for a broad range of ratios. The main conclusion was that the net economic benefit (i.e. economic benefits minus economic costs) remained positive for a broad range of capital ratios.

Similarly, Fender and Lewrick (2016) did not give precise details on the level of the optimal ratio in each of the hypotheses but concluded that *"the net economic benefits (measured by the impact on the level of GDP per year) of higher capital requirements would be exhausted only after a very substantial increase from the baseline level of 5.5% of the CET1/RWA ratio – even if one uses the lower pre-crisis estimate of the cost of a financial crisis".*

A questionable assessment of the long-term economic benefits

The economic benefit was understood to mean the reduction in the expected value of the loss of GDP caused by banking crises (the product of the probability of a banking crisis and the net present value of its cost expressed in terms of GDP). The probability of a banking crisis was evaluated by crossing the results of six different models, most of which were developed by central banks. Two models covered 13 or 14 OECD countries between 1980 and 2008, the first by the Financial Services Authority (FSA) and the National Institute of Economic and Social Research (NIESR), and the second by the Bank of Japan. Two further models, the so-called "bank portfolio" models (BIS and LEI), were based on the financial statements of the world's 51 largest banks, for the year 2007 for the BIS model and between 2000 and 2008 for the LEI model. The last two models were based on data for the five largest UK banks (Bank of England) and the six largest Canadian banks (Bank of Canada), with no indication of the time period considered. According to LEI calculations, the probability of a systemic banking crisis associated with a capital ratio of 7% (using the LEI definition, i.e. Basel I/II) was 3.3%, which is approximately equivalent to a banking crisis every 30 years. An increase in the CET/RWA capital ratio from 7% to 10% would reduce this probability from 3.3% to 1.2% (if the NSFR is also respected). Similarly, the median cost of a banking crisis was estimated based on the median results derived from several empirical studies.

The net present cost of a banking crisis according to the BIS report

In our eyes, this evaluation of the cost of a banking crisis remains very tenuous. Measured in terms of the cumulative present value of potential future losses of GDP, expressed as a percentage of GDP, the economic cost varies considerably from one estimate to the next. The most frequently used approach in empirical literature are logit-type equations[1] linking the frequency of financial crises within a selection of countries over a given time period with bank liquidity and leverage ratios. The biggest criticism of these impact studies relates to the diversity of crises taken into consideration, regardless of their primary cause. For foreign exchange crises or crises arising from inappropriate monetary policy that degenerate into banking crises, it seems highly unlikely that strengthening prudential regulations would reduce the probability of their occurrence.

In the November 2016 report, the BIS authors used three alternative hypotheses for the cost of a banking crisis, in each case expressed in terms of the net present value of cumulative losses of GDP. **The first hypothesis** was that used in the LEI report of 2011 (63% of GDP in the central hypothesis of a moderate permanent effect: part of the initial impact is absorbed, but GDP remains definitively below its initial trend). **The second hypothesis** stems from the expansion of the scope of empirical studies to include the 2007-2008 crisis, the consequences of which were more serious, resulting in an increase in the net present value of a crisis to 100% of GDP according to the BIS calculations. For example, in a 2010 speech, Haldane put the net present cost of the most recent crisis in a range of between 90% and 350% of GDP. The huge range reflects the degree of uncertainty about the consequences. Since then, the BIS report suggests that Ball (2014) confirmed these orders of magnitude, estimating the weighted average of impacts in OECD countries at around 180% of GDP. Taking a net present cost of 63% of GDP for earlier crises and 200% of GDP for the 2007-2008 crisis (the average of the Ball and Haldane figures), and weighting these estimates by the distribution of observations relating to

earlier crises (75%) and the most recent crisis (25%), the BIS authors adopt a weighted average estimate of the net present cost of a banking crisis at 100% of GDP.

The two estimates of economic losses cited above and on which this expansion of the net present cost is based nevertheless present results which are amongst the highest. In an update of their 2008 work, Laeven and Valencia (2012) estimated the net present cost of banking crises at 'just' 23% of GDP on a global scale between 1970 and 2011. They are also the only authors to distinguish between banking crises and other types of crisis. Their analysis suggests a median GDP loss of 25% for countries affected by the 2007 crisis (0% for those unaffected). Meanwhile, Cline (2016) puts the long-term damage of a banking crisis at 64% of GDP in the year preceding the crisis.

Lastly, the third hypothesis is an attenuation of the second, which takes account of the benefits of TLAC, the buffer of capital securities and eligible debt securities available to absorb losses. According to the BIS study, TLAC reduces the probability of a crisis by 26% and its net present cost by 5.4 points of GDP, due to a reduced need for public sector support. The arithmetic suggests that this last hypothesis is equivalent to a net present cost of 70% of GDP = 100% (1 – 26%) x (1 – 5.4%).

The economic cost

The determination of the economic cost of new capital and liquidity requirements under Basel III, in terms of long-term GDP, is based on a palette of economic models developed by the experts from the Macroeconomic Assessment Group (MAG), which was appointed to evaluate the economic impact of Basel III during the transition period only. These are based both on a direct method, directly inputting the capital ratio where models contained this explanatory variable to simulate the impact on GDP of a 1 percentage point increase in the ratio. Where models did not contain this variable, experts used an indirect method. As a first stage the impact of a 1 percentage point increase in the capital ratio on the interest rates of client loans was evaluated, assuming that the NSFR long-term liquidity ratio was also respected. It was assumed that banks would pass on part of the higher cost of resources to the bank lending rates applied to customers, in order to offset the negative impact on their return on equity (ROE). This increase in financing costs was in turn used as the input in models not containing capital ratios as a variable, thus allowing them nevertheless to be used to evaluate the long-term impact on GDP.

Thus on the basis of the work of MAG/LEI[4] and a conversion factor of TCE/RWA to Basel III CET1/RWA of 0.78, the economic cost associated with a 1 percentage point increase in the Basel III CET1/RWA ratio is assessed at 0.12% of GDP (=0.09%/0.78), to which should be added a fixed cost of around 0.08% of GDP, inherent in the respect of the liquidity requirements of Basel III, and a slight reduction in weighted assets.

Secondly, and to the extent that effects are linear in most models, the predicted impact of an increase in capital ratios was calculated by multiplying unitary impacts by the size of the increase in capital ratios. The latter is the difference between the average CET1 ratio resulting from the cumulative application of various standards – both those already in force and those due to be introduced in the near future, *see below* – and a TCE/RWA ratio of 7% under the LEI definition (equivalent to a fully loaded Basel III CET1 ratio of 7% x 0.78 ≈ 5.5% after application of a conversion factor of 0.78).

The net economic benefit and the optimal capital ratio

For each of the hypotheses of the net present cost of a banking crisis (100% of GDP, 63% of GDP and 94.6% of GDP with TLAC and a 26% reduction in the probability of a crisis) the BIS report determines the net economic benefit as a function of the CET1/RWA ratio as the difference between economic cost and benefit. Starting with an initial CET1/RWA Basel III ratio of 5.5%, the net economic benefit rises so long as the marginal economic benefit remains greater than the marginal economic cost (or 0.12% of GDP) and

then decreases. The optimal CET1/RWA ratio, which balances marginal economic costs and benefits and for which the net economic benefit is maximal, is 9.7% under the hypothesis of a net present cost of a banking crisis at 63% of GDP; 9.9% where the net present cost is 100% of GDP and the benefits of TLAC are included; and 10.7% under the hypothesis that the net present cost is 100% of GDP and no account is taken of TLAC (Chart 1).

The BIS then compares these optimal levels with the CET1 ratios that would result from the cumulative application of regulations. Thus the minimum CET1 requirement of 7% of risk-weighted assets implies a rise of the CET1 ratio of 1.5 percentage points from the initial level of 5.5%. Furthermore, the introduction of leverage ratio of 3% would take the CET1 ratio to 7.7%, an increase of 2.2 percentage points (again on the level of 5.5%). The additional application of 'higher loss absorbency' in the form of a specific capital surcharge for G-SIBs would take the average CET1 ratio for the banking system to 8.1% (+2.6%). Lastly, the CET1 ratio "required" would be 8.2% (+2.7%) with a G-SIB leverage surcharge of 0.5%, and 8.9% with a G-SIB leverage surcharge of 2%.

Observing that these average capital requirement levels, expressed in terms of "CET1 equivalent" (between 8.2% and 8.9% with the G-SIB leverage surcharge), are below the optimal capital ratios (between 9.7% and 10.7%), the BIS report concludes that *"ample room is available for national authorities to further raise regulatory capital."* They go on to say: *"This should provide policymakers with sufficient flexibility to activate countercyclical capital buffers and similar requirements, as needed."*

Over and above the unsuitability to the eurozone of the 'global' optimal ratio, we believe that this is a hasty conclusion for at least two reasons. First, no bank only target a capital ratio which just meets the minimum applicable requirements. In addition, the removal of the prudential filters on the occasion of Basel III may have acted to increase the "margin of security" between the target ratio and the level that was strictly required; it matters little whether this difference comes from a 'target' ratio that the banks set for themselves or an implied market requirement (the former, moreover, being subject to influence from the latter).

Secondly, the existing or proposed demands of Pillar 1 established by the banking regulator do not reflect the demands set by the supervisory authority. Thus according to the European Central Bank (ECB), the average CET1 capital ratio for 2016 and 2017 of banks placed under its direct supervision as part of the Supervisory Review and Evaluation Process (SREP) was 10%[5].

Our application of the BIS method to the eurozone

The BIS global approach does not apply in concrete terms to any specific economic region. It uses median or average parameters for all economic regions taken together. Our approach does not question the method used, but rather takes the BIS analysis and makes two adjustments to the BIS analysis to reflect the specific context of the eurozone.

The first concerns the conversion factors between the Basel II and Basel III capital ratios. We base our calculations on studies of the quantitative impact carried out by the EBA (European Union) rather than those conducted by the Basel Committee (worldwide). The second modification reflects the view that the economic cost of identical capital and liquidity ratios will be greater in the eurozone because of its higher levels of bank intermediation. As a result, the economic cost indicated by models that look only at the eurozone is higher than the economic cost suggested by all models used by the BIS.

Optimal Basel III CET1 ratio ranges from 9.7% to 10.7% according to BIS report

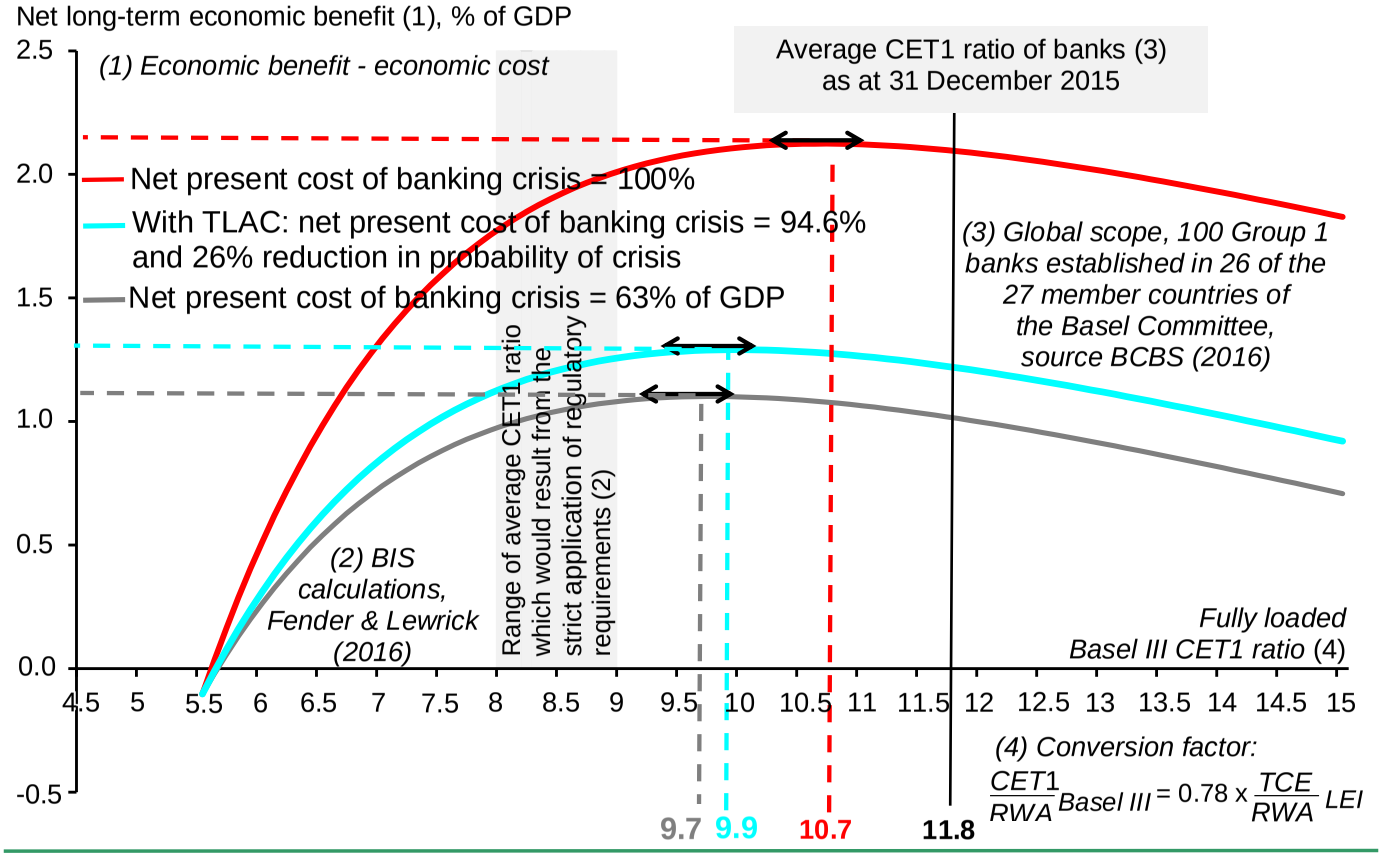


Chart 1

Sources: Fender & Lewrick (2016), BCBS (2016)

The economic benefits associated with a stronger prudential framework (lower probability of banking crises) were evaluated using the overall set of countries. Consequently, we had no choice but to transpose LEI's overall estimates with those for the European Union. Moreover, LEI only published the marginal effects of the increase in capital ratios for ratios ranging between 7% (considered the historical average) and 15% according to the LEI definition (Basel I/II), which is approximately equivalent to levels of between 4.6% and 9.9% using the fully-loaded Basel III definition. Since these levels are significantly lower than currently observed capital ratios, we extended the calculation of the supposed economic benefits to include higher capital ratios (see box 1).

Box 1:

Economic benefits as a function of the Basel III CET1 ratio

The BIS report measures economic benefits in terms of the reduction in the expected value of economic costs associated with a banking crisis. The expected value is the product of the probability of a banking crisis and its economic cost. It would therefore be more accurate to describe it as an economic cost avoided, rather than as a true economic benefit. In its report of 2010, the LEI published a table which gave the probability of a banking crisis for each "full" TCE/RWA capital ratio (LEI definition) ranging from 6% to 15%. The higher limit is equivalent to a Basel III CET1 ratio of 11.7% using the BIS report's conversion factor of 0.78, or 10.7% using the conversion factor of 0.71 that we recommend when considering European banks. This limit is below the average ratios currently observed (12.4% in the European Union at 31 December 2015). Moreover, in order to determine the optimal ratio at a precise level rather than within an approximate range limited by the ratio values for which the LEI gives probabilities of a banking crisis, we have expressed the probability of a crisis as a continuous function of the CET1/RWA capital ratio.

In graphical terms, the 10 points of the probability of a banking crisis associated with the 10 values of the TCE/RWA[6] ratio describe a concave decreasing function with a horizontal asymptote. The marginal reduction in probability therefore decreases and the probability of a crisis can be described as a function of the probability of the immediately preceding ratio (the increments being of 1 point):

$$\frac{TCE}{RWA} = a \times P\left(\frac{TCE}{RWA} - 1\right) + b$$

The econometric regression based on the values for the probability of a crisis for the 10 TCE/RWA ratios (with the NSFR liquidity ratio being respected) gives:

$$P\left(\frac{TCE}{RWA}_{LEI\,i}\right) = 0.67678 \times P\left(\frac{TCE}{RWA}_{LEI\,i-1}\right) + 0.06384 \qquad (87.6) \qquad (3.7) \text{ with } \frac{TCE}{RWA}_{LEI\,i-1} = \frac{TCE}{RWA}_{LEI\,i} - 1$$

(the Student t is in parentheses).

This is an arithmetico-geometric sequence, in which the first term is $P(6)=4.8$ *and the nth term can be written:*

$$P\left(\frac{TCE}{RWA}_{LEI_n}\right)=0.67678^{n-1}\times\left(4.8-\frac{0.06384}{1-0.67678}\right)+\frac{0.06384}{1-0.67678} \quad with \quad n=\left(\frac{TCE}{RWA}_{LEI_n}\right)-5$$

In addition, $$n=\frac{TCE}{RWA}_{LEI_n}-5 <=> \quad n-1=\frac{TCE}{RWA}_{LEI_n}-6$$

Ultimately, the probability of a banking crisis can be expressed as a function of the ratio $\frac{TCE}{RWA}$ *using the LEI definition:*

$$P\left(\frac{TCE}{RWA}_{LEI}\right)=0{,}67678^{\frac{TCE}{RWA}_{LEI}-6}\times 4.60249+0.19751 \quad \forall\left(\frac{TCE}{RWA}_{LEI}\right)\geq 6$$

Applying the conversion factor of 0.78 recommended by Fender and Lewrick (2016), we can initially express the ratio $\frac{CET1}{RWA}_{BaselIII}$ *as a function of the ratio* $\frac{TCE}{RWA}_{LEI}$: $\frac{CET1}{RWA}_{BaselIII,CF=0.78}\approx 0.78\times\frac{TCE}{RWA}_{LEI}$,

and then the probability of a banking crisis as a function of the Basel III CET1 ratio $\frac{CET1}{RWA}_{BaselIII,CF=0{,}78}$:

$$P\left(\frac{CET1}{RWA}_{BaselIII,CF=0.78}\right)=0.67678^{\left(\frac{\frac{CET1}{RWA}_{BaselIII,CF=0.78}}{0.78}-6\right)}\times 4.60249+0.19751 \quad \forall\left(\frac{CET1}{RWA}_{BaselIII,CF=0.78}\right)\geq 4.68$$

Alternatively, by applying the conversion factor we obtain by adapting the BIS calculation method to European banks (0.71), the probability of a crisis becomes the following function of the Basel III CET1 ratio $\frac{CET1}{RWA}_{BaselIII,CF=0.71}$:

$$P\left(\frac{CET1}{RWA}_{BaselIII,CF=0.71}\right)=0.67678^{\left(\frac{\frac{CET1}{RWA}_{BaselIII,CF=0.71}}{0.71}-6\right)}\times 4.60249+0.19751 \quad \forall\left(\frac{CET1}{RWA}_{BaselIII,CF=0.71}\right)\geq 4.26$$

The substitution of a conversion factor suitable to the eurozone for the 'global' factor used by the BIS

In their latest impact studies, the BIS authors (Fender and Lewrick [2015], Fender and Lewrick [2016]) use a conversion factor of 0.78 to get from the Basel I/Basel II TCE/RWA ratios to the fully loaded Basel III CET1 ratios, even though the factor used in the initial study (MAG [2011]) was 0.66. In particular, the calculations are based on the quantitative impact study of Basel III carried out by the Basel Committee in September 2014 on the basis of data at 31 December 2013. It should be remembered that the "quantitative impact" – as distinct from the economic impact – measures the regulatory deductions which would result from Common Equity Tier 1 (before deductions), on the one hand, and the increase in risk-weighted assets on the other hand, following the full application of Basel II.5 and Basel III on the date in question. The quantitative impact study published by the Basel Committee in September 2014 concludes that for Group 1[7] banks, regulatory deductions would represent an average of 20% of CET1 before deductions and an 8.3% increase in risk-weighted assets. The resultant conversion factor is a global median, which does not apply to any specific geographical region. However, the quantitative impact study carried out at the same time by the European Banking Authority indicated not only higher regulatory deductions (23.1% of CET1) but also a larger increase in risk-weighted assets (10.3%) for the European Union's Group 1 banks; this suggests a lower conversion factor for the banks of the eurozone and the European Union (Box 2).

Box 2:

Calculating a conversion factor

The Tangible Common Equity ratio TCE/RWA under the Basel I/Basel II definition (or "LEI definition") is the benchmark capital ratio used by the Long-term Economic Impact group (LEI) in its economic impact study after conversion of different 'historic' capital ratios to this single metric.

In order to assess the economic costs and benefits associated with a fully loaded Basel III CET1 ratio, it was therefore necessary to use a conversion factor. To calculate this, experts from the BIS drew in part on a transitional matrix (whose parameters were obtained by regression) from the TCE/RWA capital ratio under the LEI definition to the Tier 1 ratio under the Basel II definition, and in part on the results of quantitative impact studies. The value of the conversion factor therefore depends substantially on the date of the quantitative impact study used in the calculation.

1. From TCE/RWA to Basel II CE/RWA

The LEI calculations (LEI [2010], table A5.1 p.57) express the Basel II CE/RWA ratio as a function of the Basel II TCE/RWA ratio used as the reference ratio in its economic impact study.

$$\frac{CE}{RWA}=\frac{CE}{TA}\times\frac{TA}{Tier1}\times\frac{Tier1}{TCE}\times\frac{TCE}{RWA}=\frac{CE}{TA}\times\frac{TA}{Tier1}\times\frac{Tier1/RWA}{TCE/RWA}\times\frac{TCE}{RWA}$$

This meant, for US banks:

$$\frac{CE}{RWA}=7.6\times\frac{1}{7.6}\times\frac{13.2}{12}\times\frac{TCE}{RWA}=1.1\times\frac{TCE}{RWA} \qquad (1_{US})$$

and for eurozone banks:

$$\frac{CE}{RWA} = 5.6 \times \frac{1}{7.4} \times \frac{16.2}{12} \times \frac{TCE}{RWA} \approx 1.02162 \times \frac{TCE}{RWA} \qquad (1_{EA})$$

Fender and Lewrick (2016) used an average conversion factor for all banks within the scope of the Basel Committee, such that:

$$\frac{CE}{RWA} \approx \frac{1.1+1.02}{2} \times \frac{TCE}{RWA} \approx 1.06 \times \frac{TCE}{RWA} \qquad (1_{BCBS})$$

2. From TCE/RWA to Basel II CE/RWA

The BIS report draws here on the results of the Basel III Monitoring Report, published by the Basel Committee, on the basis of data as at 31 December 2013 collected from 101 Group 1 banks established in 21 of the 27 member states of the Basel Committee (BCBS [2014]).

According to tables A.12 and A.13 (page 40 of the report) the regulatory deductions for the calculation of Basel III Common Equity Tier 1 represent 20% of Common Equity before deductions, whilst the cumulative effect of Basel II.5 and Basel III translates to an 8.3% increase in risk-weighted assets relative to Basel II standards.

The fully loaded Basel III CET1/RWA ratio can therefore be expressed as a function of the Basel II CE/RWA ratio:

$$\frac{CET1}{RWA}_{Basel\,III} = \frac{1-0.20}{1+0.083} \times \frac{CE}{RWA}_{Basel\,II} \approx 0.73869 \times \frac{CE}{RWA}_{Basel\,II} \qquad (2_{BCBS})$$

For our part, we have used the results of the Basel III Monitoring Exercise specific to the 39 Group 1 banks of the European Union published by the European Banking Authority (EBA [2014]). According to tables 5 (p. 27) and 6 (p. 29) regulatory deductions under Basel III would have been equivalent to 23.1% of Common Equity before deductions if Basel III had been fully applied at 31 December 2013, whilst risk-weighted assets would have been 10.3% higher than under Basel II.

$$\frac{CET1}{RWA}_{Basel\,III} = \frac{1-0.231}{1+0.103} \times \frac{CE}{RWA}_{Basel\,II} \approx 0.69719 \times \frac{CE}{RWA}_{Basel\,II} \qquad (2_{EBA})$$

3. From Basel II TCE/RWA to Basel III CET1/RWA

The combination of the two equations (1_{BCBS}) and (2_{BCBS}) gives us the final calculation of an approximation to the conversion factor ratio from the Basel II TCE/RWA to the fully loaded Basel III CET1/RWA, used by the BIS report, for banks in the BCBS scope:

$$\frac{CET1}{RWA}_{Basel\,III} \approx 0.73869 \times \frac{CE}{RWA}_{Basel\,II} = 0.73869 \times 1.06 \times \frac{TCE}{RWA}_{Basel\,II} \approx 0.78 \times \frac{TCE}{RWA}_{Basel\,II}$$

Similarly the combination of equations (1_{EA}) and (2_{EBA}) gives the equivalent conversion factor for European banks alone:

$$\frac{CET1}{RWA}_{Basel\,III} \approx 0.69719 \times \frac{CE}{RWA}_{Basel\,II} = 0.69719 \times 1.02162 \times \frac{TCE}{RWA}_{Basel\,II} \approx 0.71 \times \frac{TCE}{RWA}_{Basel\,II}$$

It should also be stressed that the increase in risk-weighted assets calculated in the Monitoring Exercise of September 2014 reports the increase in risk-weighted assets that would result from the full application of Basel III on the date of the data collected from banks (i.e. 31 December 2013) relative to risk-weighted assets under the regulations applicable on that date. However, this second figure already included the increase under Basel II.5 (applied from 31 December 2011, including in the European Union). The Basel Committee and the European banking authority thus used only risk-weighted assets calculated under Basel II[9] to measure the cumulative quantitative impact of Basel II.5 and Basel III on risk-weighted assets.

Lastly, banks had begun to take corrective measures (reallocating portfolios towards assets with the lowest regulatory weights, withdrawing from the most onerous activities, such as derivatives, limiting certain holdings that would require substantial prudential deductions) as soon as the initial Basel recommendations were published in 2010; this served to gradually reduce the "quantitative impact" in the strict sense of the term. It is therefore hardly surprising that the quantitative impacts fall as we draw closer to the date of full application of the new system; this is indeed reflected in the results of successive exercises (Chart 2). In the end, the economic impact of a fall in financing volumes as the result of discretionary reductions in certain elements of bank balance sheets (hedging derivatives, trading portfolios), is comparable to the fall in financing volumes due to an increase in bank capital and the subsequent increase in lending rates (*see* "Econometric models suggest a greater increase in the cost of credit in the eurozone"). In the end, it matters little whether banks renounce certain activities, for which they believe pricing has become excessive given the requirement to remunerate additional capital, or whether demand for the corresponding transactions falls due to this higher pricing: the resulting fall in volume is liable to have a negative impact on economic activity. For this reason, the results of the Monitoring Exercises, which already include transformation of business portfolios in response to Basel III, always give a measurement of the residual quantitative impact of Basel III (i.e. that which is still to come), but cannot properly be used to evaluate the quantitative impact "with a constant business structure".

Adjustment to bank balance sheets gradually reduces the quantitative impact of regulatory changes (1)

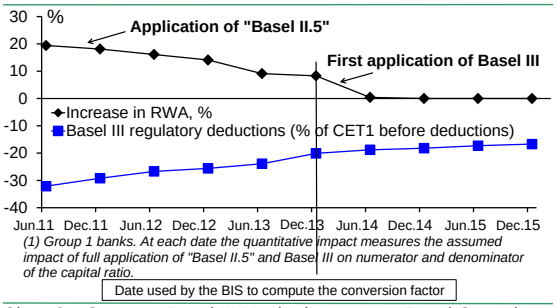


Chart 2 Sources: Basel III Monitoring reports, Basel Committee

In the light of the above, the conversion factor of 0.78 used in the BIS report, and its equivalent of 0.71 that we have calculated for the eurozone, represent extremely conservative hypotheses, which tend to inflate the conversion factor, the fully loaded Basel III CET ratio resulting from its application and thus its optimal level. Although it seems fairly close to the figure we recommend for eurozone banks, the conversion factor used by the BIS report would nevertheless lead to a 100-basis-point overestimation of the optimal CET1 ratio for European banks taken alone if it were applied to them. By way of illustration, within the eurozone and under the central hypothesis incorporating the effects of TLAC, the optimal CET1 ratio would be 9.2% using the "global" conversion ratio of 0.78. It would fall to 8.4% with the specific "local" ratio of 0.71. Under the hypothesis where the net present cost of a banking crisis is 63% of GDP, the overestimate inherent in using a factor of 0.78 for the CET1 ratio is close to 80 basis points (9.0% against 8.2%).

Econometric models suggest a greater increase in the cost of credit in the eurozone

The second proposed modification consists of using the average unit impact of eurozone-specific models, rather than that for the entire set of models regardless of the geographic region to which they apply.

For the same 1 percentage point increase in the TCE/RWA capital ratio, the averages of the median impacts on GDP are systematically higher for eurozone-specific models (see table 1). For models which incorporate capital ratios, the same increase in capital ratios would have twice the impact in the eurozone than in the United States. This impact differential is very consistent and reflects regional differences in financing structures, with the banking channel predominating in the eurozone and the financial markets in the United States. By taking account of the overall economic impact, regardless of economic regions and their specificities, the MAG/LEI expert working groups suggest that the economic cost is situated within the interval of results for the US models, but they apparently underestimate the cost for the eurozone. The median economic cost for all regions taken together (as a percentage of GDP) associated with a 1 percentage point increase in the fully-loaded CET1/RWA ratio is some 27% to 36% lower than that which would be seen in the eurozone, when using the "global" conversion factor of 0.78. This gap rises to between 33% and 41% when we use the specific conversion factor of 0.71.

Since the unit costs were linear in most of the models used (i.e. for a 1 percentage point increase in the TCE/RWA capital ratio), we simply expressed the loss of GDP (in %) as a function of the TCE/RWA ratio for the eurozone (for TCE/RWA above 7%, in line with the LEI approach), using the average of the median unit impacts of the DSGE models with and without bank capital variables, or 0.13% of GDP[10]. We also assumed compliance with NSFR, adding an additional GDP loss of 0.093%, equal to the average of the median impacts between the two types of models cited above:

$$Loss\ of\ GDP\left(\frac{TCE}{RWA}^{LEI}\right)=0.129\times\left(\frac{TCE}{RWA}^{LEI}-7\right)+0.093$$

where $\frac{TCE}{RWA}^{LEI}$ designates the capital ratio based on the LEI definition (i.e. Basel I/II) expressed in %; *TCE*, common equity and assimilated instruments minus intangible assets and goodwill; and *RWA*, the risk-weighted assets.

The initial value of the TCE/RWA ratio of 7%, which represented the starting point of the cost function for the LEI (2010), was replaced by an initial Basel III CET1 ratio of 5.5% (≈7%×0.78) by the BIS report (Fender and Lewrick [2016]), to take account of the conversion factor of 0.78. We could have chosen to start with the same 7% TCE/RWA ratio giving a fully-loaded Basel III CET1 ratio of 5.0% (≈7×0.71) after application of our conversion factor of 0.71. However, to simplify the legibility and comparability of our results, we opted instead for an initial CET1 Basel III ratio of 5.5%, similar to that used by the BIS report (but which in our case corresponds to a TCE/RWA ratio of around 7.7%). On this point, it is important to remember that the starting point does not affect the optimal ratio, merely the net benefit calculated (as a percentage of GDP).

Applying our conversion factor of 0.71, the economic cost can be expressed as a function of the fully-loaded Basel III CET1/RWA ratio:

$$Loss\ of\ GDP\left(\frac{CET1}{RWA}_{Basel\ III\ ,CF=0.71}\right)=0.182\times\left(\frac{CET1}{RWA}-5.5\right)+0.093$$

with 0.182 = 0.129/0.71

Finally, the higher economic cost of a 1 point increase in the fully-loaded Basel III CET1 ratio (Table 1 and Chart 3, page 16) results not only from the higher economic cost inherent in a 1 percentage point increase in the TCE/RWA ratio in the eurozone-specific models, but also on a lower conversion factor. A 1 percentage point increase in the TCE/RWA ratio is "converted" into a greater rise in the "equivalent" CET1/RWA ratio for the eurozone (+1 point / 0,71≈ + 1.41 points) than in the combination of economic regions considered by LEI (+1 point / 0,78 ≈ +1.28 points).

Long-term economic cost by geographic region

Impact of a 1-point increase in the Basel III CET1 ratio [1] on baseline GDP[2]

Eurozone [3]		United States [4]		UK, Italy [3]	Median estimate
DSGE models[5] with bank solvency	DSGE models[5] without bank solvency	DSGE[5] and VECM[5] models with bank solvency	DSGE[5] and VECM[5] models without bank solvency	Semi-structural models[5] without bank solvency	All geographic regions combined [4] (figures used by the regulator)
-0.194%	-0.17%	-0.073%	-0.182%	-0.20%	-0.11%
Average: -0.182%		Average: -0.127%			
Impact of NSFR compliance[6]					
-0.067%	-0.12%	-0.117%	-0.130%	-0.153%	-0.08%
Average: -0.093%		Average: -0.123%			

[1] Common Equity Tier 1 ratio, fully loaded using the Basel III definition
[2] Including international externalities (exchange rates, commodity prices, trade flows)
[3] TCE/RWA to fully-loaded Basel III CET1/RWA conversion ratio of 0.71 calculated by us by applying the BIS method to European data (EBA [2014]).
[4] TCE/RWA to fully-loaded Basel III CET1/RWA conversion ratio of 0.78 used by the BIS report.
[5] DSGE, VECM and semi-structural models: dynamic stochastic general equilibrium models (DSGE) are so-called "real cycle" models which are based on microeconomic fundamentals. They postulate the rational expectations of agents (a coherent vision of the future). Vector error correction models (VECM) can be used to specify simultaneously a stable long-term relationship and short-term dynamics for one or more variables. Semi-structural models are hybrids combining DSGE models with VAR models based on the simple statistical interdependence between temporal series.
[6] LEI considers that this analysis also applies, to a certain extent, to LCR. We also used a conservative hypothesis of a decline in weighted assets.

Table 1 Sources: BNP Paribas calculations based on LEI (August 2010), Fender and Lewrick (2016), EBA (2014).

The economic cost of raising bank capital ratios is higher in the eurozone

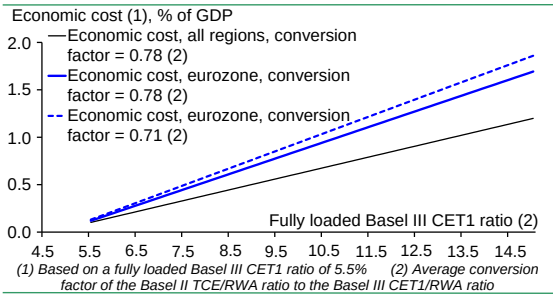


Chart 3 Sources: BNP PARIBAS calculations based on MAG/LEI, BIS, European Banking Authority

The optimal capital ratio for the eurozone has now been exceeded

The combination of a "steeper" economic cost function in the eurozone and a slightly reduced TCE/RWA to fully-loaded Basel III CET1 conversion factor causes considerable changes in the net economic benefit function, which, for the eurozone, results in an optimal capital ratio between 1.5 and 1.7 points below that calculated by the BIS for all of the main economic regions taken together (Charts 1 and 4). Our calculations suggest an optimal CET1 ratio of between 8.2% and 9.0% (8.4% in the central 'TLAC' hypothesis) for the eurozone, whilst the optimal ratio given by the BIS report is between 9.7% and 10.7% (9.9% in the central 'TLAC' hypothesis) across all the economic regions considered. According to the EBA, the fully-loaded Basel III CET1 ratio observed for major banks in the European Union in December 2015 was 12.4%. This is comparable to the 12.6% published in July 2016 as part of the results of the stress tests carried out on 51 eurozone banks.

Optimal Basel III CET1 ratio in the eurozone ranges from 8.2% to 9%

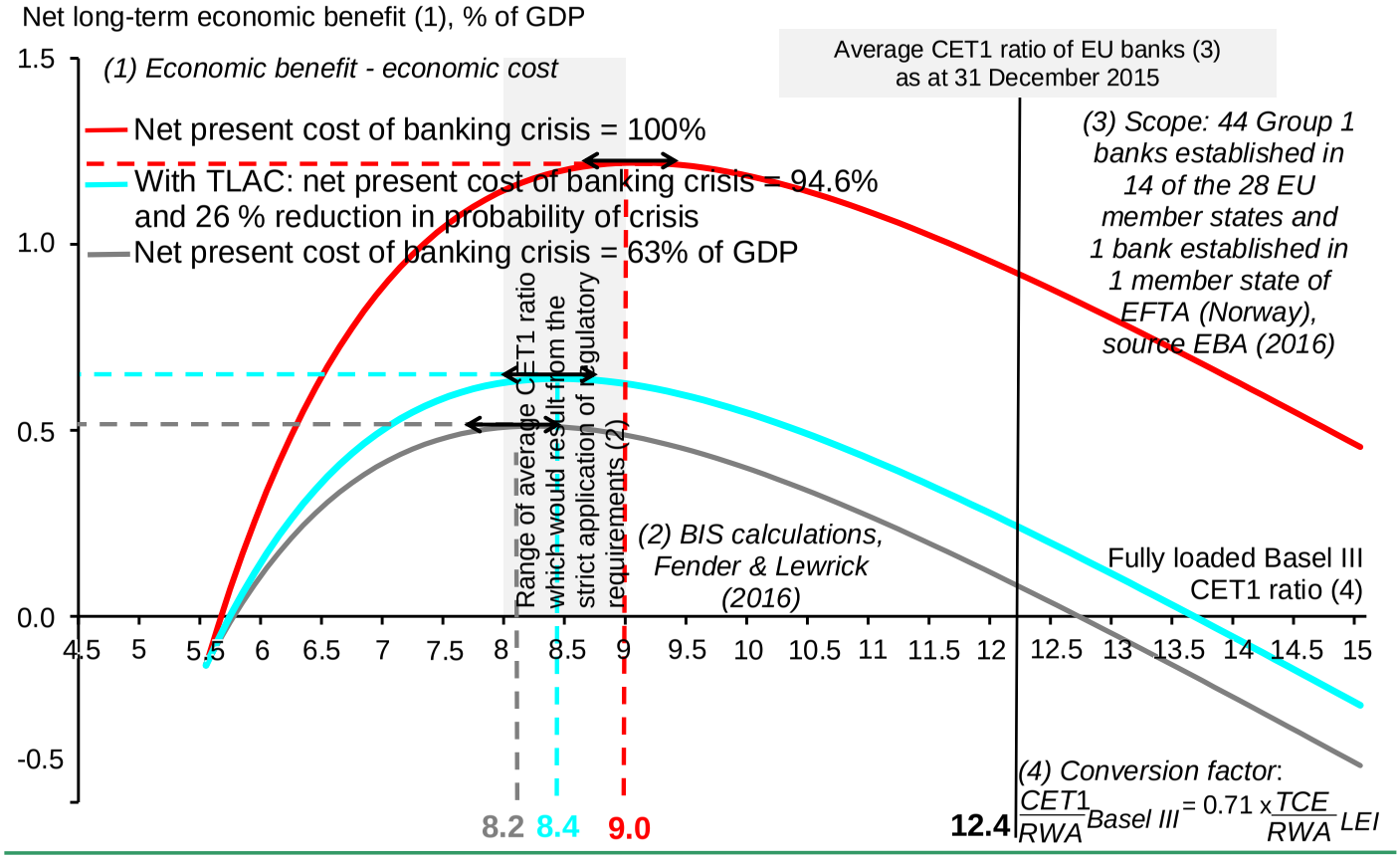


Chart 4 Sources: BNP Paribas calculations based on Fender & Lewrick (2016), EBA (2014 & 2016)

In November 2016, the BIS published an update of the 2010 economic impact study carried out by LEI experts in response to the introduction of a series of new hypotheses. On the basis of recent empirical studies expanded to include the economic consequences of the 2007-2008 financial crisis, the hypothesis of the net present cost of a banking crisis was raised from 63% to 100% of GDP, which automatically increases the economic benefit associated with any given capital ratio. Then the conversion factor from the Basel II TCE/RWA ratio to the Basel III ratio was increased from 0.66 to 0.78, so that a given optimal TCE/RWA ratio is now 'equivalent' to a higher fully-loaded Basel III CET1 ratio. The cumulative effect of these changes was an increase in the optimal 'global' capital ratio of around two points. Conversely, taking account of the benefits of TLAC (reducing both the probability and cost of a banking crisis) reduces it by 1 percentage point. Overall, the optimal ratio therefore rises from around 9% in the initial BIS economic impact study to around 10% in the updated version, published in November 2016 for all economic regions.

However, the generic nature of these results constitutes their principal limit. Based as they are on median hypotheses for "all regions taken together", they are not applicable to any one specific economic area. From this observation it follows that it is necessary to revisit the BIS approach in order to calculate the optimal ratio relevant to the eurozone alone. We have adopted the methodology used in the report, together with the new hypotheses of a net present cost of a crisis of 100% of GDP and for the economic benefits of TLAC. However, we have substituted eurozone-specific parameters (higher economic costs, lower conversion factor) for the 'global' parameters used by the BIS. On the basis of these more pertinent hypotheses, we show that the optimal, fully-loaded CET1 capital ratio in the eurozone is probably around 8.5%.

Over and above the discussion of an optimal capital ratio according to the economic region in question, we believe that the BIS report's conclusions are skewed. The report examines the optimal average CET1 ratio, resulting from a strict respect of regulatory requirements already in force or due to come into effect soon (between 8.2% and 8.9%) rather than the observed fully-loaded CET1 ratio, which is significantly higher. The security buffer which has always existed between regulatory requirements in their strict sense and the observed level of capital ratios, which results from implied market requirements and from the target ratios set by banks for themselves, is therefore simply ignored. In the medium term, and looking beyond the measures yet to be introduced but included in the BIS report's analysis (leverage ratio, G-SIB specific leverage ratio), the work now under way in the Basel Committee (talked of by insiders as 'Basel IV', but considered by the regulator as a 'finalisation' of Basel III) could lead to a significant increase in risk-weighted assets (the denominator of the capital ratio). In other words, the redefinition of RWA under Basel IV would reduce the optimal capital ratio. However, if the required capital ratio would not be adjusted (i.e. lowered) accordingly, this would imply that the positive gap between the target capital ratio and the optimal capital ratio would under Basel IV even be bigger than is currently the case under Basel III. As a result, the gap between the latter and effective CET1 ratios will be further increased. As the implementation of Basel III has demonstrated, if demonstration was needed, a tighter definition of capital ratios does not reduce the implicit requirements of the market (which, it is true, have been influenced by the increase in regulatory requirements, particularly for the G-SIBs, and by the introduction of the leverage ratio). Increasing capital requirements in EUR without increasing capital ratios (as a percentage of RWA) has the negative effect of muddying the waters around improved bank solvency, which is generally understood in terms of higher capital ratios rather than increases in capital. And yet, the change in definition that will come under 'Basel IV' will be the equivalent of an increase in capital ratios at constant definition, sufficient to wipe out the net, long-term economic benefit of these prudential reforms within the Eurozone because well beyond optimal ratio. This will be the consequence of an

increase in financing costs which is currently obscured by the exceptionally accommodating monetary policy stance of the ECB and the (continuing) historically low level of long-term interest rates, despite their recent jump following the election of Donald Trump as US President and his announcement of plans for fiscal stimulus. In the near term, the secondary effects on bank lending of a fresh increase in capital requirements could counteract the objectives of monetary policy at a time when loan books have returned to positive growth in the eurozone since 2015.

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NOTES

[1] The denominator of the capital ratio includes, among other things, off-balance sheet items and is restated for accounting differences between European and US standards.

[2] Total Loss Absorbing Capacity. The final recommendations were published by the Financial Stability Board (FSB) on 9 November 2015. http://www.fsb.org/2015/11/tlac-press-release/

This requirement, which applies only to global systemically important banks (G-SIBs) sets a minimum quantity of resources to be mobilised in the event of a 'bail in' during resolution. These resources must be at least 16% of risk-weighted assets (6% of leverage exposure) from 1 January 2019, rising to 18% (6.75%) from 1 January 2022. They can consist of capital instruments or unsecured subordinated debt with a residual maturity of more than one year. Senior debt with maturity of over one year is eligible up to a limit of 2.5% (ratio of 16%) and then 3.5% (18%) of risk-weighted assets.

[3] *Tangible Common Equity/Risk-Weighted Assets*. Tangible Common equity is equal to Common Equity before regulatory deductions and less any goodwill and intangible assets.

[4] See LEI (2010), table 7, pages 25 to 27.

[5] See European Central Bank, "The Supervisory Review and Evaluation Process in 2016". https://www.banking supervision.europa.eu/banking/srep/2016/html/index.en.html

"*Overall, the amount of Common Equity Tier 1 (CET1) capital that directly supervised banks are expected to hold, as determined by the SREP, will be broadly stable from 2016 to 2017. It remains at an average and median of around 10 % of total risk-weighted assets."*

[6] The values of capital ratios are already expressed as a percentage, i.e. a ratio of 8.5% corresponds to a value of 8.5.

[7] Group 1 banks are those with excess Tier 1 capital of EUR3 billion or more and which are active internationally.

[8] See Fender and Lewrick (2016), note 11 page 5: *"Calculations are based on BCBS (2010), Table A5.1 (average for US and euro area banks) and BCBS (2014), Tables A12 and A13. The adjustment reflects an increase in RWA, given the more stringent rules for calculation, and a decline in capital, given the more restrictive eligibility criteria for regulatory capital."*

[9] See BCBS (2014), note 1 under table A13, page 40.

[10] LEI (2010), table 7 page 27: the first step is to calculate the median impact of a 1 point increase in the TCE/RWA ratio for each family of models. For DSGE models with a bank capital variable, the unit median impact is 0.1375% (= (0.29% / 2 + 0.53% / 4 + 0.81%/6) /3). For DSGE models without a bank capital variable, the unit median impact is 0.1208% (= (0.24% / 2 + 0.49% / 4 + 0.72% / 6) /3). This gives an average median impact for the two families of models of ((0.1375% +0.1208%) /2) or approximately 0.13% of GDP.

REFERENCES

Ball L., *Long-term damage from the great recession in OECD countries*, European Journal of Economics and Economic Policies, vol 11, n° 2, 2014, p. 149–60

BCBS (2014), *Basel III Monitoring Report*, Bank for International Settlements, September. http://www.bis.org/publ/bcbs289.pdf

BCBS (2016), *Basel III Monitoring Report*, Bank for International Settlements, September. http://www.bis.org/bcbs/publ/d378.pdf

Cline W., *Benefits and costs of higher capital requirements for banks*, Petersen Institute Working Paper, n° 16-6, March 2016

EBA (2014), *Basel III monitoring exercise, Results based on data as of 31 December 2013,* 11 September. http://www.eba.europa.eu/documents/10180/534414/Basel+III+monitoring+report+%28results+as+of+December+2013%29.pdf/9b9a96b4-0c23-4ea5-bf8e-4651acfa2acd

EBA (2016), *CRD IV – CRR / Basel III monitoring exercise – Results based on data as of 31 December 2015*, 13 September 2016. http://www.eba.europa.eu/documents/10180/1360107/CRDIV-CRR+Basel+III+Monitoring+Exercise+Report+-+1309.pdf/fd57198b-6aa6-442e-bfea-eabd7d3e13c1

Fender I., Lewrick U., *Calibrating the leverage ratio,* BIS Quarterly Review, December 2015 and Fender I., Lewrick U., *Adding it all up: The macroeconomic impact of Basel III and outstanding reform issues,* BIS Working Papers, n° 591, November 2016. http://www.bis.org/publ/qtrpdf/r_qt1512f.pdf

Fender I., Lewrick U., *Adding it all up: the macroeconomic impact of Basel III and outstanding reform issues*, BIS Working Papers, n° 591, November 2016. http://www.bis.org/publ/work591.pdf

Haldane A., *The $100 billion question*, speech at the Institute of Regulation & Risk, North Asia (IRRNA), Hong Kong, 30 March 2010

Laeven L., Valencia F., *Systemic banking crises database: an update*, *IMF Working Papers*, n° WP/12/163, *June 2012*

LEI, *An assessment of the long-term economic impact of stronger capital and liquidity requirements*, Basel Committee on Banking Supervision, *August 2010*. http://www.bis.org/publ/bcbs173.pdf

MAG, Report *Assessment of the macroeconomic impact of higher loss absorbency for global systemically important banks*, BIS, *10 October 2011*

Mexico: US anchor called into question

Sylvain Bellefontaine & Tarik Rharrab

As the only Latin American country in North America, Mexico plays a special role on the continent. Today it is in the frontline of the new US administration's swerve towards protectionism and anti-immigration policies. Despite relatively solid macroeconomic fundamentals, Mexico's economic growth has been disappointing, and its prospects are eroding. The country has to seize the opportunity offered by Donald Trump's challenge to redefine its economic model, lessen its dependence on the United States and strengthen productivity by further integrating in global value chains.

Rising populism and a backlash against globalisation are taking root in the developed countries. Donald Trump's election and Brexit seem to have sounded the death knell for multi-lateral international cooperation and its "institutional and regulatory straitjacket", in favour of bilateralism. Unlike Theresa May and her ongoing support for free trade as the backbone of UK trade policy, US policy is clearly veering towards protectionism under Donald Trump. The rules governing international trade relations are being called into question by their main instigators, creating a major source of uncertainty and concern. Mexico is in the frontline of this policy change, given its dependence on the United States and its economic and financial openness, which lies at the core of its economic model.

Despite generally solid macroeconomic fundamentals, Mexico is exposed to external shocks and a downturn in the sentiment of international investors. Mexico has woven an intricate network of trade agreements with more than 40 countries, foremost of which is the North American Free Trade Agreement (Nafta) signed in 1994. Mexican exports now account for 34% of GDP, up from 14% in 1994. Of these, 75% are manufactured goods (a third for the automobile industry alone), thanks to a highly integrated supply chain with the United States (81% of Mexican exports). Capital controls have been completely eliminated. One of the rare convertible currencies from an emerging country, the Mexican peso (MXN) is also one of the most heavily traded on the financial markets, and international investors are highly active in the local equity and bond markets.

This article will first review Mexico's macroeconomic trajectory since it joined Nafta, and then will examine the new US economic and trade situation and its consequences for Mexico's economy.

An emerging country with the sluggish growth rates of a developed economy

Disappointing economic growth

Mexico entered the new millennium as the leader of Latin America, bolstered by structural reforms (public finance, monetary policy and financial sector reforms) launched after the so-called "Tequila" crisis of 1994-1995, and by its Nafta membership. Yet after five years of exceptional economic growth (5.5% a year on average), several factors marked the end of this buoyant period: the bursting of the dot.com bubble, the New York terrorist attacks, and intense international competition, exacerbated by China's entry into the World Trade Organisation (WTO) in 2001 and the expiration of the Multifibre Arrangement (MFA) in 2005. Since then, Mexico's economic performances have been disappointing. Real GDP growth did not surpass an average of 2.5% in 2003-2015, pulling down Latin America's average economic performance (3.3%) and falling far short of the 6% growth rates reported by the 40 main emerging economies.

Mexico's economy was slammed by the 2008 financial crisis and plunged into recession in 2009 (-4.7%). Exports declined by nearly 12% that year, which had a major gearing effect on domestic demand (-6.2%). As America's workshop and the adjustment variable for the US market, the Mexican economy destroyed 570,000 formal jobs in just a few months, before restoring them again starting in 2010, illustrating the enormous flexibility of the exposed *maquiladora* sector. The slowdown in foreign direct investment (gross FDI inflows averaged USD 26 bn a year in 2006-2015, half of which was from the United States) and transfers from roughly 30 million Mexican descendants living in the United States (USD 24 bn a year on average) also squeezed gross fixed capital formation (GFCF) and household consumption in Mexico in 2009.

Thereafter, Mexico benefited less than the South American countries from the rapid rebound in commodity prices – despite major oil potential – and the dynamic momentum of Asia, especially China. Pemex, the state-owned monopoly since 1938, lacked the financial and technical resources for deep-water exploration and unconventional hydrocarbons. As a result, oil production declined 35% from its 2004 peak, including a 10% decline since the drop-off in oil prices in 2014. With oil production of 2.2 million barrels a day, Mexico now ranks 12th worldwide, down from 5th in 2004.

Yet the country did manage to regain market share in the United States as of 2009 (13.6% in mid-2016 vs. 10.4% in 2008), thanks notably to its renewed cost competitiveness with China (weak peso, lower cost of labour since 2011 and low transport costs). Export growth in volume was a strong 7% in 2014 and 9% in 2015. Mexico generated a trade surplus with the United States of nearly USD 70 bn. It attracted new European and Asian investors despite a tough business climate and the erosion of the rule of law in certain northern industrial regions (violence, battle against/between drug cartels, corruption). Mexico also benefited from technological transfers in aeronautics and other sectors offering higher value-added than automobile assembly and electronics, and it has developed numerous competitiveness clusters.

Real GDP growth and demand components

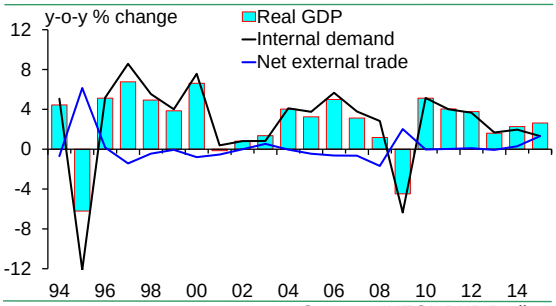


Chart 1 Sources: INEGI, BNP Paribas

Real GDP growth and supply components

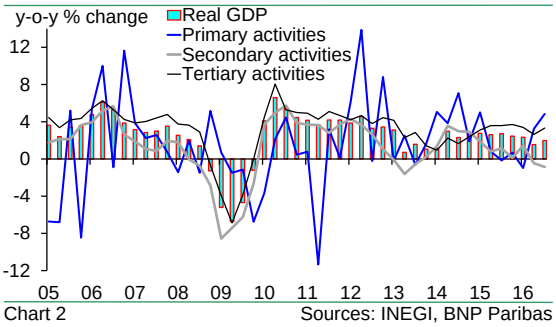


Chart 2 Sources: INEGI, BNP Paribas

Market shares of US imports

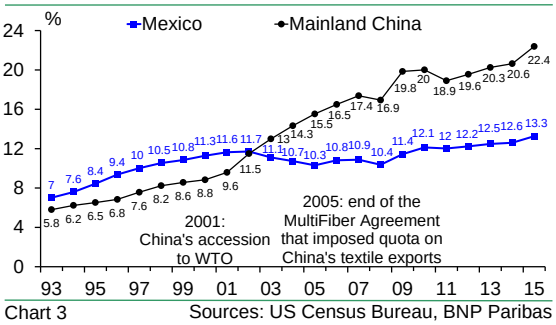


Chart 3 Sources: US Census Bureau, BNP Paribas

The Peña Nieto administration (2012-2018) launched long-awaited structural reforms in energy, competition, telecommunications, taxation, the job market, education and financial services, which were expected to lift Mexico's potential growth rate as of 2015. The government initially planned to boost GDP growth to more than 5%, including one extra point of growth due to the simple opening of the energy market to the international oil giants – but this target seemed very ambitious without an investment effort of at least 6.5% a year and major technical progress resulting from the reforms. It seemed more plausible that average annual growth would rise just above 4% through 2018 (see Conjoncture of May 2014: "Latin America: divergent trajectories").

Unfortunately, economic growth was squeezed in 2016 by financial market volatility in the emerging countries (concerns about China, rising geopolitical risks, and the vicissitudes of monetary policies in the developed countries, notably the Fed), by the US economic slowdown and by Mexico's rather restrictive fiscal policy to counter the decline in oil prices. As a result, full-year GDP growth is estimated at only about 2% on average.

Nafta does not spark catching-up effect or convergence

So far, Nafta has not produced all of the gains expected from the catching-up movement and economic convergence between Mexico on the one hand and the United States and Canada on the other. Ironically, the agreement did not unfold under the most auspicious conditions, since economic and financial deregulation and the capital inflows that began in the late 1980s were one of the vectors behind the Mexican crisis of 1994-1995.

Privileged access to the North American market has had a positive impact on direct and indirect job creations in Mexico. Over the past twenty years, the Mexican economy has created 8 million formal jobs. Export sectors, namely manufacturing industry and part of the agricultural sector, now account for 29% of formal employment. Manufacturing industry alone accounts for 16%, and this figure has been relatively stable for the past decade.

Yet in terms of real GDP, the average annual growth rate has been only 0.3 percentage points higher than in the US since 2001. Over the same period, demographic growth has been extremely dynamic (1.2% vs. 0.9% in the United States). As a result, in purchasing power parity, per capita GDP relative to the US has stagnated at only 32% over the past 20 years (the same level as in the 1950s), even though it had climbed to 46% on the dawn of the 1982 debt crisis.

This trajectory reflects the absence of absolute and relative productivity gains in Mexico. According to Conference Board data, the productivity gap has widened sharply to the detriment of Mexico over the past three decades. Hourly productivity increased 65% in thirty years in the United States, but was stagnant in Mexico. Relative hourly productivity between the two countries dropped from 57% in 1982 to only 31% in 2015 (where it has stabilised since 2011, after dropping sharply in 2008-2010), but the productivity gap per employee is not as big because the average working time in Mexico is 20% longer. In Mexico, total factor productivity (TFP) has declined by 1% a year since 2001 (compared to +0.2% in the United States), illustrating the chasm that still exists between the two neighbours in terms of technical progress (innovation, R&D, quality of human capital).

Reflecting this low productivity, real wages have stagnated, squeezing household purchasing power and restraining private consumption. A conservative banking sector – largely owned by international banks since the 1994-1995 crisis – has not fully played its role of financing the economy, notably for corporate investment. For the private sector, the credit penetration rate is barely 20% of GDP. The government has also had to keep a tight grip on public spending due to the weak tax base and declining oil-related revenues (which fell from a third of total revenues to less than 20% today), which has

hampered public investment in education, healthcare and infrastructure. Lastly, the Mexican economy's duality (export vs. domestic sectors; formal vs. informal employment, which accounts for nearly 60% of total employment) has fuelled big inequalities, although extreme poverty and the official unemployment rate (3.7%) are both low (though the jobless rate only partially reflects the real job market situation).

Growth regime has shown some signs of autonomy

The Mexican and US economic cycles are highly synchronised. Nonetheless, since the financial crisis we can see a weakening of the correlation between GDP growth trends (5-year moving average), although the correlation between Mexican export growth and US import growth remains very high. Through 2008, Mexican growth was more volatile but held relatively close, on average, to US growth. But since then it has grown faster than the United States by nearly a percentage point, even though this growth differential has narrowed over the past two years.

Despite the constraints outlined above, Mexico's growth regime has shown some signs of autonomy in the recent period. The expansion of the tertiary sector (62% of GDP in 2016) via the dynamic momentum of the services sector (+3.7% on average since 2010) has provided a solid source of domestic growth. At the same time, industrial production (i.e. the manufacturing, mining and construction sectors) has only increased 2% and has slowed gradually since 2014, handicapped primarily by the oil sector and to a lesser extent by construction.

Mexico boasts a large domestic market with 120 million inhabitants, of which three quarters belong to the middle class according to an absolute definition (disposable income of between USD10 and USD100 in PPP per day). As a general rule, the consolidation of a country's middle class is a factor that strengthens domestic demand and is synonymous with new means of consumption (services, leisure).

Relative productivity and wealth
Mexico *vs* the US

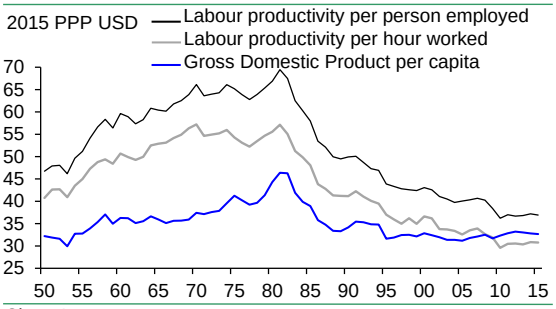


Chart 4 Sources: Conference Board, BNP Paribas

Synchronisation of business cycles

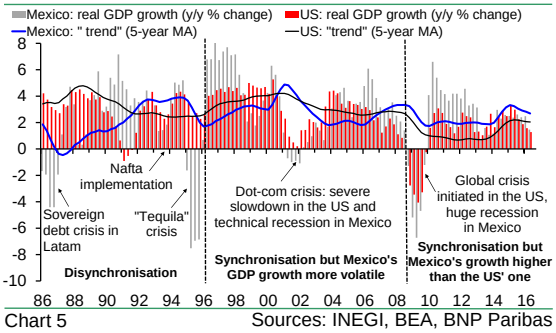


Chart 5 Sources: INEGI, BEA, BNP Paribas

Correlation between Mexico's and the US' economic performance

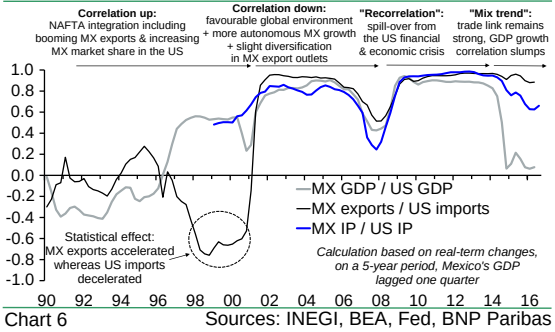


Chart 6 Sources: INEGI, BEA, Fed, BNP Paribas

Of course, the export sector has continued to play a key role as a leverage on the economy as a whole. From a purely accounting perspective, however, the external sector's net contribution to GDP growth is structurally negligible (except in 2015). This can be attributed to the high integration of the production chain within Nafta, which means the dynamic pace of exports in volume is closely correlated with that of imports, notably for intermediate and capital goods. This implies that Mexico is incapable of generating trade surpluses (other than with the United States), especially now that it generates an oil deficit: the country exports crude oil and imports more expensive refined petroleum products and their derivatives.

The authorities' intentions to diversify export markets (Latin America, Europe, and even Asia) have run up against the attractiveness of the United States (a reciprocal force). Mexico is still enclosed in its economic model as the workshop for the world's largest economy, whose potential growth rate has slowed from about 2.5% to 1.8% since the financial crisis according to the Congressional Budget Office (CBO).

It is still hard to evaluate what impact recent and pending structural reforms will have on Mexico's economic growth. According to preliminary estimates, starting in 2015, job market and financial sector reforms could jointly boost Mexico's growth potential by about 0.5 percentage points from a 5-year horizon. On top of this, we can also add the expected impact of the current opening of the energy sector to international investors. The fourth bid to tender was held in early December 2016 – the first to include very promising deep-water hydrocarbon fields – and six others could follow in the years ahead. But the first barrel is not expected until 2020 or so.

Most importantly, president Trump's rhetoric and his first protectionist and anti-immigration measures are a big source of uncertainty and concern for Mexico.

The "US new deal"

The weight of words and the first symbolic acts

Between the announcement effects and enormous uncertainty, the election of the new US president had a positive shock on US confidence (rather unexpectedly) and a predictable negative impact on Mexico. The US equity markets are expecting an acceleration in economic growth and inflation, which combined with corporate tax cuts, should offset higher interest rates (tightening of the Fed's monetary policy, expectations of higher fiscal deficits). According to the University of Michigan's monthly survey, household confidence hit a 13-year high in January. Inversely, higher interest rates and the dollar's appreciation placed a big strain on Mexico. The Mexican peso (MXN) began to depreciate in early May 2016 as Donald Trump's main rivals dropped out of the running to be the Republican candidate. The peso has depreciated by 12% since the 8 November election. CDS premiums on foreign-currency government bonds rose 50 basis points (bp) in just a few days before gradually easing to 155bp on 3 February. The Mexican Stock Exchange's general index has also picked up, but it was still down 3% in the local currency and 13% in USD for the past three months. Yields on 5-year domestic bonds rose 130bp over the period to 7.15%.

Foreign exchange rates

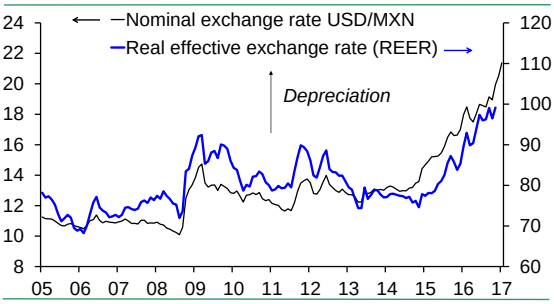


Chart 7 Source: Banxico

The slew of executive orders since the 20 January inauguration shows that Donald Trump intends to rapidly fulfil his campaign promises. The first symbol is the order to withdraw from the Trans-Pacific Partnership, a trade agreement supported by the Republican Party but that had not yet been ratified.

While waiting to renegotiate or even to repeal Nafta, president Trump is threatening to introduce trade tariffs on Mexican imports (a 20% tariff has been mentioned), to encourage US companies to maintain or relocate their businesses to the domestic market. Seventy-five percent of the 500 largest American companies and thousands of SMEs have already located in Mexico. The automobile sector is emblematic: nearly 20% of GM's North American production and 13% of Ford's is located in Mexico. In early January, Ford announced that it would abandon a USD 1.6 bn investment project in a new Mexican plant, and that USD 700 m would be reallocated to its Michigan plant, with the creation of 700 jobs. The Fiat Chrysler group announced that it might withdraw from Mexico depending on the level of import tariffs. At the same time, GM will relocate the production of one of its models in Canada to one of its Mexican sites.

Executive orders on immigration restrictions (the constitutionality of which is still being challenged) and building a wall on the Mexican border (the legal framework has been in place for 10 years but the cost is prohibitive) clearly mark the new administration's determination to restrain the free circulation of both people and goods. The administration is also considering regulatory and fiscal measures restricting money transfers to Mexico (*remesas*) and tighter controls on the status of the people originating these transfers.

Trump doctrine vs. economic reality

The new government's vision is bolstered by Q4 2016 statistics for US economic growth and the trade deficit: according to preliminary estimates, net external trade made a negative contribution to GDP growth of 1.7 points. Despite vigorous consumption and investment in the year-end period, full-year GDP growth slowed sharply in 2016 to an average annual rate of 1.6%, the second weakest performance since the recession ended.

Donald Trump managed to capture the vote of blue collar workers from the Rust Belt against a backdrop of deindustrialisation, impoverishment and downward social mobility. Presenting himself as the advocate of "made in USA", he promised to create 25 million jobs in four years. Although the job market has been particularly buoyant over the past four years, it has "only" created 10 million jobs, slashing the unemployment rate from 8.1% to 4.7%. Unemployment in the broad sense of the term (including underemployment) is two points higher than the 2000 peak of 7%, wage growth has remained subdued and inflation is still in line with the Fed's target (even though it spiked in January, driven by energy prices), which indicates that the economy has not yet reached full employment nor a cyclical peak. Yet even if the labour force were to grow by about 2 million persons a year and economic patriotism were to reach a fervent pitch, Donald Trump's goal of creating jobs seems utopic without resorting to massive immigration. His infrastructure stimulus plan might boost job creations in construction, a big employer of immigrant workers, notably Mexicans. The same can be said about the agriculture and agri-food sector, which along with the industrial sector, is likely to be at the heart of Nafta renegotiation.

Nearly 5 million American jobs depend on trade with Canada and Mexico. For every dollar exported by the Mexican *maquiladoras,* inputs (intermediate goods) from the United States account for no less than 40 cents. Moreover, higher import tariffs would increase import prices, which in the absence of competitive substitutes "made in USA", would end up eroding the purchasing power of US consumers.

Institutional and legal checks and balances

Confronted with economic reality and major institutional safeguards (the separation of powers and the major prerogatives of Congress, the courts and the States), the new US administration will need the support of the Republican majority in Congress to

implement its programme. The Republicans widely support the proposal for massive corporate tax cuts. Yet Paul Ryan, the influential chairman of the House of Representatives, continues to advocate free trade and oppose government intervention. His doctrine does not sit well with Donald Trump's plans for greater protectionism and a stimulus package based on federal infrastructure investment (which may take the form of investment tax credit for companies). Some Republican congressmen might see renegotiating Nafta as an opportunity to strengthen America's economic interests. Nonetheless, it is bound to encounter some powerful opposition. The biggest pressure will come from lobbying by major companies and business sectors that have a big interest in maintaining the status quo, and of course, from the "fourth estate", i.e. the press and the media.

Under article 2205, a Nafta country has the right to unilaterally withdraw from the agreement by simply providing written notice 6 months in advance. It remains to be seen whether the US president has the legal capacity to make such a decision via a simple executive order: article 1-8 of the US Constitution stipulates that questions pertaining to international trade are the prerogative of Congress. Mexico could also file suit with the World Trade Organisation (WTO), if the US administration decided to impose tariff barriers or discriminatory regulations, which are prohibited under the most favoured nation clause in trade agreements.

Mexico's economic prospects

Against this backdrop, we now look at the concrete consequences that future US economic and trade policies could have on Mexico's economic performance. We used a vector auto-regression (VAR) econometric model to evaluate the effects of different external economic and financial shocks on economic activity in Mexico.

Our model can be written as follows[1]:

$$y_t = [\Delta y_t^{US},\ IR10_t^{US}, Spread_t\ , RER_t\ , \Delta y_t^{Mex}, IR_t^{Mex}]$$

where Δy_t^{US} is real US GDP growth, $IR10_t^{US}$ is the interest rate on 10-year US Treasury bonds, $Spread_t$ is the yield spread on 10-year Mexican government bonds in foreign currency, RER_t is the real exchange rate of the peso against the US dollar, Δy_t^{Mex} is real Mexican GDP growth and IR_t^{Mex} is the Mexican interbank interest rate. The breakdown of annual Mexican GDP growth (Cholesky matrix) confirms that external factors are key explanations, mainly US GDP growth (31%) and yield spreads (20%), which are influenced by international market conditions, but also by internal factors specific to Mexico (political risk, stability of public finances).

The results of our simulation, summarised in Table 1, can be interpreted as follows: an initial shock on US GDP growth of 1 percentage point (pp) would generate an instantaneous response of 0.24 pp of real GDP growth for Mexico, a cumulative response over four quarters of 0.86 pp, and a cumulative response over eight quarters of 0.98 pp.

Impulse response of real Mexican GDP to external shocks (standardised at 1 percentage point)

	Real US GDP	US 10-year rates	Yield spreads	Real exchange rate MXN/USD
Q1	0.24	-0.11	-0.16	-0.13
Cumul Q1-Q4	0.86	-0.55	-0.81	0.09
Cumul Q5-Q8	0.12	-0.09	0.29	0.20
Cumul Q1-Q8	0.98	-0.63	-0.52	0.29

Table 1 Source: BNP Paribas

Using VAR, we construct a system of equations to predict real GDP growth for Mexico using the following three alternative scenarios based on whether or not Donald Trump's programme is realised (see table 2):

1. S1: the most favourable scenario for Mexico

US GDP growth accelerates to an annual average of 2.3% in 2017 and 2.8% in 2018, bolstered by a fiscal stimulus package (infrastructure), corporate tax cuts (acceleration of investment and job creations rather than hoarding or dividend payments) and financial deregulation (acceleration of lending). At the same time, we consider a mild increase in tariffs on Mexican imports, which would be proxied by a 10% appreciation in the real exchange rate in Q3 2017.

2. S2: intermediate scenario

The same assumptions for US growth as in S1, but with the introduction of major tariff and non-tariff barriers on Mexican goods, which would be proxied by a 30% appreciation in the real exchange rate in Q3 2017.

3. S3: worst-case scenario for Mexico

No stimulus in the US (GDP growth would average between 2% and 2.2% in 2017-18) accompanied by major trade barriers, identical to those in S2.

We conclude (see chart 8) that under the most favourable scenario (S1), Mexican economic growth would stall on a year-on-year basis in Q4 2017 and Q1 2018, reducing the carryover for 2018, before regaining some traction to finish 2018 with an average annual growth rate of 0.5%. In both S1 and S2, real GDP growth would average 1.2% in 2017. Yet in S2, economic activity would slump from Q1 2018-Q3 2018 (on a year-on-year basis). This would bring average GDP growth to -0.3% in 2018. Lastly, under worst-case scenario S3, real GDP would remain in negative territory until early 2019. It would increase at an average annual rate of 1.1% in 2017 before contracting 0.5% in 2018.

Hypotheses for explanatory variables

	Y_US	IR_US10	Spread	RER	IR_MEX
			Scenario 1		
2017 Q1	2.2	2.6	232	729	6.8
2017 Q2	2.4	2.8	232	729	7.8
2017 Q3	2.2	2.9	232	656	8.0
2017 Q4	2.4	3.0	232	656	8.0
2018 Q1	2.6	3.2	232	656	8.0
2018 Q2	2.8	3.3	232	656	8.0
2018 Q3	2.8	3.4	232	656	8.0
2018 Q4	2.9	3.5	232	656	8.0
			Scenario 2		
2017 Q1	2.2	2.6	232	729	6.8
2017 Q2	2.4	2.8	232	729	7.8
2017 Q3	2.2	2.9	280	510	8.0
2017 Q4	2.4	3.0	280	510	7.8
2018 Q1	2.6	3.2	280	510	7.5
2018 Q2	2.8	3.3	280	510	7.5
2018 Q3	2.8	3.4	280	510	7.5
2018 Q4	2.9	3.5	280	510	7.5
			Scenario 3		
2017 Q1	2.2	2.6	232	729	6.8
2017 Q2	2.0	2.8	232	729	7.8
2017 Q3	1.9	2.9	280	510	8.0
2017 Q4	2.1	3.0	280	510	7.8
2018 Q1	2.2	3.0	280	510	7.5
2018 Q2	2.3	3.0	280	510	7.5
2018 Q3	2.3	3.0	280	510	7.5
2018 Q4	2.1	3.0	280	510	7.5

Table 2 Source : BNP Paribas

Mexico's GDP growth projections

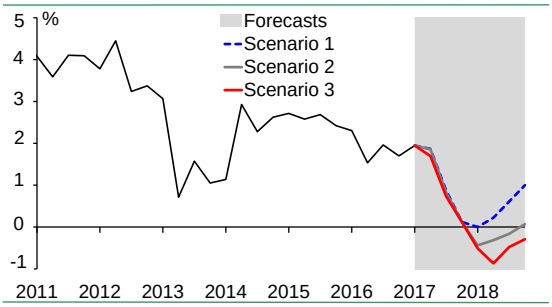
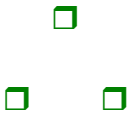


Chart 8 Source: BNP Paribas



Renouncing the principles of openness that have forged the identity and wealth of the United States is probably not a panacea for the economic and social ills plaguing the country. Mexico seems to be the sacrificial lamb and collateral victim of the economic and trade policies being pushed by the new US administration. Under these conditions, Mexico's short-term economic prospects have been revised significantly downwards. The consensus forecast of economists for 2017 GDP growth was lowered from 2.2% in October 2016 to 1.5% in January's latest survey, while 2018 prospects were lowered from 2.8% to 2.1%, respectively.

Whatever the US decides, and even though it will probably take several months or even quarters before any policy changes actually materialise, the size of the negative shock on confidence and the wait-and-see behaviour of non-resident and local investors are likely to have a big impact on investment spending in Mexico in the months ahead. Consequently, investment is likely to contract in 2017. Already shaken by a big fuel price increase announced in January, household confidence is also expected to deteriorate, straining private consumption. Nor should we expect any support from economic policies. Fiscal policy is likely to remain relatively restrictive, as it has been over the past two years, against a backdrop of declining oil revenues and the financial difficulties of the state-owned company Pemex. Constrained by the peso's sharp drop and surging inflation, the monetary authorities are likely to tighten monetary conditions more severely than was expected just a few months ago, largely leading the Fed rather than following behind. Paradoxically, exports might end up being the only support factor for economic growth while awaiting the concretisation of US trade retaliation measures.

In the longer term, the potential scope of the economic, trade and diplomatic policy shifts that could be introduced over the next four years is alarming when it comes to Mexico's trajectory. Undermined by its comparative and competitive advantages that have trapped itself into the role of a workshop for its Northern neighbour, Mexico must redefine its economy model, lessen its dependence on the United States and strengthen its productivity by further integrating in global value chains. Seen in this light, the acceleration of trade negotiations between Mexico and the European Union should be considered to be good news.

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REFERENCES

IMF: Mexico Country Report No. 15/314, *Selected issues: trade and financial spillovers to Mexico*, pp.11-23 (November 2015)
Jean-Baptiste Gossé, Cyriac Guillaumin*: Christopher A. Sims et la représentation VAR* (2011)
Gilbert Colletaz: *VAR processes* (2013)
S. Ouliaris, A.R. Pagan and J. Restrepo: *Quantitative Macroeconomic Modelling with SVAR – An EViews Implementation* (September 2016)

NOTE

[1] Considering that the 1994-1995 crisis and the start-up of Nafta marked a structural rupture for the Mexican economy, we have calibrated our model on the period Q1 2000 - Q4 2016 (quarterly data) to evacuate the memory effect (persistence of past phenomenon).

We consider $VAR(p)$ with n variables:

$$Y_t = \Phi_0 + \Phi_1 Y_{t-1} + \Phi_2 Y_{t-2} + \ldots + \Phi_p Y_{t-p} + \varepsilon_t \qquad (1)$$

where p^* is the optimal number of lags and ε_t is white noise

The equation (1) can be rewritten: $\Phi(L)Y_t = \Phi_0 + \varepsilon_t$ (2)

With L the lag operator, I_d the identification matrix, $\Phi(L) = I_d - \sum_{i=1}^{p} \Phi_i L^i$

Under the stationarity hypothesis, the Wold theorem allows us to rewrite the VAR process as an infinite order moving average ($VMA(\infty)$):

$$Y_t = \sum_{j=0}^{\infty} \psi_j \varepsilon_{t-j} = \Psi(L)\varepsilon_t \qquad (3)$$

where $\Psi(L) = \sum_{j=0}^{\infty} \psi_j L^j$, $\psi_0 = I_d$ and ε_t represents the shock vector of the process.

Using equation (3) we can determine the shock effect ε_t on endogenous variables.

Therefore:

$$\psi_{h(i,j)} = \frac{\partial Y_{i,t+h}}{\partial \varepsilon_{j,h}}$$

($\psi_{h(i,j)}$ is the partial derivative of $Y_{i,t+h}$ with relation to $\varepsilon_{j,h}$)

$\psi_{h(i,j)}$ is the estimated impact of shock ε_j at date t on variable Y_i for h periods following the shock.

∗ The choice of the number p of lags that minimises the Akaike information criterion (AIC) and Schwarz criterion (SC) are defined as follows:

$$AIC(p) = \log\left[det\widehat{M}\right] + \frac{2}{N}pk^2 \qquad SC(p) = \log\left[det\widehat{M}\right] + \frac{\log(N)}{N}pk^2$$

where k is the number of variables in the system, N the number of observations and $\widehat{M}$ an estimator of the variance-covariance matrix of the residuals.

For our study, we have selected 3 lags.

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