

Economic Watch

Mexico

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Economic Analysis

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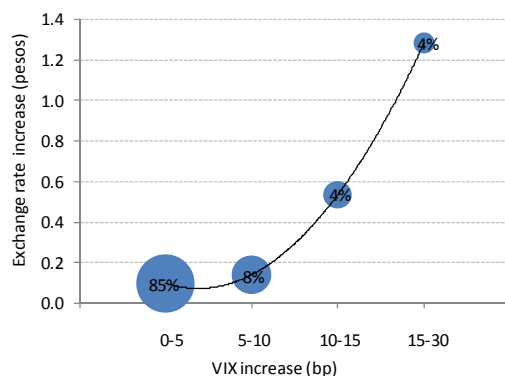
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Exchange rate, fundamental level and the influence of global volatility

- Uncertainty regarding US cycle strength and the generalization of the solvency and liquidity crisis of public debt in the euro area led the peso exchange rate against the dollar to suddenly depreciate intensely.
- The episodes of the exchange rate volatility temporarily deviate it from a long-term path. This path is an estimation consistent with borrowing decisions and the course of productivity and prices in relation to the US.
- As global uncertainty is reduced, our outlook for productivity and prices in Mexico, in relation to the US, and for the stability of foreign debt are consistent with an exchange rate level within the 12.0 to 12.4 pesos/dollar interval.

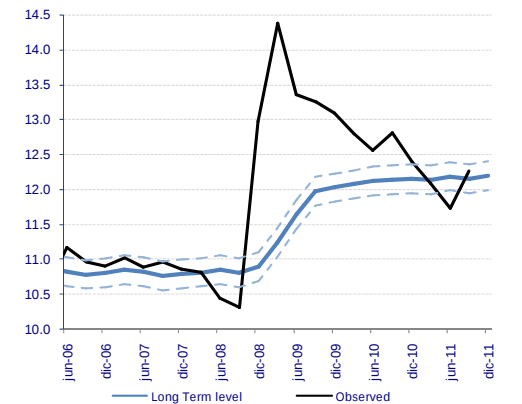
In its September 21 monetary policy announcement, the FED presented a more pessimistic tone regarding economic growth, which generated an increase in risk aversion to assets in emerging markets. In Mexico, the peso depreciated against the dollar and its volatility rose after a period of relative stability despite the worsening of the public debt situation in Europe. Though this episode indicates that the exchange rate responds to changes in the global perception of risk, especially in the US (Chart a), there are also economic bases that contribute to anchoring its course in terms of a long-term range. These bases include relative prices and productivities of Mexico and the US and foreign public debt as a percentage of GDP. Beyond the short-term movements, the economic foundations enable the determination of an exchange rate level, to which the parity should tend as long as global uncertainty decreases (Chart b).

Chart a
 Perception of global risk (VIX) and peso/dollar exchange rate



Sources: BBVA Research and Bloomberg. The VIX volatility index indicates the volatility of the US Standard and Poor's 500 stock options.

Chart b
 Exchange rate. Long-term level (peso/dollar)



Source: BBVA Research.

In Mexico and in other emerging markets, the exchange rate recently recorded a strong depreciation, as well as an increase of volatility (Chart 1). This was the result of heightened uncertainty regarding the US economic cycle, in addition to the lack of resolution of debt problems in some European countries. As a result, the perception of risk in Mexico increased (Chart 2). Considering this behavior, it would be useful to assess what the exchange rate would be in the absence of these global risk events. This Economic Watch analyzes the economic bases behind the exchange rate and determines its long-term level in line with the aforementioned bases. Moreover, it will also reflect on the influence of global risk on exchange rate parity.

Economic fundamentals of the exchange rate and its long-term level

Empirical models for explaining exchange rate behavior are based on various studies on purchasing power parity (PPP), interest rate parity and the effects of productivity across countries. Specifically, the Balassa-Samuelson approach indicates that the determining factors of the exchange rate are productivity and prices in relation to those of the trading partners of the country in question. In this case, the peso/dollar parity is evaluated, given that commercial activity (exports plus imports) in Mexico stand at approximately 80% with the US.

Chart 1

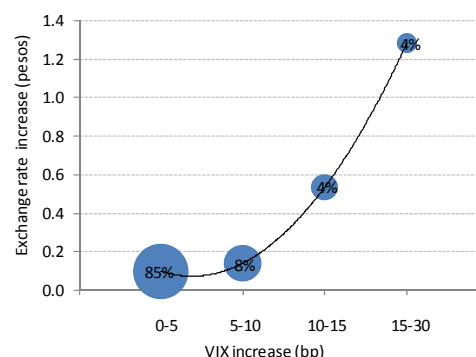
Exchange rate (peso/dollar) and implied volatility (%)



Sources: BBVA Research and Bloomberg.

Chart 2

Perception of global risk (VIX) and peso/dollar exchange rate



Source: BBVA Research. The VIX volatility index indicates the volatility of the US Standard and Poor's 500 stock options.

In addition to the relative productivities and prices between Mexico and the US, the level of foreign public debt as percentage of GDP is incorporated as a determinant of the exchange rate as it is deemed able to capture the credit risk of the Mexican economy.

In order to identify the statistical relationship between the exchange rate and its fundamental bases, the cointegration methodology was along with a Vector Error Correction Model (VEC) due to their advantage of being able to incorporate short and long-term determining factors (see Appendix). Specifically, it was found that the price and productivity relationship between Mexico and the US, as well as the level of foreign debt, share a common relationship with the exchange rate level in such a way that their long-term trends are linked. Thus, it may infer that these variables present a long-term relationship. As such, the deviations of each of these variables, with respect to their long-term levels, should be corrected to the extent that the exogenous, short-term, factor that caused them disappears.

As is explained in the Appendix, the long-term relationship indicates that the exchange rate depreciates to the extent that prices rise faster in Mexico than in the US, and that the reverse applies in the case of the productivity of employment. Likewise, as was to be expected, the increase of foreign debt as percentage of GDP is consistent with a more depreciated exchange rate. Based on these elements, it is important to mention that the long-term relationship is not a constant, but rather the contrary. It has depreciated over time as a result of the faster rise of prices in Mexico and the worse performance in terms of productivity. Both factors contribute to

the impairment of the purchasing power of the currency. Moreover, foreign debt recorded a sustained fall up to 2008, and then increased as a result of the drop in economic activity in 2009.¹

Global risk reduces the convergence of the exchange rate to its long-term level

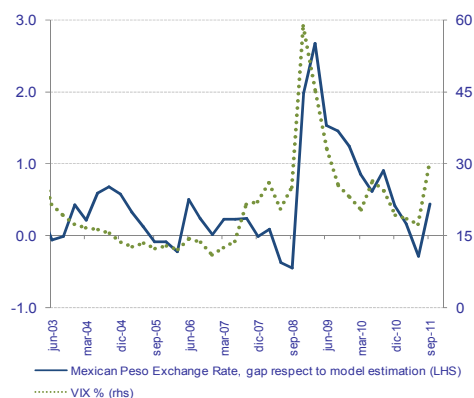
By including the long-term relationship in a model to explain the changes in peso/dollar parity, it is found that as the exchange rate increases above the long-term level, it will tend to appreciate in the subsequent periods. Using the coefficients from the first column of Table 1 of the Appendix, in the absence of debt growth, a 1% depreciation in the previous period would be corrected by nearly 90% in the subsequent period.² Now, if the model is calculated with a risk variable, like the VIX volatility index as shown in column 2, a 1 percent depreciation in the previous period, plus a 10 percent increase in the VIX (average quarterly increase of the last 4 years), would make the correction stand at only 30 percent in the following period.³ That is, the exchange rate correction is upwardly offset by the increase in the perception of global risk, making the correction to the long-term level slower. These magnitudes reveal the influence of changes in the perception of global risk on exchange rate movements.

As further proof of the influence of global risk perception on the exchange rate, Chart 3 presents the differences between the observed exchange rate and the exchange rate estimated by the specification (I) of Table 1 and the VIX index. The correlation between both series is 0.7. This indicates that the deviations with regard to the long-term level are largely linked to the oscillations in the perception of global risk.

Therefore, as global uncertainty is reduced, in a scenario of positive economic growth, inflation in line with the objective of price stability and a foreign government debt that remains stable as a percentage of GDP, the fundamentals of the peso will anchor its level between 12.0 and 12.4 pesos/dollar.

Chart 3

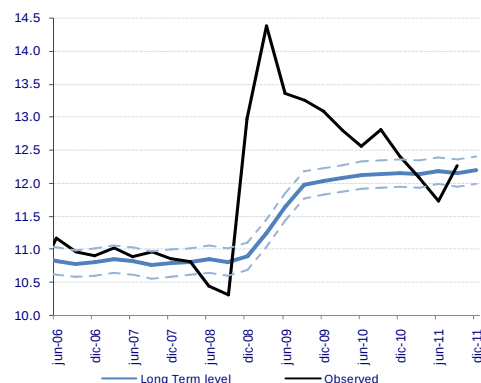
Unexpected movements in the exchange rate and global risk



Sources: BBVA Research and Bloomberg.

Chart 4

Exchange rate. Long-term level (peso/dollar)



Source: BBVA Research.

¹ The Pidiregas scheme in the Pemex investment was cancelled as of January 2009. Thus, the liabilities for said scheme were reclassified from non-budgetary debt to budgetary debt of Pemex. This move is reflected as a jump on the Net Debt of the Public Sector starting in 2009.

² This effect is obtained by adding the following factors: i) the coefficient for the lag of growth of the exchange rate multiplied by 1% of depreciation; ii) the coefficient of the constant and; iii) the coefficient of the error correction term multiplied by the deviation of the exchange rate with regards to its long-term level, resulting from said depreciation. This makes a 1% depreciation of the exchange rate be followed by a 0.9% appreciation in the following period, assuming there are no changes in the other variables in the estimation.

³ This effect is obtained by adding, to the aforementioned 90% correction, the effect of the average quarterly increase of the last 4 years in the VIX (10%) multiplied by the coefficient of the VIX variable, which results in the 30% of the indicated correction.

Appendix

Based on the approach of purchasing power parity (PPP) and difference in productivities, it is sought to identify the economic bases behind the nominal exchange rate.⁴ First, unit roots tests were conducted to test that stationarity of the variables on a quarterly basis and within the March 1995 to September 2011 period. The results of the Dickey Fuller tests indicated that both the price and productivity ratios between Mexico and the US, the exchange rate and the foreign public debt as percentage of GDP follow a unit root process.⁵ Therefore, the existence of long-term relationships maintained by the Consumer Price Index ratio and productivity between Mexico and the US with the nominal exchange rate was verified. In addition, total debt and a constant were included as variables in the long-term relationship. In accordance with the Johansen methodology, there is only one cointegration or long-term linear relationship between the variables mentioned. That which makes the relationship between these variable be stationary and the estimate is consistent. The relationship for the variables expressed as their natural logarithm is yielded by:

$$ER_t = 3.34 + 0.47(\text{Price ratio}_t) - 0.78(\text{Productivity ratio}_t) + 0.03(\text{Debt}_t). \quad (A)$$

Where ER is the nominal exchange rate; the Price ratio variable is the ratio of Consumer Price Indexes between Mexico and the US; the Productivity ratio is the ratio of productivities between Mexico and the US. Productivity was defined as the quotient of real GDP and the total number of employed inhabitants in the economy. The Debt variable refers to Mexico's foreign public debt as a percentage of GDP.

The signs of the variables are correct and all of the variables are significant with a 90% confidence interval. The long-term relationship between the aforementioned variables is not constant. That is, the exchange rate consistent with the long-term relationship has depreciated over time, which is in line with the greater growth of prices in Mexico and the higher increase of productivity in the US, as shown in Charts 5 and 6.

Once the long-term relationship is estimated, it is included in the Vector Error Correction Model (VEC) together with other short-term variables to identify the temporary nature of the different variables on the exchange rate. The sample period for the estimate covers quarterly data from 1995 to September 2011. The equation is as follows:

$$\Delta ER_t = \alpha + \gamma(\beta_0 + \beta_1 \text{Price ratio}_{t-1} + \beta_2 \text{Productivity ratio}_{t-1} + \beta_3 \text{Debt}_{t-1} - ER_{t-1}) + \beta_4 \Delta ER_{t-1} + \beta_5 \Delta \text{Price ratio}_{t-1} + \beta_6 \Delta \text{Productivity ratio}_{t-1} + \beta_7 \Delta \text{Debt}_{t-1} + \beta_8 D_{95} + \beta_9 D_{08} + u_t \quad (B)$$

Where Δ indicates the quarterly difference of the variable, D_{95} is a dummy variable for the first quarter of 1995 that indicates the crisis in that year and D_{08} is a dummy variable for the fourth quarter of 2008, when Lehman Brothers went bankrupt and the *subprime* crisis began. All the variables are expressed in natural logarithms.

Note that γ can be interpreted as a parameter for the rate of exchange speed of adjustment with regards to its long-term level. Thus, as γ increases, the greater the response will be of the rate of variation of the exchange rate to the difference with respect to the long-term level of the previous period. The following table shows the results of the estimation. The term error correction includes the cointegration vector obtained previously.

⁴ For a review of these approaches and the various exchange rate models, see Driver and Westaway (2004).

⁵ The results are maintained for the different specifications of the Dickey Fuller tests: with constant, with trend, without constant and without trend.

Table 1

Determinants of the exchange rate

<i>Exchange rate growth (%)</i>	(1)	(2)
Constant	0.233 *** (0.053)	0.198 *** (0.051)
Error Correction Term	-0.096 *** (0.023)	-0.081 *** (0.021)
Exchange rate growth % (t-1)	-1.061 *** (0.056)	-1.034 *** (0.053)
Debt growth (%)	0.131 *** (0.025)	0.136 *** (0.023)
Dummy 1995 1Q	0.418 *** (0.033)	0.440 *** (0.031)
Dummy 2008 4Q	0.191 *** (0.031)	0.136 *** (0.033)
VIX change (%)		0.063 *** (0.019)
Observations	67	67

*** Statistically significant at 99% confidence level. Quarterly sample 1995 - 2011
Standard errors in parenthesis

Source: BBVA Research.

According to the Column (1), the coefficient for the speed of adjustment is significant to 5 percent and has a negative sign, indicating that if the exchange rate moves away from the long-term relationship, it tends to appreciate to return to it. The rest of the variables have the correct sign and are significant. Note that the short-term elements of the productivity and price relationships were not significant; thus they were not included in the final estimation. From these results, we can confirm that, in the absence of debt growth, a 1 percent depreciation in the previous period would be corrected by approximately 90 percent in the following period.

In an attempt to quantify the effect of the perception of global risk on exchange rate movements, the VIX index was added to the column (1) as a short-term variable. Column (2) shows that this variable is significant and has a positive sign. Specifically, a 1 percent depreciation in the previous period together with a 10 percent increase in the VIX (average quarterly increase for the last 4 years) would only be corrected by 30 percent in the following period. That is, the exchange rate correction is upwardly offset by the increase in the perception of global risk, making the correction to the long-term level slower.

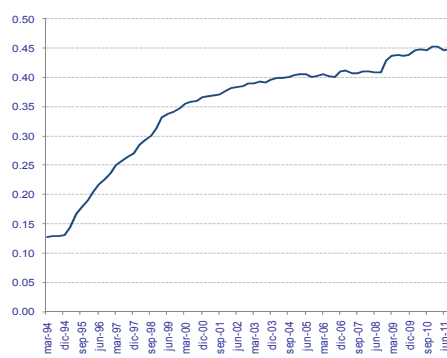
Finally, an additional exercise, different from that presented above, was carried out for the purpose of determining if the exchange rate presents a different speed of adjustment in periods of greater risk. The model (1) was estimated in two different samples. The first contains the periods of greatest risk aversion, defined as those quarters in which the VIX index increased with respect to the previous period, while the second is made up of the remaining quarters.⁶ Though the results of the estimations yield a coefficient for the speed of adjustment that is lower for periods of

⁶ Alternatively, using monthly data, the effect of the Standard and Poor's 500 volatility index (VIX) on the exchange rate in the different samples, with and without increase of the VIX, is estimated. The difference between the VIX coefficients was not statistically significant.

greater global risk, the difference of the coefficients under the different samples was not statistically significant.

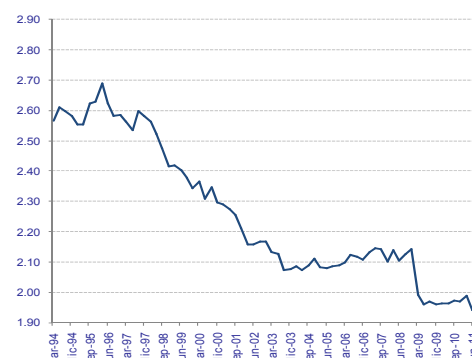
Therefore, there do not appear to be different adjustment rates to the long-term level.

Chart 5
Mexico-US price ratio



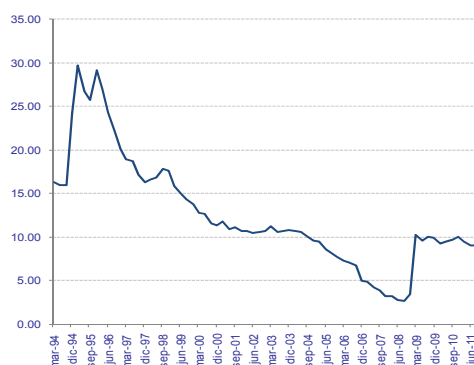
Source: BBVA Research with Banxico and BLS data.

Chart 6
Mexico-US productivity ratio



Source: BBVA Research with INEGI data

Chart 7
Foreign public debt as percentage of GDP.



Source: BBVA Research with Banxico data.

References

López, Arnoldo and Iván Martínez (2011), "Economic fundamentals anchor Mexico CDS spread in an uncertain global environment". *BBVA Research Economic Watch*.

Driver, Rebecca and P. Westaway (2004), "Concepts of equilibrium exchange rates". *Bank of England Working Papers*.

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