



Asset Liability Projection Model

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BANCO DE MÉXICO

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Outline

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Motivation

- The main goal of this presentation is to describe an ***Asset Liability Projection Model*** developed by the Risk Management Directorate of Banco de México for the forecast not only for the future evolution of some elements of Banco de México's balance sheet but also and more importantly the Central Bank's financial results.
- This model represents a tool that could be used to "*translate*" our expectations regarding financial variables, macroeconomic figures and monetary policy indicators, among others, into the evolution of the main components of the Balance Sheet and the Financial Statements for Banco de México.

Motivation

- Monetary Policy variables
- Financial variables
 - ✓ Interest rates
 - ✓ Exchange rates
- Macroeconomic variables
 - ✓ GDP
 - ✓ Inflation
 - ✓ Oil market
 - ✓ etc.

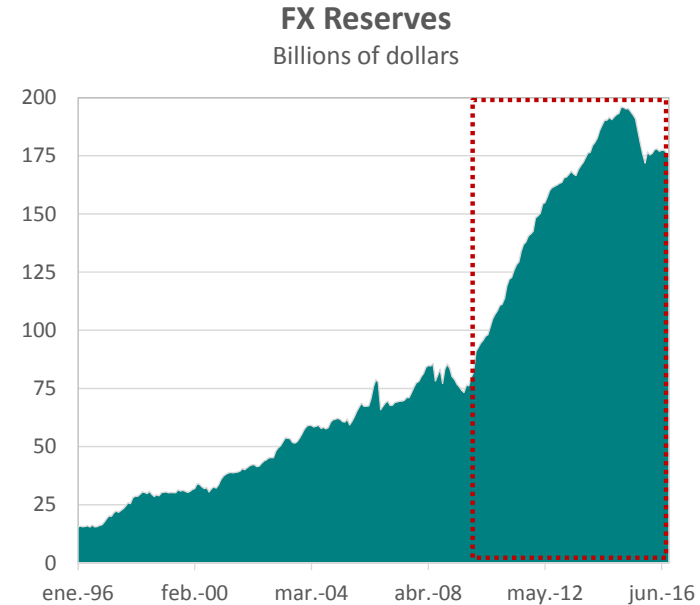
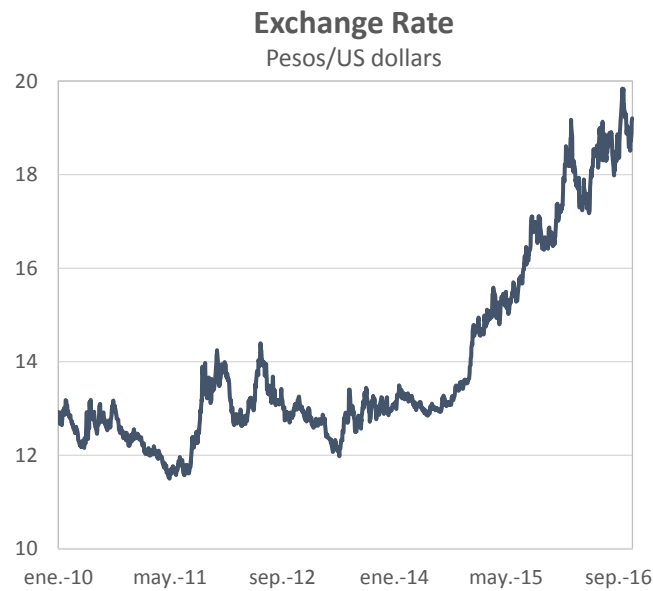


- Projections:
 - ✓ Asset & Liability
 - ✓ Income Statement
- Sensitivity & Scenario analysis

Motivation

The model has been extremely useful for the analysis of extreme movements of the exchange rate due to the fact that Banco de México's FX Reserves (*International Reserves*) results are reported in pesos in the annual financial statements.

Banco de México's results could be significantly affected -although temporarily- by the exchange rate variations that could lead to considerable changes in the Bank's financial results for an specific period.

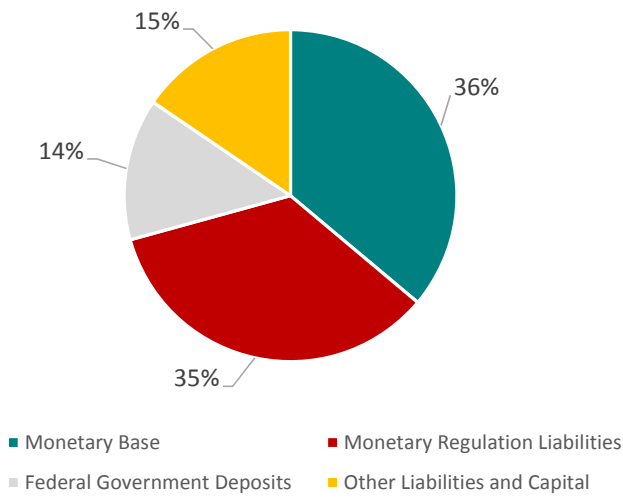
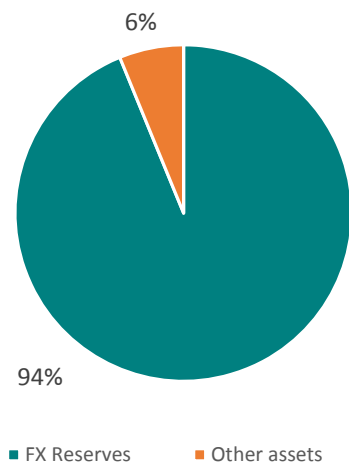


Source: <http://www.banxico.org.mx/SielInternet/consultarDirectorioInternetAction.do?accion=consultarCuadro&idCuadro=CF102§or=6&locale=en> (exchange rate historical information)
<http://www.banxico.org.mx/SielInternet/consultarDirectorioInternetAction.do?sector=4&accion=consultarCuadro&idCuadro=CF169&locale=en> (International Assets information)

Banco de México's Balance Sheet

Balance Sheet of Banco de México (Billions of Pesos, as of Oct 28, 2016)

Assets		Liabilities	
FX Reserves	3,280	Monetary Base	1,263
Other assets	216	Federal Government Deposits	483
		Monetary Regulation Liabilities	1,209
		Other Liabilities and Capital	541
	3,495		3,495

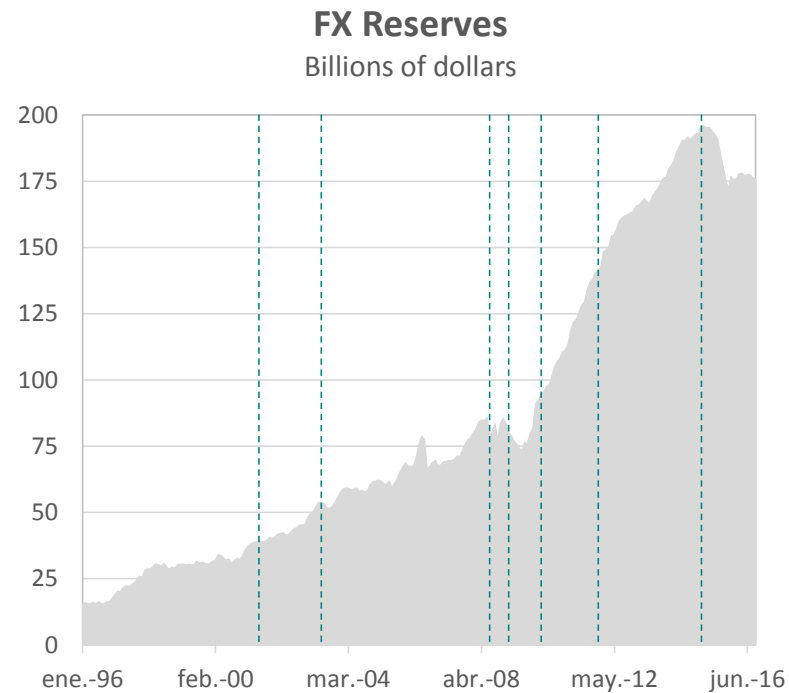


Source: <http://www.banxico.org.mx/SielInternet/consultarDirectorioInternetAction.do?sector=4&accion=consultarCuadro&idCuadro=CF105&locale=en> (Balance Sheet historical information)

Banco de México's Balance Sheet - Assets

The behavior of Banco de México's FX Reserves has been determined by the following factors:

- Banco de México's operations on the open MXN-USD exchange markets.
- USD purchases to PEMEX (Mexican Government Oil Company).

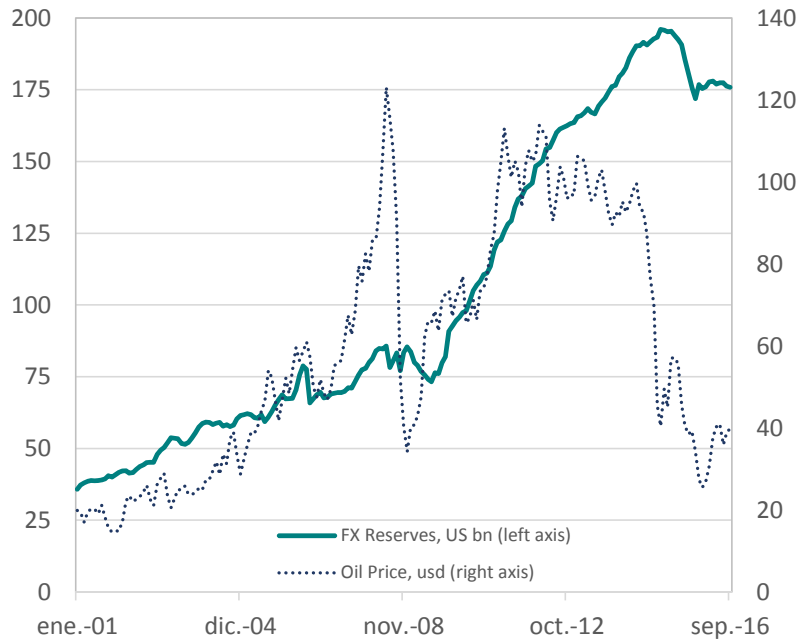


Source: <http://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=6&accion=consultarDirectorioCuadros&locale=en> (Auctions historical information)

Banco de México's Balance Sheet - Assets

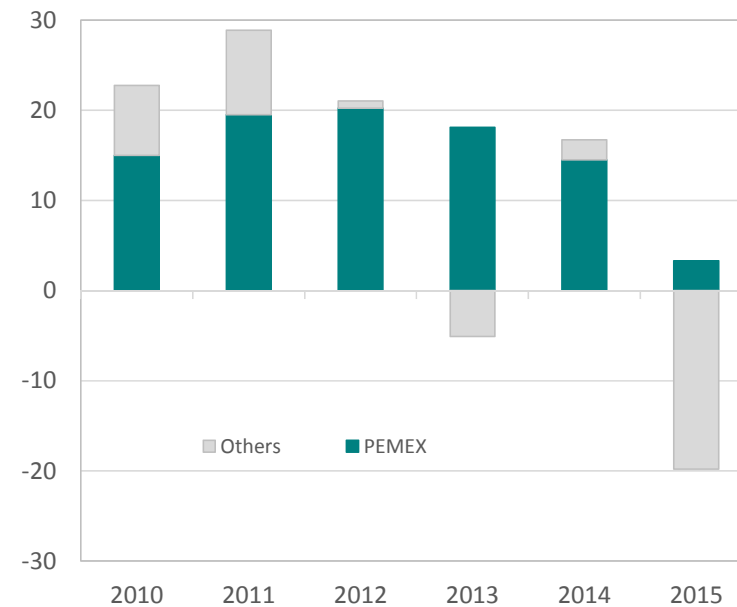
The FX Reserves has shown a significant growth, especially during the period between 2010 and 2015. This is mainly due to the oil prices increase throughout that same period, which results in a accordingly larger USD sales from PEMEX to Banco de México.

FX Reserves and Oil Price



Changes in FX Reserves composition

Billions of dollars

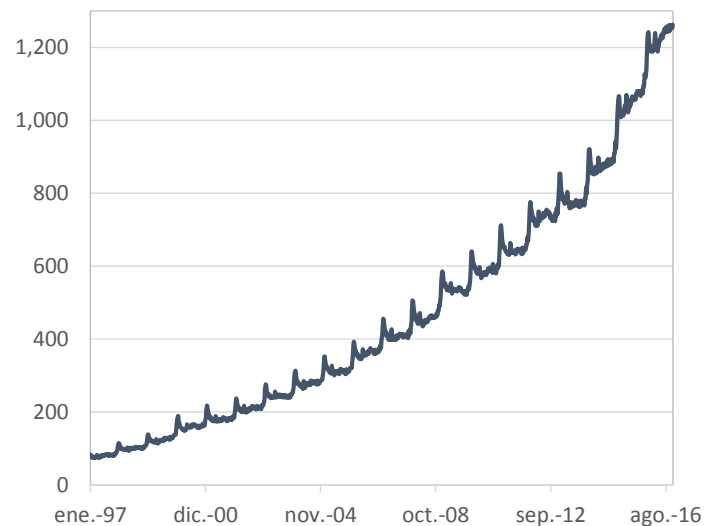


Source: Bloomberg and Banco de México.

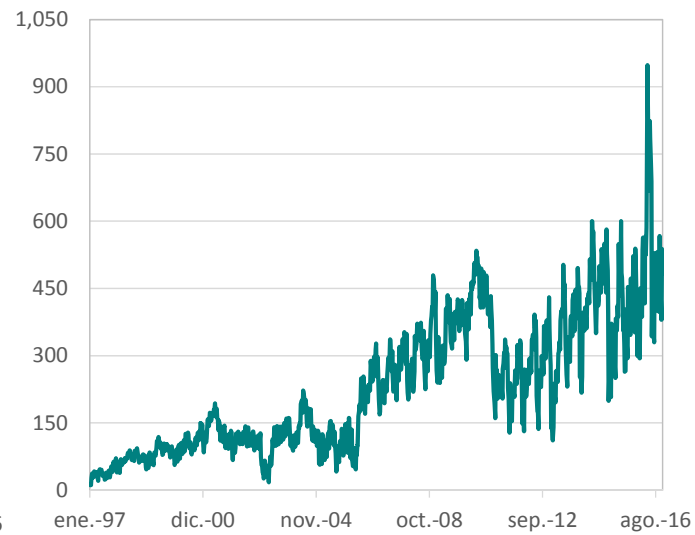
Banco de México's Balance Sheet - Liabilities

The following graphs show the evolution of Banco de México's main liabilities, in particular the Monetary Base, the Federal Government Deposits and the Monetary Regulation Liabilities.

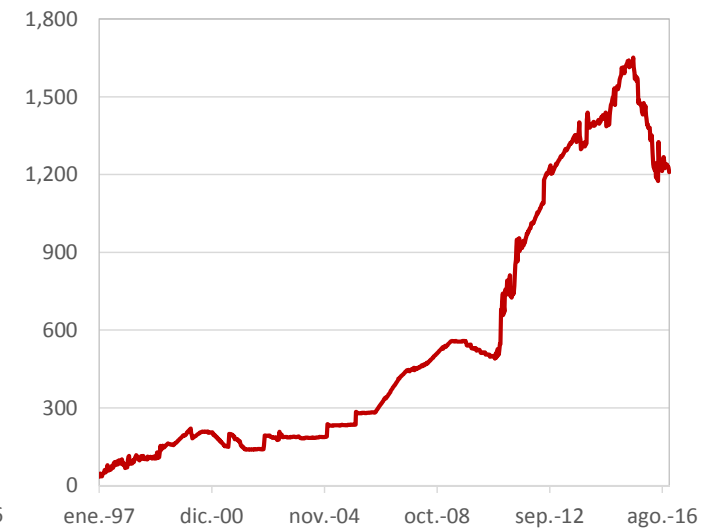
Monetary Base
Billions of pesos



Federal Government Deposits
Billions of pesos



Monetary Regulation Liabilities
Billions of pesos



Source: <http://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=4&accion=consultarCuadro&idCuadro=CF105&locale=en> (Balance Sheet historical information)

Asset Liabilities Projection Model

This model can be used to generate a central development path for Banco de México's financial results and for the behavior of some key components of its Balance Sheet, by using fundamental relationships and financial and macroeconomic expectations. In particular, the information regarding the MXN-USD exchange rate could be obtained from:

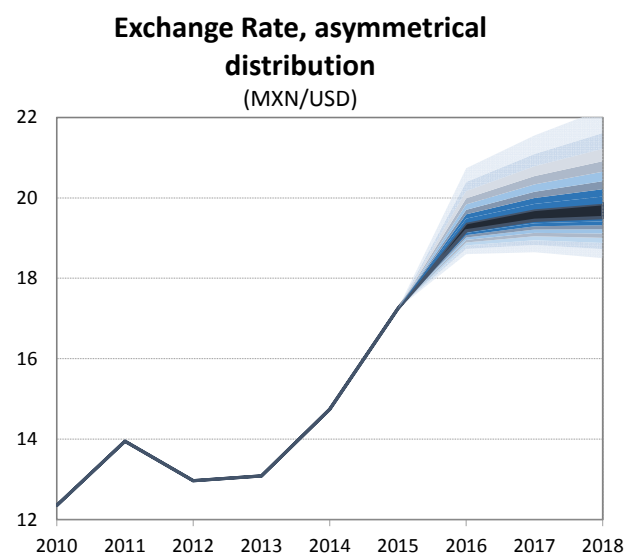
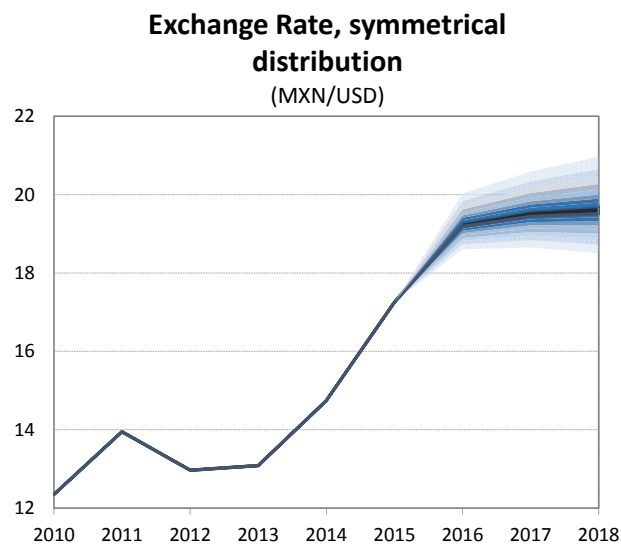
- Own expectations based on fundamental relationships among the exchange rate and a group of explanatory variables
- Surveys (e.g. private sector survey published by Banco de México, Bloomberg, etc.)
- Futures markets
- Forward markets

On the other hand, as we already discussed, since the behavior of the MXN-USD exchange rate may have a significant effect on Banco de México's financial results, we focus not only on the central path but also on the distribution of the possible scenarios to finally generate confidence intervals.

Asset Liabilities Projection Model – Exchange Rate

Additionally, in order to incorporate the historical behavior of the MXN-USD exchange rate, which has shown some skewness toward depreciation, it is also possible to include an additional parameter to the probability distribution that will render it with the same kind of bias.

It is important to note that this exercise assumes a *Ceteris Paribus* condition. However, we could increase the model's complexity by incorporating the correlation structure among the financial and/or macroeconomic variables that we consider most relevant, which will render much more accurate results.



Asset Liabilities Projection Model

As a way to keep the model as simple as possible we will assume that the Bank's whole assets are represented by the FX Reserves and the Monetary Base is only constituted by the outstanding Notes and Coins.

Using the standard accounting equation as a initial point, Banco de México's Balance Sheet at any given date could be represented by the following equation:

$$\underbrace{TC_t \cdot RI_t}_{Assets} = \underbrace{BM_t + L_t}_{Liabilities} + K_t$$

where:

TC_t Exchange rate (MXN/USD)

RI_t FX Reserves balance (USD)

BM_t Monetary Base

L_t Monetary Policy Liabilities (net from other assets)

K_t Capital

Asset Liabilities Projection Model

- The evolution of the FX Reserves will be determined by the following factors:
 - USD net sales from PEMEX will be determined based on PEMEX's net debt and oil production.
 - USD net sales from the Federal Government will be determined based on its USD net demand (e.g. external debt net issuance).
 - USD net sales from the Market will be determined by Banco de México.
 - Investment results will be determined by interest rates and FX global market.
- The evolution of the Monetary Base outstanding will be a function of nominal economic growth and interest rates.
- The evolution of the Federal Government deposits at the Central Bank will be determined based on the expected public deficit and its debt issuance.
- Finally, the Monetary Policy liabilities will be determined by the autonomous factors that affect the level of liquidity in the market.

Asset Liabilities Projection Model – Results

Balance Sheet of Banco de México				
(Billions of Pesos)				
	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>
Assets	3,048	3,249	3,331	3,364
FX Reserves	3,048	3,249	3,331	3,364
(US dollars)	177	175	179	182
Liabilities	2,630	3,090	3,257	3,295
Monetary Base	1,242	1,350	1,494	1,654
Federal Government Deposits	418	451	519	467
Monetary Regulation Liabilities	860	1,184	1,143	1,082
Other Net Liabilities	110	105	102	92

Banco de México's Profit and Loss Account				
(Billions of Pesos)				
	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>
Total	378	223	-34	-88
Financial Results	-79	-9	-37	-54
MXN revaluation income	463	237	9	-27
Other expenses	-5	-6	-6	-6

Note: These figures represent just an example for the purpose of this presentation.

Source: <http://www.banxico.org.mx/dyn/informacion-para-la-prensa/comunicados/banco-de-mexico/info-contable-mensual/indexpage.html> (Latest Financial Statements report publication –in Spanish)

Final Remarks

In general this model could be used to “*translate*” a set of financial and economic expectations into Banco de México's Balance Sheet and Results' evolution. In particular, we could extract relevant information regarding the following scenarios:

- The MXN-USD exchange rate that would result in a specific value for Banco de México's revaluation income.
- The level of oil price and/or production that would affect PEMEX's USD net supply to Banco de México and therefore the evolution of the FX Reserves.



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