RESTRICTED INFORMATION

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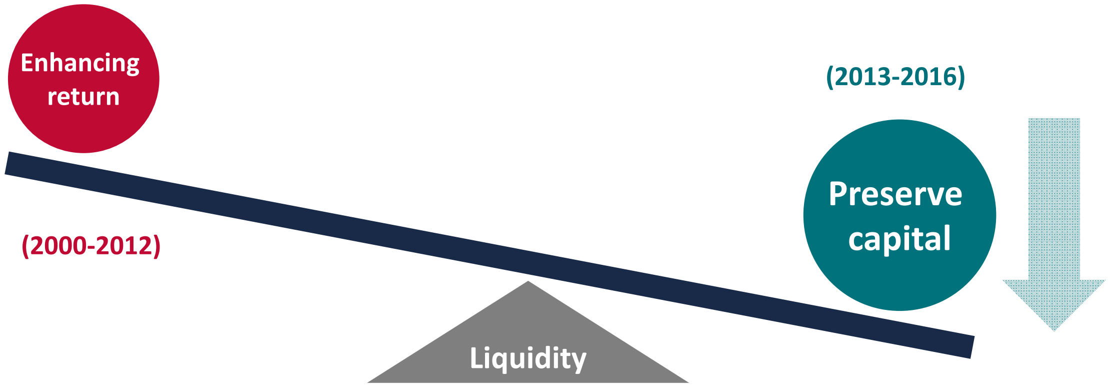
The Impact of the Current Interest Rate Environment and Increased Uncertainty on the Management of Foreign Exchange Reserves

BANCO DE MÉXICO

Introduction

- In September 2015, during the High Level Reserve Management Seminar in China, Banco de México elaborated on the arguments behind its shift on its reserve management objectives: from focusing on enhancing the return of the portfolio to the preservation of capital.



- Since then, reserve management has not become any easier. From a domestic perspective, reserve accumulation has come to a halt given low oil prices. In fact, Banco de México has used its reserves in several occasions to restore the adequate functioning of the FX market. At the same time, interest rates in the developed world have remained at very low levels, and now it finally seems that, as inflation increases to the central banks' objectives, we are posed toward higher interest rates that could result in capital losses.

- Additionally, policy uncertainty has increased significantly, mainly because the long-standing paradigms of economic integration have been put into question.

- In order to deal with these challenges, and achieve its objective of capital preservation, Banco de México has implemented additional changes to the way it approaches reserve management. We represent these as several crossroads.

The economic environment

Given the possibility of transitioning out of the low interest rate environment and the early expansion phase of the economic cycle.

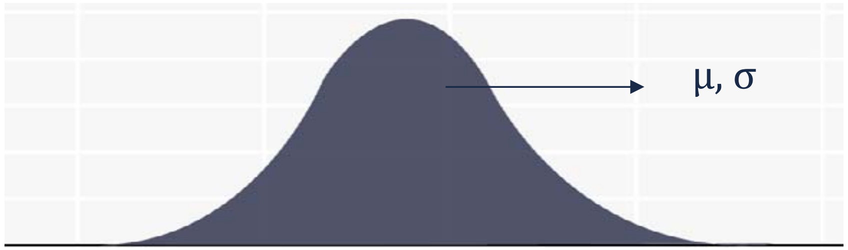
Crossroad #1

How could we account for a possible regime shift in our optimal asset allocation analysis?

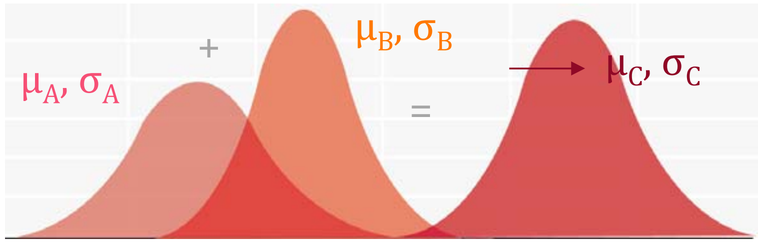
Crossroad #1. Optimal Asset Allocation Analysis

- The possibility of entering into a different economic and financial *regime* made Banco de México adjust its asset allocation framework in several dimensions, making it more robust and forward looking.

(A) Portfolio optimization algorithm
- Traditional mean-variance
- Historical data

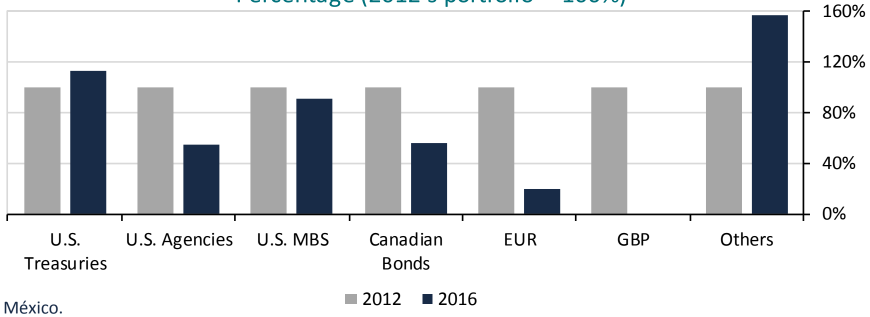


- Bayesian optimization
- Historical + simulated data



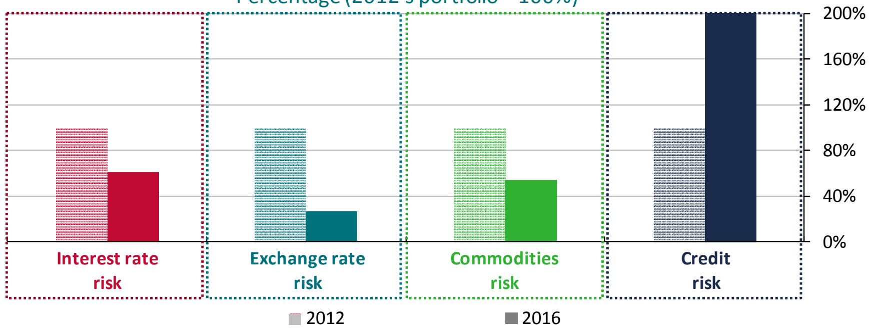
(B) Allocation analysis
- Asset class selection

Banco de México's exposure by asset class
Percentage (2012's portfolio = 100%)



- Risk factor identification

Banco de México's exposure to distinct risk factors
Percentage (2012's portfolio = 100%)



Source: Banco de México.

INTEREST RATES

Given the uncertainty regarding the future path of interest rates.

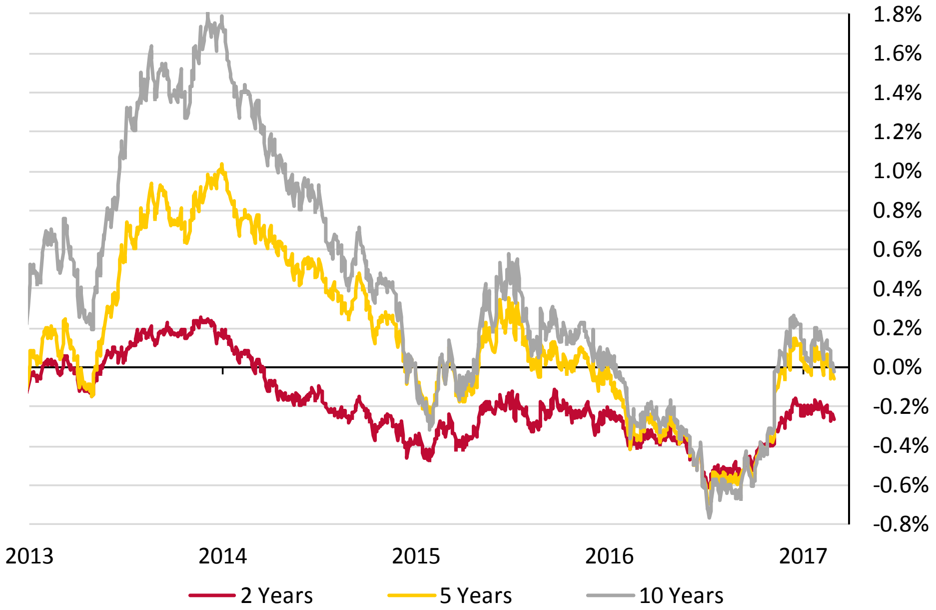
CROSSROAD #2

How could we avoid facing negative returns in our investments?

Crossroad #2. Interest Rate Risk

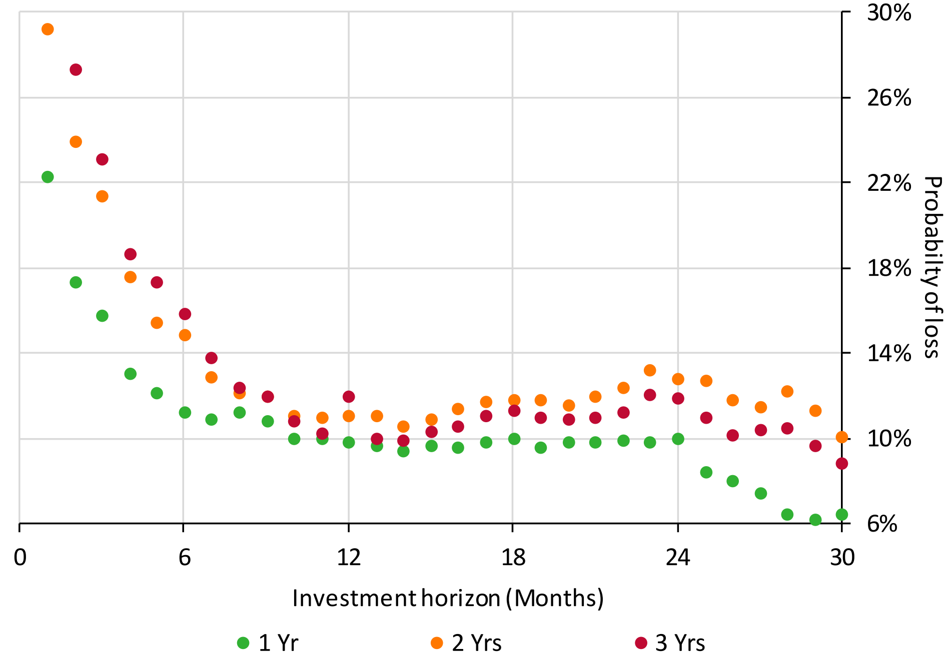
- In determining the interest rate risk profile of the portfolio, we asked ourselves whether we would be compensated for increasing the duration of the portfolio. Our general conclusion was twofold:
    1. Historically low term premia suggests that investors are not being compensated enough for bearing the risk of larger duration assets.
    2. The priority of Banco de México to preserve capital to preserve capital argues for a low duration portfolio that reduces the volatility of the international reserve´s returns and mitigates potential losses that may result from higher interest rates in the future.

U.S. Treasury Term Premium for Selected Maturities
Percentage



Source: Federal Reserve Bank of New York.

Probability of Loss for a Given Level of Duration
Percentage



Source: Banco de México with data from Bloomberg and BofA / Merrill Lynch.

Exchange rates

Given the expectations of a stronger U.S. Dollar.

Crossroad #3

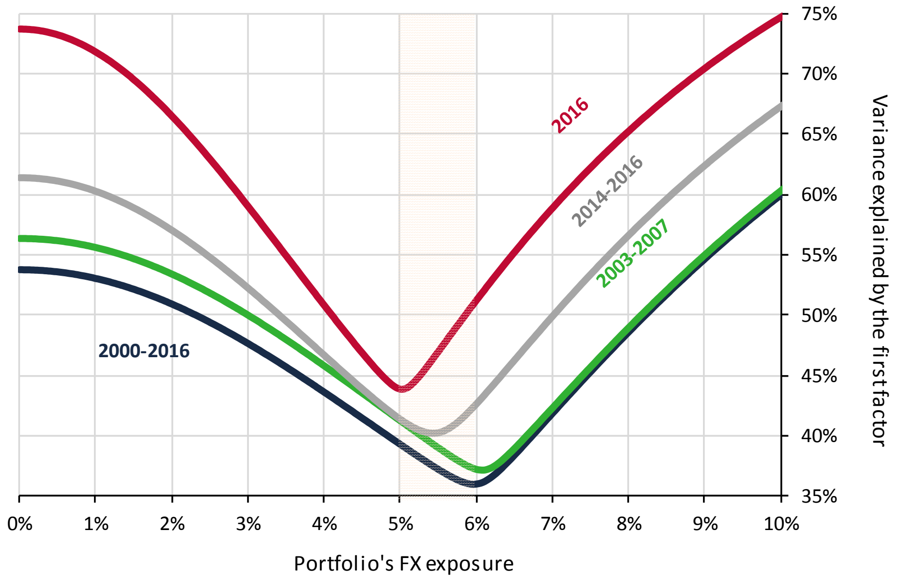
How far should we go in reducing our exposure to non-USD assets?

Crossroad #3. FX Allocation

- Traditional asset allocation models may suggest a significant decrease in the exposure to non-USD assets. However, these provide significant diversification benefits. Hence, to determine our allocation to non-USD assets we included two new features to our AA model:

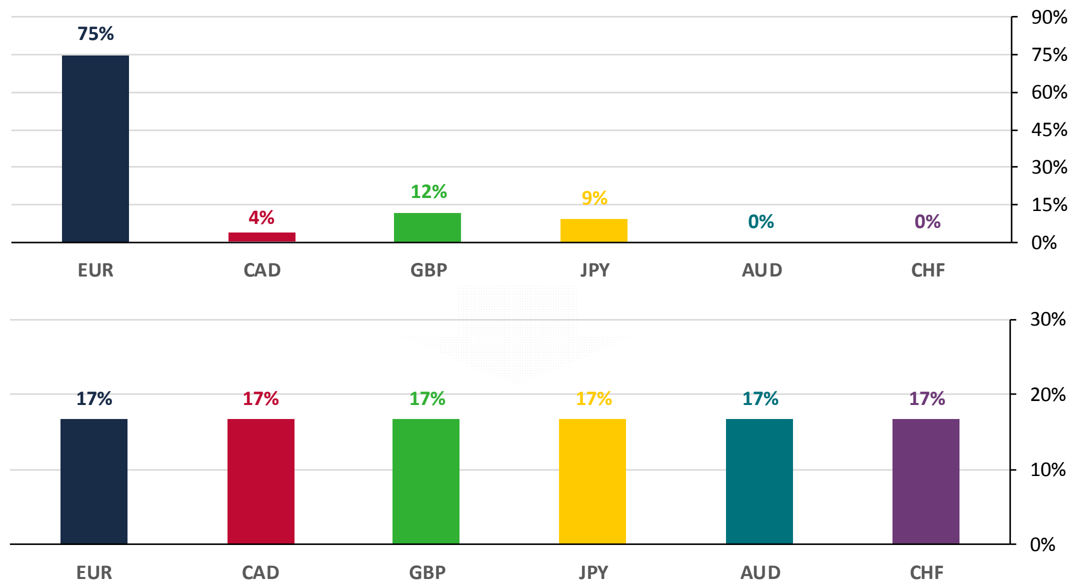
1. **Principal component analysis.** Allows to find the proportion of non-USD assets that would minimize the variance of the returns of the portfolio explained by a single risk factor (ideally a diversified portfolio should be sensitive to a variety of risk factors, not only one).
2. **Risk-parity approach.** Allocates resources independently of the expected return, and distributes the currency risk component more evenly across the eligible currencies.

Variance explained by the first factor of a principal components analysis depending on the FX exposure*
Percentage



Source: Banco de México with data from Bank of America / Merrill Lynch.
*Principal component analysis over the returns of the components for a simulated international reserves portfolio varying its FX allocation.

Contribution of each currency to the portfolio's overall FX volatility according to different asset allocations*
Percentage of total FX volatility



Source: Banco de México with data from Bank of America / Merrill Lynch and the International Monetary Fund's COFER.
*Risk parity portfolio analysis over a sample of commonly investable reserve currencies, as in COFER.

Risk factors

Given that we realized that our benchmarked portfolio was tilted toward certain risk factors.

Crossroad #4

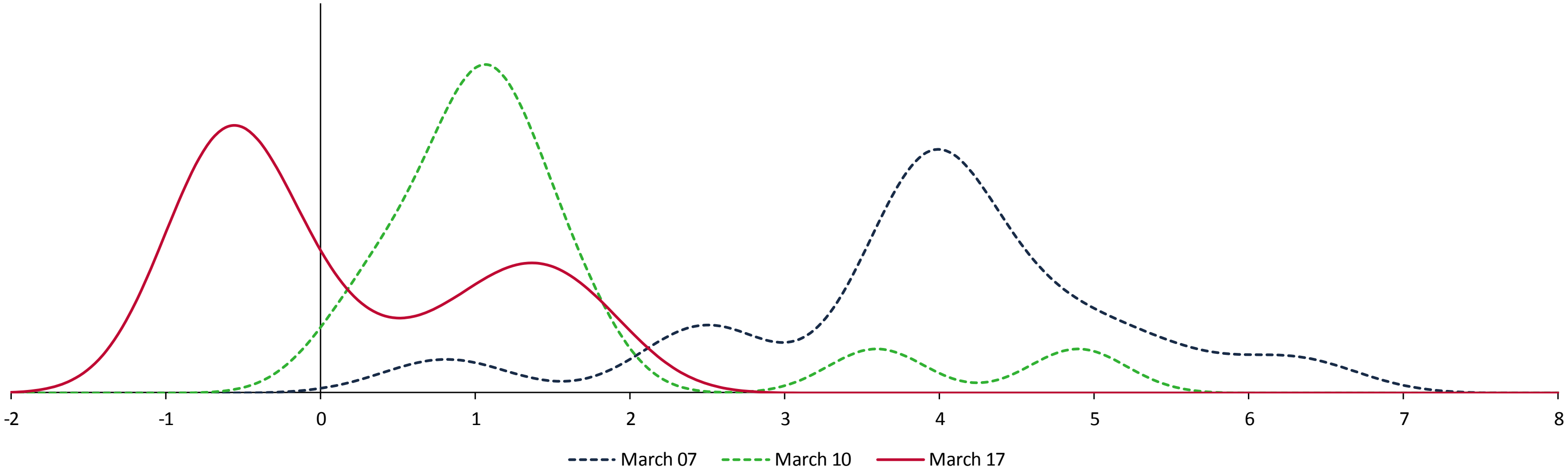
Is there scope for alternative strategies that allows us to vary how we're exposed to them?

Crossroad #4. Diversification Strategies

- The utilization of benchmark portfolios to frame investment decisions usually exposes asset-managers to risks that they may not always want to bear. At this juncture, the most salient risk is a sudden increase of interest rates (normalization of term-premium).
- As such, having alternative investment portfolios – not subject to a benchmark – could allow portfolio managers to focus in those assets and strategies in which they have their highest conviction. In fact, they could even benefit from the normalization of interest rates through carrying a negative duration in their portfolios.
- In that regard, we believe non-benchmarked investments could be an additional tool to preserve capital under difficult circumstances for reserve management.
- At the same time, these portfolios (which are externally managed) could highlight investment opportunities that could be expanded internally at a later stage.

Two-year sovereign interest rate distribution in developed countries*

Percentage



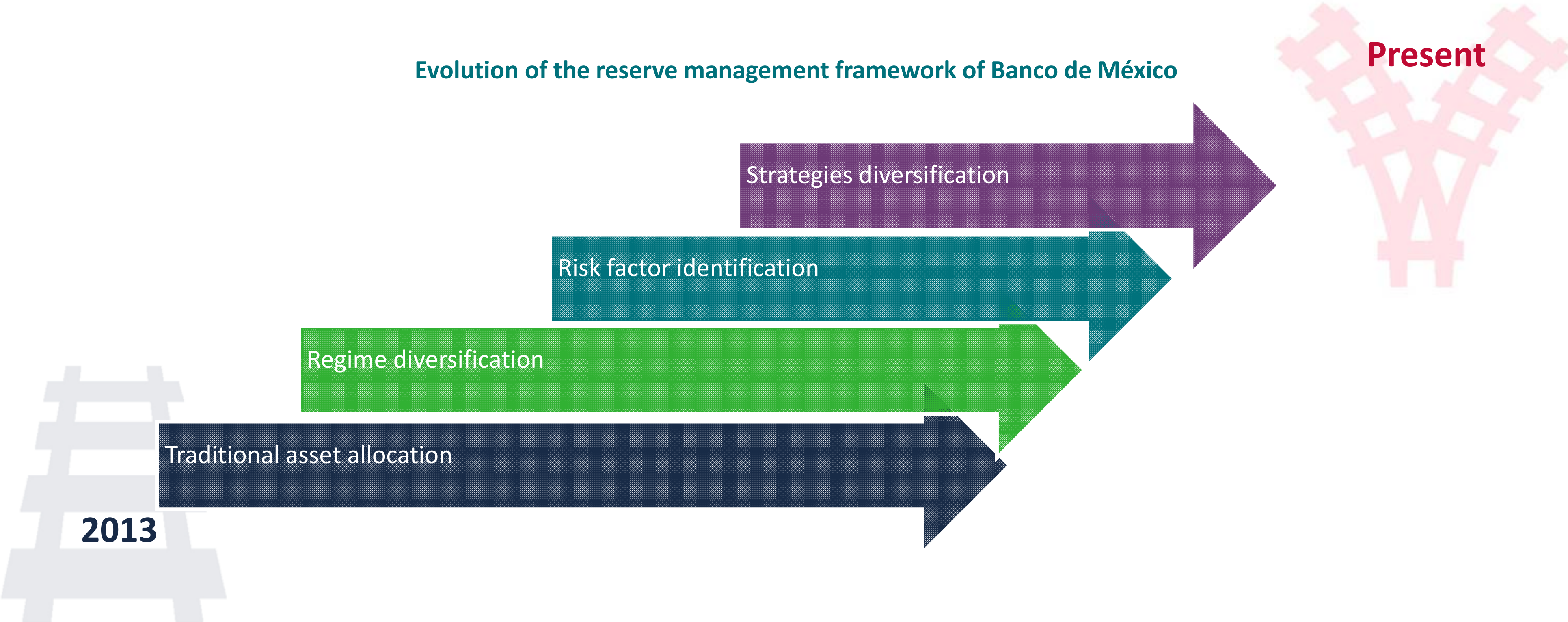
Source: Bloomberg.

*Includes the following countries: Germany, Australia, Austria, Belgium, Canada, South Korea, United States, France, Netherlands, Japan, United Kingdom, Singapore, Sweden and Switzerland.

Final Remarks

- Financial markets are posing unprecedented challenges for reserve managers.
- Banco de México has approached this new economic and financial landscape with a reassessment of the priorities of reserve management towards the preservation of capital.
- In doing so, we have come to different cross-roads. There is one constant however, and that is having a flexible and comprehensive approach to portfolio construction and management.

Evolution of the reserve management framework of Banco de México



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