BANCO CENTRAL DE RESERVA DEL PERÚ

INSTITUTIONAL AND STRATEGIC FRAMEWORK FOR THE MANAGEMENT OF THE INTERNATIONAL RESERVES OF THE CENTRAL BANK OF PERU

International Operations Division
September 2019

INSTITUTIONAL FRAMEWORK

International Reserves of the BCRP

- Net International Reserves (RIN):

RIN = International Assets - International Short-Term Obligations

Gross International Reserves (RIB)

- Net International Position of the BCRP (PC):

PC = RIN – Domestic Short-Term Obligations

International Reserves owned by the Central Bank

International Reserves of the BCRP

The RIB of Peru comes from different sources:

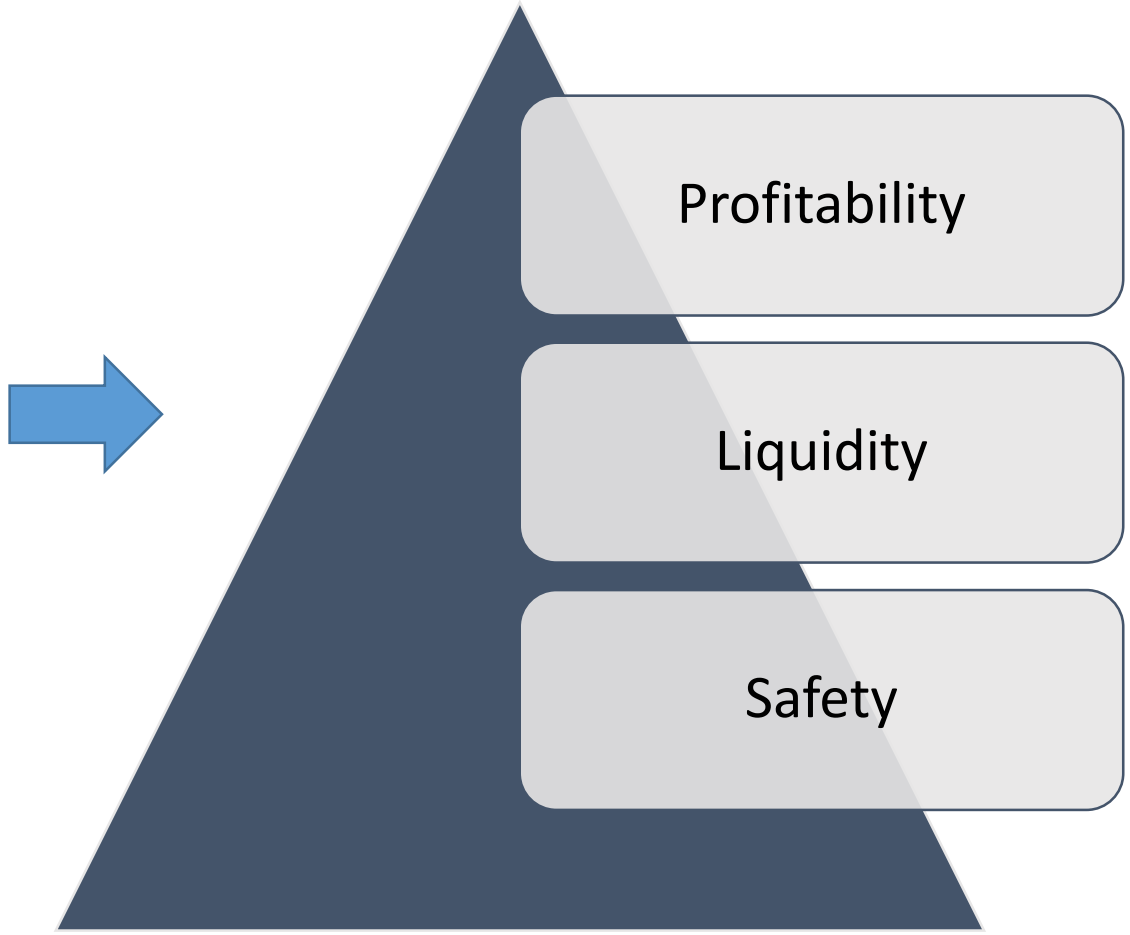
- Intervention in the domestic foreign exchange market
- Domestic banking reserve deposits
- Public sector deposits

These funds are invested abroad in deposits, securities and gold

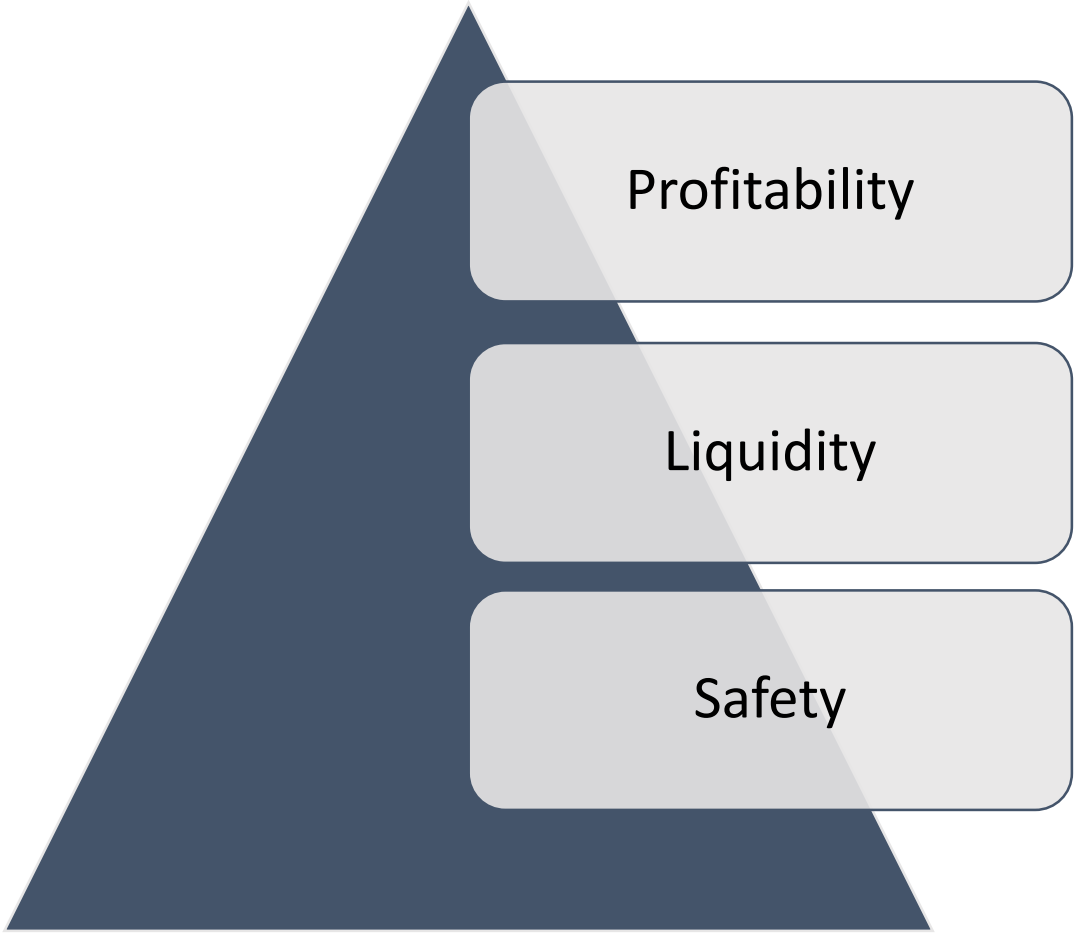
USES (assets)		**SOURCES (liabilities)**	
Deposits	25%	Banking reserve deposits	20%
Securities	70%	Public sector deposits	15%
Gold	5%	Net international position	65%

Importance and Criteria for Reserve Management

- Support and maintain **internal confidence** in monetary and FX management measures.
- Offer **confidence to international markets** on the country's ability to meet its external obligations, reducing the country risk.
- Serve as **financial support** to limit external vulnerability of the economy to adverse shocks on the balance of payments or speculative attacks on the domestic currency.
- Keep a **value reserve** for national emergencies and as savings for future generations.



Criteria and Definition of Investment Policies



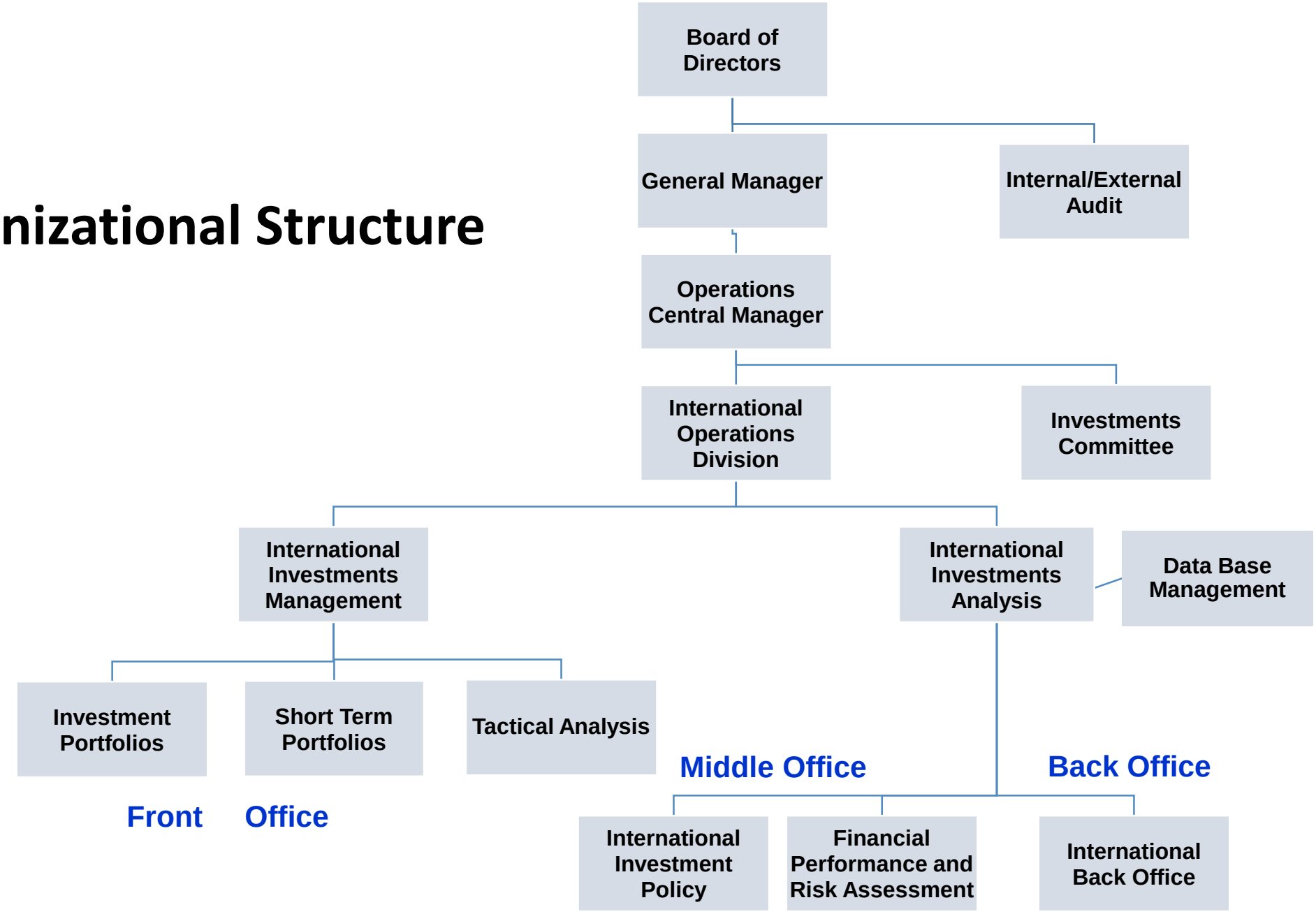
Investment Policies

- Have a clear **legal framework** for the reserves management
- Identify the **investment policies** compatible with the levels of **risk** that we are willing to take
- Define the **Strategic Asset Allocation** which allows to build a ***benchmark*** that reflects the risk-return profile of the institution.

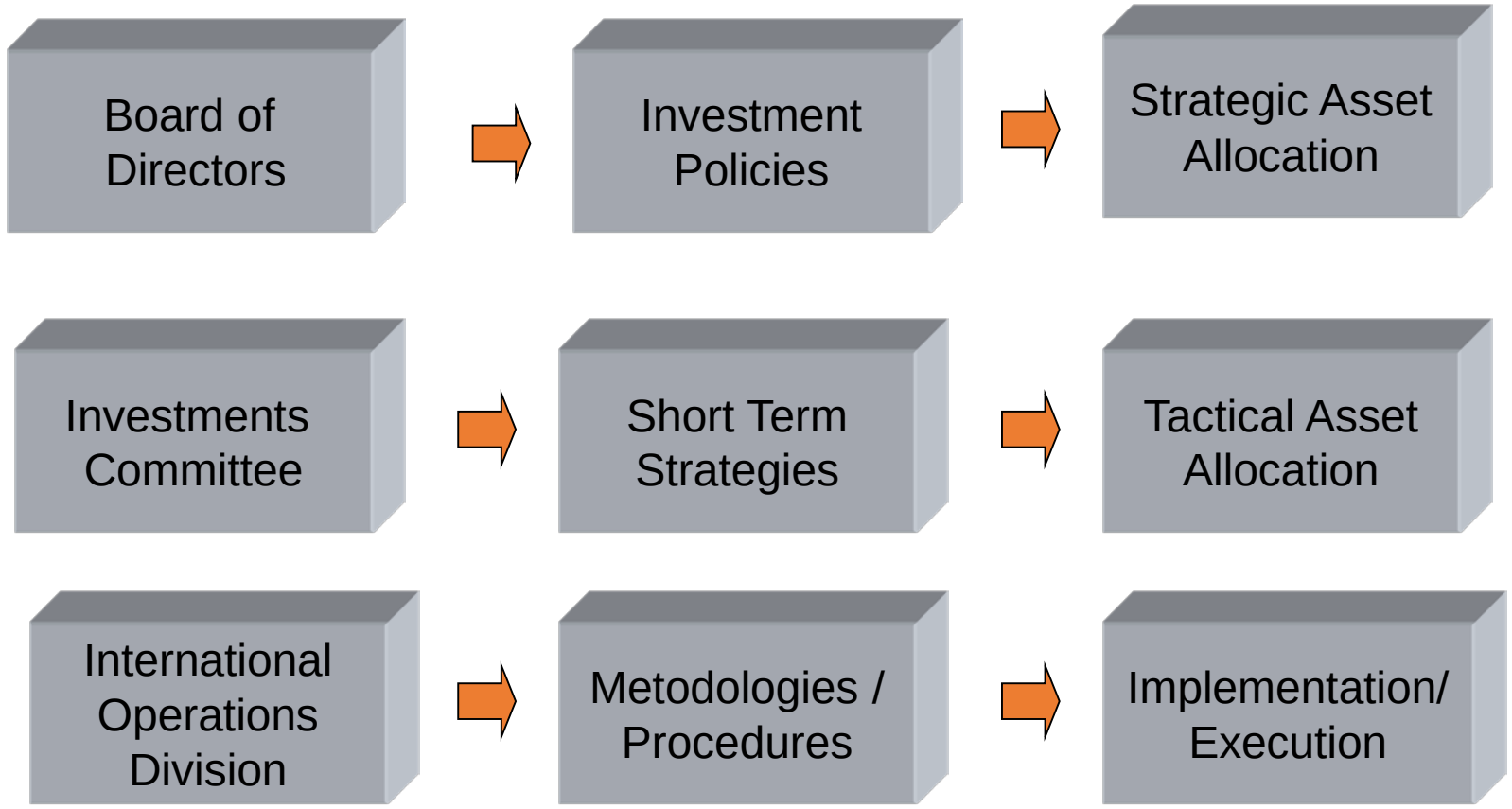
Legal Framework

The role of international reserves management is exclusive of the BCRP.	→	Art. 84 of the Constitution
The BCRP is a legal entity under public law with autonomy and indefinite duration.	→	Art. 1 of the Organic Law of the Central Bank
The duties of the Board are: (...) approve the guidelines for the international reserves management.	→	Art. 24 of the Organic Law
Criteria of safety, liquidity and profitability must be taken into account.	→	Art. 71 of the Organic Law
Types of eligible assets: bank deposits, securities issued by governments or entities backed by them or supranational organizations and gold.	→	Art. 72 of the Organic Law

Organizational Structure



Decision-Making Process

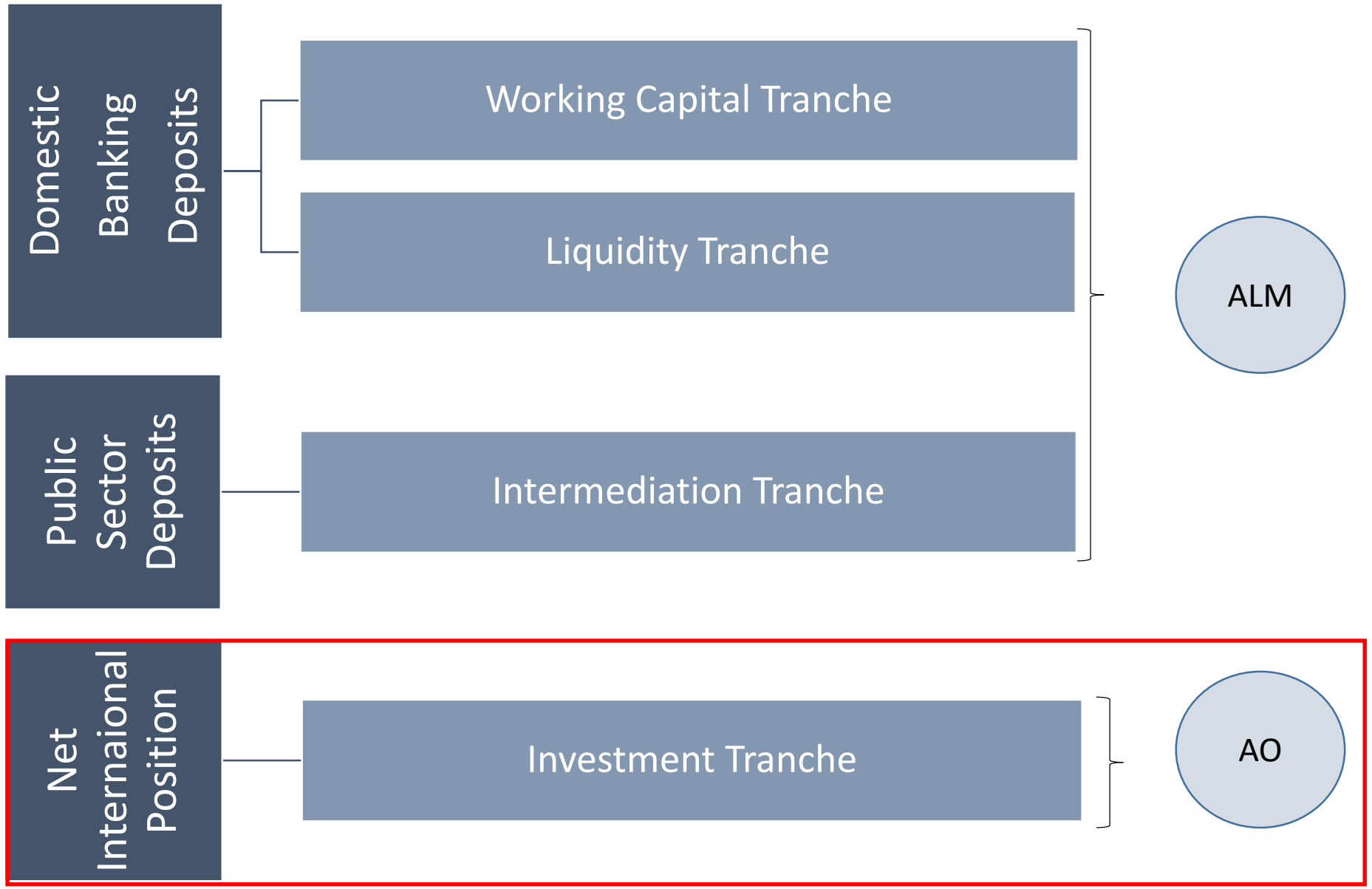


STRATEGIC FRAMEWORK

Investment Policies and Guidelines

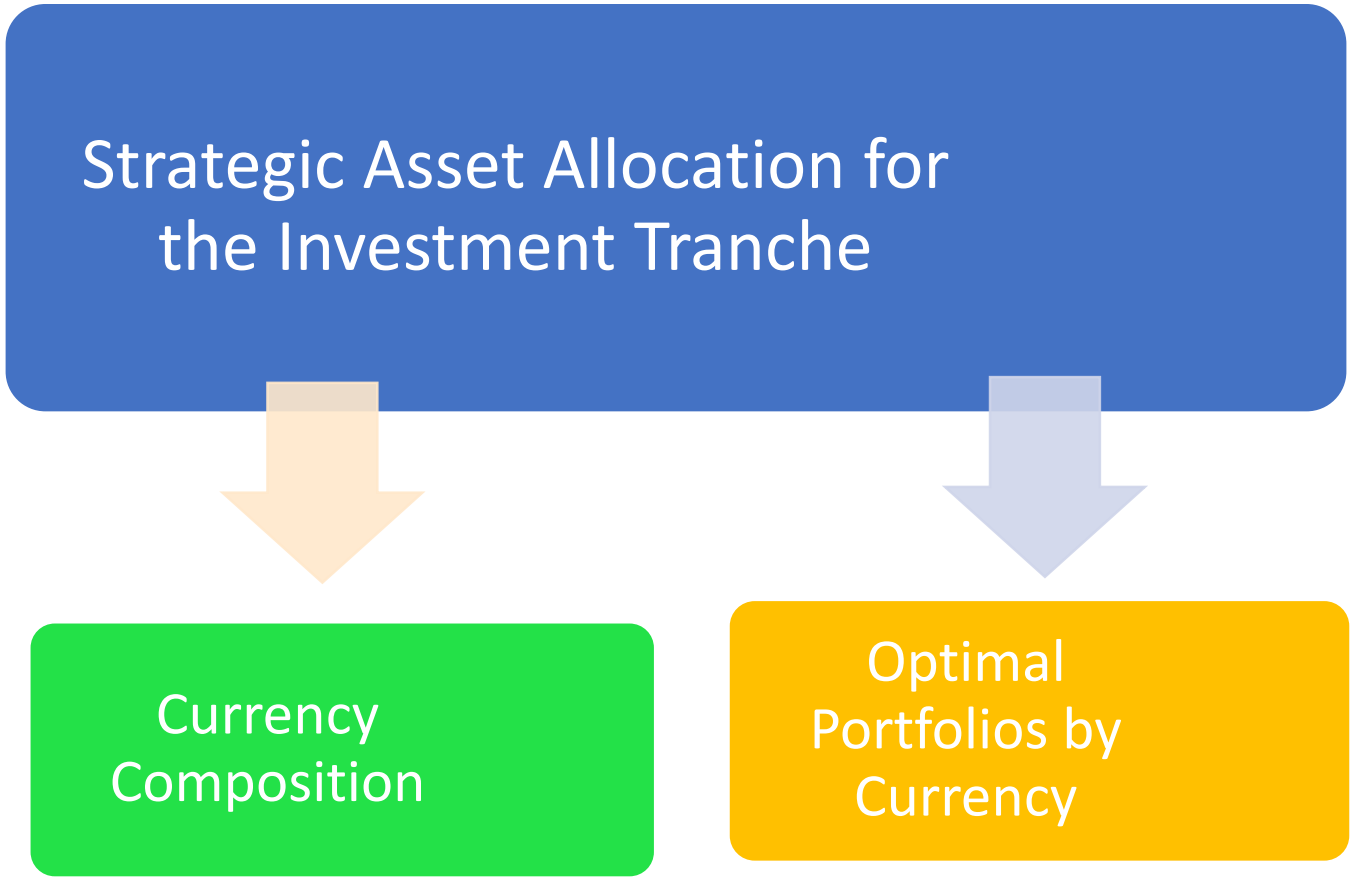
Risk	Investment Policy	Investment Guidelines
Liquidity Risk	Invest in liquid assets traded in deep secondary markets Asset – Liability Management (ALM) Avoid excessive concentration in few issues	List of eligible instruments and authorized financial centers Portfolio divided by tranches Limits of minimum issue size and maximum purchase percentage of issue
Credit risk	Avoid investments in counterparties that may present breaches affecting the Bank's reputation Avoid excessive concentration in few issuers	Counterparty limits related to minimum capital Minimum credit ratings with low probability of default Market monitoring (CDS)
Interest rate risk	Reduce the likelihood of capital losses in a year ALM Avoid excessive concentration in sectors of the yield curve	Benchmarks with low probability of negative returns for each currency Benchmarks for each tranche with durations related to the characteristics of its sources Limits in duration and KRD deviations
Exchange rate risk	Higher proportion in the currency used for the domestic FX intervention (USD) ALM Limited currency risk	Limits for currency tactical deviations from the strategic asset allocation Forwards for hedging Risk approach for choosing the currency composition

Benchmark Tranches



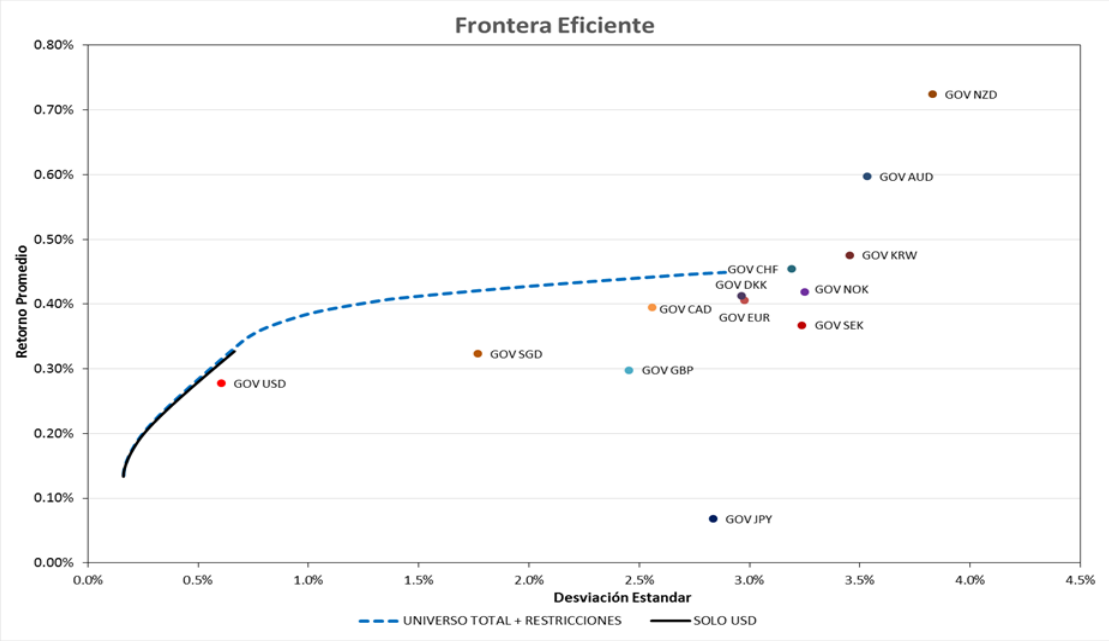
Framework of Strategic Allocation

Strategic Asset Allocation of BCRP



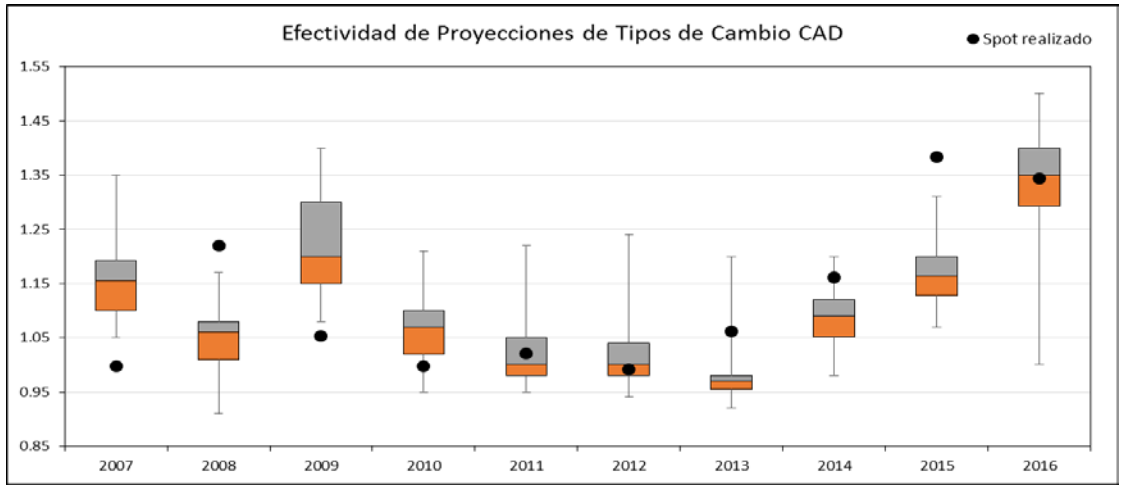
CURRENCY COMPOSITION

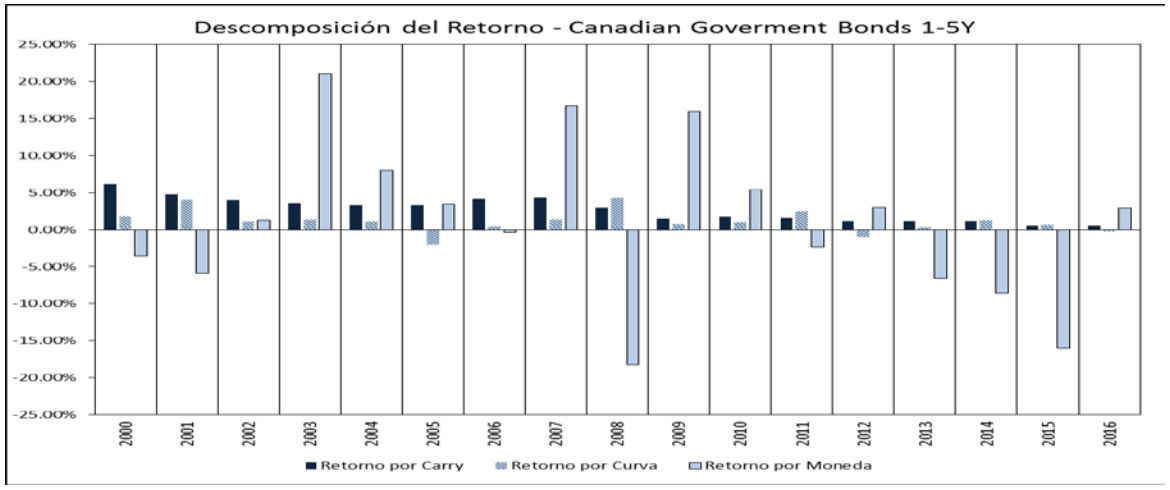
Initial Considerations



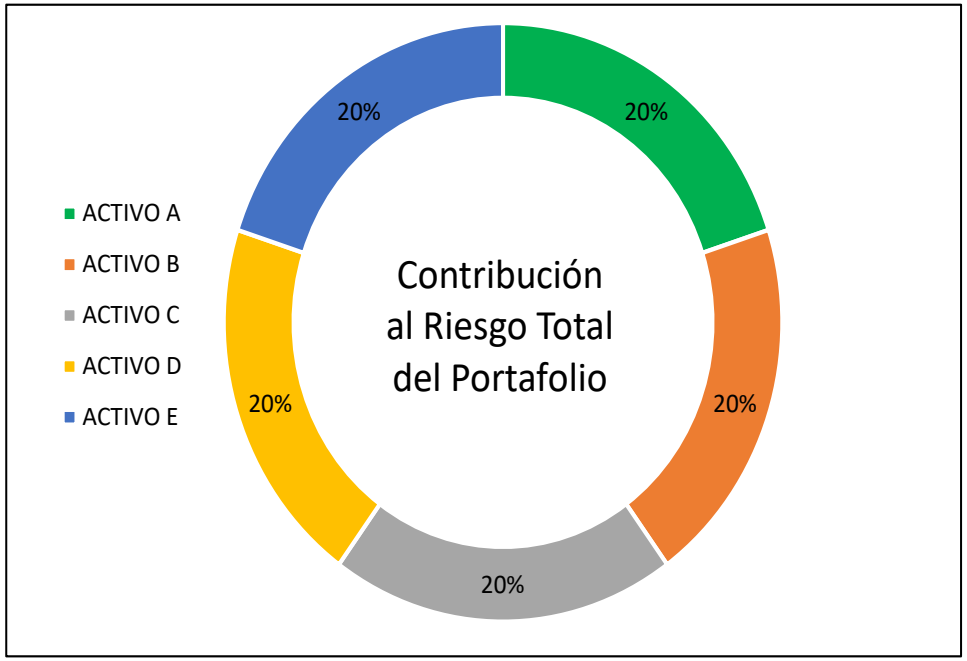
- For low levels of risk, there is no benefit with the inclusion of non-USD currencies.
- Effectiveness of exchange rate forecasts in recent years has been very low and the impact of FX return on total return very high.

We require an expectations-neutral approach that prioritizes risk control.





Risk Parity Approach



Asset allocation methodology used to build diversified portfolios not based on any expected return assumption. Risk management is the center of the investment strategy.

Methodology: The set of assets in each currency must have the same contribution to the total risk of the portfolio. Therefore, the share of each currency in the portfolio will be higher when its risk is lower.

It is necessary to define:

- Risk Measure: Conditional Value at Risk (CVaR)
- Rebalance Frequency: at the beginning of each year
- Criteria for inclusion of currencies: deep fixed income markets

Depth of Market

Profundidad de mercado[1/]

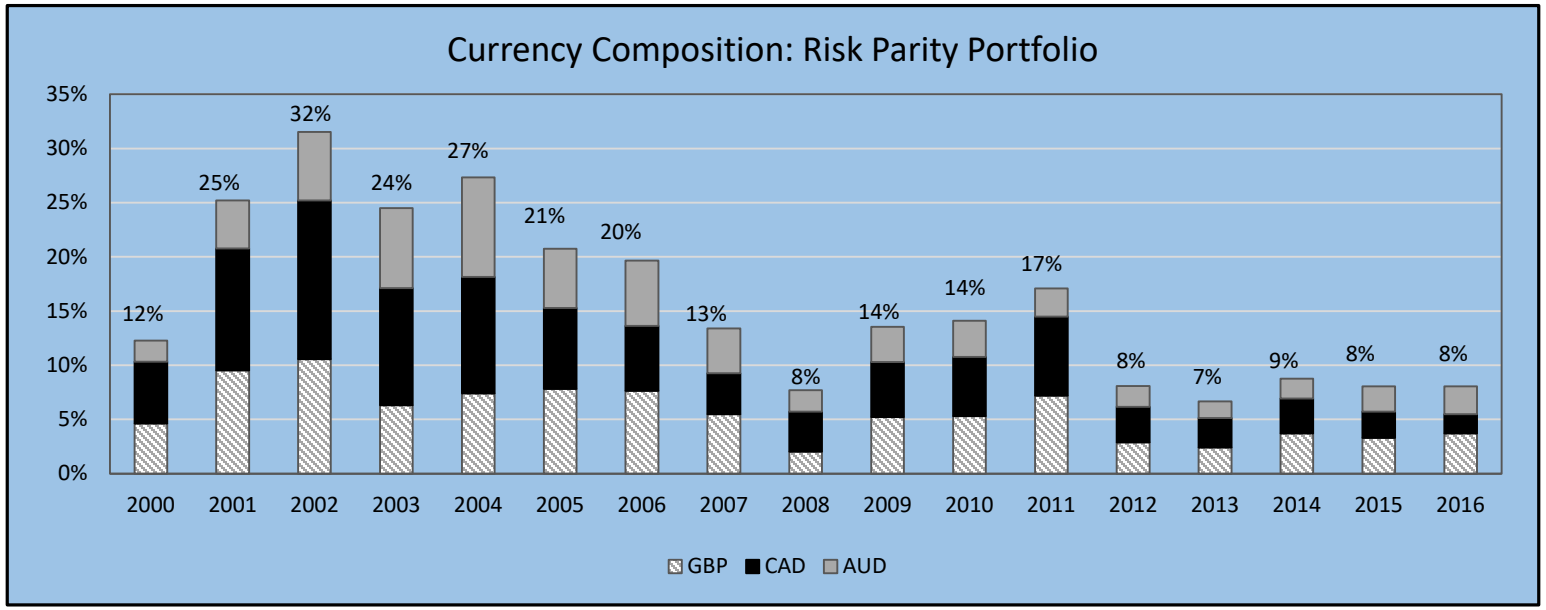
País	Moneda	Participación	Valor de Mercado (MM USD)
Estados Unidos	USD	29.72%	9 525 399
Japón	JPY	23.89%	7 657 594
Europa[2/]	EUR	13.46%	4 314 266
Reino Unido	GBP	5.67%	1 818 330
China	CNY	4.38%	1 404 169
Corea del Sur	KRW	1.32%	424 169
Canadá	CAD	1.15%	369 970
Australia	AUD	1.14%	366 499
Taiwán	TWD	0.57%	184 121
Dinamarca	DKK	0.34%	109 668
Mundo	-	100%	32 047 826

Fuente: ICE BofAML Indices

1/ Las 10 monedas con mayor participación en el índice ICE BofAML World Sovereign Bond Index (WSOV). Se tomó en cuenta países con un rating mínimo de A+. Datos al 30.11.2017.

2/ Considera a los países de la Unión económica y monetaria en el índice.

Applying the Methodology (back testing example)



To take into account:

- Additional constraints by currency: stress scenarios to reflect potential risks not seen historically, maximum share for some currencies
- Definition of the frequency of portfolio rebalancing (turnover): tolerance for loss on sales.
- Ex-ante definition of the maximum level of risk that will assume the total portfolio: tolerance for negative returns.

Statistics	Simulated Portfolio
Average monthly return	0,26%
Monthly standard deviation	0,48%
Maximum monthly return	1,90%
Minimum monthly return	-1,56%
Percentage of months with loss	28,37%
Maximum loss 1/	-1,56%
Average annual turnover	4,70%
Maximum annual turnover	13,55%
Minimum annual turnover	0,42%
Monthly 99% VaR (historical)	-1,08%
Monthly 99% CVaR (historical)	-1,43%

1/ In consecutive months.

OPTIMAL PORTAFOLIOS BY CURRENCY

Portfolio Construction Methodology

Factors estimation & curves forecasting

- Model for the estimation of factors
- Projection of factors
- Construction of forecasted yield curves

Calculation of returns

- Transformation of curves to generic instruments returns
- Transformation of generic instruments returns to market indexes returns

Portfolio construction

- Inclusion of investment constraints
- Optimization for building an efficient frontier
- Results validation

Optimal portfolios by Currency

Factors Estimation

Yield Curves Estimation

- Level
- Slope
- Curvature

Factors Proyection

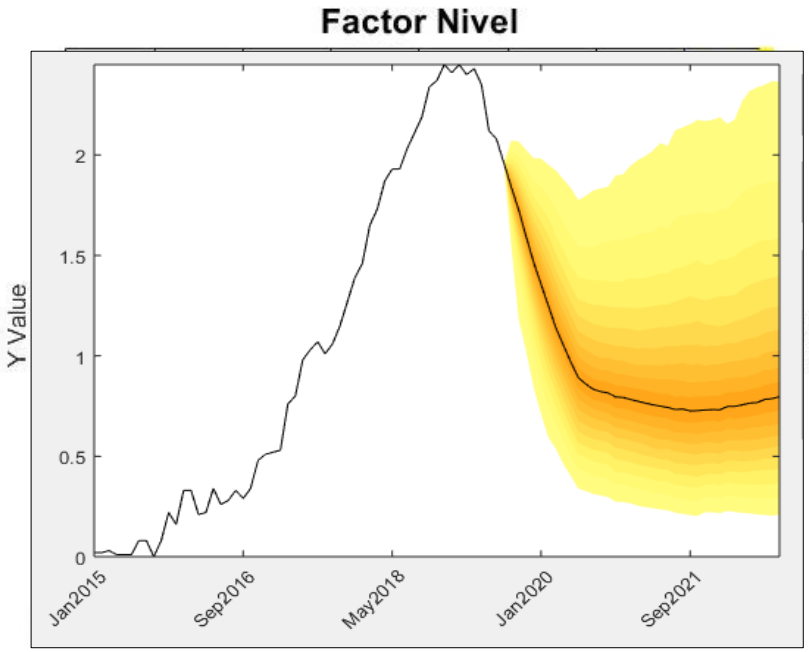
- Dynamic Evolution
- Multiple Scenarios

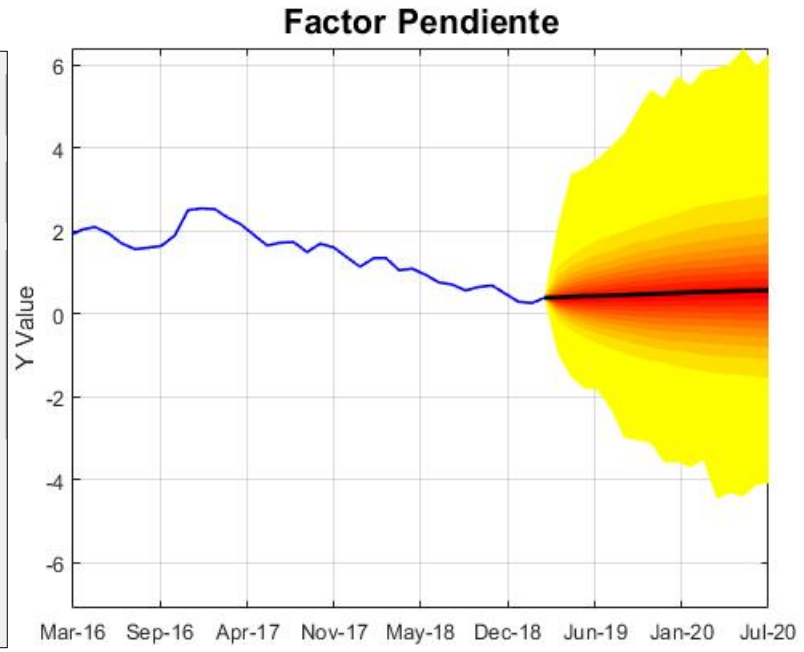
Rotated Dynamic Nelson-Siegel model

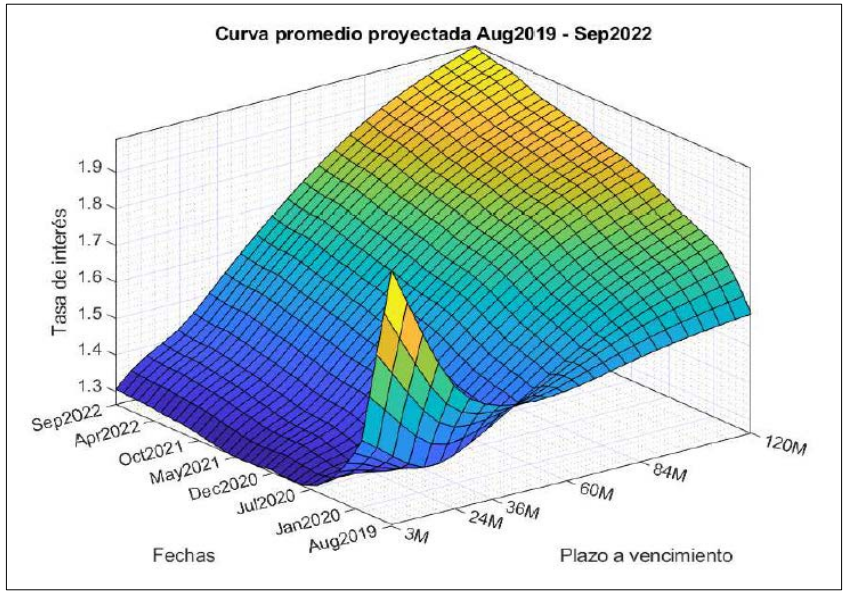
- The model factors have a straightforward interpretation to represent various forms that can take the yield curve along any period. The simplicity of model allows us to make good forecasts
- The model has been modified (rotated) to carry exogenous projections of short-term rates based on views about the expected level of the monetary policy rate
- We could incorporate different scenarios associated with monetary policy regimes that would affect the level and slope of the curve

Factors Proyection and Forecasted Yield Curves

Using the historical yield curve factors that were calculated in the previous step, a time series model is estimated to capture their dynamic. A non-parametric joint probability distribution is calibrated using the historical errors of the time series model, the one that is used to project a large number of scenarios of the yield curve factors that incorporate their uncertainty and the dependency relationships among them. The projected factors subsequently give us the evolution of the yield curve for each scenario in the chosen investment horizon. We can add exogenous projections to modify the average path for any factor.



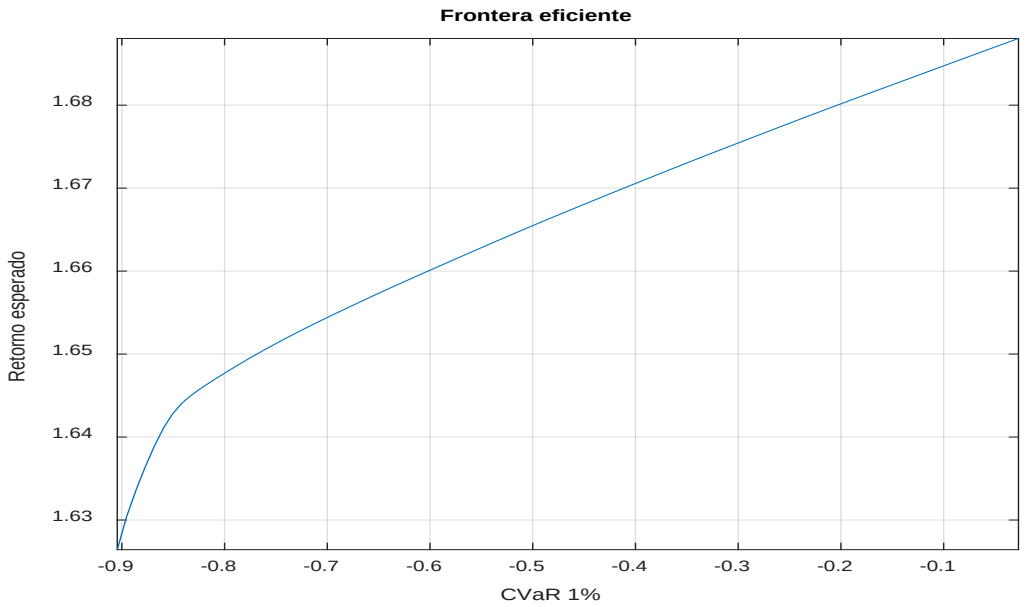




Transformation of Yield Curves into Returns and Construction of the Efficient Frontier

- With the projected behaviour of the yield curve for each of the generated scenarios, we obtain distributions of returns for generic instruments (zero coupon bonds).

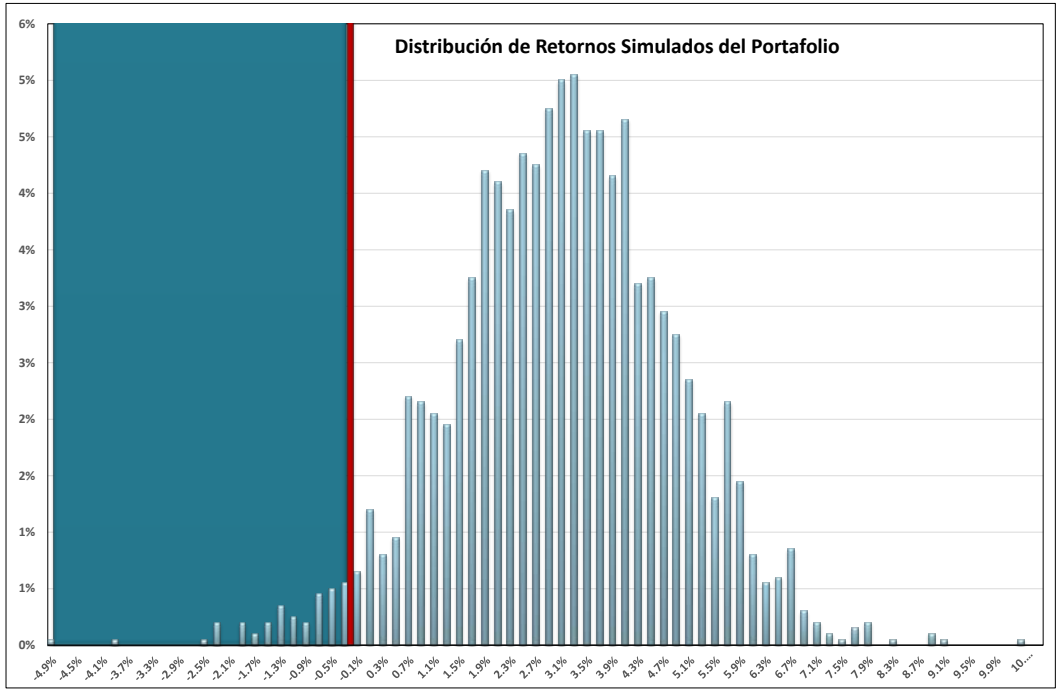
Par Curve Yields → Spot Curve Yields → Zero Coupon Bond Prices → Returns for Bonds → Returns for Indexes



- Using these distributions, we construct distributions of market indexes returns which will be used in the optimization.
- The efficient frontier is constructed by an optimization process which seeks to capture the estimation error (resampling), from which we obtain asset portfolios with the maximum expected return for each level of the chosen risk measure (CVaR).

Optimal Portfolio Selection

Each point on the efficient frontier is a portfolio of assets which has a projected distribution of returns with specific characteristics. Optimal portfolio is whichever one that is better suited to long-term strategy to be implemented according to risk-return preferences of the institution (eg. minimum probability of losses on the investment horizon). Distributions capture the non-normality of returns that usually present the financial assets.



VaR	-1.20%	Sharpe	184.68%
CVaR	-1.98%	Duración	3.34 años
σ_R	1.74%	Prob. Pérdida	3.50%
$E(R)$	3.21%		

Results Validation

It is performed a final quantitative analysis to verify the properties of the selected strategic allocation, regardless of the assumptions used during the optimization process. This analysis includes:

- Analysis of Historical Properties (*Back Testing*): Comparison of projected risk-return profile with the historical risk-return profile.
- Analysis in Extreme Scenarios (*Stress Testing*): Evaluation of the impact of historical and simulated extreme scenarios on the performance of the portfolio.
- Analysis of Sensibility to changes in the proyected factors of the model (in each specific factor).

Final Remarks

- We have developed a dynamic strategic asset allocation framework that is easy to analize and that reflects the main aspects of our investment policies, includying a vast number of scenarios in periods of uncertainty.

- It allows us to incorporate exogenous expectations of projected factors for the yield curve, which can easily adjust the strategic asset allocation to major changes in market conditions, and can reflect the view of most people involved in the reserves management.

- The development of a strategic allocation methodology with clearly defined stages, not only facilitates the introduction of improvements in the models used in each stage, but also allows a direct and intuitive interpretation that helps proper communication and explanation of the results.

- Having a set of statistics for each optimal portfolio helps to better understand the risks to which we are exposed in choosing the desired level of return.