BANCO CENTRAL DEL URUGUAY

Value at Risk BCU balance sheet and SAA implications

XIII Meeting on International Reserves Management
11-13 September, 2019
Lima, Peru

Uruguay at a glance

Uruguay at a glance

1. GDP   USD 56,5 BIO (2018).

2. Population   3,45 MIO (2018).

3. Per Capita GDP   USD 16.732

4. Inflation   7,76% (Aug 2019).

5. International Assets   USD 14,67 BIO (Aug 30th 2019).

6. Credit Rating   Baa2/BBB/BBB-

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Risk Measurement: VaR

How to measure the market risks to which the BCU's equity is exposed?
Value at Risk applied at BCU Balance

Why?

Commonly used in the financial
world and not yet applied to the BCU

How?

Dividing the balance sheet in main currencies

- Active-USD
- Passive-UYU/UI

Technique used

Value at risk:
Worst loss that can be predicted in a certain time interval for a given level of confidence and in normal market conditions.

Función de Densidad Normal de los Rendimientos de un Portafolio

A **Parametric VaR** was chosen:

Why?
- It allows the development of other more detailed VaR measurements more directly
- More intuitive
- It does not require too much computing capacity
- Normal distribution of returns is assumed (Monte Carlo distribution with loglogistic best fits the distribution of curve returns).
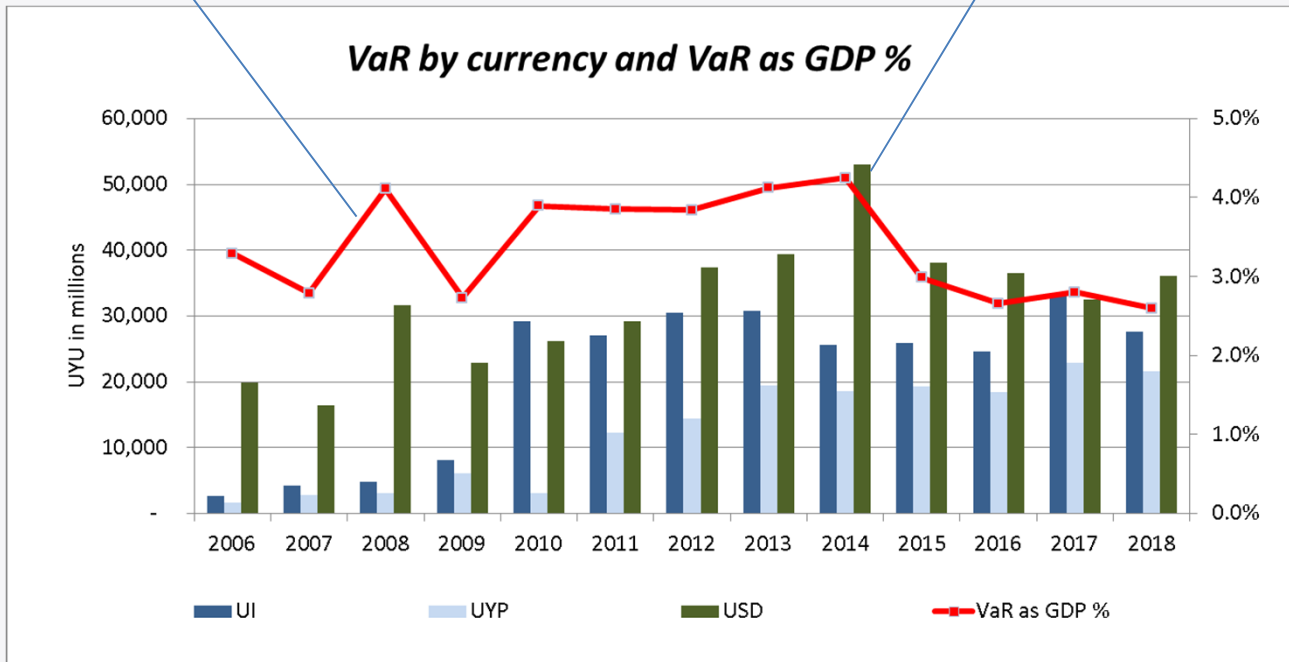
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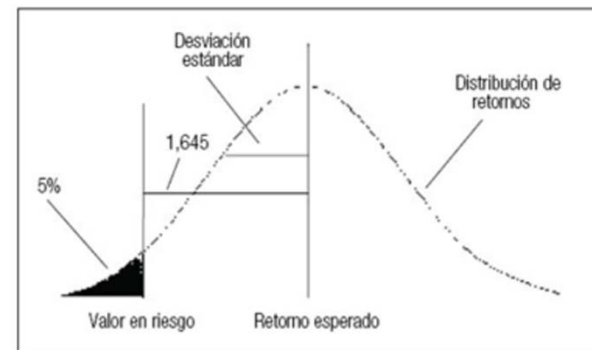
Results

2008 Crisis: High mismatch and volatility

High USD VaR, but lower volatility.

VaR by currency and VaR as GDP %

Legend: UI | UYP | USD | VaR as GDP %

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
VaR in UYU millions	15,582	14,895	25,811	19,471	31,238	35,430	39,885	48,309	55,933	43,872	42,702	47,154	47,409
VaR as GDP %	3.3%	2.8%	4.1%	2.7%	3.9%	3.9%	3.8%	4.1%	4.2%	3.0%	2.7%	2.8%	2.6%
Diversification benefits	36%	47%	42%	51%	49%	50%	53%	48%	44%	49%	48%	48%	46%

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Why BCU VaR is so big?

BCU Mismatch: Active Position in USD and Passive Position in UYU/UI

– Active Position USD: International Reserves
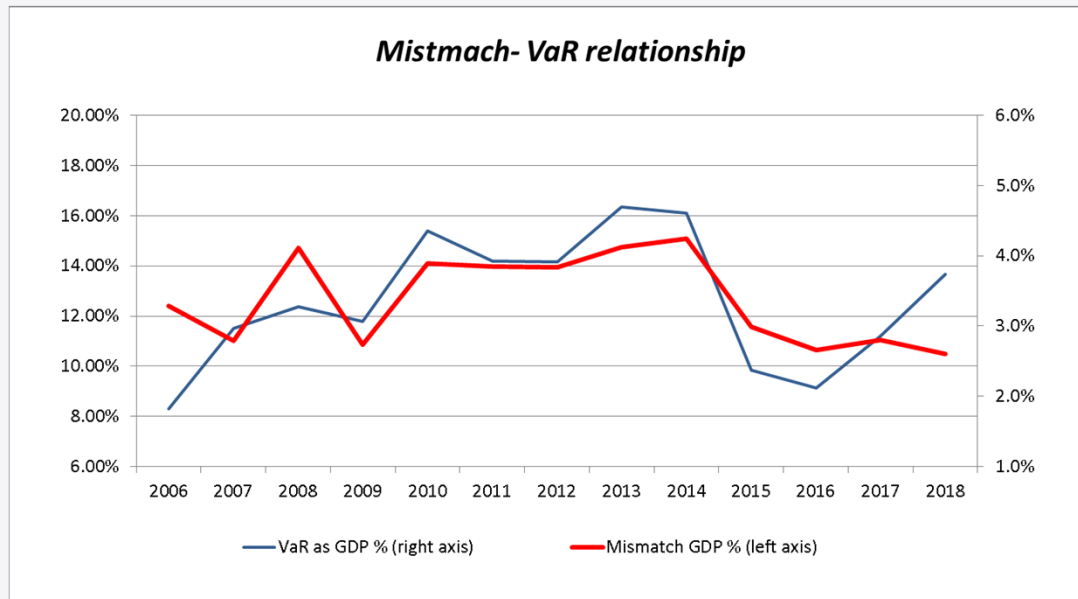
– Passive Position UYU/UI: Monetary Regulation Letters

The institution has difficulty matching assets with liabilities.

Evolution of the variation of Positions and Net in USD
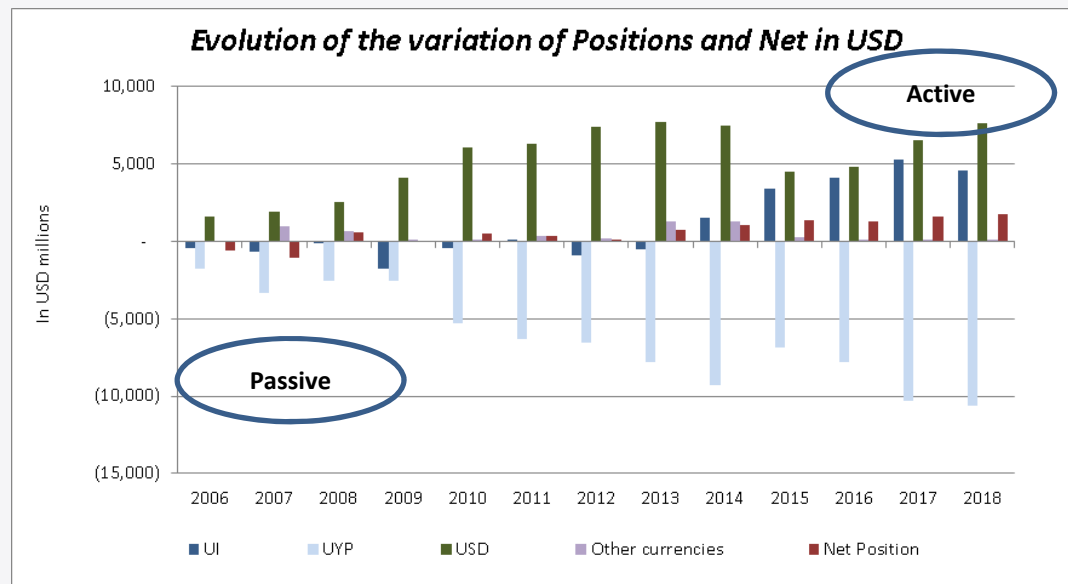
Main Conclusions

High correlation between Assets-Liablities' mismatch and VaR's evolution.

- 2006-2018: 68%   2009-2018: 83%

Mistmach- VaR relationship

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Mismatch GDP % (left axis)	8.29%	11.51%	12.38%	11.79%	15.38%	14.18%	14.16%	16.35%	16.11%	9.84%	9.13%	11.21%	13.68%
VaR as GDP % (right axis)	3.3%	2.8%	4.1%	2.7%	3.9%	3.9%	3.8%	4.1%	4.2%	3.0%	2.7%	2.8%	2.6%
VaR as Int.Res. % (left axis)	35%	59%	44%	47%	71%	59%	52%	56%	51%	29%	34%	40%	47%
VaR as Balance Sheet % (left	29%	39%	30%	34%	47%	40%	37%	38%	36%	22%	24%	27%	33%

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What we can to do?

Operating with Active Position

- International Reserves (in USD)

The steps to follow will be subject to the context

Reserve Level

Utilization probability		Deficit	Excess
	Low	USD diversification	ALM
	High	USD defensive	USD defensive, ALM for the rest?

Operating with Passive Position: Why not?

- Monetary Regulation Letters (in UYU/UI)
    - They are used to control the amount of money in the economy (monetary aggregates target)
    - Outside the control of BCU
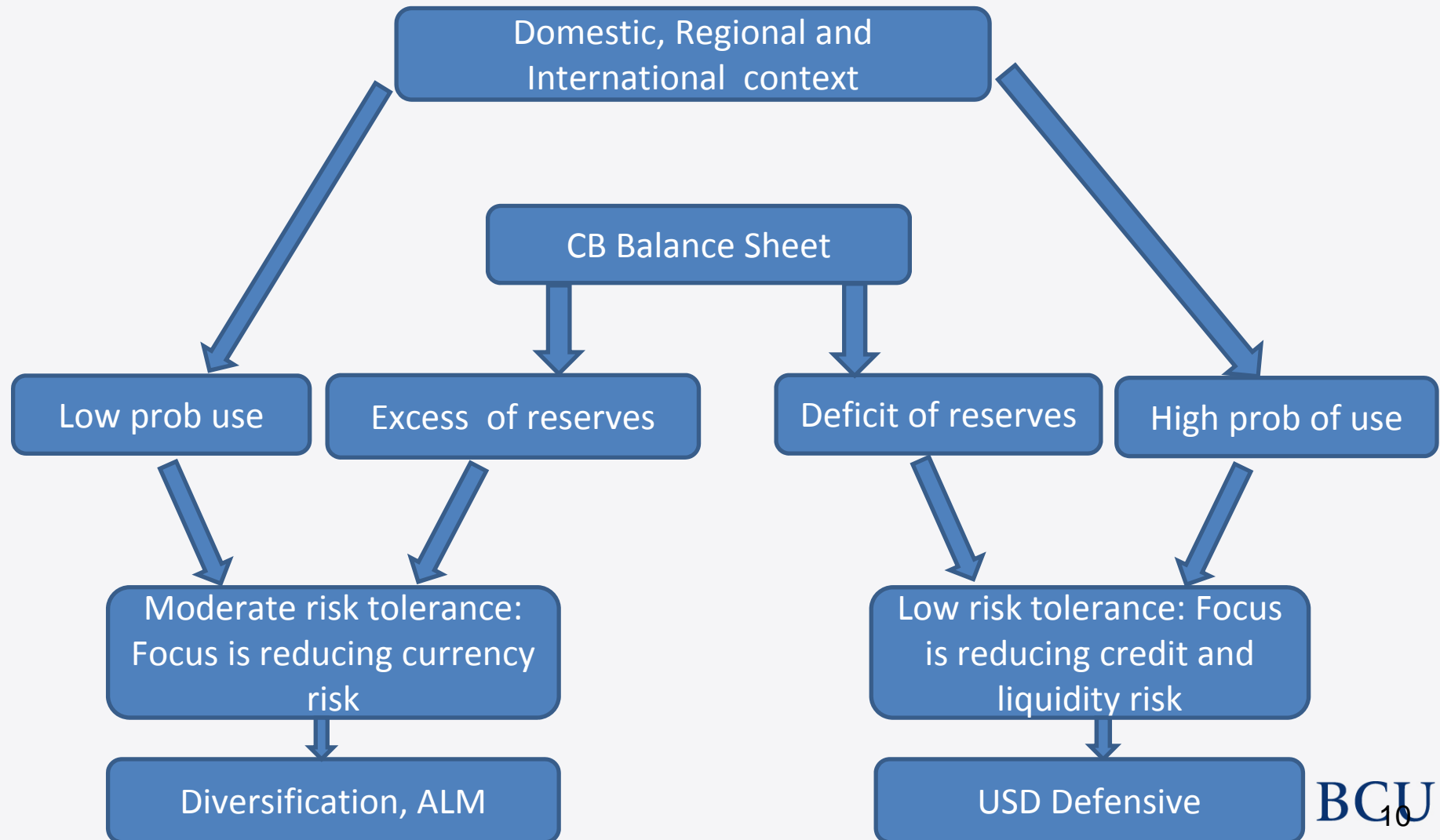
🌟 **BCU**

Dynamic SAA proposal

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                    ┌─────────────────────────────┐
                    │   Domestic, Regional and    │
                    │   International  context     │
                    └─────────────────────────────┘

                         ┌───────────────────┐
                         │  CB Balance Sheet │
                         └───────────────────┘

┌──────────────┐  ┌──────────────────┐  ┌──────────────────┐  ┌──────────────────┐
│ Low prob use │  │ Excess of reserves│  │ Deficit of reserves│  │ High prob of use │
└──────────────┘  └──────────────────┘  └──────────────────┘  └──────────────────┘

   ┌──────────────────────────────┐          ┌──────────────────────────────┐
   │  Moderate risk tolerance:    │          │  Low risk tolerance: Focus   │
   │  Focus is reducing currency  │          │  is reducing credit and      │
   │  risk                        │          │  liquidity risk              │
   └──────────────────────────────┘          └──────────────────────────────┘

   ┌──────────────────────────────┐          ┌──────────────────────────────┐
   │     Diversification, ALM     │          │        USD Defensive         │
   └──────────────────────────────┘          └──────────────────────────────┘
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Dynamic SAA proposal
USD diversification

Case:

- Low utilization probability
- Insufficient reserves relative to the requirements.

Stylized fact:

- Typically in periods after capital outflows → USD appreciation.
- No structural problems in the domestic economy.

Objective:

- Preserve some liquid reserves relative to requirements.
- Assume some liquidity and credit risk in USD.

	Reserve Level	
	Deficit	Excess
Low	USD diversification	ALM
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Utilization probability

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Dynamic SAA proposal
USD defensive

Case:

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Stylized fact:

- Typically in periods of capital outflows and risk off sentiment with some level of vulnerability in the domestic economy.
- USD appreciation tends to give strength to the balance sheet.
- The economy might suffer some BoP speculation.

Objective:

- Minimize liquidity and credit
risk in the intervention currency (USD).

		Reserve Level	
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Dynamic SAA proposal
ALM Portfolio

Case:

- Low utilization probability.
- Excess reserves relative to the requirements.

Stylized fact:

- Typically in periods of capital inflows to EM currencies.
- CBs run huge financial deficits.

Objective:

- Mitigate the financial deficit of the bank.
- Stabilize the equity of the bank by immunizing liabilities with a portfolio of diversified assets.

		Reserve Level	
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Dynamic SAA proposal
USD defensive, ALM for the rest?

Case:

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Stylized facts:

- USD appreciation strengthens the balance sheet.
- Some fragility in the economy with huge protection buffers, in a risk off context.
- The reserves act as a buffer to avoid speculative attacks.

Objective:

- Comfort reserves: Have all the liquidity timely in case of need.
- Excess reserves depends on the board's equity/liquidity risk tolerance.

Utilization probability		Reserve Level	
		Deficit	Excess
	Low	USD diversification	ALM
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How to determine parameters?

- Expert opinion is main driver (front, middle, backoffice and managers).

- Inhouse modelling is used, but it is not the only source.

- SAA changes of this magnitude must be approved by the board of directors.

Probability of using reserves:
- Error Correction Model with dependent variable UYP volatility regressed against fundamentals.

Required level of reserves:
- Economic model based in a VaR at 99% of the reserve requirements.

☀ BCU

Probability of using reserves model

Error Correction Model with dependent variable UYP volatility regressed against fundamentals, fitted to a lognormal distribution.

Model Output: Medium to low.
Expert opinion: Conservative.

Probability: HIGH

Required level of reserves

Access at Risk model with a 99% probability of covering the reserves requirements given objectives.
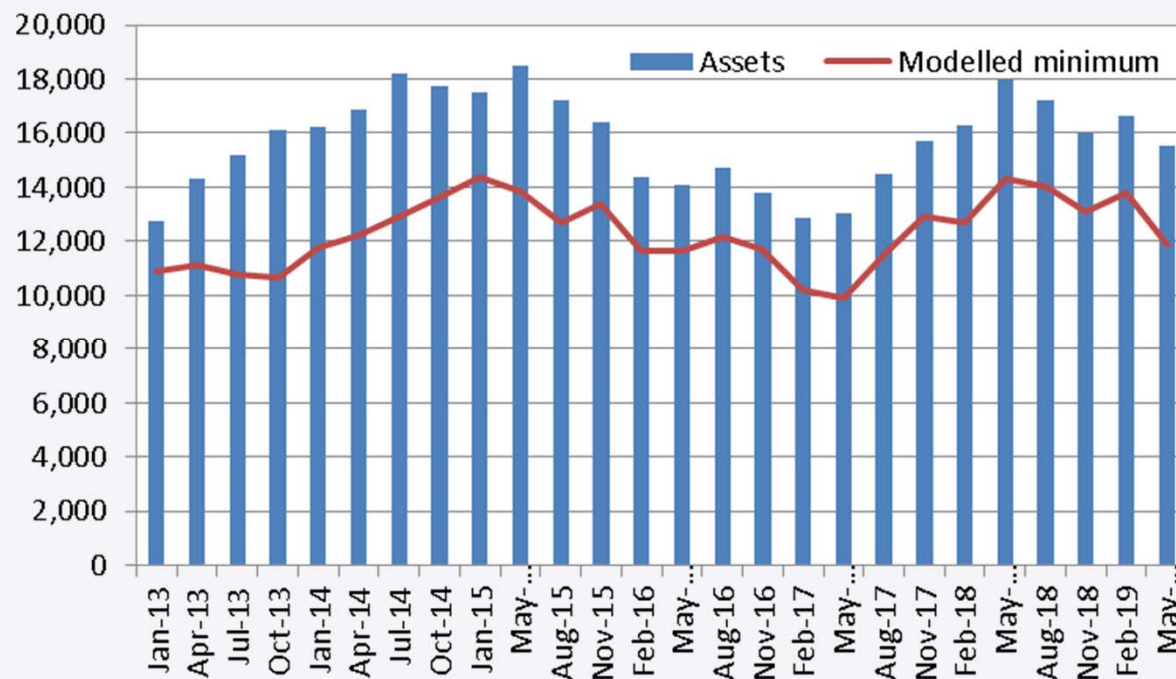
Model Output: Excess reserves.
Expert opinion: Excess reserves.

Reserves: Excess

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Current SAA

- **Probability** of using reserves is **high**.

- **Excess** reserves are **held**.

- *Portfolio*:
  - Defensive for the required position.
  - Diversified in USD for the excess (according to board's equity risk / liquidity risk tolerance).

Reserve Level

Utilization probability		Deficit	Excess
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What we know

BCU Minimum capital: UI 5.000 millions (USD 600 millions)

When it is below that number, must be capitalized

BCU has received significant capitalizations in recent years

Capitalization's received		
In 2010	in millons USD	2,432
As GDP % 2010		6%
In 2012	in millons USD	835
As GDP % 2012		2%
In 2013	in millons USD	633
As GDP % 2013		1%

Dynamic SAA proposal
USD diversification

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Post LATAM BoP problems of turn of the century.
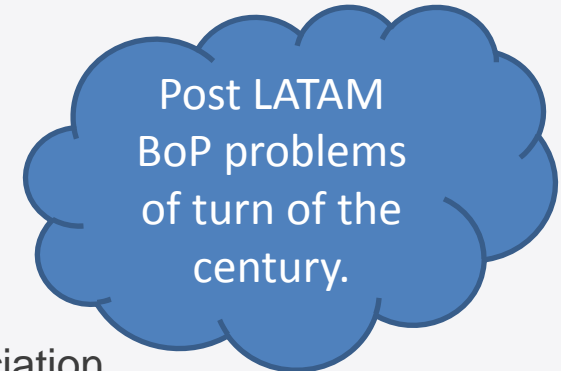
Stylized fact:

- Typically in periods after capital outflows → USD appreciation.
- Past FX appreciation gave strength to the balance sheet.
- No structural problems in the domestic economy.

Objective:

- Preserve some liquid reserves relative to requirements.
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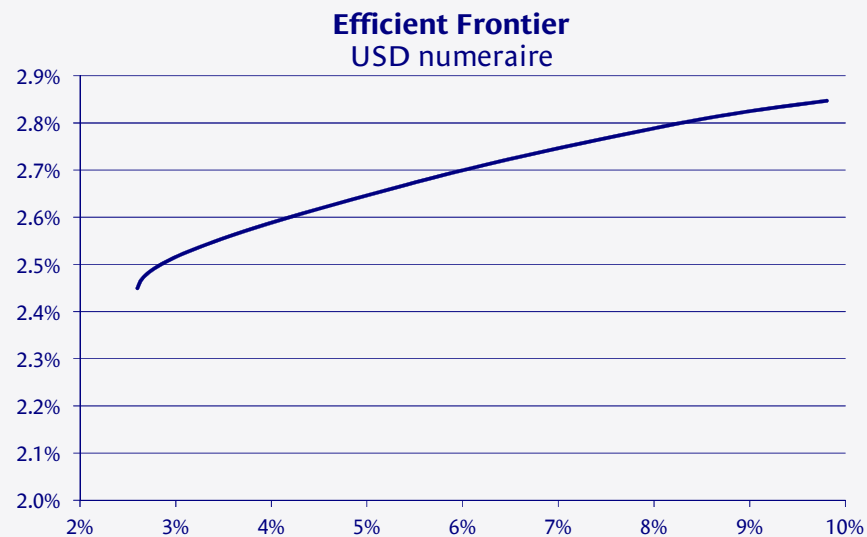|		Reserve Level	
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Dynamic SAA proposal
USD diversification

Portfolio:

- Multiasset portfolio nominated in USD.

- Estimated using BL with I/L USD as numeraire.

Eligible assets:

- T-Bills, Notes, Bonds.

- Sovereign / supra.

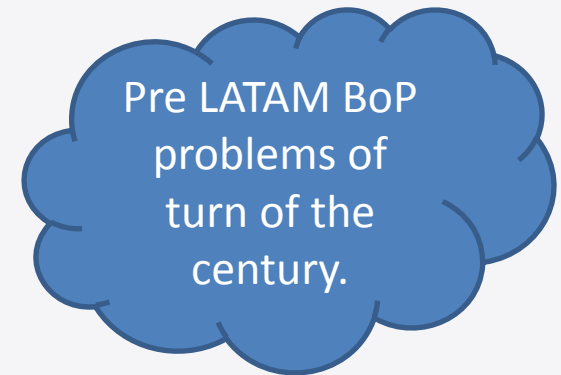- Agencies.

- MBS.

- USD covered G7.

Efficient Frontier
USD numeraire

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Dynamic SAA proposal
USD defensive

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Pre LATAM BoP problems of turn of the century.

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risk in the intervention currency (USD).

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Dynamic SAA proposal
USD defensive

Portfolio:

- Tilted to liquidity risk minimization.

- The portfolio should comply with the following:
  - It should be sold in less than one week with minimum loss.

- Composition:
  - Depos
  - T-bills, notes and bonds.
  - Top credit rating counterparties.

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Dynamic SAA proposal
ALM Portfolio

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Post Global Financial Crisis Period

Reserve Level

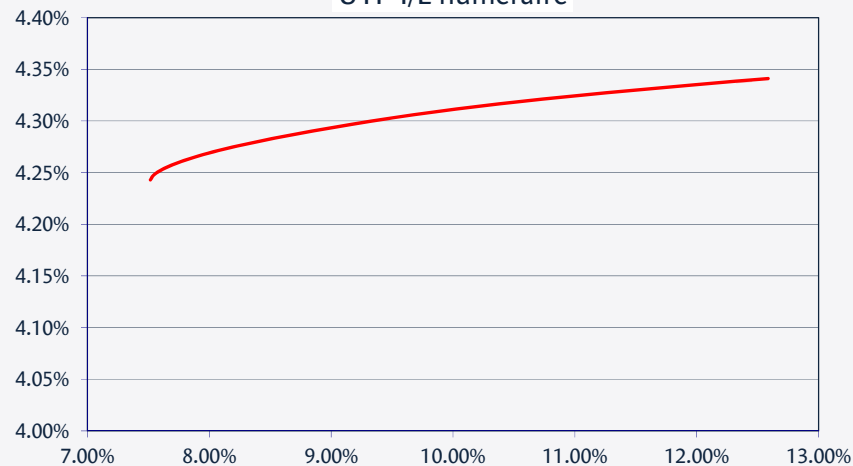|	Deficit	Excess
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Utilization probability

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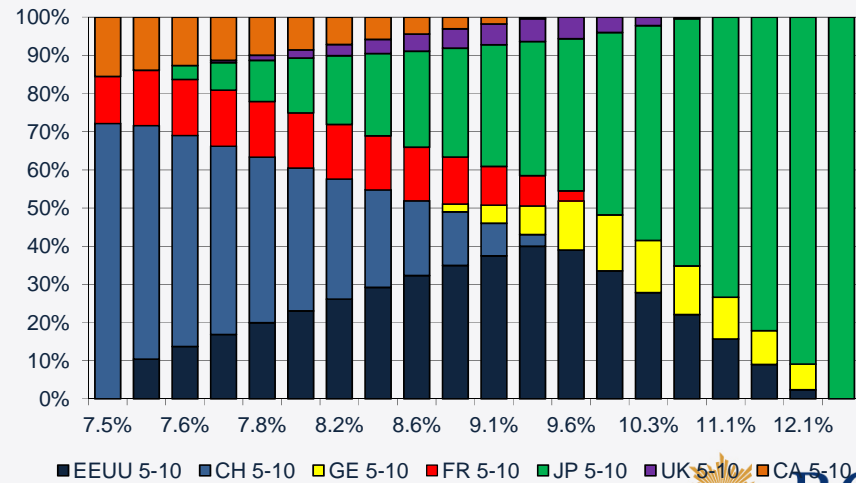
Dynamic SAA proposal
ALM Portfolio

Portfolio for matching domestic liabilities:

- Multicurrency with high correlation to domestic currency, but basis risk exists.
- Estimated using BL with I/L UYP as numeraire.
- Using tranches of UST, China and G6 (excluding Italy):

Efficient Frontier
UYP I/L numeraire

Composition

Legend: EEUU 5-10, CH 5-10, GE 5-10, FR 5-10, JP 5-10, UK 5-10, CA 5-10

Dynamic SAA proposal
USD defensive, ALM for the rest?

Case:

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2018

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Utilization probability

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USD defensive, ALM for the rest?

Portfolio divided in two:

- Reserves matching requirements:
  - Same portfolio as in USD defensive:
    - Minimize liquidity and credit risk.
    - Sold back in 1 week.

- Excess reserves management depends on equity / liquidity risk tolerance of the board:
  - Same as ALM portfolio (immunize liabilities).
  - Open USD position to take advantage of its appreciation.

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