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).
3. Per Capita GDP USD 16.732
6. Credit Rating Baa2/BBB/BBB-
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.

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).
Results

2008 Crisis: High mismatch and volatility

High USD VaR, but lower volatility.

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

![Graph showing Evolution of the variation of Positions and Net in USD](image)
Main Conclusions

High correlation between Assets-Liabilities’ mismatch and VaR’s evolution.

- 2006-2018: 68%
- 2009-2018: 83%
What we can to do?

**Operating with Active Position**
- International Reserves (in USD)
  The steps to follow will be subject to the context

<table>
<thead>
<tr>
<th>Utilization probability</th>
<th>Reserve Level</th>
<th>Deficit</th>
<th>Excess</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>USD diversification</td>
<td>ALM</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>USD defensive</td>
<td>USD defensive, ALM for the rest?</td>
<td></td>
</tr>
</tbody>
</table>

**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
Domestic, Regional and International context

CB Balance Sheet

Low prob use
- Moderate risk tolerance: Focus is reducing currency risk
- Diversification, ALM

Excess of reserves

Deficit of reserves
- Low risk tolerance: Focus is reducing credit and liquidity risk
- USD Defensive

High prob of use
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.

<table>
<thead>
<tr>
<th>Utilization probability</th>
<th>Reserve Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Deficit</td>
</tr>
<tr>
<td>Low</td>
<td>USD diversification</td>
</tr>
<tr>
<td>High</td>
<td>USD defensive</td>
</tr>
</tbody>
</table>
Dynamic SAA proposal
USD defensive

Case:
• High utilization probability
• Insufficient reserves relative to the requirements.

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).

<table>
<thead>
<tr>
<th>Reserve Level</th>
<th>Deficit</th>
<th>Excess</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>USD diversification</td>
<td>ALM</td>
</tr>
<tr>
<td>High</td>
<td>USD defensive</td>
<td>USD defensive, ALM for the rest?</td>
</tr>
</tbody>
</table>

Utilization probability
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.

<table>
<thead>
<tr>
<th>Utilization probability</th>
<th>Reserve Level</th>
<th>Deficit</th>
<th>Excess</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>USD diversification</td>
<td>ALM</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>USD defensive</td>
<td>USD defensive, ALM for the rest?</td>
<td></td>
</tr>
</tbody>
</table>

BCU
Dynamic SAA proposal
USD defensive, ALM for the rest?

Case:
• High utilization probability
• Excess reserves relative to the requirements.

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.

<table>
<thead>
<tr>
<th>Utilization probability</th>
<th>Reserve Level</th>
<th>Deficit</th>
<th>Excess</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>USD diversification</td>
<td>ALM</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>USD defensive</td>
<td>USD defensive, ALM for the rest?</td>
<td></td>
</tr>
</tbody>
</table>
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.
Probability of using reserves model

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

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
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).

<table>
<thead>
<tr>
<th>Reserve Level</th>
<th>Utilization probability</th>
<th>Deficit</th>
<th>Excess</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td><strong>USD diversification</strong></td>
<td></td>
<td>ALM</td>
</tr>
<tr>
<td>High</td>
<td><strong>USD defensive</strong></td>
<td></td>
<td>USD defensive, ALM for the rest?</td>
</tr>
</tbody>
</table>
Thank you
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 millions USD | As GDP %
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>In 2010</td>
<td>2,432</td>
<td>6%</td>
</tr>
<tr>
<td>As GDP % 2010</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In 2012</td>
<td>835</td>
<td>2%</td>
</tr>
<tr>
<td>As GDP % 2012</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In 2013</td>
<td>633</td>
<td>1%</td>
</tr>
<tr>
<td>As GDP % 2013</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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.
• Past FX appreciation gave strength to the balance sheet.
• No structural problems in the domestic economy.

Objective:
• Preserve some liquid reserves relative to requirements.
• Assume some liquidity and credit risk in USD.

<table>
<thead>
<tr>
<th>Utilization probability</th>
<th>Reserve Level</th>
<th>Deficit</th>
<th>Excess</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>USD diversification</td>
<td>USD defensive</td>
<td>ALM</td>
</tr>
<tr>
<td>High</td>
<td></td>
<td>USD defensive</td>
<td>USD defensive, ALM for the rest?</td>
</tr>
</tbody>
</table>
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.
Dynamic SAA proposal
USD defensive

Case:
- High utilization probability
- Insufficient reserves relative to the requirements.

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

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

<table>
<thead>
<tr>
<th>Utilization probability</th>
<th>Reserve Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>USD diversification</td>
</tr>
<tr>
<td>High</td>
<td>USD defensive</td>
</tr>
</tbody>
</table>

Pre LATAM BoP problems of turn of the century.
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.
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.

<table>
<thead>
<tr>
<th>Utilization probability</th>
<th>Reserve Level</th>
<th>Deficit</th>
<th>Excess</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>USD diversification</td>
<td>ALM</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>USD defensive</td>
<td>USD defensive, ALM for the rest?</td>
<td></td>
</tr>
</tbody>
</table>

BCU
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):
Dynamic SAA proposal
USD defensive, ALM for the rest?

Case:
• High utilization probability
• Excess reserves relative to the requirements.

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.

<table>
<thead>
<tr>
<th>Utilization probability</th>
<th>Reserve Level</th>
<th>Deficit</th>
<th>Excess</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>USD diversification</td>
<td>ALM</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>USD defensive</td>
<td>USD defensive, ALM for the rest?</td>
<td></td>
</tr>
</tbody>
</table>
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.
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.