Current Account Sustainability Considering Nonlinearities

IDB-Banco de la República Conference on Current Account Sustainability

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More than Current Account Sustainability

- Milessi-Ferreti and Razin (1986) present three relevant and interconnected concepts:
  - Solvency: The present value of the expected trade surpluses must be greater than or equal to the expected present value of the liabilities.
  - Sustainability: Solvency condition + non drastic changes in government policy.
  - "Excessive" Current Account Deficit: Misalignment with respect to the equilibrium current account.

Current Account Sustainability

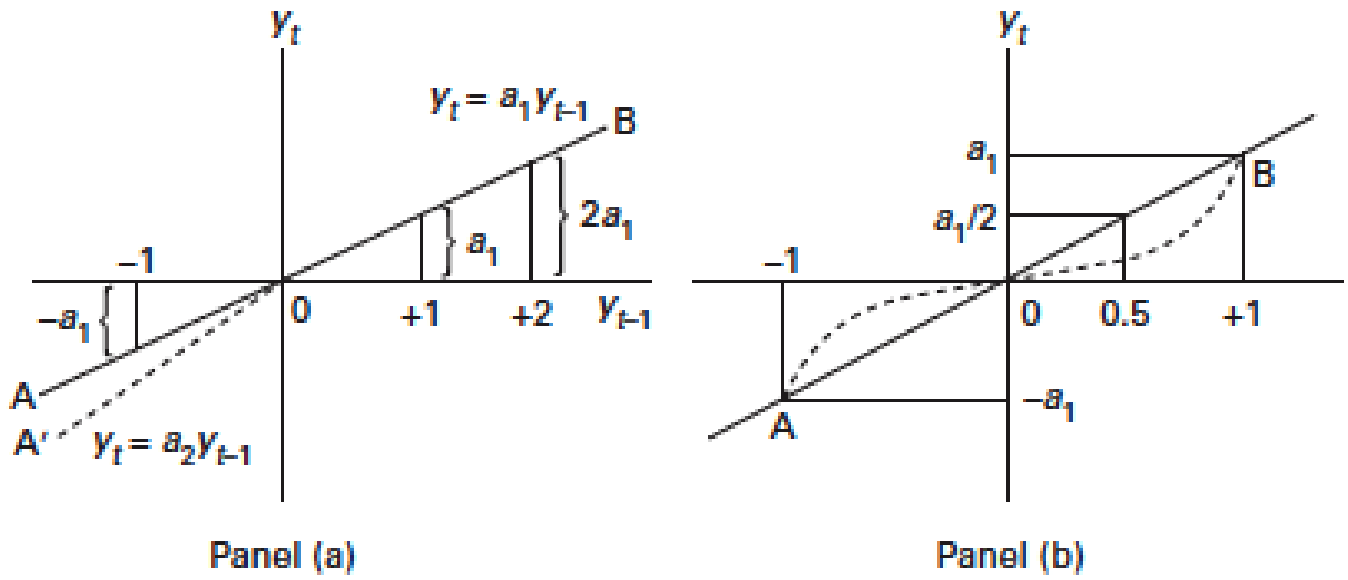
- How to measure current account sustainability?
  - Econometric test:
    - Standard unit root tests apply for linear autoregressive models.
- Disadvantage: There is a bias toward the acceptance of unit root when the process is not linear but still stationary.

Nonlinearities in the current account

- Why is it important to consider nonlinearities in the current account?
  - Changes in the current account dynamics in response to shocks (transitory/permanent).
  - Spread dynamics, risk perceptions, and portfolio decisions can be determinants of the non-linearity of the current account. (Raybaudi et al., 2004).
  - Borrowing constraints and sudden stops

Nonlinearities in the current account

Figure: Phase Diagram, source: Enders, 2010



Current Account Sustainability

- In this presentation: univariate and multivariate methods to test current sustainability considering non linearities
  - Exogenous threshold:
    - Markov Switching (univariate). Raybaudi et al., 2004
  - Endogenous threshold:
    - Threshold Autoregressive Model (TAR), univariate. Clarida (2006)
    - Smooth Transition Regression model (STAR), (univariate). Christopoulos and León-Ledesma (2010)
    - Threshold VEC (TVEC). Ordoñez, Melo and Valencia (2017)

Univariate Methods: Markov Switching Model

- Model

$$\triangle cc_t = \mu_0 (1 - S_t) + \mu_1 S_t + \alpha (1 - S_t) cc_{t-1} + \varepsilon_t \qquad (1)$$

- Exogenous States. $S_t = \{0, 1\}$
- $S_t = 0 \Rightarrow \triangle cc_t = \mu_0 + \alpha cc_{t-1} + \varepsilon_t$. Stationary process.
- $S_t = 1 \Rightarrow \triangle cc_t = \mu_1 + \varepsilon_t$. Random walk with drift.
- Dynamics : Markov chain
  - $p_{ij} = \Pr(S_t = j \mid S_{t-1} = i), i, j \in \{0, 1\}$

Univariate Methods: Markov Switching Model

- Outcome:
  - Test unit root vs nonlinear stationary process.
  - Characterization of the regimes (duration and filter probabilities).
  - "Red signal" for local non-sustainability of the current account.

Univariate Methods: TAR model

- Model:

$$cc_t = \begin{cases} \alpha_{10} + \alpha_{11} cc_{t-1} + \sum_{j=1}^{p} \alpha_{1j} cc_{t-j} & +\varepsilon_t \text{ if } cc_{t-k} > \tau \\ \alpha_{20} + \alpha_{21} cc_{t-1} + \sum_{j=1}^{p} \alpha_{2j} cc_{t-j} & +\varepsilon_t \text{ if } cc_{t-k} \leq \tau \end{cases} \quad (2)$$

- Regime: Optimal decay + threshold
- Regime depends on the state of the current account and the endogenous threshold.

Univariate Methods: TAR model

- Outcome:
  - Test unit root vs non linearity stationary process. Wald statistic using bootstrap procedures Caner and Hansen (2001) and Chortares (2004).
  - Time to adjust between regimes.
  - Can be extended to multiple thresholds.

Univariate Methods: STAR model

- Model

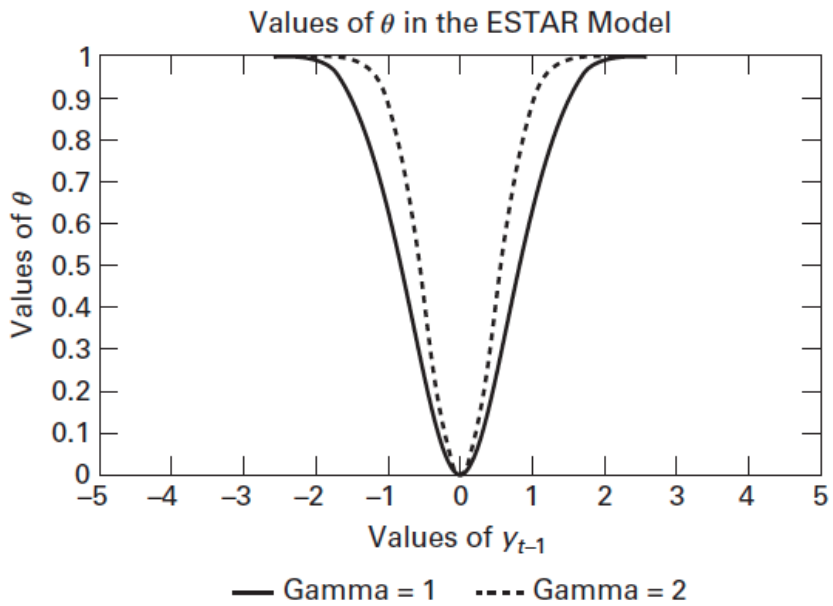
$$\triangle cc_t = \alpha cc_{t-1} + \rho^* \phi\left(\gamma, \theta, \triangle cc_{t-k}\right) + \sum_{j=1}^{p} \gamma_j \triangle cc_{t-j} + \varepsilon_t \quad (3)$$

- Nonlinearity depends on $\phi\left(\gamma, \theta, \triangle cc_{t-k}\right)$.
- Where γ is the smooth parameter and θ is the threshold.

Univariate Methods: Smooth Transition Regression Model (STAR)

Figure: ESTAR model

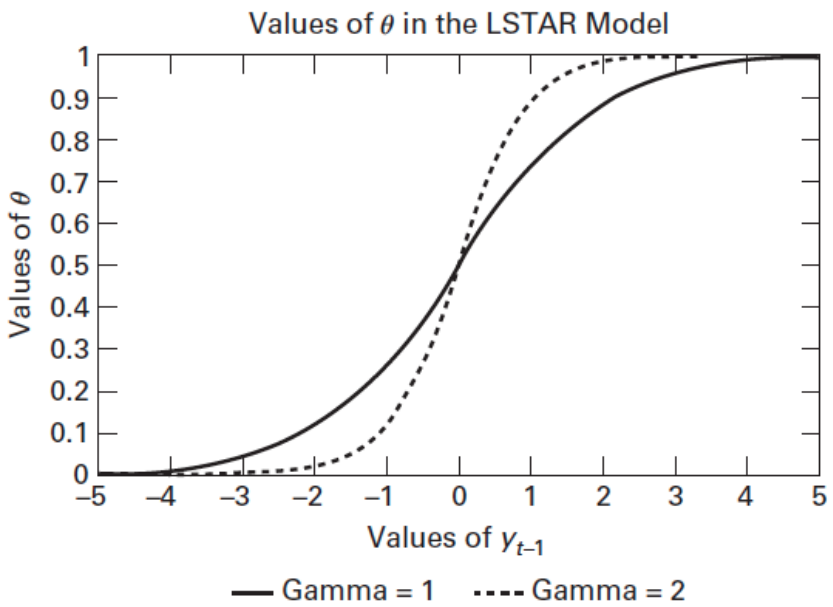
$$\phi(\gamma, \theta, \triangle cc_{t-k}) = 1 - \exp\left(-\gamma\left(\triangle cc_{t-k} - \theta\right)^2\right), \gamma > 0$$



Univariate Methods: Smooth Transition Regression Model (STAR)

Figure: LSTAR model

$$\phi(\gamma, \theta, \triangle cc_{t-k}) = [1 + \exp(-\gamma(\triangle cc_{t-k} - \theta))]^{-1}, \gamma > 0$$



Univariate Methods: STAR model

- Outcome:
  - Test unit root vs non linearity stationary process. Supremum-type-test statistic, Kilic (2003)
  - Indicators about :
    - Desviation from the mean.
    - The degree of mean reversion (speed of the adjustment).
  - Symmetric adjustment of the current account.

Multivariate: Threshold VEC Model

- The changes in the net of foreign assets can be written:

$$\triangle B_t = MM_t - X_t^s \tag{4}$$

where $MM_t = M_t + rB_{t-1}$

- The cointegration equation is:

$$MM_t - \beta X_t^s = a^* + \varepsilon_t \tag{5}$$

- Long run is linear
- $\beta = 1$ strong sustainability; $\beta \neq 1$ weak sustainability.

Multivariate: Threshold VEC Model

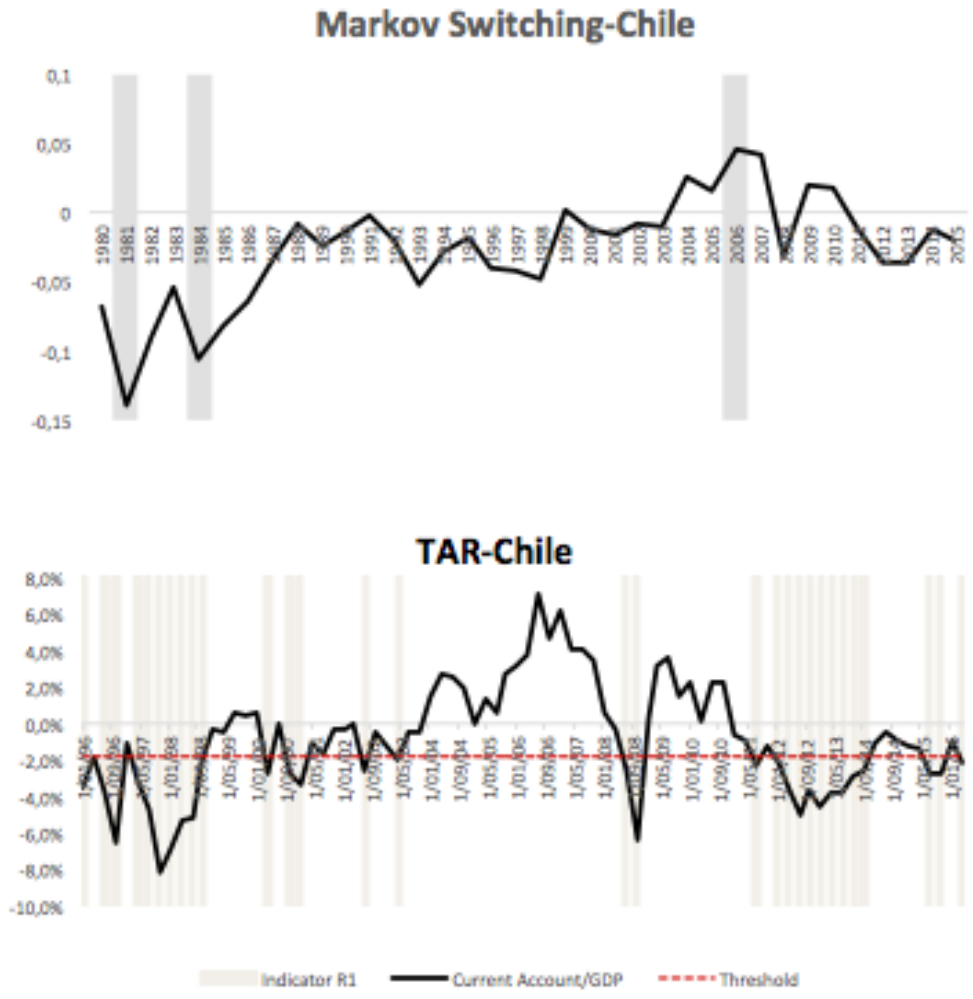
- The model:

$$\triangle X_t = A_1^{'} X_{t-1}(\beta) + A_2^{'} X_{t-1}(\beta) I(Z_{t-1}(\beta) > \tau) \qquad (6)$$

- Two components: short-run nonlinear dynamics and linear long-run equilibrium.
- Outcome:
  - Sustainability criteria for income and expenses of current account.
  - Endogenous thresholds and regimes⇒predominant (stables), non-predominant regimes (unstable).

Results: Univariate Case- Chile

Figure: Univariate Case

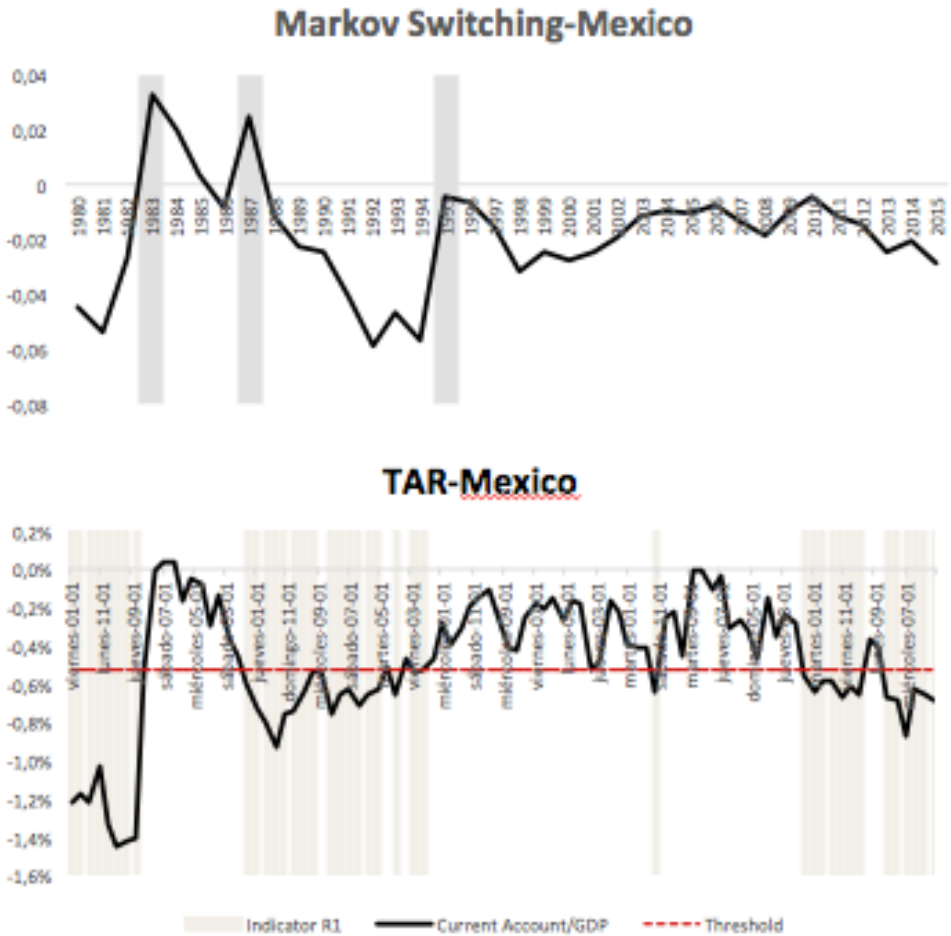


Results: Univariate Case- Chile

Figure: Univariate Case

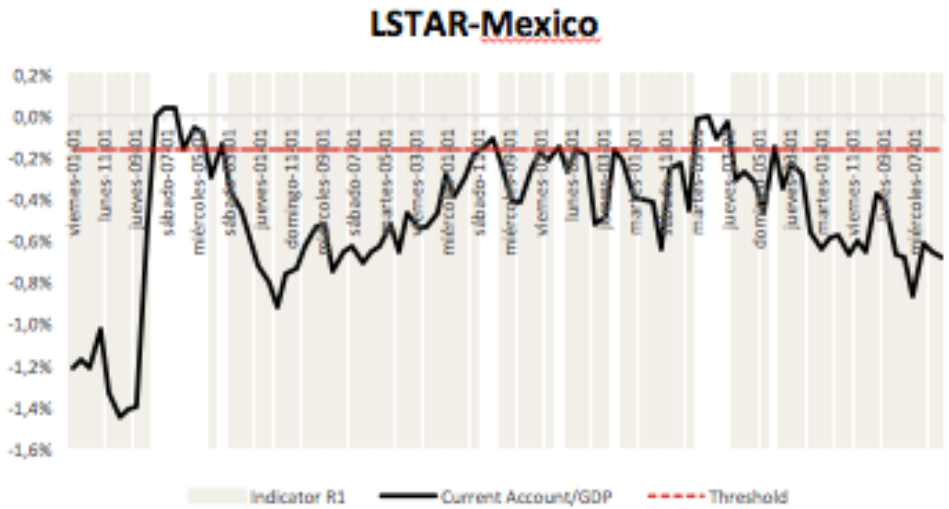
Results: Univariate Case- Mexico

Figure: Univariate Case



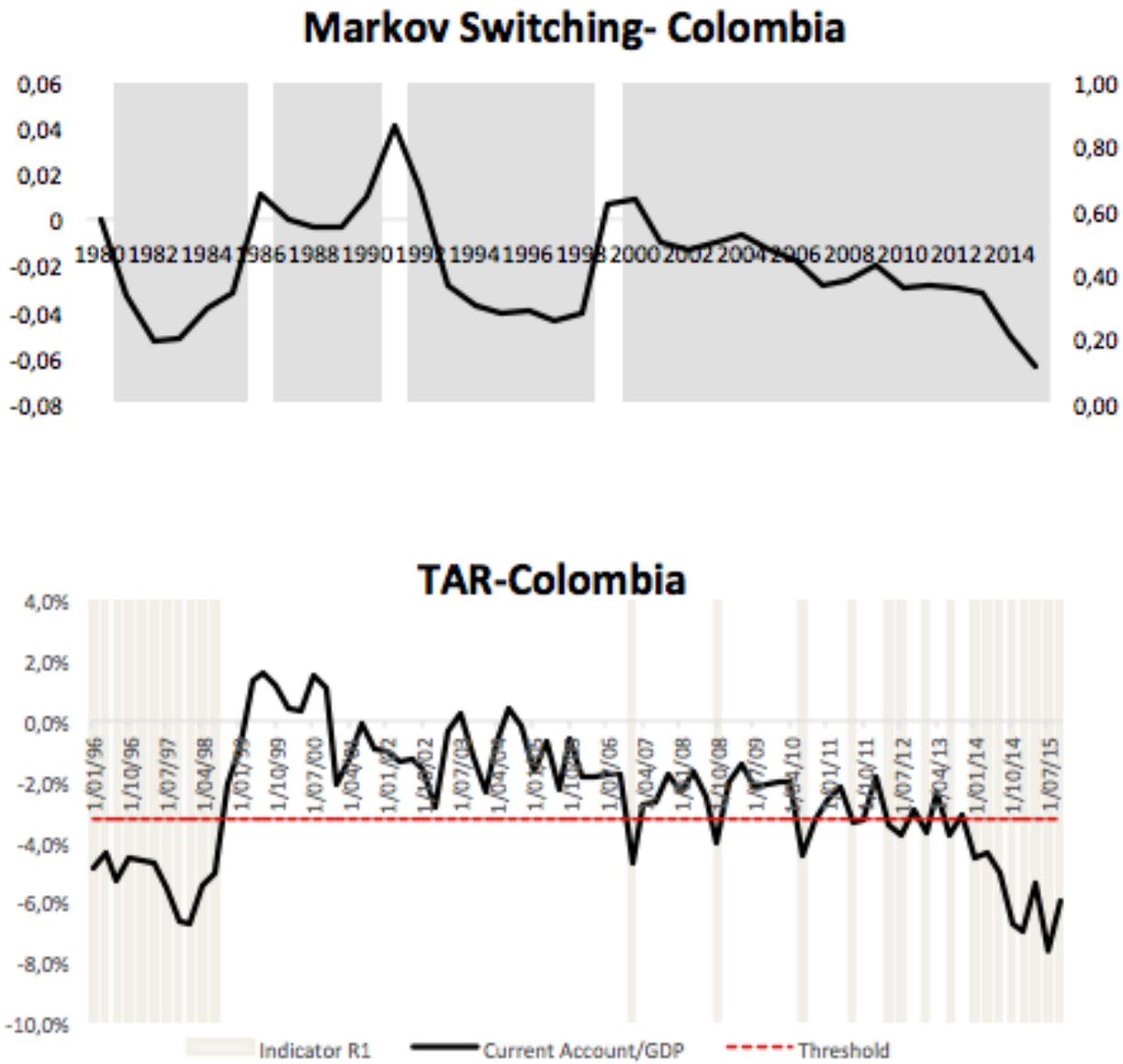
Results: Univariate Case- Mexico

Figure: Univariate Case



Results: Univariate Case- Colombia

Figure: Univariate Case



Results: Univariate Case- Colombia

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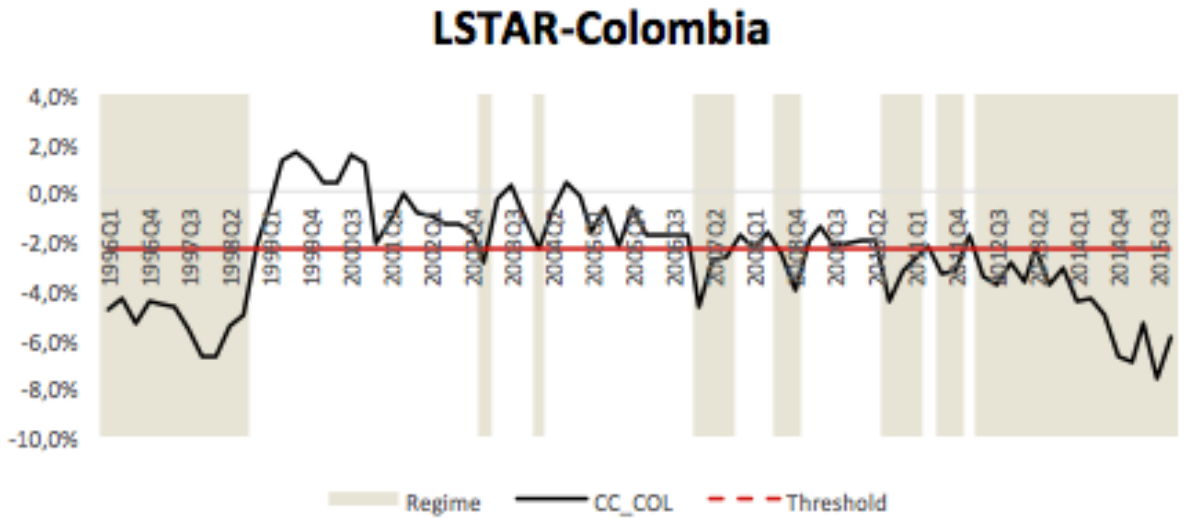
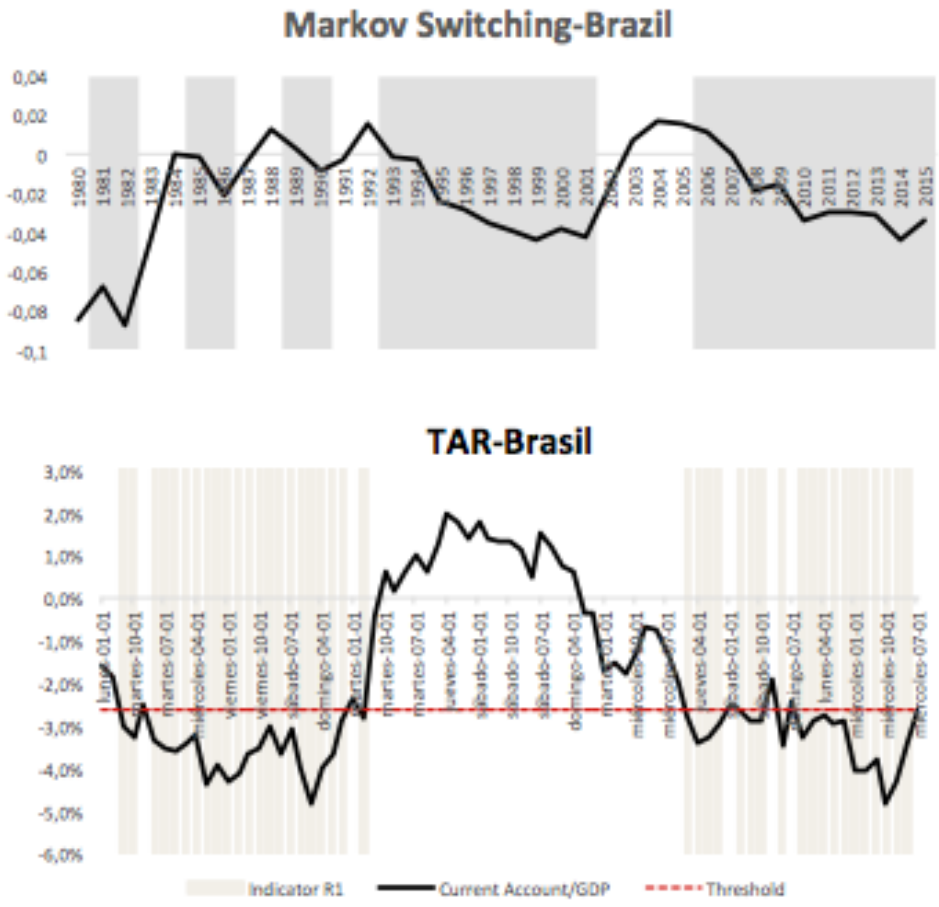


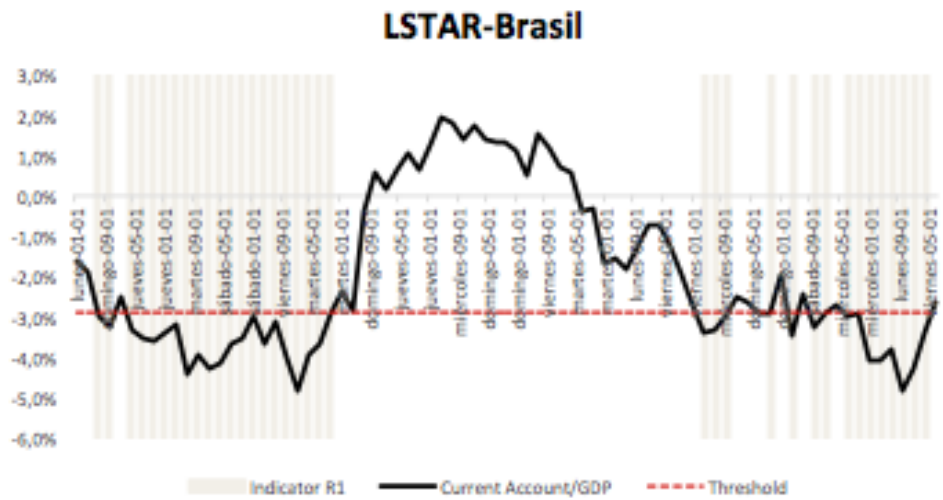
Results: Univariate Case- Brasil

Figure: Univariate Case



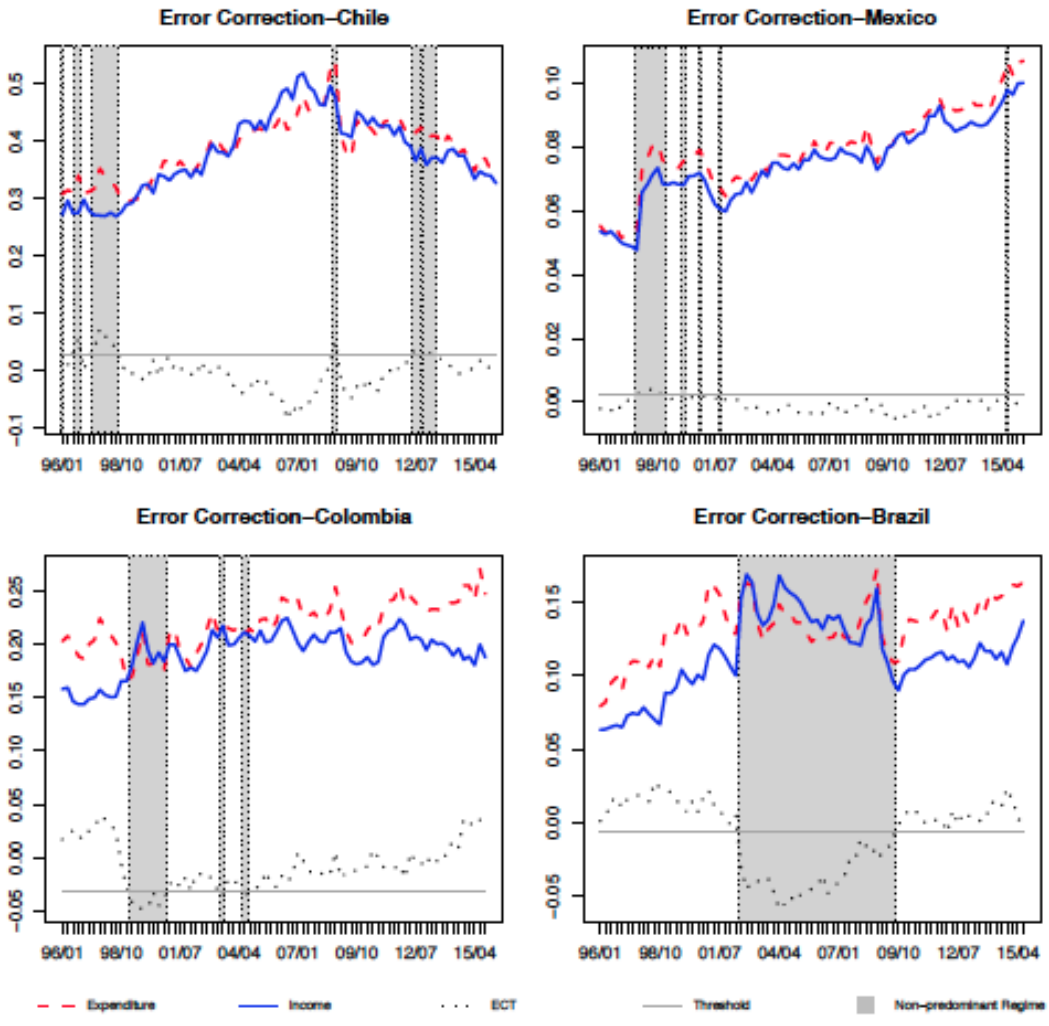
Results: Univariate Case- Brasil

Figure: Univariate Case



Results: Multivariate Case

Figure: Multivariate Case



Concluding remarks

- Econometric methodologies for testing current account sustainability based non stationary no linear process.
- Characterization of regimes that allows us to understand local non sustainability.
- The multivariate methodology can be extended to understand the dynamics of the current account with other macro variables.