Sticky Capital Controls

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¹Disclaimer: Views do not correspond to those of the Central Bank of Chile or its board members.
Novel dataset

- We use *textual analysis*.
- Focus on *de joure* measures of the intensive margin (rates).
- Other macroprudential tools.
What We Do

- Novel dataset
  - We use *textual analysis*.
  - Focus on *de joure* measures of the intensive margin (rates).
  - Other macroprudential tools.
- Document 6 stylized facts.
  - Main finding: Capital controls are *Sticky*. 
What We Do

Theory

- Take the canonical model of pecuniary externalities to the data.

- The model cannot account for the observed behavior of capital controls.

- We propose a reduced-form S-s extension to the canonical model.

- The augmented model accounts for the observed patterns of capital controls.

- Policy-making costs reduce their welfare-improving properties.
What We Do

- Theory
  - Take the canonical model of pecuniary externalities to the data.
  - The model cannot account for the observed behavior of capital controls.
  - We propose a reduced-form S-s extension to the canonical model.
  - The augmented model accounts for the observed patterns of capital controls.
  - Policy-making costs reduce their welfare-improving properties.
  - Provide a discussion of possible underlying reasons behind the S-s costs.
Dataset: Key Features

- Two *de jure* capital controls:
  - URRs rates applied to cross-border flows.
  - Tax rates to cross-border flows.
- Methodology: *Textual analysis* on different sources: Multilateral (AREAER), national, other studies, domestic authorities.
## Dataset: Key Features

**Table:** Number of observations by instrument

<table>
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<tr>
<th>Observation Instrument</th>
<th>Total Observations</th>
<th>With Observation</th>
<th>Without Observation</th>
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**Stylized Facts - 1. Lack of Widespread Use**

**Figure:** Use of Capital Control & Macro Prudential Instruments

Panel A. Share of Countries

Panel B. Share of Time
Stylized Facts - 2. Heterogeneity in the Intensive Margin

Figure: The Intensive Margin of Capital Control & Macro Prudential Instruments
Stylized Facts - 3. Infrequent and Persistent Changes

Figure: Frequency of changes in capital controls
Stylized Facts - 3. Infrequent and Persistent Changes

Figure: Episodes of Capital Controls
Stylized Facts - 3. Infrequent and Persistent Changes

Figure: Serial Correlation of Capital Controls
Households maximize

$$E_0 \sum_{t=0}^{\infty} \beta^t \frac{c_t^{1-\sigma} - 1}{1 - \sigma}$$

subject to

$$c_t = [a(c_t^T)^{1-1/\zeta} + (1-a)(c_t^N)^{1-1/\zeta}]^{1/(1-1/\zeta)}$$

$$c_t^T + p_t c_t^N + d_t = y_t^T + p_t y_t^N + \frac{d_{t+1}}{1 + r_t}$$

$$d_{t+1} \leq \kappa(y_t^T + p_t y_t^N)$$
Canonical Model - Ramsey Planner

The Planner maximizes:

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta_t \frac{c_t^{1-\sigma} - 1}{1 - \sigma}$$

subject to:

$$c_t^T + d_t = y_t^T + \frac{d_{t+1}}{1 + r_t}$$

$$d_{t+1} \leq \kappa [y_t^T + \frac{1 - a}{a} (\frac{c_t^T}{y_t^N})^{1/\zeta} y_t^N]$$
The government’s and households’ new SBC:

$$\tau_t \frac{d_{t+1}}{1 + r_t} = l_t$$

$$c_t^T + p_t c_t^N + d_t = y_t^T + p_t y_t^N + (1 - \tau_t) \frac{d_{t+1}}{1 + r_t} + l_t$$

The optimal capital control tax is:

$$\tau_t = 1 - \frac{E_t \lambda_{t+1}^R}{E_t \lambda_{t+1}^R(1 - \mu_{t+1}^R \Psi_{t+1})}$$

Where $$\Psi_t = \kappa \frac{1-a}{a} \lambda_t (c_t^N y_t^N) \frac{1}{\zeta} - 1$$

The canonical model does not reproduce stickiness in capital controls.
Augmented Model: An S-s Extension

The recursive formulation for the Ramsey Planner becomes:

$$ V(y^T, r, d, \tau) = \max[V^A(y^T, r, d, \tau), V^{NA}(y^T, r, d, \tau)] $$

Where:

$$ V^A(y^T, r, d, \tau) = [U(c^T(\tau^*)) - K] + \beta E[\max(V^A(y'^T, r', d', \tau'), V^{NA}(y'^T, r', d', \tau'))] $$

$$ V^{NA}(y^T, r, d, \tau) = U(c^T(\tau)) + \beta E[\max(V^A(y'^T, r', d', \tau'), V^{NA}(y'^T, r', d', \tau'))] $$
Calibration

- We calibrate the bivariate endowment process for each country as a VAR(1) and then transform it into a Markov Chain of 16 states.

- Canonical model: We calibrate $\kappa$ to match the frequency of crisis in R&R (2010).

- Augmented (S-s) model: We calibrate $\kappa$ and $K$ to match the frequency of crisis in R&R (2010) and the frequency of changes in $\tau_t$

- The rest of the parameters follow Bianchi (2011).
Results - Share of time (Use)

Figure: Share of time with $\tau > 0$ - Cross-country mean: Canonical Model, S-s Model, Data
Results - Mean value of the tax

**Figure:** Mean value of $\tau$ - Cross-country mean: Canonical Model, S-s Model, Data
Results - Number of changes in the tax

*Figure*: Number of changes in $\tau$ (20-year mean) - Cross-country mean: Canonical Model, S-s Model, Data
Results - Autocorrelation

Figure: Order $t + j$ autocorrelation of $\tau$, $j = \{-2, -1, ..., +2\}$. - Cross-country mean: Canonical Model, S-s Model, Data
Results - Episodes of activation

Figure: Episodes of activation in $\tau$ - Cross-country mean: Canonical Model, S-s Model, Data
Welfare

- For the canonical model:
  \[
  \sum_{t=0}^{\infty} \beta^t u \left[ C_t^{UR} \left(1 + \lambda^{UR} \right) \right] = \sum_{t=0}^{\infty} \beta^t u \left[ C_t^R \right]
  \]

- For the augmented (S-s) model:
  \[
  \sum_{t=0}^{\infty} \beta^t u \left[ C_t^{S-s} \left(1 + \lambda^{S-s} \right) \right] = \sum_{t=0}^{\infty} \beta^t u \left[ C_t^R \right]
  \]

- Cross-country mean: \( \lambda^{UR} = 0.94\% \) & \( \lambda^{S-s} = 0.76\% \)

- We also find that, the higher the value of \( K \) in a given country, the higher the value of \( \lambda^{S-s} \)
Microfundations of Ss costs: A Discussion

While a fully fledged theory is beyond our scope, we believe that the literature offers (at least) 5 causes of S-s costs:

1. Negative effects / Unintended consequences.
2. Credibility and signaling.
3. Political economy.
5. Lack of effectiveness.
We contribute to the debate on capital controls by addressing positive and normative features.

Positive: Using a novel data on the intensive margin of controls and document that they are Sticky.

Normative: An S-s structure allows the theory of pecuniary externalities to better account for the data. Welfare implications are considerable.
THANKS!
We focus on priced-based measures of capital controls.

Two intensive margins on *de joure* cross-border capital controls: URRs (and equivalent), Taxes; both on cross-border flows.


Countries: Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, Peru. China, India, Indonesia, Korea, Malaysia, Philippines, Thailand, Czech Republic, Hungary, Poland, Russia, Turkey, South Africa, and Israel.
Stylized Facts - 4. Asymmetric Cyclicality Across Instruments

Figure: Episodes of Capital Control and the Business Cycle
Stylized Facts - 5. No Complementarity with Macroprudential Tools

**Figure:** Episodes of Capital Control & Broader Macro Prudential Instruments
Stylized Facts - 6. Stickiness is robust to the extensive margin

**Figure:** Share of instruments that are Price-Based and Non Priced-Based
Stylized Facts - 6. Stickiness is robust to the extensive margin

Figure: Annual Episodes of Capital Controls - Extensive Margin Including All Instruments (Priced-Based and Non Priced-Based)
Stylized Facts - 6. Stickiness is robust to the extensive margin

**Figure:** Serial Correlation of Capital Controls - Extensive Margin Including All Instruments (Priced-Based and Non Priced-Based)
Model: Households Unregulated - F.O.C

\[
\begin{align*}
[c_t^T] & : U'(A(c_t^T, c_t^N))A_1(c_t^T, c_t^N) = \lambda_t \\
[c_t^N] & : U'(A(c_t^T, c_t^N))A_2(c_t^T, c_t^N) = p_t \lambda_t \\
[d_{t+1}] & : (\frac{1}{1 + r_t} - \mu_t)\lambda_t = \beta E_t \lambda_{t+1} \\
& \quad \mu_t \geq 0
\end{align*}
\]

and

\[
\mu_t[d_{t+1} - \kappa(y_t^T + p_t y_t^N)] = 0
\]

Combining the first two yields:

\[
p_t = \frac{1 - a}{a} (\frac{c_t^T}{c_t^N})^{1/\zeta}
\]
Model: Households Unregulated - Equilibrium

\[
\left(\frac{1}{1 + r_t} - \mu_t\right) U'(A(c_t^T, y_t^N)) A_1(c_t^T, y_t^N) = \beta E_t U'(A(c_{t+1}^T, y_{t+1}^N)) A_1(c_{t+1}^T, y_{t+1}^N)
\]

\[
c_t^T + d_t = y_t^T + \frac{d_{t+1}}{1 + r_t}
\]

\[
d_{t+1} \leq \kappa [y_t^T + \frac{1 - a}{a} (c_t^T)^{1/\zeta} (y_t^N)^{1-1/\zeta}]
\]

\[
\mu_t \geq 0
\]

\[
\mu_t [\kappa (y_t^T + \frac{1 - a}{a} (c_t^T)^{1/\zeta} (y_t^N)^{1-1/\zeta}) - d_{t+1}] = 0
\]
### Calibration

**Table: Baseline Parameters**

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<tr>
<th>Parameter</th>
<th>Value</th>
<th>Description</th>
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<td>$\beta$</td>
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<td>$a$</td>
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<td>Weight on tradables in CES aggregator</td>
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Table: Calibration Canonical Model ($K = 0$) - Country-by-country

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<thead>
<tr>
<th>Country Name</th>
<th>Currency Crisis 1995-2010</th>
<th>Number of crises every 100 years</th>
<th>Number of changes in $\tau$ every 20 Years</th>
<th>$\kappa$</th>
<th>$K$</th>
<th>Simulated Crisis</th>
<th>Simulated Changes in $\tau$</th>
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Table: Calibration S-s Model - Country-by-country

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<th>Country</th>
<th>Currency Crisis 1995-2010</th>
<th>Number of crisis every 100 years</th>
<th>Number of changes in $\tau$ every 20 Years</th>
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### Welfare Argentina

**Table:** Moments and welfare gains generated by the model for different values of K: One million years (1M Y) and 20 years around a financial crisis (20Y). All variables are in percentage points except for Frequency of Change and first order autocorrelation.

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<th>( \lambda_{FC} ) (1M Y)</th>
<th>( \lambda_{FC} ) (20 Y)</th>
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