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Main contributions

- Propose a novel specification of an occasionally binding constraint.
  - *Endogenous* regime switching between the unconstrained and constrained states
  - Switching probabilities are determined by variables that characterize the constraint.
- Develop a solution method using a higher-order perturbation approach.
- Estimate a small-open RBC model with an occasionally binding borrowing constraint to fit it to Mexico’s business cycles and financial crisis episodes.
  - Conduct nonlinear estimation very efficiently.
Empirical results

- The estimated model can explain three crisis episodes well.
  - Varying duration and severity
  - Without relying on large or skewed shocks
  - Endogenous regime switching amplifies the propagation of shocks.
Do the proposed specification and solution method well approximate the occasionally binding constraint?
Specifications for the borrowing constraint

- **Traditional inequality specification:**
  \[
  \frac{1}{(1 + r_t)} B_t - \phi(1 + r_t)(W_t H_t + P_t V_t) \geq -\kappa q_t K_t
  \]

- **Endogenous regime switching specification:**
  Define
  \[
  B^*_t = \frac{1}{(1 + r_t)} B_t - \phi(1 + r_t)(W_t H_t + P_t V_t) + \kappa q_t K_t
  \]
  In the traditional inequality specification, \( B^*_t = 0 \) means that the constraint is binding.
Endogenous regime switching specification

- Transition probability from the non-binding to the binding regime:

\[
\frac{\exp(-\gamma_0 B_t^*)}{1 + \exp(-\gamma_0 B_t^*)}
\]

- As \( B_t^* \) decreases, the transition probability increases gradually around \( B_t^* = 0 \).
  - As \( \gamma_0 \to \infty \), this specification coincides with the traditional inequality specification.
A possible criticism to the endogenous regime switching specification

- Even if $B_t^* \leq 0$, the economy could still be in the non-binding regime with some probability.
  - It must be binding in the traditional inequality specification.

- However, the authors defend their specification by referring to micro evidence on lending and borrowing behaviors.
  - "... loan covenants are applied smoothing over time ..., triggering renegotiation rather than suddenly cutting off borrowers from funding once activated."
  - "Thus, in practice, collateral constraints bind for a range of leverage ratios rather than at any particular level as in the model with inequality constraints, ..."
Possible solution methods for models with occasionally binding constraints

- Fully nonlinear (global solution) approach
  - Projection methods

- Piecewise linear approach
  - Constraints are imposed but other equilibrium conditions are linearized.
  - OccBin toolbox

- Higher-order perturbation approach
  - Proposed solution method in the paper
  - 2nd-order Taylor-series approximation around the ergodic mean of each variable
Pros and cons for each solution method

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<th>Fully nonlinear</th>
<th>Piecewise linear</th>
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*Can the proposed solution method generate distinct IRFs, depending on whether the constraint is binding or not?*
Specific question and comment

- Section 6.4 analyzes model-simulated crisis dynamics.
- How are the simulated paths constructed?
  - How are the shock series calculated to replicate the crisis episodes of 8 consecutive quarters?
- Several shocks exhibit huge changes as if there were regime switching in the shock processes.
- If the endogenous regime switching worked well, such huge changes in shocks would not be needed.
  - Section 5.2 demonstrates that the estimated model can replicate actual crisis episodes well, without relying on large shocks.
Figure 7: Dynamics of Crisis Episodes

Notes: The figure plots model-simulated dynamics during crisis episodes of eight quarters, five years (20 quarters) before the crisis, and 10 years after the crisis (40 quarters). The economy is in the binding regime from period \( t = 0 \) to period \( t = 7 \) (vertical dashed lines). The plotted dynamics in all panels are medians across all crisis episodes identified, in log-levels, setting \( t = 20 \) = 0.

Suddenly reverts, improving persistently during the crisis phase, after a sharp deterioration right before the beginning of the event, by about six percentage points as a share of output from trough to peak. In line with these dynamics, the autonomous component of expenditure continues to increase during the crisis period, which can be interpreted in terms of the import compression typically associated with sudden stops.

The economy rebounds quickly from these crisis episodes, but only partially, recovering only half of the ground lost during the crisis or about 4 percentage points. After the initial rebound, a combination of persistently adverse external and internal circumstances coalesces to produce a protracted output decline, as we can see in the Mexican data after the Debt crisis, and also in line with empirical evidence on the long-term consequences of financial crises in other emerging markets in (Cerra and Saxena, 2008). The cost of borrowing and...