Sudden Stops, Market Exclusion and Default

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Motivation

- Emerging Market economies (EMs) are characterized by the occurrence of ’sudden stops’ (i.e. large and abrupt reversals in external credit flows)

- Sudden stops are key macroeconomic episodes: they are associated with deep recessions, large consumption adjustment and unemployment spikes
Economic Relevance of Sudden Stops

Figure: Current Account and GDP

EMs Debt Crisis
Includes:
LAC: Argentina, Brazil, Chile, Ecuador, Mexico, Peru, Uruguay
MEA: Ivory Coast, Morocco, South Africa,

EMs Asian/Russian Crisis
Includes:
EA: Indonesia, Korea, Malaysia, Philippines, Thailand
LAC: Argentina, Chile, Colombia, Ecuador, Peru
EU and MEA: Lebanon, Turkey, Russia

Euro Crisis
Includes:
EU: Cyprus, Estonia, Greece, Ireland, Portugal, Slovak Republic, Slovenia, Spain

Note: Current account in % of GDP, GDP peak=100
Main explanations of sudden stops:

1. Optimal response to exogenous shocks:
   - Interest rates (Neumeyer-Perri (05), Uribe-Yue (06))
   - Permanent productivity shocks (Aguiar-Gopinath (07))

2. Borrowing constraints
   - Arellano-Mendoza (02), Mendoza (02,11), Bianchi et al. (12)

3. Loss of access to credit markets
   - Cole-Kehoe (00)
Main Objective and Key Ingredients

Main Objective:

- Build a simple model that:
  - Accounts for the basic stylized facts of sudden stops
    - Sharp current account reversals accompanied by output drops
  - Endogeneizes occasionally-binding borrowing constraints
  - Allows for the possibility of market exclusion

Key ingredients of the model:

- Non-enforceability of debt contracts / Default
- Possibility of multiple debt contracts with multiple lenders
- Non-seniority of debt
Model Setup

- Two periods
- One risk averse borrower
  - Endowment economy
  - Receives $y_0$ and $y_1 \sim F$ with support $[y_L, y_H]$
- $\mathbb{I} = \{1, 2, \ldots\}$ risk neutral lenders
  - Can lend risk-free at the interest rate $1 + r$
- Contracts: $(q_i, d_i)$ offered by borrower to lender $i$
Unique Contracts Setup

- **Unique contracts**: the borrower may not offer additional contracts after one is accepted

- Game tree:

```
(q_1, l_1) R (q_2, l_2) R (q_3, l_3) R (q_4, l_4) R

A

Default decision

A

Default decision

A

Default decision

A

Default decision
```

...
Borrower Payoffs

Let \((q, d)\) be the accepted contract.

\[
U(q, d, z) = u(c_0) + \beta \mathbb{E}(u(c_1))
\]

s.t. \[
\begin{align*}
c_0 &= y_0 + qd \\
c_1 &= \begin{cases} y_1 - d & \text{if } z = 0 \\ y_{def} & \text{if } z = 1 \end{cases}
\end{align*}
\]

If \(A^i = 0\) for all \(i\)

\[
U = u(y_0) + \beta \mathbb{E}(u(y_1))
\]

Optimal default decision: \(z^* = 1 \iff y_1 - d \leq y_{def}\)
Walrasian Demand for Debt

Let $d^W (q)$ be the solution of the problem if borrowers could also choose $d$ subject to a debt limit

$$\max_{d,z} u(c_0) + \beta \mathbb{E} (u(c_1))$$

s.t. $c_0 = y_0 +qd$

$$c_1 = \begin{cases} y_1 - d & \text{if } z = 0 \\ y_{def} & \text{if } z = 1 \end{cases}$$

$$d \leq \bar{d}$$

In an interior solution:

$$u'(y_0 +qd)q = \beta (1 - F(y_{def} + d)) \mathbb{E}[u'(y_1 - d)|z = 0]$$
Lender Decision

Lender will accept the contract if

$$R(q_i, d_i) = \frac{\mathbb{E}[1 - z(d_i)]}{q_i} \geq 1 + r$$
Equilibrium with Unique Contracts

Let $h^i = (q_j, d_j,)_1 \leq j \leq i$ be the history of past contracts that have been rejected

Definition

A Unique Contracting Equilibrium (UCE) is a set of contracts $(q_i(h^{i-1}), d_i(h^{i-1}))$ for $i \in \mathbb{I}$, acceptance rules $A_i(h^{i-1}, (q_i, d_i))$ and default choices $z(h^{i-1}, (q_i, d_i), A_i)$ such that:

1. $(q_i, d_i), z$ is a best response to $A_j$ for all $i, h^{i-1}, j \geq i$

2. $A_i$ is chosen optimally by lenders for all $h^{i-1}$
Proposition
The contract \((q^*, d^*)\) that solves:

\[
\max U(q, d)
\]

subject to

\[
R(q, d) \geq 1 + r
\]

together with optimal default choices \(z^*\) is the unique outcome of a unique contracting equilibrium (UCE)
Equilibrium with Unique Contracts

\[ d^w(q) \]

\[ U(q,d) \]

\[ R(q,d) = 1 + r \]

Inefficient Zone
Multiple Contracts Setup

**Multiple Contracts**: Borrower can still offer contracts after one has been accepted.

![Decision Tree Diagram]

\[(q_1, l_1)\]

\[(q_2, l_2)\]

- A
- R

\[
egin{align*}
\text{\cdots Default decision} \\
\text{\cdots Default decision} \\
\text{\cdots Default decision} \\
\text{\cdots Default decision}
\end{align*}
\]
Multiple Contracting Payoffs

Lender Payoffs
Let $d = \sum_i d_i A^i$ be the total debt acquired by the borrower
Optimal decision

$$A_i = 1 \iff R(q_i, d) = \frac{\mathbb{E}[1 - z(d)]}{q_i} \geq 1 + r$$

Borrower Payoffs
Let $q = \sum_i q_i d_i A_i/d$ be the total debt acquired by the borrower

$$U(q, d) = u(y_0 + qd) + \beta \mathbb{E}(u(\max\{y_1 - d, y_{def}\}))$$
Equilibrium with Multiple Contracts

Let $h^i = (q_j, d_j, A^j)_{1 \leq j \leq i}$ be the history of past contracts and acceptances/rejections.

**Definition**

A Multiple Contracting Equilibrium (MCE) is a set of contracts $(q_i(h^{i-1}), d_i(h^{i-1}))$ for $i \in \mathbb{I}$, acceptance rules $A_i(h^{i-1}, (q_i, d_i))$ and default choices $z(h^{i-1}, (q_i, d_i), A_i)$ such that:

1. $(q_i, d_i), z$ is a best response to $A_j$ for all $i, h^{i-1}, j \geq i$

2. $A_i$ is chosen optimally by lenders for all $h^{i-1}$
MC: Negative Externalities on Lenders

\[ d^w(q) \]

\[ R(q, d) = 1 + r \]
Equilibrium with Multiple Contracting

Proposition
Let \((q^*, d^*)\) be the contract characterized by:

1. \(d^*\) is the lowest \(d\) that solves:

\[
\max_d U(d; q^*) \quad \text{s.t.} \quad d \leq \bar{d}
\]

2. \(q^* > 0\) is such that

\[
R(q^*, d^*) = 1 + r
\]

Then \((q^*, d^*)\) together with optimal default choice \(z^*\) is the unique outcome of a multiple contracting equilibrium (MCE).
Equilibrium with Multiple Contracting

\[ d^W(q) \]

\[ U^{UCE} \]
\[ U^{MCE} \]

\[ R(q,d) = 1 + r \]
Sudden Stops in the Model

Comparative statics approach:

- Negative shocks to output $y_0$
- Consumption reaction will depend on which region the MCE is
- Another possible shock to consider: increases in the required interest rate of lenders $1 + r$
Normal Times: Consumption Smoothing

\[ qd \]

\[ d_0^w (q) \rightarrow y_0 \rightarrow d_1^w (q) \]

\[ q_0 d_0 \rightarrow MCE_0 \]

\[ q_1 d_1 \rightarrow MCE_1 \]

\[ R(q, d) = 1 + r \]

Inefficient Zone

\[ d_0 \rightarrow d_1 \]
Sudden Stops

\[ d_0^W(q) \]

\[ d_1^W(q) \]

\[ R(q, d) = 1 + r \]

Inefficient Zone
Findings

Multiple contracting may lead to equilibrium in two regions

- **Normal Region:**
  - Debt is used to smooth income shocks
  - Borrowers do not attain their borrowing limit

- **Inefficient Region (Sudden Stop Region):**
  - Decreases in output lead to larger decreases in consumption
  - Borrowers attain their borrowing limit
  - Big enough shocks can precipitate loss of access to credit markets
Roadmap

• Study the quantitative features of Sudden Stops and compare them to normal times
  ▶ Excess volatility of consumption
  ▶ Other business cycle properties

• Extend the model to infinite horizon and make it quantitative to match business cycle data