Liquidity and International Trade

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Outline

Motivation

Closed-economy model

Liquid Assets and International Trade

Financial Development and Trade

Liquidity Crises
Private assets (e.g., equity, commercial paper, and corporate bonds) provide **liquidity services** to the financial system: they can be used as media of exchange or as collateral in financial transactions

- The money role of private assets expands the size of the financial sector: allows more and larger financial transactions
- But may also affect real economic activity in sectors where the assets are generated. **Why?**
- Because their values include a liquidity premium that reflects their degree of *moneyness* in financial-sector activities
- These altered firm values can then affect the international allocation of economic activity
But what is the *market for liquidity*?

- **Demand:** The financial system relies on safe and liquid assets to perform its activities
  - Financial transactions are secured with collateral, with liquid assets taking the collateral role: Financiers demand liquid assets because they serve as “money”
  - According to ISDA (2014), 84 percent of all transactions in OTC derivatives involve a collateral agreement
- **Supply:** Government bonds and private assets
  - According to the IMF (2012), the composition of the world supply of safe assets ($74.4 trillion) in 2011 was: sovereign debt (56%), asset-backed and mortgage-backed securities (17%), corporate debt (11%), covered bonds (4%), gold (11%)

The interaction between demand and supply determines the equilibrium interest rate and the equilibrium amount of liquidity
This paper

**Goal:** To propose a tractable framework to explore the links between the market for liquid assets and the international allocation of economic activity

**Two basic ingredients:**

- **Market for liquidity:** Over-the-counter (OTC) market for financial transactions determines demand for liquidity, while supply of liquidity has public and private sources (Rocheteau and Rodriguez-Lopez, 2014)

- **Melitz’s model:** Heterogeneous firms in a monopolistically competitive industry—claims on Melitz firms’ profits provide the supply of private liquidity
Questions we address:

- What is the impact of the liquidity market on the size and aggregate productivity of the sector that generates liquid assets?
- How do changes in public liquidity (e.g., government bonds) affect the sector providing private liquidity?
- How do cross-country differences in asset liquidity affect the international allocation of economic activity?
- What are the effects of trade liberalization in the presence of liquidity differences across countries?
- How does a liquidity crisis affect interest rates and the allocation of economic activity?
Preview of the Results

- In a closed economy, the market for liquid assets causes an expansion (in size and productivity) of the sector that supplies liquid assets.
- There is a crowding out of private liquidity by public liquidity—empirical support in Krishnamurthy and Vissing-Jorgensen, 2015.
- Cross-country differences in financial development have dramatic effects on the international allocation of economic activity (in favor the most financially developed country).
- Trade liberalization magnifies the gaps between the countries when there are asymmetries in financial development.
Related Literature

- Liquidity is priced—the most liquid assets have higher prices and lower rates of return
- Relationship between public and private liquidity
  - Supply of U.S. Treasuries affects interest rate spreads: Krishnamurthy and Vissing-Jorgensen (2012)
Related Literature II


- Capital flows from emerging countries to rich countries (Lucas paradox) due to differences in financial development: Caballero, Farhi, and Gourinchas (2008), Angeletos and Panousi (2011), Mendoza, Quadrini, and Rios-Rull (2009)
Outline

Motivation

Closed-economy model
  Setup
  Equilibrium

Liquid Assets and International Trade

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Liquidity Crises
Environment

- Time is continuous
- Three categories of agents:
  - A unit measure of households
  - A unit measure of financiers
  - An endogenous measure of heterogeneous (in productivity) firms
- Three types of goods:
  - A *homogeneous good* (the numéraire), produced and consumed under perfect competition by households and financiers
  - A *heterogeneous good* that is produced in many varieties by heterogenous firms and that is consumed by households only
  - A *financial service* that is produced and consumed by financiers only
Households

The representative household’s lifetime utility is $\int_0^\infty e^{-\rho t} C(t) dt$, where $\rho > 0$ is the discount rate and

$$C(t) \equiv H(t)^{1-\eta} Q(t)^\eta,$$

- $H(t)$: homogeneous good consumption
- $Q(t) = \left( \int_{\omega \in \Omega} q^c(\omega, t) \frac{\sigma-1}{\sigma} d\omega \right)^{\frac{\sigma}{\sigma-1}}$ is the CES consumption aggregator of differentiated-good varieties
- $\eta \in (0, 1)$
- $\sigma > 1$: elasticity of substitution between varieties
Financiers exchange financial services in an OTC market.

Lifetime expected utility of a financier is

\[
E \left\{ \sum_{n=1}^{\infty} e^{-\rho T_n} \{ f(y(T_n)) - x(T_n) \} + \int_{0}^{\infty} e^{-\rho t} H(t) dt \right\},
\]

\{ T_n \} is a Poisson process with arrival rate \( \nu > 0 \).

\{ T_n \} indicates the financier’s trading opportunities.

Role as buyer or seller of services is random.

Utility of buyer: \( f(y) \), where \( f \) is strictly concave.

Disutility of seller: \( x \).

With lack of commitment, financiers will rely on liquid assets to secure their transactions in the OTC market.
Production of differentiated-good varieties

- Labor is the only factor of production
- Melitz-type heterogeneity in productivity: After paying a sunk entry cost of $f_E$, a firm realizes its productivity $\varphi$ from distribution $g(\varphi)$
- Production function of a firm with productivity $\varphi$:
  \[
  q(\varphi, t) = \Phi \varphi L(t)
  \]
- $\Phi$ is an aggregated productivity factor and $L(t)$ is labor
- $f$: fixed cost of operation
- $\delta > 0$: rate of arrival of death shock
- There exists a cutoff productivity level, $\hat{\varphi}(t)$, such that $\pi[\hat{\varphi}(t), t] = f$ (Melitz’s ZCP condition)
Market for liquidity

- In the absence of perfect commitment, financiers demand liquidity to secure their debt obligations.
- Focus on steady-state equilibria: the cutoff productivity level, the mass of firms, and the real interest rate are constant over time.
- Supply of liquidity arises from:
  1. Claims on differentiated-good firms (private liquidity).
  2. A supply, $B$, of government bonds (public liquidity).
Supply of private liquidity

- Financiers fund the entry of each firm in exchange for claims on the firm’s profits
- All claims on producing firms’ profits are part of the liquidity of the economy and yield a rate of return \( r \)
- Aggregate capitalization of firms \( \equiv \) private liquidity available to financiers
- Value of a firm with productivity \( \varphi \):

\[
V_F(\varphi) = \frac{\pi(\varphi) - f}{r + \delta}
\]

- Average value of producing firms:

\[
\bar{V}_F = \int_{\hat{\varphi}}^{\infty} V_F(\varphi)g(\varphi|\varphi \geq \hat{\varphi})d\varphi = \frac{f}{r + \delta} \left[ \left( \frac{\bar{\varphi}}{\hat{\varphi}} \right)^{\sigma^{-1}} - 1 \right]
\]
Supply of private liquidity

- Pre-entry expected value of a firm:

\[ V_E = \int_{\hat{\varphi}}^{\infty} V_F(\varphi)g(\varphi)d\varphi \]

- Free-entry condition \((V_E = f_E)\):

\[
\frac{f[1 - G(\hat{\varphi})]}{r + \delta} \left[ \left( \frac{\bar{\varphi}}{\hat{\varphi}} \right)^{\sigma-1} - 1 \right] = f_E
\]

- For a given \(r\), the FEC determines a unique \(\hat{\varphi}\)

- \(\frac{d\hat{\varphi}}{dr} < 0\): an increase in \(r\) negatively affects the value of firms and hence the value of entry \(\rightarrow \hat{\varphi}\) declines to restore the free-entry condition
Supply of liquidity

- Private provision of liquidity ($A = N\hat{V}_F$):

$$A(r) = \frac{\eta f_E}{\sigma \left\{ f[1 - G[\hat{\phi}(r)]] + f_E(r + \delta) \right\}},$$

- $dA(r)/dr < 0$: as the real interest rate increases, the private supply of liquidity shrinks

- Aggregate liquidity supply of the economy:

$$L_s(r) \equiv A(r) + B$$
Supply of liquidity

\[ L_s(r) \equiv A(r) + B \]

Figure 1: Rates of return
Demand for liquidity: Financiers’ OTC bargaining

- The buyer sets the terms of the contract, \((y, \alpha)\), in order to maximize \(f(y) - \alpha\)
  - \(y\): amount of financial services
  - \(\alpha\): transfer of liquid assets to the seller

- Participation constraint for the seller is \(\alpha \geq y\)

- Feasibility condition: \(\alpha \in [0, a^b]\), where \(a^b\) is the amount of assets held by the buyer

- Solution: \(y = \alpha = \hat{y}\), where \(f'(\hat{y}) = 1\), if \(a^b \geq \hat{y}\); otherwise, \(y = \alpha = a^b\)

But, will financiers hold enough liquid assets to be able to reach \(\hat{y}\) in their OTC trades?

If liquidity is costly to hold \((r < \rho)\), the answer is NO!
Demand for liquidity

- From optimal control problem and bargaining outcome:

\[ f'(a) - 1 = \frac{\rho - r}{\theta} \]

- Financier accumulates assets up to the point where the marginal surplus of an OTC trade is equal to the holding cost of the asset, where \( \theta = \nu/2 \)

- Liquidity demand:

\[ L_D(r) = f'^{-1} \left( 1 + \frac{\rho - r}{\theta} \right) \text{ if } r < \rho \]
Demand for liquidity

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Liquidity demand:

\[ L_D(r) = f'^{-1} \left( 1 + \frac{\rho - r}{\theta} \right) \quad \text{if} \quad r < \rho \]
Demand for liquidity

\[ \rho - \delta \equiv L_D(r) \]

Figure 1: Rates of return
Equilibrium in the market for liquidity

\[ \rho - \delta_{LD,Ls}\]

\[ LD(r), Ls(r) \equiv A(r) + B \]

\[ Ae Le A(\rho) \]

\[ r^e \]

\[ -\delta \]

\[ A(\rho), Ae, Le, \hat{y}, L_D, L_s \]
Description of the equilibrium

- $A(\rho)$: “fundamental-value” capitalization
- Due to private assets’ liquidity services: $A^e > A(\rho)$
- $\hat{\phi}(r^e) > \hat{\phi}(\rho)$: lower $P$ and higher $\bar{\phi}$ with liquidity services
- Public liquidity *crowds out* private liquidity
Crowding-out effect of public liquidity

\[ \rho - \delta LD,Ls LD(r) = Ls(r) \equiv A(r) + B \]
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Liquidity Crises
Liquid Assets and International Trade

How do cross-country differences in the ability to generate liquid assets affect the international allocation of economic activity?

Enrich the previous framework to include:

▶ Two countries, Home and Foreign, who trade homogeneous and differentiated goods
▶ International OTC financial market in which Home and Foreign financiers trade financial services
▶ Four categories of assets: Home and Foreign private assets, and Home and Foreign government bonds
▶ Heterogeneity in liquidity properties across assets within and between countries
Standard two-country Melitz’s structure

- Producers in the differentiated-good sector are heterogeneous in productivity
- Each Home and Foreign firm draws its productivity from the same distribution, $G(\varphi)$
- There is an iceberg cost of exporting, $\tau$
- Decision to produce for domestic and export markets depends on ability to cover fixed costs
- Model is summarized by cutoff productivity levels: $\hat{\varphi}_D, \hat{\varphi}_X, \hat{\varphi}^*_D, \hat{\varphi}^*_X$
The International Market for Liquid Assets

Liquidity differences across assets between and within countries:

1. Home assets are acceptable as collateral in a larger fraction of OTC matches than Foreign assets
2. For a country’s assets, public liquidity is acceptable in a larger fraction of matches than private liquidity
3. There is heterogeneity in pledgeability across private assets: firm-level productivity is positively correlated with collateral fitness
Acceptability of assets in OTC matches (1. and 2.)

Figure 1: Rates of return
Heterogeneity in *pledgeability* across private assets (3.)

- Each producing Home firm (with $\varphi \geq \hat{\varphi}_D$) has a loan-to-value ratio, $\lambda(\varphi) \in [0, 1)$.
- $\lambda(\varphi)$: fraction of the asset value that can be pledged as collateral in an OTC transaction.
- $\lambda'(\varphi) > 0$ for all $\varphi \geq \hat{\varphi}_D$, $\lambda(\hat{\varphi}_D) = 0$, $\lambda(\infty) \rightarrow 1$, and $d\lambda(\varphi)/d\hat{\varphi}_D < 0$.
- Firm-level productivity is positively correlated with collateral fitness.
Heterogeneity in *pledgeability* across private assets (3.)

Useful functional form:

\[ \lambda(\varphi) = 1 - \left( \frac{\hat{\varphi}_D}{\varphi} \right)^\beta \quad \text{and} \quad \lambda^*(\varphi) = 1 - \left( \frac{\hat{\varphi}_D^*}{\varphi} \right)^{\beta^*} \]

- \( \varphi \geq \varphi_D \) for Home firms, \( \varphi \geq \varphi_D^* \) for Foreign firms
- \( \beta > 0 \) and \( \beta^* > 0 \)
- If \( \beta \to \infty \), then \( \lambda(\varphi) \to 1 \) for all \( \varphi > \hat{\varphi}_D \)
- \( d\lambda(\varphi)/d\beta > 0 \) for all \( \varphi > \hat{\varphi}_D \)
- A decline in \( \beta \) resembles a liquidity crisis affecting loan-to-value ratios of Home private assets
Certification costs

For a private asset to be part of the available liquidity to financiers in OTC transactions, the asset must be certified

- If certified, rating agency makes public the asset’s underlying productivity
- Certification sunk costs: $f_A$ and $f_A^*$
- Two more cutoff productivity levels, $\hat{\phi}_A$ and $\hat{\phi}_A^*$, that separate assets into “non-certified” and “certified” categories
- Non-certified assets: $[\hat{\phi}_D, \hat{\phi}_A)$, illiquid, and pay the illiquid rate of return, $\rho$
- Certified assets: $[\hat{\phi}_A, \infty)$, liquid, and pay a return below $\rho$
Demand for multiple liquid assets

Financier’s optimal portfolio solves...

Foreign private assets:
\[
\frac{\rho - r^*(\varphi)}{\theta} = \mu_p^\ast \lambda^\ast(\varphi) \left[ f'(y_p^\ast) - 1 \right]
\]

Foreign government bonds:
\[
\frac{\rho - r_g^*}{\theta} = \mu_p^* \left[ f'(y_p^\ast) - 1 \right] + \mu_g^* \left[ f'(y_g^\ast) - 1 \right]
\]

Home private assets:
\[
\frac{\rho - r(\varphi)}{\theta} = \mu_p^\ast \lambda(\varphi) \left[ f'(y_p^\ast) - 1 \right] + \mu_g^\ast \lambda(\varphi) \left[ f'(y_g^\ast) - 1 \right] + \mu_p \lambda(\varphi) \left[ f'(y_p) - 1 \right]
\]

Home government bonds:
\[
\frac{\rho - r_g}{\theta} = \mu_p^* \left[ f'(y_p^\ast) - 1 \right] + \mu_g^* \left[ f'(y_g^\ast) - 1 \right] + \mu_p \left[ f'(y_p) - 1 \right] + \mu_g \left[ f'(y_g) - 1 \right]
\]

Holding cost of an asset must be equal to the expected marginal surplus from holding an additional unit of that asset
Demand for multiple liquid assets

Financier’s optimal portfolio solves...

Foreign private assets:

\[
\frac{\rho - r^*(\varphi)}{\theta} = \mu_p^* \lambda^*(\varphi) \left[ f'(y_p^*) - 1 \right]
\]

Foreign government bonds:

\[
\frac{\rho - r_g^*}{\theta} = \mu_p^* \left[ f'(y_p^*) - 1 \right] + \mu_g^* \left[ f'(y_g^*) - 1 \right]
\]

Home private assets:

\[
\frac{\rho - r(\varphi)}{\theta} = \mu_p^* \lambda(\varphi) \left[ f'(y_p^*) - 1 \right] + \mu_g^* \lambda(\varphi) \left[ f'(y_g^*) - 1 \right] + \mu_p \lambda(\varphi) \left[ f'(y_p) - 1 \right]
\]

Home government bonds:

\[
\frac{\rho - r_g}{\theta} = \mu_p^* \left[ f'(y_p^*) - 1 \right] + \mu_g^* \left[ f'(y_g^*) - 1 \right] + \mu_p \left[ f'(y_p) - 1 \right] + \mu_g \left[ f'(y_g) - 1 \right]
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Demand for multiple liquid assets

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\[
\frac{\rho - r^g}{\theta} = \mu_p^* \left[ f'(y_p^*) - 1 \right] + \mu_g^* \left[ f'(y_g^*) - 1 \right]
\]

Home private assets:
\[
\frac{\rho - r(\varphi)}{\theta} = \mu_p^* \lambda(\varphi) \left[ f'(y_p^*) - 1 \right] + \mu_g^* \lambda(\varphi) \left[ f'(y_g^*) - 1 \right] + \mu_p \lambda(\varphi) \left[ f'(y_p) - 1 \right]
\]

Home government bonds:
\[
\frac{\rho - r^g}{\theta} = \mu_p^* \left[ f'(y_p^*) - 1 \right] + \mu_g^* \left[ f'(y_g^*) - 1 \right] + \mu_p \left[ f'(y_p) - 1 \right] + \mu_g \left[ f'(y_g) - 1 \right]
\]

Holding cost of an asset must be equal to the expected marginal surplus from holding an additional unit of that asset
Quantity of financial services traded in each OTC match:

\[
\begin{align*}
y_p^* &= \min \{ A + A^* + B + B^*, \hat{y} \}, \\
y_g^* &= \min \{ A + B + B^*, \hat{y} \}, \\
y_p &= \min \{ A + B, \hat{y} \}, \\
y_g &= \min \{ B, \hat{y} \}.
\end{align*}
\]

Example: Liquidity is scarce in matches that only accept Home assets, but is abundant in matches that also accept Foreign assets

\[
\begin{align*}
&\quad A + B < \hat{y} \text{ but } A + B + B^* > \hat{y} \\
&\quad f'(y_p^*) - 1 = f'(y_g^*) - 1 = 0, \text{ but } f'(y_g) - 1 > f'(y_p) - 1 > 0 \\
&\quad \text{Therefore, } r_g^* = r^*(\varphi) = \rho, \text{ while Home liquid assets give returns } r_g < r(\varphi) < \rho
\end{align*}
\]
Liquidity structure of interest rates

Foreign private assets:
\[ r^*(\varphi) = \rho - \mu_p^* \theta \lambda^*(\varphi) \left[ f'(A + A^* + B + B^*) - 1 \right]^+ \]

Foreign government bonds:
\[ r_g^* = \rho - \mu_p^* \theta \left[ f'(A + A^* + B + B^*) - 1 \right]^+ - \mu_g^* \theta \left[ f'(A + B + B^*) - 1 \right]^+ \]

Home private assets:
\[ r(\varphi) = \rho - \mu_p^* \theta \lambda(\varphi) \left[ f'(A + A^* + B + B^*) - 1 \right]^+ - \mu_g^* \theta \lambda(\varphi) \left[ f'(A + B + B^*) - 1 \right]^+ \]
\[ - \mu_p \theta \lambda(\varphi) \left[ f'(A + B) - 1 \right]^+ \]

Home government bonds:
\[ r_g = \rho - \mu_p^* \theta \left[ f'(A + A^* + B + B^*) - 1 \right]^+ - \mu_g^* \theta \left[ f'(A + B + B^*) - 1 \right]^+ \]
\[ - \mu_p \theta \left[ f'(A + B) - 1 \right]^+ - \mu_g \theta \left[ f'(B) - 1 \right]^+ \]

where \([x]^+ = \max\{x, 0\}\)
Liquidity structure of interest rates (scarce liquidity in all OTC matches)
Supply of Private Liquid Assets ($A$ and $A^*$)

- Financiers fund the entry of differentiated-good firms in both countries in exchange for claims on firms’ profits
- Total market capitalization of firms is no longer equivalent to the amount of private liquidity. Why?
- Because of loan-to-value ratios and certification costs

\[
A = \mathcal{N}_A \int_{\hat{\varphi}_A}^{\infty} \lambda(\varphi) V_F(\varphi) g(\varphi | \varphi \geq \hat{\varphi}_A) d\varphi,
\]

\[
A^* = \mathcal{N}^*_A \int_{\hat{\varphi}^*_A}^{\infty} \lambda^*(\varphi) V^*_F(\varphi) g(\varphi | \varphi \geq \hat{\varphi}^*_A) d\varphi
\]

- $\mathcal{N}_A$ and $\mathcal{N}^*_A$: Measures of certified firms at Home and Foreign
Steady-state equilibrium solves for:

- $\hat{\varphi}_D, \hat{\varphi}_X, \hat{\varphi}_D^*, \hat{\varphi}_X^*$: Tradability cutoff productivity levels
- $\hat{\varphi}_A, \hat{\varphi}_A^*$: Cutoff levels that separate certified and non-certified firms
- $A, A^*$: Amounts of Home and Foreign private liquidity
- $y_p^*, y_g^*, y_p, y_g$: Amount of financial services traded in each type of match
- $r^*(\varphi), r_g^*, r(\varphi), r_g$: Liquidity structure of interest rates
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Liquidity Crises
Financial development

A country’s ability to generate assets that are acceptable as collateral or means of payment in financial transactions

Parameters of financial development in this model:

- Acceptability parameters $\mu_p^*$, $\mu_g^*$, $\mu_p$, and $\mu_g$
- Loan-to-value ratio parameters $\beta$ and $\beta^*$
- Asset certification costs $f_A$ and $f_A^*$

Now we can analyze the effects that liquidity differences across countries can have on the international allocation of economic activity
Focus on a very simple case:

- Home and Foreign have identical production structures
- Their differences will only span from the values of $\mu_p^*$ and $\mu_p$
- Assume:
  1. $f_A = f_A^* = 0$, so that $\hat{\varphi}_D = \hat{\varphi}_A$ and $\hat{\varphi}_D^* = \hat{\varphi}_A^*$
  2. $\beta = \beta^* \rightarrow \infty$: loan-to-value ratio of every producing firm is 1
  3. $\mu_g^* = \mu_g = 0$
- All Home assets (public and private) are acceptable in all OTC matches ($\mu_p^* + \mu_p = 1$)
- All Foreign assets are acceptable in a fraction $\mu_p^*$ of matches
- Same interest rate for all Home assets, $r$, and same interest rate for all Foreign assets, $r^*$
Acceptability of Home and Foreign Assets with only $\mu_p$ and $\mu_p^*$

Figure 1: Rates of return

<table>
<thead>
<tr>
<th>Type of asset</th>
<th>Fraction of OTC matches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home bonds and private assets</td>
<td>$0$</td>
</tr>
<tr>
<td>Foreign bonds and private assets</td>
<td>$\mu_p^*$</td>
</tr>
<tr>
<td></td>
<td>$\mu_p$</td>
</tr>
</tbody>
</table>

$\mu_p$ and $\mu_p^*$
The polar cases

- If $\mu_p = 0$ (or equivalently $\mu_p^* = 1$) all Home and Foreign assets are acceptable in all OTC matches and thus there are no liquidity differences across countries.

- If $\mu_p = 1$ (so that $\mu_p^* = 0$), Home assets are acceptable in all OTC matches, but Foreign assets are totally illiquid (they are never accepted in OTC transactions).

- As $\mu_p$ rises from 0 to 1 (and $\mu_p^*$ declines), the relative liquidity differences between Home and Foreign assets become larger in favor of Home.
We study changes in $\mu_p$ under three scenarios:

1. “Illiquid Assets”: no liquidity services, or abundant liquidity so that OTC matches always reach $\hat{y}$

2. “Autarky”: scarce liquidity and no international trade in differentiated goods ($\tau \to \infty$)

3. “Trade”: scarce liquidity and $\tau$ sufficiently small
Financial development and allocation of economic activity

\[ \mu_p = 1 - \mu_p^* \]

Illicit Assets

Equally liquid Home liquid, Foreign liquid

Figure 3: Rates of return

Autarky

Trade

Equally liquid Home liquid, Foreign illiquid

ρ

Figure 4: Rates of return
Results

▶ In the “equally liquid” case ($\mu_p = 0$), liquidity role of private assets expands the market capitalization of firms in both countries whether there is trade or not

▶ In autarky, $A^*$ declines towards its fundamental value as Foreign assets become less liquid, while $A$ increases

▶ With trade, the differentiated-good sector in Foreign gets wiped out by Home firms as $\mu_p$ rises

▶ Further liberalization ends up totally depleting the Foreign production sector

▶ Disadvantaged country’s best response to protect the differentiated-good industry: no international trade

Cross-country liquidity differences can have dramatic consequences on the international allocation of economic activity
Cross-country liquidity differences and interest rates

\[ \mu_p = 1 - \mu_{p^*} \]

Illiquid Assets

Autarky

Trade

Equally liquid Home liquid, Foreign illiquid

Figure 3: Rates of return

Figure 4: Rates of return

\( \rho \)
Cross-country liquidity differences and productivity

Figure 1: Aggregate productivity

\[ \mu_p = 1 - \mu_{p^*} \]

Illiquid Assets (Autarky)

\[ \bar{\varphi}_D, \bar{\varphi}_D^* \]

Autarky

Trade

Equally liquid

\( \mu_p = 1 - \mu_{p^*} \)

Home liquid, Foreign illiquid
Cross-country liquidity differences and aggregate prices

\[ \mu_p = 1 - \mu_{p^*} \]

Illiquid Assets

\[ P, P^* \]

Autarky

Trade

Equally liquid

Home liquid, Foreign illiquid

Figure 1: Aggregate prices
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Liquidity Crises
Liquidity Crises

- Financial crisis of 2007-2008 had its origins on bad private assets that were widely held by financiers
- As the financial system realized its exposure to these bad assets, many other private assets were downgraded by rating agencies

**Exercise:** Liquidity crisis that resembles the one of 2007-2008

- Home is the source of the liquidity shock on private assets, but also issues the most liquid asset (Home government bonds)
Alternatives to study this type of crisis:

1. A decline in $\mu_p$ while keeping $\mu_p^*$ and $\mu_g^*$ constant: financial system’s general aversion toward Home private assets

2. A decline in the parameter $\beta$ of the loan-to-value function, $\lambda(\varphi) = 1 - (\hat{\varphi}_D/\varphi)^\beta$: similar to rating downgrades for Home private assets

   ▶ According to the IMF (2012), 63 percent of AAA-rated mortgage-backed securities issued from 2005 to 2007 had been downgraded by 2009
Liquidity crisis with decline in $\mu_p$

Figure 1: Rates of return $r(\varphi), r_g$
Liquidity crisis with decline in $\mu_p$
Results for decline in $\mu_p$

- The return on Home government bonds declines despite Home being the origin of the crisis.
- Interest rates increase for most Home private assets, with the exception of some low productivity assets that become liquid after the decline in $\hat{\phi}_A$.
- Why do the Home cutoffs decline? There is such a strong negative effect on the aggregate amount of Home private liquidity, that financiers start to use some lower-quality assets to compensate.
- Negative real effects in Home that are very similar to those observed for Foreign after an increase in $\mu_p$.
- Most Foreign assets experience higher liquidity premiums (lower rates of return).
Liquidity crisis with decline in $\beta$

Figure 1: Rates of return
Liquidity crisis with decline in $\beta$

Figure 1: Rates of return $r^*(\varphi), r_g^*$
After an adverse adjustment in Home loan-to-value ratios (decline in $\beta$)

- $\hat{\varphi}_D$ and $\hat{\varphi}_A$ increase, which causes
  - An increase in the average quality of Home collateral used in OTC transactions
  - An increase in Home aggregate productivity

- **Flight-to-quality**: not only toward Home government bonds, but also toward high-productivity Home firms

- Although the amount of Home private liquidity, $A$, declines, the total capitalization of Home firms may even increase
Final Remarks

- This paper proposes a tractable theoretical framework to study the links between the market for liquidity and the international allocation of economic activity.
- We show that the use of private assets as part of the liquidity of the financial system can have strong consequences on the international allocation of economic activity.
- In a closed economy, there is a positive spillover effect of a market for liquid assets on real economic activity.
- In an open economy, the effects of an international market for liquid assets can generate an allocation of economic activity that substantially damages the country with less ability to generate liquid assets.