Interest Arbitrage under Capital Controls: Evidence from Reported Entrepôt Trades

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Capital Controls

• Capital Controls or Not?
  ▶ Washington Consensus: No.
  ▶ After Asian Financial Crisis: Really?

• Openness and Stability
  ▶ Macro-prudential Regulation v.s. Capital Controls

• Capital controls may be increasingly difficult and/or costly for outward-oriented economies like China.
Questions

• Effectiveness of Capital Controls
  ▶ Capital controls segment currency markets, creating arbitrage opportunities.

• Linkage between Current Accounts & Capital Accounts
  ▶ Do international trades provide means to circumvent capital controls?

• Trade Finance
  ▶ Does bank-intermediation in international trades play a role in capital account liberation?
This Paper

• uses a novel administrative data set;

• documents arbitrage opportunities in onshore-offshore RMB markets;

• demonstrates how bank-intermediation of trades facilitates the interest arbitrages; and

• provides evidence that firms bypass capital controls through supposed “entrepôt trades” to arbitrage.
Related Literature

• Merit of Capital Controls
  ▶ Motiel & Reinhart (1999); Kaplan & Rodrik (2002); Glick et al. (2006); Frasad & Rajan (2008); Jinjarak et al. (2013); Forbes et al. (2015); Mitchener & Wandschneider (2015); Korinek & Sandri (2016)

• International Firms’ Evasion of Capital Controls, Tariff, and Income Tax
  ▶ Fisman & Wei (2004); Auguste et al. (2006); Fisman et al. (2008); Davies et al. (forthcoming)

• RMB Internationalization & Global Monetary System
  ▶ Eichengreen & Flandreau (2012); Chițu et al. (2014); Cheung & Rime (2014); Funke et al. (2015); IMF (2015); Prasad (2016)

• Trade Finance
  ▶ Schmidt-Eisenlohr (2013)
Background

• China’s Currency Policy
  ▶ Exchange rate policy
    • Fixed to float within the trading band
  ▶ RMB internationalization
    • Cross-border Settlements of Trades in RMB
    • Capital Accounts
    • Financial Infrastructure

• The Role of Hong Kong
  ▶ The main RMB offshore market
  ▶ Intermediates a large portion of China’s trades
RMB Interbank Offered Rates (3-Month)

Shanghai Interbank Offered Rate
Shanghai-HK Rate Difference
Hong Kong Interbank Offered Rate

CNH HIBOR Fixing Launched


Hong Kong
Shanghai

%
Cross-border Trade Settlements in RMB

- **July 2009**
  - Guangzhou, Shenzhen, Zhuhai, Dongguan, and Shanghai
  - Settlements with Hong Kong, Macau, and ASEAN
  - Available to selected firms

- **June 2010**
  - Extended to 20 provinces, including the province of our dataset
  - Settlements with all economies
  - Qualified firms

- **August 2011**
  - Nationwide
  - Any firms
Entrepôt Trades

- Re-exporting imports with little or no processing

- Entrepôt ports:
  - Hong Kong, Singapore, 17th century Amsterdam

- Ideal for bypassing capital controls to arbitrage:
  - Do not need to clear the Chinese custom
  - Both inflows and outflows
Letter of Credit (L/C)

- L/C is the most popular means of trade finance in China and India.

- Mainly dollar-denominated L/C before RMB cross-border settlement allowed.

- RMB L/C
  - No foreign debt management
  - Longer maturity: 360 days
Interest Arbitrage under Capital Controls through Entrepôt Trades

Arbitrageur

Onshore

Offshore
Interest Arbitrage under Capital Controls through Entrepôt Trades

- Arbitrageur deposits $K$ for L/C
- Onshore Bank

1. Deposit $K$ for L/C

Onshore

<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td>-------------------------</td>
</tr>
</tbody>
</table>

Offshore
Interest Arbitrage under Capital Controls through Entrepôt Trades

1. Deposit $K$ for L/C

2. Issue L/C

Arbitrageur

Onshore Bank

Onshore

Offshore

Offshore Bank
Interest Arbitrage under Capital Controls through Entrepôt Trades

1. Deposit $K$ for L/C

2. Issue L/C

3. Deliver Documents

Discount L/C for $K/(1 + r_h + d)$
Interest Arbitrage under Capital Controls through Entrepôt Trades

1. Arbitrageur Deposit $K$ for L/C
2. Offshore Bank Issue L/C
3. Offshore Bank Deliver Documents
4. Return Inflow $K/(1 + r_h + d)$

Buyer

Seller

Onshore

Offshore

Discount L/C for $K/(1 + r_h + d)$
Interest Arbitrage under Capital Controls through Entrepôt Trades

1. Arbitrageur deposits K for L/C.
2. Offshore Bank issues L/C.
4. Return inflow: K/(1 + r_h + d).

Onshore

Buyer

Discount L/C for K/(1 + r_h + d)

Forward Outflow via L/C

Offshore

Offshore Bank

Deliver Documents
Data Description

• Transaction level trade settlements in RMB
  ▶ Both inflows & outflows
  ▶ A large well-off coastal province
  ▶ 2011 – 2016
  ▶ Value, firm ID, date, means of settlement etc.

• Onshore and offshore interest and exchange rates of RMB
  ▶ Bloomberg
  ▶ Hong Kong Treasury Markets Association
## Shares of RMB Inflows by Settlement Means

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount (billion ¥)</th>
<th>Letter of Credit</th>
<th>Wire Transfer</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>67.2</td>
<td>0.003</td>
<td>0.961</td>
<td>0.035</td>
</tr>
<tr>
<td>2012</td>
<td>123.1</td>
<td>0.006</td>
<td>0.978</td>
<td>0.016</td>
</tr>
<tr>
<td>2013</td>
<td>227.1</td>
<td>0.004</td>
<td>0.981</td>
<td>0.015</td>
</tr>
<tr>
<td>2014</td>
<td>294.1</td>
<td>0.003</td>
<td>0.991</td>
<td>0.006</td>
</tr>
<tr>
<td>2015</td>
<td>255.7</td>
<td>0.005</td>
<td>0.991</td>
<td>0.003</td>
</tr>
<tr>
<td>2016</td>
<td>84.5</td>
<td>0.014</td>
<td>0.985</td>
<td>0.002</td>
</tr>
<tr>
<td>Total</td>
<td>1051.6</td>
<td>0.005</td>
<td>0.985</td>
<td>0.010</td>
</tr>
</tbody>
</table>

## Shares of RMB Outflows by Settlement Means

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<thead>
<tr>
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<th>Amount (billion ¥)</th>
<th>Letter of Credit</th>
<th>Wire Transfer</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>14.0</td>
<td>0.567</td>
<td>0.400</td>
<td>0.032</td>
</tr>
<tr>
<td>2012</td>
<td>96.5</td>
<td>0.737</td>
<td>0.249</td>
<td>0.013</td>
</tr>
<tr>
<td>2013</td>
<td>127.9</td>
<td>0.801</td>
<td>0.174</td>
<td>0.025</td>
</tr>
<tr>
<td>2014</td>
<td>271.3</td>
<td>0.907</td>
<td>0.085</td>
<td>0.009</td>
</tr>
<tr>
<td>2015</td>
<td>353.9</td>
<td>0.733</td>
<td>0.255</td>
<td>0.012</td>
</tr>
<tr>
<td>2016</td>
<td>208.9</td>
<td>0.647</td>
<td>0.343</td>
<td>0.009</td>
</tr>
<tr>
<td>Total</td>
<td>1072.5</td>
<td>0.766</td>
<td>0.221</td>
<td>0.013</td>
</tr>
</tbody>
</table>
Onshore-Offshore Exchange Rates of Chinese Yuan

- **CNH (offshore)**
- **CNY (onshore)**

<table>
<thead>
<tr>
<th>Date</th>
<th>CNH (offshore)</th>
<th>CNY (onshore)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Jan-2012</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-Jul-2013</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-Jan-2015</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-Jul-2016</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**August-11 Reform**

Chinese Yuan per U.S. Dollar
Onshore-Offshore RMB Exchange Rate Differentials and RMB Outflows via Wire Transfers

![Graph showing Onshore-Offshore RMB Exchange Rate Differentials and RMB Outflows via Wire Transfers]
Onshore-Offshore Interest Differentials, RMB Inflows, and 12-Month Forward L/C Outflows

RMB Inflow
- Interest Differential (3-Month)
- RMB Outflow (L/C; 12 Months Forward)

Interest Differential

Yuan (billion)


Graph showing fluctuations in RMB Inflow, Interest Differential, and RMB Outflow over time.
<table>
<thead>
<tr>
<th></th>
<th>Inflow</th>
<th>Outflow (L/C, 1-Year Forward)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Interest Rate Differential</td>
<td>0.190***</td>
<td>0.190***</td>
</tr>
<tr>
<td></td>
<td>(0.070)</td>
<td>(0.069)</td>
</tr>
<tr>
<td>Exchange Rate Differential</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Export</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Import</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital Account Inflows</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital Account Outflows</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day of Week Fixed Effects</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>0.172</td>
<td>0.228</td>
</tr>
<tr>
<td>Observations (days)</td>
<td>698</td>
<td>698</td>
</tr>
</tbody>
</table>
Introduction of Interbank Certificates of Deposit

![Graph showing RMB Inflows from Entrepot Trade and Interest Differential over weeks.](image-url)
Extensive and Intensive Margins of Flows

\[ \ln(y_t) = \ln(n_t) + \ln(\bar{y}_t). \]

To separately estimate the impacts on the extensive margin and the intensive margins of entrepôt flows, we estimate

\[ \ln(n_t) = \gamma_E D_t + X_t' \beta_E + \epsilon_t^E \]
\[ \ln(\bar{y}_t) = \gamma_I D_t + X_t' \beta_I + \epsilon_t^I \]

where

- \( n_t \) : number of flows on day \( t \);
- \( \bar{y}_t \) : average value of each flow on day \( t \);
- \( D_t \) : interest differential;
- \( X_t \) : controls
Decomposing the Extensive Margins of Flows by Firms

We further decompose the extensive margin of transactions and estimate separately:

\[
\ln(n^F_t) = \gamma_F D_t + X'_t \beta_F + \epsilon^F_t
\]
\[
\ln(n^P_t) = \gamma_P D_t + X'_t \beta_P + \epsilon^P_t
\]

where

- \( n^F_t \): number of trading firms on day \( t \)
- \( n^P_t \): \( n_t^P \) is the average number of transactions per firm
Decomposing the Effects of Onshore-Offshore Interest Differentials on Various Margins of Inflows

<table>
<thead>
<tr>
<th>Outcome Variable (log):</th>
<th>Total Value (A)</th>
<th>Mean Value (I)</th>
<th>Transactions (E)</th>
<th>Transactions per Firm (E_p)</th>
<th>Transacting Firms (E_f)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest Rate Differential</td>
<td>0.207*** (0.068)</td>
<td>0.016 (0.057)</td>
<td>0.191*** (0.022)</td>
<td>-0.005 (0.010)</td>
<td>0.196*** (0.021)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.236</td>
<td>0.010</td>
<td>0.316</td>
<td>0.043</td>
<td>0.351</td>
</tr>
<tr>
<td>Observations (days)</td>
<td>698</td>
<td>698</td>
<td>698</td>
<td>698</td>
<td>698</td>
</tr>
<tr>
<td>Outcome Variable (no log):</td>
<td>Mean</td>
<td>0.990</td>
<td>0.018</td>
<td>53.82</td>
<td>1.39</td>
</tr>
<tr>
<td></td>
<td>Standard Deviation</td>
<td>0.428</td>
<td>0.005</td>
<td>19.04</td>
<td>0.20</td>
</tr>
</tbody>
</table>

Notes: Newey-West HAC robust S.E.s in parentheses. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$. 
Decomposing the Effects of Onshore-Offshore Interest Differentials on Various Margins of Outflows

<table>
<thead>
<tr>
<th>Outcome Variable (log):</th>
<th>Total Value (A)</th>
<th>Mean Value (I)</th>
<th>Transactions (E)</th>
<th>Transactions per Firm (Eₚ)</th>
<th>Transacting Firms (Eᵣ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome Variable (no log):</td>
<td>Mean</td>
<td>Standard Deviation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outflow (L/C, 1-Year Forward)</td>
<td>0.279*** (0.062)</td>
<td>0.130*** (0.020)</td>
<td>0.149** (0.064)</td>
<td>-0.094* (0.052)</td>
<td>0.242*** (0.019)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interest Rate Differential</th>
<th>0.774</th>
<th>0.019</th>
<th>40.71</th>
<th>1.50</th>
<th>26.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Deviation</td>
<td>0.610</td>
<td>0.007</td>
<td>29.13</td>
<td>0.39</td>
<td>15.7</td>
</tr>
</tbody>
</table>

Notes: Newey-West HAC robust S.E.s in parentheses. * p < 0.10; ** p < 0.05; *** p < 0.01.
Economy of Scale in Interest Arbitrage

- Fixed costs
- The availability of offshore branches.
- The ability of accessing capital.
- Bill of lading requirement.
- Variation of interest rates for deposits of different size.
Bunching of L/C Outflows

L/C Outflows for Entrepot Trades

L/C Outflows for Regular Trades
Return to Arbitrage

After infinite rounds of arbitrages, the initial capital $K$ becomes:

$$K' = \sum_{i=0}^{\infty} \frac{r_s K}{(1 + r_h + d)^i} = \frac{r_s (1 + r_h + d)K}{r_h + d}$$

The rate of return to arbitrage $r_a$ is:

$$r_a = r_s + \frac{r_s - r_h - d}{r_h + d}$$
Fixed Costs to Arbitrage

In a frictionless world, arbitrage if and only if:

\[ r_s > r_h + d. \]

With a fixed cost \( F \) to initiate arbitrage, arbitrage if and only if:

\[ K \left( \frac{r_s - r_h - d}{r_h + d} \right) > F \]

With a fixed cost \( L \) for each round of arbitrages, arbitrage if and only if:

\[ \tilde{K} > L \left( \frac{r_s}{1 + r_s} - \frac{r_h + d}{1 + r_h + d} \right)^{-1} := K_{min} \]
Onshore-Offshore Interest Differentials on the Distribution of Outflows

Letter of Credit (1-Year Forward)

Wire (1-Year Forward)

Quantile

Coeff. Estimate (L/C, 1-Yr Forward)  95% C.I. (L/C, 1-Yr Forward)

Coeff. Estimate (Wire, 1-Yr Forward)  95% C.I. (Wire, 1-Yr Forward)

Coeff. Estimate (Wire, Contemporary)  95% C.I. (Wire, Contemporary)
Onshore-Offshore Interest Differentials and Entry of Entrepôt Traders

<table>
<thead>
<tr>
<th>Time Trend:</th>
<th>None</th>
<th>Linear</th>
<th>Quadratic</th>
<th>Cubic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variable:</td>
<td>Number of New Firms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest Rate Differential</td>
<td>0.603***</td>
<td>0.596***</td>
<td>0.820***</td>
<td>0.811***</td>
</tr>
<tr>
<td></td>
<td>(0.122)</td>
<td>(0.112)</td>
<td>(0.261)</td>
<td>(0.237)</td>
</tr>
</tbody>
</table>

| Dependent Variable: | Share of New Firms | | | |
| Interest Rate Differential | 0.004 | 0.004** | 0.010** | 0.009*** |
| | (0.003) | (0.002) | (0.004) | (0.003) |

| Dependent Variable: | New Firms’ Share of Transaction Volume | | | |
| Interest Rate Differential | 0.002 | 0.002 | 0.016*** | 0.016*** |
| | (0.004) | (0.003) | (0.006) | (0.003) |

Observations (days) | 698 | 698 | 698 | 698 |

Notes: Newey-West HAC robust S.E.s in parentheses. * p < 0.10; ** p < 0.05; *** p < 0.01.
Concluding Remarks

- RMB Interest arbitrages are feasible but costly.
- Entrepôt trades and bank instruments for trade finance facilitate the arbitrages.
- In the short run, the circular arbitraging flows inflate statistics of RMB usage in international trades.
- In the long run, whether the arbitrages opportunities crowd out real international trades.