Information Asymmetry and Asset Prices
Evidence from the China Foreign Share Discount

Kalok Chan
Hong Kong University of Science and Technology

Albert J. Menkveld
Vrije Universiteit Amsterdam

Zhishu Yang
Tsinghua University Beijing

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Motivation

- Information asymmetry in the international equity market has become an important topic...
  - domestic investors have a linguistic and cultural advantage (e.g. Brennan and Cao (1997), Choe, Kho, and Stulz (2001), and Hau (2001))
  - foreign investors have more experience and expertise (e.g. Seasholes (2000), Grinblatt and Keloharju (2000), Froot and Ramadorai (2001))

- It is, however, more commonly accepted that an informational disadvantage explains foreigners’ reluctance to invest in foreign securities (Kang and Stulz (1997), Brennan and Cao (1997), and Grinblatt and Keloharju (2001))

- Few studies focus on whether information asymmetry affects equity prices (Bailey and Jagtiani (1994), Domowitz, Glen and Madhavan (1997))
Contribution

Objective: Is information asymmetry (across foreign and domestic investors) priced in international equity markets?

Laboratory: Perfectly segmented Chinese A (domestic) and B (foreign) share markets in 2000

Tools: Information asymmetry measures inspired by market microstructure literature

Controls: B-share illiquidity, and other explanatory factors based on Mei, Scheinkman, and Xiong (2003) and Karolyi and Li (2003)

Model: Grossman and Stiglitz (1980) type noisy rational expectations model to formalize the intuition

Robustness: Redo analysis after A-share market opened up to domestic investors in February 2001
Model

The model we propose is simple and based on Grossman and Stiglitz (1980):

- CARA investors trade in two fully segmented markets (A is domestic and B is foreign), but observe prices across markets
- future payoff is random, but identical across markets $v \sim N(\overline{v}, \sigma_v^2)$
- a proportion $\lambda$ of A (domestic) share investors receives a noisy signal: $S = v + \varepsilon_S$
- uninformed A and B share investors extract information (imperfectly) from A-share prices
- asset supply is noisy in both markets

We conjecture that prices are linear in the signal and in market supply and then find equilibrium prices. The partial derivative w.r.t. supply is inverse market depth $(1/\Delta)$. 
Model (ctd)

We find the following equilibrium price for the A-share market...

\[ P_A = \beta_0^A + \beta_S^A \Delta S + \beta_y^A \Delta y \]

\[
\beta_0^A = \frac{1}{1 + r} \overline{v} - \frac{1}{(1 + r)(\omega^I + \omega^U)} \overline{y}
\]

\[
\beta_S^A = \frac{1}{(1 + r)(\omega^I + \omega^U)} \left( \omega^I \frac{\tau_{\varepsilon}}{\tau_v + \tau_{\varepsilon}} + \omega^U \frac{\phi \tau_{\varepsilon}}{\tau_v + \phi \tau_{\varepsilon}} \right)
\]

\[
\beta_y^A = \frac{1}{\Delta_A} = \frac{1}{(1 + r)(\omega^I + \omega^U)} \left( 1 + \left( \omega^U \frac{\phi \tau_{\varepsilon}}{\tau_v + \phi \tau_{\varepsilon}} \right) / \left( \omega^I \frac{\tau_{\varepsilon}}{\tau_v + \tau_{\varepsilon}} \right) \right)
\]

where \( \phi = \frac{\lambda^2 \eta^2 \tau_y \tau_{\varepsilon}}{1 + \lambda^2 \eta^2 \tau_y \tau_{\varepsilon}} \), \( \omega_I = \lambda \eta (\tau_v + \tau_{\varepsilon}) \), \( \omega_U = (1 - \lambda) \eta (\tau_v + \phi \tau_{\varepsilon}) \)
Model (ctd)

...and for the B-share market:

\[
P_B = \beta_0^B + \beta_S^B \Delta S + \beta_y^B \Delta y + \beta_z^B \Delta z
\]

\[
\beta_0^B = \frac{1}{1 + r} \bar{v} - \frac{1}{(1 + r) \omega^B} \bar{z}
\]

\[
\beta_S^B = \frac{1}{(1 + r)} \left( \frac{\phi \tau_\varepsilon}{\tau_v + \phi \tau_\varepsilon} \right)
\]

\[
\beta_y^B = \frac{1}{(1 + r)} \left( \frac{\phi \tau_\varepsilon}{\tau_v + \phi \tau_\varepsilon} \right) / \left( \omega^I \frac{\tau_\varepsilon}{\tau_v + \tau_\varepsilon} \right)
\]

\[
\beta_z^B = \frac{1}{\Delta_B} = \frac{1}{(1 + r) \omega^B}
\]

where \( \omega^B = \eta(\tau_v + \phi \tau_\varepsilon) \)
Equilibrium Price vs $\lambda$

![Graph showing the relationship between equilibrium price and the proportion of informed A-share investors (\lambda). The graph includes three lines: a dashed line labeled 'Price A', a dotted line labeled 'Price B', and a solid line labeled 'Price A - Price B'. The x-axis represents the proportion of informed A-share investors ranging from 0 to 1, and the y-axis represents the price ranging from 0 to 2.](image)
Price Impact Coefficient vs $\lambda$

![Graph showing the relationship between the proportion of informed A-share investors and the price impact coefficient. The graph includes three curves labeled $1/\Delta_A$, $1/\Delta_B$, and $1/\Delta_A \cdot 1/\Delta_B$.](image)
B-Share Discount vs Price Impact Coefficient

FOREIGN SHARE DISCOUNT: $P_A - P_B$

PRICE IMPACT COEFFICIENT DIFFERENCE: $1/\Delta_A - 1/\Delta_B$
Experiment

We study TAQ data on Chinese firms listed as A (local) and B (foreign) shares for the year 2000.

- Markets are fully segmented
- Both shares are equal in terms of dividend and voting rights
- B-shares trade at a discount of 72% on average
- Exchanges run automated, order-driven markets
- Off-exchange trading is forbidden

We study dispersion in foreign share discount across the 76 “cross-listed” stocks.
Summary Statistics

Cross-sectional averages, N=76, year=2000:

<table>
<thead>
<tr>
<th></th>
<th>A-share</th>
<th>B-share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time between Trades</td>
<td>62 sec</td>
<td>313 sec</td>
</tr>
<tr>
<td>Daily Volume</td>
<td>1.7 mln</td>
<td>0.9 mln</td>
</tr>
<tr>
<td>Trade Size</td>
<td>5,769</td>
<td>16,769</td>
</tr>
<tr>
<td>Quoted Spread</td>
<td>0.027 Y</td>
<td>0.035 Y</td>
</tr>
<tr>
<td>Effective Spread</td>
<td>0.035 Y</td>
<td>0.035 Y</td>
</tr>
</tbody>
</table>
Information Asymmetry Measures

We use three measures for information asymmetry:

1. **LAMBDA** - price impact of trade, based on transaction data
   (Glosten (1987), Kyle (1985), Glosten (1987), and Easley and O’Hara (1987), and Glosten and Harris (1988))
   \[
   \Delta P_t = \lambda Q_t V_t + \phi (Q_t - Q_{t-1}) + e_t
   \]

2. **AS** - adverse selection component of spread
   (Glosten & Harris (1988))
   \[
   \Delta P_t = z_0 Q_t + z_1 \hat{e} + c_0 (Q_t - Q_{t-1}) + c_1 (Q_t V_t - Q_{t-1} V_{t-1}) + u_t, \quad u_t \sim MA(1)
   \]

3. **PIN** - probability of informed trading
   (Easley, Kiefer, and O’Hara (1996, 1997a, 1997b))
Information Asymmetry Measures (ctd)

Information asymmetry measures, N=76, year=2000:

<table>
<thead>
<tr>
<th></th>
<th>A-share</th>
<th>B-share</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAMBDA</td>
<td>9.66</td>
<td>2.61</td>
</tr>
<tr>
<td>AS</td>
<td>0.0056 Y</td>
<td>0.0047 Y</td>
</tr>
<tr>
<td>$\mu$ in PIN model$^a$</td>
<td>0.38</td>
<td>0.11</td>
</tr>
<tr>
<td>PIN</td>
<td>0.13</td>
<td>0.20</td>
</tr>
</tbody>
</table>

$^a$: Arrival rate informed investors
### Information Asymmetry Measures (ctd)

Correlation information asymmetry measure differences, $N=76$, year=2000:

<table>
<thead>
<tr>
<th></th>
<th>$\Delta \text{LAMBDA}$</th>
<th>$\Delta \text{AS}$</th>
<th>$\Delta \text{PIN}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta \text{LAMBDA}$</td>
<td>1.00</td>
<td>0.86</td>
<td>0.16</td>
</tr>
<tr>
<td>$\Delta \text{AS}$</td>
<td></td>
<td>1.00</td>
<td>0.18</td>
</tr>
<tr>
<td>$\Delta \text{PIN}$</td>
<td></td>
<td></td>
<td>1.00</td>
</tr>
</tbody>
</table>
B-Share Discount vs Price Impact Coefficient

![Graph showing the relationship between B-share discount and log lambda A_min B. The x-axis represents log lambda A_min B, ranging from -1 to 3, and the y-axis represents B_share discount, ranging from 0.52 to 0.88. The graph displays a scatter plot with data points.](image_url)
# Cross-Sectional Regressions B-share Discount

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔΛAMBDΔA</td>
<td>+</td>
<td>0.04**</td>
<td></td>
<td>0.07**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔAS</td>
<td>+</td>
<td>0.07**</td>
<td></td>
<td>0.08**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔPIN</td>
<td>+</td>
<td>0.05**</td>
<td></td>
<td></td>
<td>-0.06</td>
<td></td>
</tr>
<tr>
<td>T/O A-share</td>
<td>+\textsuperscript{a}</td>
<td>0.03</td>
<td>-0.03</td>
<td>0.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T/O B-share</td>
<td>-</td>
<td></td>
<td>-0.07**</td>
<td>-0.04**</td>
<td>-0.08**</td>
<td></td>
</tr>
<tr>
<td>#Trades A-share</td>
<td></td>
<td>-0.03</td>
<td>0.03</td>
<td>-0.13**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#Trades B-share</td>
<td></td>
<td></td>
<td>0.13**</td>
<td>0.08**</td>
<td>0.20**</td>
<td></td>
</tr>
<tr>
<td>Market Cap A-share</td>
<td>+\textsuperscript{a}</td>
<td>0.03**</td>
<td>-0.03*</td>
<td>0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market Cap B-share</td>
<td></td>
<td>-0.09**</td>
<td>-0.06**</td>
<td>-0.10**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Momentum</td>
<td>+\textsuperscript{b}</td>
<td></td>
<td>0.01</td>
<td>0.00</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>R\textsuperscript{2}</td>
<td></td>
<td>0.44</td>
<td>0.46</td>
<td>0.08</td>
<td>0.77</td>
<td>0.74</td>
</tr>
</tbody>
</table>

\textsuperscript{a}: Mei, Scheinkman, and Xiong (2003)  \textsuperscript{b}: Karolyi and Li (2003)
Robustness, Post Event IA Measures

Information asymmetry measures, N=76, before and after entry of A-share investors into B-share market:

<table>
<thead>
<tr>
<th></th>
<th>A-share</th>
<th>B-share</th>
<th>Δ</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before</td>
<td>After</td>
<td>Δ</td>
</tr>
<tr>
<td>LAMBDA</td>
<td>9.66</td>
<td>11.70</td>
<td>+21%</td>
</tr>
<tr>
<td>AS</td>
<td>0.0056</td>
<td>0.0067</td>
<td>+20%</td>
</tr>
<tr>
<td>$\mu$ in PIN model$^a$</td>
<td>0.38</td>
<td>0.27</td>
<td>-29%</td>
</tr>
<tr>
<td>PIN</td>
<td>0.13</td>
<td>0.15</td>
<td>+15%</td>
</tr>
</tbody>
</table>

$^a$: Arrival rate informed investors
Conclusions

- Many studies on information asymmetry in international asset markets, but few study whether it is priced.
- We demonstrate the effect of information asymmetry on asset prices through analysis of the cross-sectional variation in the Chinese foreign share discount.
- Three measures of information asymmetry across markets (LAMBDA, AS, and PIN) do particularly well in explaining this variation, controlling for rival explanations.
- Robustness is demonstrated by a significant increase in informed trading in the B-share market after it opened up to domestic investors in 2001.
- As a result, the discount decreases (from 72% to 42%), but does not disappear. Redoing the cross-sectional regressions post-entry, we find similar results.