Motivation

\[ E(R_e) = R_e + AMCov(R_i, R_w) + (A_p - A)M_Cov(R_i, R_I | R_e) \]

• Many emerging markets (EMs) have embarked on liberalization policies to develop financially integrated markets. Increased integration should lower cost of capital.

• Complete integration and one factor model:
  \[ E_{t-1}[r_{I,t}] = \lambda_{t-1} \text{cov}_{t-1}(r_{I,t}, r_{w,t}). \]

• Complete segmentation and one factor model:
  \[ E_{t-1}[r_{I,t}] = \lambda_{i,t-1} \text{var}_{t-1}(r_{I,t}). \]
Motivation


• The process of liberalization is gradual, evolves over time as countries continuously adopt their policies.

• Hence, we need to evaluate impact of liberalization policy to-date that would inform further steps.
We take a long-term perspective and focus on a specific ongoing liberalization—Investability.

Research Questions

• Can we provide a tractable model that takes into account investability?

• Is the model supported empirically?

• What is the effect of investability on C.E.C?
Main Results

Expected returns

- Unrestricted assets are priced solely with a global factor
- Restricted assets are priced with 3 factors: global factor, conditional local premium and local discount factors.

Results for 18 major EMs strongly support the model.

Discount measures economic benefits of loosening equity ownership restrictions. Move from non-investable to binding portfolio results in average reduction of 26% and further reduction of 21% in C.E.C. to an unrestricted status. Total reduction 42%
Agenda

- The Models
- Methodology
- Results
- Conclusion
THE MODEL
MILD SEGMENTATION
Errunza & Losq (1985)
Limiting Case of Stulz (1981)
PARTIAL SEGMENTATION
Chaieb & Errunza (2007)

Domestic market

Foreign market

Domestic Ineligible Securities

Eligible Securities

Foreign Ineligible Securities
Market Structure with Ownership Restriction
Errunza & Ta (2011)
Investable Weight Factor - IWF

• Value range in $[0, 1]$. 
• Zero indicates non-investable; one denotes unrestricted.

• IWF is a composite index that takes into account:
  -- Foreign investment restriction at firm & country level
  -- Size and liquidity
  -- Available float
EMs Have Been Relaxing Foreign Portfolio Restrictions

Investability Weight Factor of Select Countries
EM Market Structure

• Unrestricted assets - freely accessible to all investors, IWF > 0.5
• Binding ownership assets - available to non-nationals up to a certain limit, IWF < or = 0.5
• Non-investable assets can not be traded by non-nationals, IWF = 0
• Last two subsets constitute restricted assets for the non-nationals.

First time the pricing of different sets of securities has been modeled and tested
Model Assumptions

• Two countries: domestic (U.S.) & foreign (E.M.). Each has a representative agent.
• Returns are measured in domestic currency.
• All investors borrow and lend at the domestic risk free rate.
• Foreign investors can freely access all stocks.
• Domestic investors have access to their domestic stocks, unrestricted securities of the foreign market and up to the legal limit of foreign stocks.
• Markets are otherwise perfect.
A Constrained Optimization Problem

- Investor \( l = \{ D, F \} \) maximizes indirect utility,

\[
J^l (W^l) = \max_{C^l, \pi^l} E_0 \int_0^\infty U^l (C^l (t)) dt
\]

- with budget constraint,

\[
dW^l = \left[ \sum_{i=1}^N \pi_i^l (\mu_i - r) + rW^l - C^l \right] dt + \sum_{i=1}^N \pi_i^l \sigma_i dz_i
\]

- and portfolio constraint for domestic investor,

\[
\pi_m^D \leq \omega_m \circ M_m
\]
Pricing of Unrestricted Assets

- Priced solely with a global risk premium - the covariance with the world market portfolio,

\[ \mu_i - r = AM \text{cov}(R_i, R_w) \]

- where \( M \) is the world market capitalization, \( A \) is the aggregate absolute risk aversion, defined below,

\[ \frac{1}{A} = \frac{1}{A^D} + \frac{1}{A^F} \]
Definitions

- Local Premium Factor is the value weighted index of all restricted assets (those with binding ownership restrictions),
  \[ \tilde{R}_{K_1} = \sum_{i \in S_k} \frac{M_i}{M_{K_1}} \tilde{R}_i \quad M_{K_1} = \sum_{i \in S_k} M_i \]

- Local Discount Factor is the value weighted index of investable portion of restricted assets,
  \[ \tilde{R}_{K_2} = \sum_{i \in S_k} \frac{\omega_i M_i}{M_{K_2}} \tilde{R}_i \quad M_{K_2} = \sum_{i \in S_k} \omega_i M_i \]
Pricing of Restricted Assets

• Restricted assets command a global premium, a conditional local premium and a conditional local discount

• Global risk premium, $\text{AMcov}(R_i, R_W)$

• Conditional local premium, $(A^F - A)M_{K_1} \text{cov}(R_i, R_{K_1} | R_p)$

• Conditional local discount, $-A^F M_{K_2} \text{cov}(R_i, R_{K_2} | R_p)$
Limiting Cases

• All foreign assets non investable Model collapses to EL
• At the limit, if unrestricted risky assets are perfect substitutes for restricted assets, the markets will be effectively integrated.
• As domestic investors are allowed to hold increasing proportions of restricted foreign securities, the contribution of discount increases which at the limit (when all ownership restrictions are removed), equalizes the local discount to local risk premium and the security is priced with only the world risk factor. Thus, the discount provides a measure of the economic benefits of loosening equity ownership restrictions.
Methodology
Construction of Test Portfolios & Factors

Test portfolios are constructed based on the firm level IWF data.

• Non-investable: zeros IWF, ownership-binding IWF < or = 0.5, unrestricted: IWF > 0.5

• Portfolios are rebalanced annually at the end of calendar year

• Local premium factor consists of non-investable and binding securities and local discount factor consists of investable portion of binding securities
we regress the return of the local factor $\tilde{R}_{K_1}$ or $\tilde{R}_{K_2}$ on the world portfolio return and the returns of 38 world sector portfolios. Using a stepwise regression procedure with backward and forward threshold criteria to select from the set of sector portfolios, we obtain an initial DP, $\tilde{R}_{DP_1}$.

In the second step, we augment $\tilde{R}_{DP_1}$ with U.S. and globally traded CF and DRs, and allow the weights assigned to these securities to be time-varying as the CF and DRs become available in the U.S. or the global market. In particular, we run the following regressions for $\tilde{R}_{K_1}$ and $\tilde{R}_{K_2}$

$$\tilde{R}_{K,t} = \omega_{1,t} \tilde{R}_{DP_1,t} + \omega_{2,t} \tilde{R}_{CF,t} + \sum_{i=1}^{N} \omega_{3_i,t} \tilde{R}_{DR_i,t} + \tilde{r}_{res,t}$$

fitted value of this regression is $\tilde{R}_{DP}$, whereas the residual $\tilde{r}_{res,t}$ is the residual factor of the corresponding local factor.\textsuperscript{18}
Estimation Method

- We test our model for unrestricted, binding and non-investable portfolios for each country.

\[
E(\tilde{r}_n) = \delta_w \text{cov}(\tilde{r}_n, \tilde{r}_w) + \delta_p \text{cov}(\tilde{r}_n, \tilde{r}_{res_p}) - \delta_d \text{cov}(\tilde{r}_n, \tilde{r}_{res_d})
\]

\[
E(\tilde{r}_b) = \delta_w \text{cov}(\tilde{r}_b, \tilde{r}_w) + \delta_p \text{cov}(\tilde{r}_b, \tilde{r}_{res_p}) - \delta_d \text{cov}(\tilde{r}_b, \tilde{r}_{res_d})
\]

\[
E(\tilde{r}_u) = \delta_w \text{cov}(\tilde{r}_u, \tilde{r}_w)
\]

where, \( \delta_w, \delta_p, \) and \( \delta_d \) are respectively the price of risk the world, local premium and local discount factors; \( \tilde{r}_n, \tilde{r}_b, \) and \( \tilde{r}_u \) are excess returns for the non-investable, binding and unrestricted portfolios respectively; \( \tilde{r}_{res_p} \) and \( \tilde{r}_{res_d} \) are returns on residual factors built upon the concept of diversification portfolios described in section 4.1. Briefly, \( \tilde{r}_{res_p} \) and \( \tilde{r}_{res_d} \) are respectively the residual returns from the regression of \( \tilde{R}_K_1 \) and \( \tilde{R}_K_2 \) on \( \tilde{R}_p \). Note that
Estimation Method - continued

• A system of 6 equations for each country

\[
\begin{align*}
\tilde{r}_{b,t} &= \delta_{w,t-1} h_{b,w,t} + \delta_{p,t-1} h_{b,resp,t} - \delta_{d,t-1} h_{b,resp_d,t} + \tilde{\varepsilon}_{b,t} \\
\tilde{r}_{n,t} &= \delta_{w,t-1} h_{n,w,t} + \delta_{p,t-1} h_{n,resp,t} - \delta_{d,t-1} h_{n,resp_d,t} + \tilde{\varepsilon}_{n,t} \\
\tilde{r}_{u,t} &= \delta_{w,t-1} h_{u,w,t} + \tilde{\varepsilon}_{u,t} \\
\tilde{r}_{resp,t} &= \delta_{w,t-1} h_{resp,w,t} + \delta_{p,t-1} h_{resp,t} - \delta_{d,t-1} h_{resp,resp_d,t} + \tilde{\varepsilon}_{resp,t} \\
\tilde{r}_{resp_d,t} &= \delta_{w,t-1} h_{resp_d,w,t} + \delta_{p,t-1} h_{resp,resp_d,t} - \delta_{d,t-1} h_{resp_d,resp_d,t} + \tilde{\varepsilon}_{resp_d,t} \\
\tilde{r}_{w,t} &= \delta_{w,t-1} h_{w,t} + \tilde{\varepsilon}_{w,t}
\end{align*}
\]

• Price of risk specifications:

\[
\begin{align*}
\delta_{w,t} &= \exp(k_{w}' Z_{w,t}) \\
\delta_{p,t} &= \exp(k_{p}' Z_{Lp,t}) \\
\delta_{d,t} &= \exp(k_{d}' Z_{Ld,t})
\end{align*}
\]

$Z_{w}$ is a set of global information variables and $Z_{L}$ is a set of local instrumental variables
Estimation Method - continued

- Specify dynamics of covariance matrix with BEKK-VVT-BW specification to capture asymmetric volatility.

\[ H_t = \Omega_0 \circ (ii' - bb' - cc') - \Pi_0 \circ dd' + bb' \circ H_{t-1} + cc' \circ \tilde{\varepsilon}_{t-1} \tilde{\varepsilon}'_{t-1} + dd' \circ \tilde{\eta}_{t-1} \tilde{\eta}'_{t-1} \]

where \( b, c, d \) are 6 \times 1 coefficient parameter vectors, \( \tilde{\varepsilon}_t \) is a 6 \times 1 vector of residuals and \( \tilde{\eta}_t \) is a 6 \times 1 vector defined as follows,

\[
\begin{align*}
\tilde{\eta}_{i,t} & = -\tilde{\varepsilon}_{i,t}, \text{ if } \tilde{\varepsilon}_{i,t} < 0, \forall i = 1, \ldots, n \\
\tilde{\eta}_{i,t} & = 0, \text{ otherwise}
\end{align*}
\]

- Compared to De Santis and Gerard (1987) the BEKK-VVT-BW has one additional vector of coefficient, \( d \), designed to capture the asymmetry of volatility.
Results
Data

• Weekly data, 18 major EMs, from 01/01/89 to 30/04/07
• Country stock-level data from S&P/IFC EMDB
• Investable Weight Factor (IWF)
• World market and global sector data from Datastream
• Country Fund and ADR Data from CRSP and Datastream
• Instruments:
  -- Global: excess world dividend yield, U.S. term premium, U.S. default premium, change in Eurodollar rate
  -- Local: local market return, local dividend yield, and local value weighted IWF
Specification tests

Null Hypotheses:

• H1: Time-varying price of the discount factor, $k_{K,i} = 0 \ \forall i > 1$
• H2: Time-varying price of the local premium and discount factors, $k_{L,i} = 0$ and $k_{K,i} = 0 \ \forall i > 1$
• H3: Time-varying price of the global factor, $k_{W,i} = 0 \ \forall i > 1$
• H4: Are the factor risk premia constant? $k_{W,i} = 0$ & $k_{L,i} = 0$ & $k_{K,i} = 0 \ \forall i > 1$

where $i$ denotes the index of the coefficient vectors.

Average prices of risk for the global, local premium and local discount factors are 2.27, 2.3, 2.16-all very significant.
### Specification Tests – Robust Wald Stats.

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>d.f.</th>
<th>Argentina</th>
<th>Brazil</th>
<th>Chile</th>
<th>China</th>
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<th>Korea</th>
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<td>20.37**</td>
<td>9.43*</td>
<td>33.64**</td>
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<tr>
<td>H2</td>
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<td>79.97**</td>
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<td>107.35**</td>
<td>127.34**</td>
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<th>Philippines</th>
<th>S Africa</th>
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<th>Thailand</th>
<th>Turkey</th>
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<td>101.77**</td>
<td>33.91**</td>
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<td>27.95**</td>
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*Note:* ** and * denote the statistical significance at 1% and 5% levels respectively.
## Risk Premium Non-Investables

<table>
<thead>
<tr>
<th>Country</th>
<th>Global Premium</th>
<th>Local Premium</th>
<th>Local Discount</th>
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</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>5.50%</td>
<td>94.50%</td>
<td>-8.80%</td>
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<tr>
<td>Brazil</td>
<td>51.24%</td>
<td>48.76%</td>
<td>-29.09%</td>
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<tr>
<td>Chile</td>
<td>17.24%</td>
<td>82.76%</td>
<td>-29.79%</td>
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<tr>
<td>China</td>
<td>16.50%</td>
<td>83.50%</td>
<td>-11.83%</td>
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<tr>
<td>Colombia</td>
<td>1.90%</td>
<td>98.10%</td>
<td>-25.23%</td>
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<tr>
<td>India</td>
<td>12.84%</td>
<td>87.16%</td>
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<tr>
<td>Indonesia</td>
<td>21.04%</td>
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<tr>
<td>Israel</td>
<td>22.60%</td>
<td>77.40%</td>
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<td>Turkey</td>
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<td><strong>Average</strong></td>
<td><strong>23.43%</strong></td>
<td><strong>76.57%</strong></td>
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## Risk Premium-Binding Portfolios

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<th>Local Discount</th>
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<td>Brazil</td>
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<td>46.75%</td>
<td>-15.34%</td>
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<tr>
<td>Thailand</td>
<td>42.44%</td>
<td>57.56%</td>
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<tr>
<td>Turkey</td>
<td>30.92%</td>
<td>69.08%</td>
<td>-39.59%</td>
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<tr>
<td><strong>Average</strong></td>
<td><strong>37.14%</strong></td>
<td><strong>62.86%</strong></td>
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### Average Annual Expected Return %

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<td>6.81</td>
<td>6.18</td>
</tr>
<tr>
<td>Peru</td>
<td>6.89</td>
<td>6.59</td>
<td>5.55</td>
</tr>
<tr>
<td>Philippines</td>
<td>8.34</td>
<td>6.72</td>
<td>6.91</td>
</tr>
<tr>
<td>S Africa</td>
<td>10.09</td>
<td>8.88</td>
<td>6.09</td>
</tr>
<tr>
<td>Taiwan</td>
<td>9.53</td>
<td>7.14</td>
<td>8.26</td>
</tr>
<tr>
<td>Thailand</td>
<td>11.74</td>
<td>7.52</td>
<td>7.49</td>
</tr>
<tr>
<td>Turkey</td>
<td>9.78</td>
<td>10.00</td>
<td>7.31</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>11.60</strong></td>
<td><strong>8.52</strong></td>
<td><strong>6.72</strong></td>
</tr>
</tbody>
</table>
Average Annual Expected Return %

- Argentina
- Brazil
- Chile
- China
- Colombia
- India
- Indonesia
- Israel
- Korea
- Malaysia
- Mexico
- Pakistan
- Peru
- Philippines
- S. Africa
- Taiwan
- Thailand
- Turkey
Major Empirical Findings

• Global & conditional local factors are significantly priced and time varying in most countries.

• Discount accounts for 30% and 36% of the total premium for non-investable and binding portfolios.

• Move from non-investable to binding portfolio results in average reduction of 26% and further reduction of 21% in C.E.C. to an unrestricted status. Total reduction 42%.
Conclusions

• Our IAPM characterizes more realistic international market structure characterized by ownership restrictions

• In equilibrium, unrestricted assets are priced solely with the global risk premium. The restricted assets are priced with three factors: the global premium, a conditional local premium, and a conditional local discount.

• Results for 18 major EMs strongly support the model.

• Discount provides a measure of economic benefits of loosening equity ownership restrictions. Move from non-investable to binding portfolio results in average reduction of 26% and further reduction of 21% in C.E.C. to an unrestricted status. Total reduction 42%