Is Liquidity Risk Priced in Partially Segmented Markets?

Ines Chaieb
University of Geneva

Vihang Errunza
McGill University

Hugues Langlois
HEC Paris

Indira Gandhi Institute for Development Research

December 15-16, 2016

The Critical Element

- Liquidity costs and their uncertain variation affect the willingness and the ability of foreign investors to invest in emerging markets (EMs).
- Two Elements:

1. Market liquidity level = ability to trade at low cost
2. Market liquidity risk = risk that trading costs will rise

Existing Models

CAPM of Acharya and Pedersen (2005) adjusts for Liquidity

International asset pricing models (IAPMs) under barriers to portfolio flows do not take into account liquidity concerns.

We develop a formal IAPM to analyze the effect of illiquidity cost and systematic liquidity risk factors on the pricing of EM securities.

Liquidity CAPM of Acharya and Pedersen (2005)

$$E_t[r_{i,t+1}] = r_f + E_t[c_{i,t+1}] + \lambda_t(\beta_t^{r_i,r_M} + \beta_t^{c_i,c_M} - \beta_t^{r_i,c_M} - \beta_t^{c_i,r_M})$$

where

- $\beta_t^{r_i,r_M} = \frac{cov_t(r_{i,t+1}, r_{M,t+1})}{var_t(r_{M,t+1} - c_{M,t+1})}$, market beta
- $\beta_t^{c_i,c_M} = \frac{cov_t(c_{i,t+1}, c_{M,t+1})}{var_t(r_{M,t+1} - c_{M,t+1})}$, commonality in liquidity
- $\beta_t^{r_i,c_M} = \frac{cov_t(r_{i,t+1}, c_{M,t+1})}{var_t(r_{M,t+1} - c_{M,t+1})}$, return sensitivity to aggregate liquidity
- $\beta_t^{c_i,r_M} = \frac{cov_t(c_{i,t+1}, r_{M,t+1})}{var_t(r_{M,t+1} - c_{M,t+1})}$, liquidity sensitivity to economic conditions

Key contributions

- We derive an international asset pricing (IAPM) model in a setting with random transaction costs and partially segmented markets that include investable securities and non-investable securities.
- Investables are priced a la Acharya and Pedersen liquidity CAPM with 4 global risks: the world market risk and 3 liquidity risks
- Non-investables command 4 global and 4 local risk premia. All of the local market and liquidity risks are conditional on the degree of spanning of the non-investable portfolio.
- Liquidity risk is significantly priced but is economically small. The total contribution of illiquidity level and risk to risk premiums is on average 0.75% annually across EMs and its magnitude is time varying and higher in crisis periods.

Investability

- Investable securities are legally and practically available to foreign investors.
- Non-investability can arise from explicit (legal restrictions on ownership, foreign exchange transactions, repatriation of profits) & implicit barriers (institutional, informational, governance, and market development variables).
- A stock is investable if there exists a related cross-listed stock, an ADR, or a GDR traded on a major stock exchange in a developed country, see Karolyi and Wu (2012)

Our Model

Market structure

1. Domestic market (e.g, US): investables
2. Foreign market (e.g., India): investables and non-investables

Investment opportunity set:

1. Domestic (e.g., American) investor : Invest in domestic and foreign investables
2. Foreign (e.g., Indian) investor : Invest in all securities

Transaction Costs

one-period investor investing at t pay transaction costs, C_t , proportional to the current price when closing the position at time t+1. Transaction costs are stochastic. Both long and short holders pay transaction costs.

Our Model

- The pricing of liquidity risk for investables is an extension of AP : 3 global liquidity risk premia
- The pricing of liquidity risk for non-investables include 3 global and 3 local liquidity risk components. The local components are conditional on the degree of spanning of the non-investable market portfolio by the diversification portfolio (DP), which is the portfolio of investable assets that are most highly correlated with the non-investable market portfolio.
- Liquidity risk is significantly priced but is economically small. The total contribution of illiquidity level and risk to risk premiums is on average 0.75% annually across EMs.

Equilibrium Expected Return for Non-investables

$$
\begin{aligned}
E_t\left[r_{n,t+1}-r_f\right] \;=\; & -\frac{1}{2}var_t\left(r^{net}_{n,t+1}\right)+E_t\left[c_{n,t+1}\right]+\gamma_t[cov_t\left(r_{n,t+1},r_{W,t+1}\right)+cov_t\left(c_{n,t+1},c_{W,t+1}\right) \\
& -cov_t\left(c_{n,t+1},r_{W,t+1}\right)-cov_t\left(r_{n,t+1},c_{W,t+1}\right)] \\
& +\pi_t[cov_t\left(r_{n,t+1},r_{N,t+1}\mid \boldsymbol{r}^{net}_{i,t+1}\right)+cov_t\left(c_{n,t+1},c_{N,t+1}\mid \boldsymbol{r}^{net}_{i,t+1}\right) \\
& -cov_t\left(c_{n,t+1},r_{N,t+1}\mid \boldsymbol{r}^{net}_{i,t+1}\right)-cov_t\left(r_{n,t+1},c_{N,t+1}\mid \boldsymbol{r}^{net}_{i,t+1}\right)]. \qquad (6)
\end{aligned}
$$

The extra conditional liquidity risks are

1. $cov_t\left(c_{n,t+1},c_{N,t+1}\mid \boldsymbol{r}^{net}_{i,t+1}\right)$: the conditional commonality in transaction risk between a security n and the local non-investable market N;
2. $cov_t\left(c_{n,t+1},r_{N,t+1}\mid \boldsymbol{r}^{net}_{i,t+1}\right)$: the conditional covariance between a security's transaction cost and the local non-investable market return;
3. $cov_t\left(r_{n,t+1},c_{N,t+1}\mid \boldsymbol{r}^{net}_{i,t+1}\right)$: the conditional covariance between a security's return and the local non-investable market transaction cost.

Equilibrium Expected Return for Non-investables

We can then obtain the conditional expected gross return on the local non-investable market portfolio, $r_{N,t+1}$ as,

$$
\begin{aligned}
E_t\left[r_{N,t+1} - r_f\right] = & -\frac{1}{2} var_t\left(r^{net}_{N,t+1}\right) + E_t\left[c_{N,t+1}\right] + \gamma_t[cov_t\left(r_{N,t+1}, r_{W,t+1}\right) + cov_t\left(c_{N,t+1}, c_{W,t+1}\right) \\
& - cov_t\left(c_{N,t+1}, r_{W,t+1}\right) - cov_t\left(r_{N,t+1}, c_{W,t+1}\right)] \\
& + \pi_t[var_t\left(r_{N,t+1}\right) + var_t\left(c_{N,t+1}\right) - 2cov_t\left(r_{N,t+1}, c_{N,t+1}\right)]\left(1 - II_t\right). \qquad (9)
\end{aligned}
$$

Empirical Model and Methodology

- Country by country estimation. For each country, we estimate a system of 6 equations:

$$
\begin{aligned}
r_{W,t+1} - r_{f,t+1} &= \alpha_W - \frac{1}{2} var_t\left(r^{net}_{W,t+1}\right) + \kappa_W E_t\left[c_{W,t+1}\right] + \gamma_{t+1} var_t\left(r^{net}_{W,t+1}\right) + \epsilon_{1,t+1} \\
r_{N^k,t+1} - r_{f,t+1} &= \alpha_{N^k} - \frac{1}{2} var_t\left(r^{net}_{N^k,t+1}\right) + \kappa_{N^k} E_t\left[c_{N^k,t+1}\right] + \gamma_{t+1} cov_t\left(r^{net}_{N^k,t+1}, r^{net}_{W,t+1}\right) \\
&\quad + \pi^k_{t+1} var_t\left(r^{net}_{N^k,t+1}\right)\left(1 - \frac{cov_t\left(r^{net}_{N^k,t+1}, r^{net}_{DP^k,t+1}\right)^2}{var_t\left(r^{net}_{N^k,t+1}\right) var_t\left(r^{net}_{DP^k,t+1}\right)}\right) + \epsilon_{2,t+1} \\
r_{DP^k,t+1} - r_{f,t+1} &= \alpha_{DP^k} - \frac{1}{2} var_t\left(r^{net}_{DP^k,t+1}\right) + \kappa_{DP^k} E_t\left[c_{DP^k,t+1}\right] \\
&\quad + \gamma_{t+1} cov_t\left(r^{net}_{DP^k,t+1}, r^{net}_{W,t+1}\right) + \epsilon_{3,t+1} \\
c_{W,t+1} &= E_t[c_{W,t+1}] + \epsilon_{4,t+1} \\
c_{N^k,t+1} &= E_t[c_{N^k,t+1}] + \epsilon_{5,t+1} \\
c_{DP^k,t+1} &= E_t[c_{DP^k,t+1}] + \epsilon_{6,t+1}
\end{aligned} \tag{11}
$$

Empirical Model and Methodology

- Three model specifications:
  - Net Returns and κ=1
  - Net Returns and calibrated κ
  - Gross Returns and κ=0

- Proceed in 3 steps
  1. Estimate a dynamic replicating portfolio DP
  2. Estimate the equation for the world market portfolio
  3. Estimate the system of equations imposing estimates of DP and of the world market equation from steps (1) and (2)

DATA

- A sample of 21 emerging markets from 1990-2015
- Daily data on individual stocks from Datastream to construct the liquidity measure
- Use only local common stocks (apply filters of Griffin, Kelly and Nardari, 2010)
- Apply filters on daily and monthly data similar to Lee (2011) and Karolyi et al. (2011)
- We use stock exchanges from developed markets to determine Depositary Receipts' (DR) and direct listings' eligibility and to build the world market portfolio
- Number of stocks & % of investables across all countries & over time

	1993	2003	2013
All countries	2176	6031	8445
% of investables	2.8	7.1	7.1

Illiquidity Measure

- Corwin and Schultz (2012) high-low spread as proxy for bid-ask spread
- Construct monthly measure as an average of daily individual-stock measures.
- Simple measure that only requires high and low prices from 2 consecutive days; good proxy for the cost of a round-trip transaction of small size; captures liquidity more broadly than bid-ask spread (e.g. captures price pressure from large orders)
- However, it does not capture other dimensions of liquidity such as market depth, resilience and search costs.
- Alternatives: Amihud's (2002) price impact measure; Frequency of zero returns of Lesmond et al. (1999)

Our Results

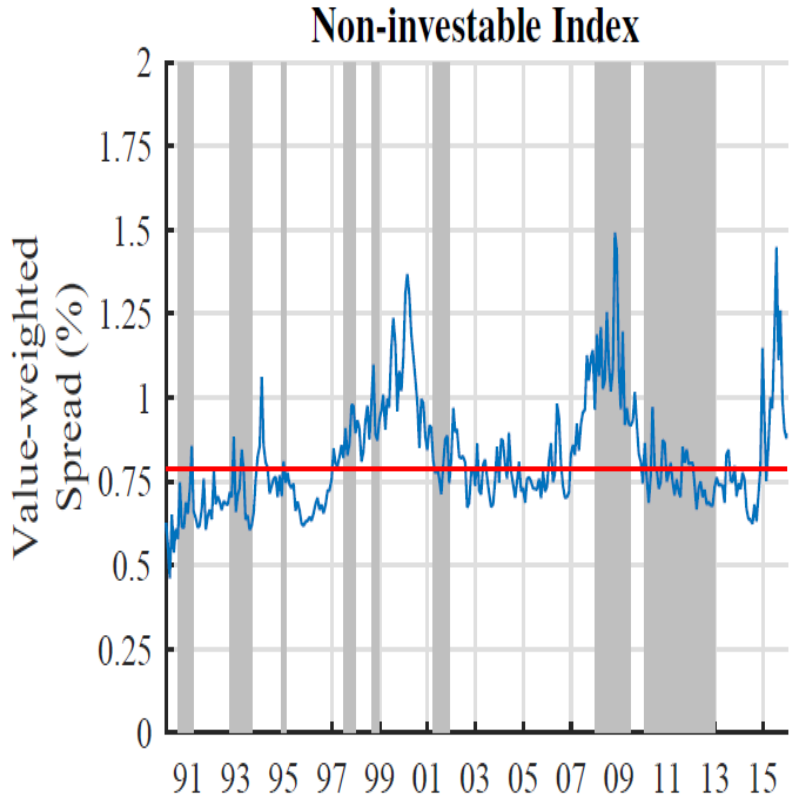
Across all model specifications

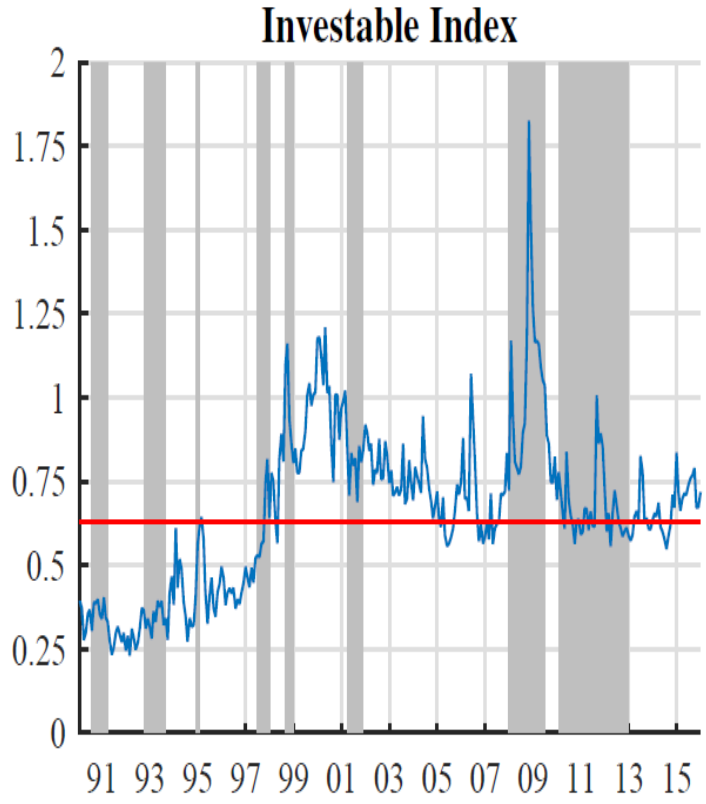
- World covariance risk is significant and time-varying
- Local covariance risk is significant and time-varying

Results robust to

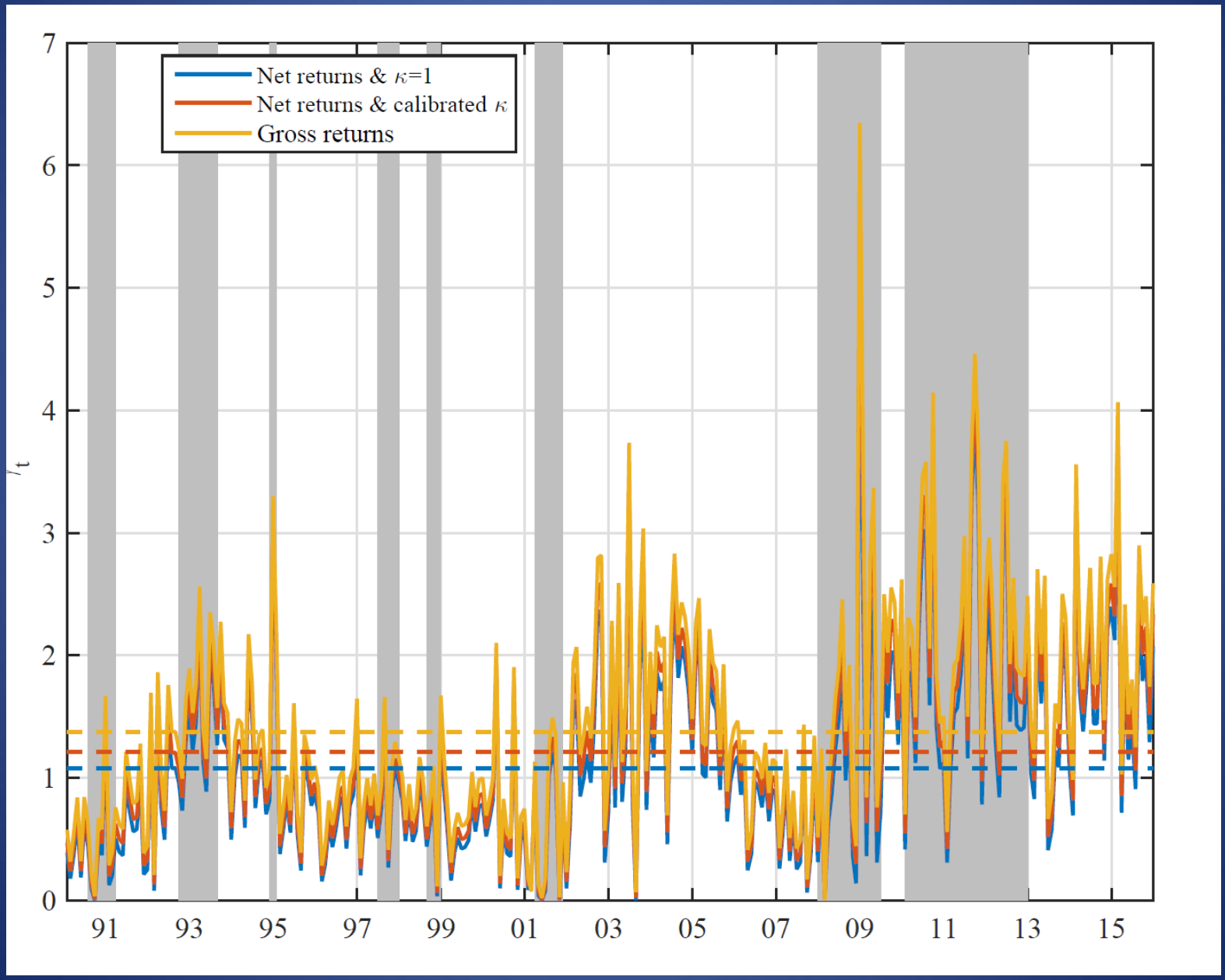
- Alternative model specification: calibrated κ
- Specification of the investable set: All emerging market securities are non-investable (see Carrieri, Chaieb and Errunza, 2013).

Bid-ask spread for investable and non-investable securities averaged across emerging markets

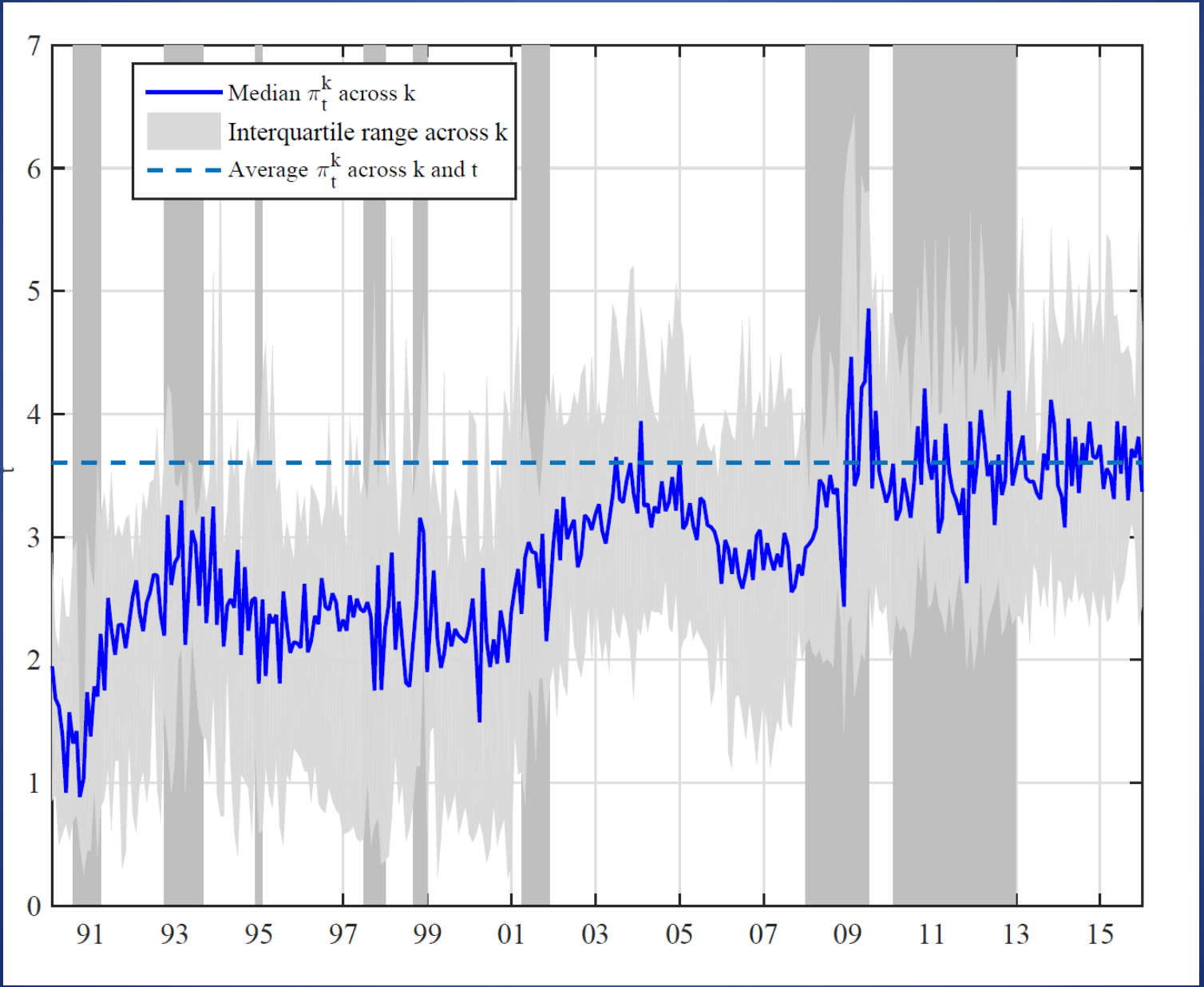




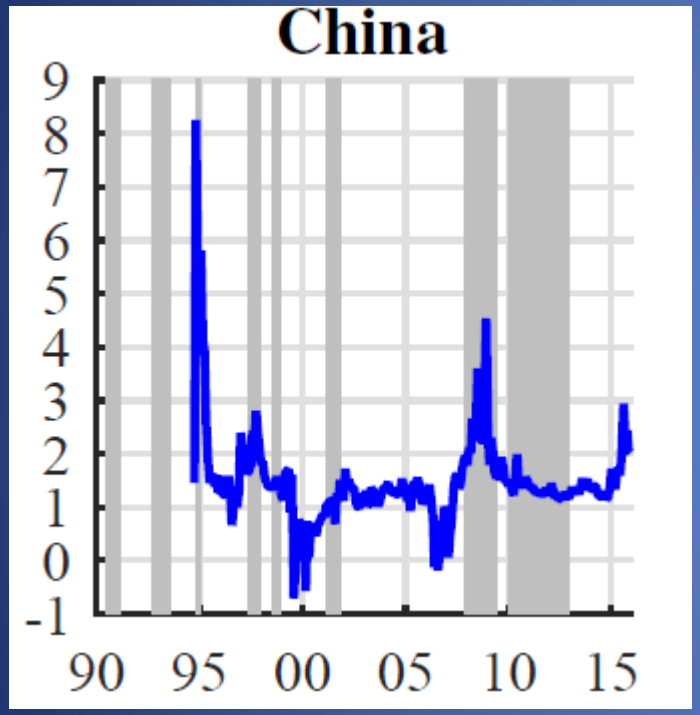
Price of world covariance risk

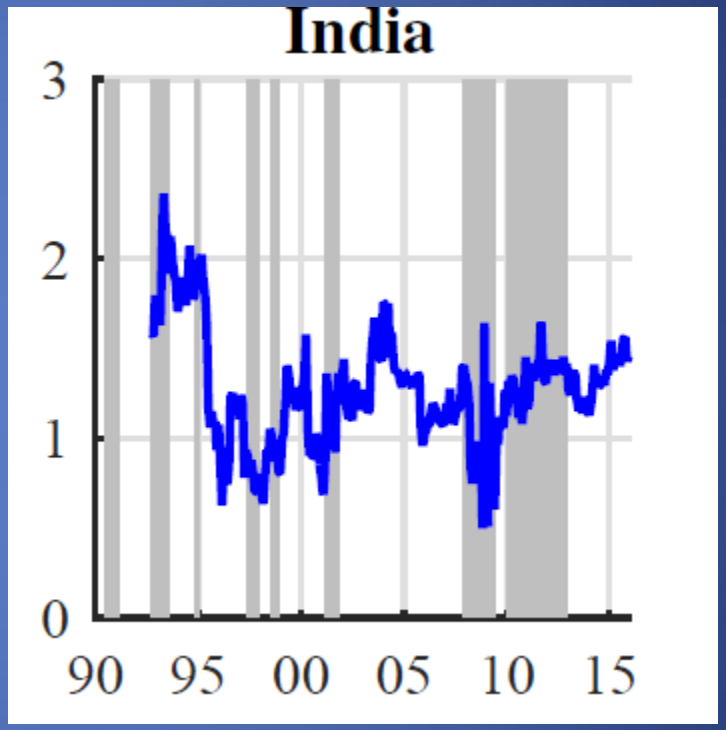


Price of Local Covariance Risk



Contribution of illiquidity to expected returns , % annualized





Conclusion

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