Correlations across Asia-Pacific bond markets
and the impact of capital flow measures

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Background

• **Asia-Pacific bond markets**
  - Cross-sectional differences
  - Development of markets before and after the GFC
  - Correlations across bond markets (flows and returns)

• **Capital flow measures**
  - Actively used in emerging Asia
  - Impact of capital flow measures (CFMs) on the correlations across Asia-Pacific bond markets
  - First step for discussion on the need for cross-border coordination of CFMs
Capital Flow Management Measures (CFMs) become popular toolkits among EAEs

Capital Flow Management Measures (CFMs)-with announcement date

Note: 1/Bank levy in 2011H2 for Korea; Limit bank ST borrowing in Mar 11 and raise RR on FCD in Mar & Jun 11 for Indonesia
Capital Flow Management Measures (CFMs) become popular toolkits among EAEs.

Other types of Capital Flow Management Measures (CFMs)—with announcement date:

- **Nov 09**: Further Liberalize outflows
- **Dec 09**: Liberalize outflows
- **Feb 10**: Liberalize outflows
- **Jun 10**: Liberalize outflows
- **Sep 10**: Liberalize outflows
- **Oct 10**: Liberalize outflows
- **Nov 10**: Liberalize outflows
- **Dec 10**: Liberalize outflows

**Note:**
1/Bank levy in 2011H2 for Korea; Limit bank ST borrowing in Mar II and raise RR on FCD in Mar & Jun II for Indonesia.
Main questions

Cross country comparison of linkages:
• How different are the correlations of bond flows (and bond returns) for different pairs of economies in the Asia-Pacific region?

Evolution of linkages:
• How have the correlations of bond flows (and bond returns) across Asia-Pacific economies changed over the past ten years (2004–2013)?

Determinants of linkages:
• What factors explain these cross-sectional patterns and time variations?

Implications of CFMs on linkages:
• What is the impact of capital flow measures on the correlations of bond flows (and bond returns) across Asia-Pacific economies over 2004–2013?
Additional questions

Determinants of bond flows and returns:

- What factors explain bond flows (foreign investment in local currency bonds of Asia-Pacific economies) into an economy and also foreign investors’ returns?

Effectiveness of CFMs:

- How effective were capital flow measures (CFMs) in dealing with capital inflows in their own jurisdictions?
Main results

• **Global factors generally increase the correlation of bond flows across Asia-Pacific economies.**

• **Policy measures on bond inflows taken by each of the seven emerging Asian economies (CN, IN, ID, KR, MY and TH) generally lowered the correlations of its own bond flows with the other economies in Asia and the Pacific.**

• **Bond flow measures taken by each of the seven economies tended to reduce the bond flow correlations among the other countries in the region.**
Drivers of bond flows and returns

• **Global factors:** Push factors explaining the incidence of a surge
  - Global liquidity expansion
  - Investors’ perception of global risk

• **Regional factors:** Pull/push factors explaining the magnitude of surges
  - Favourable regional fundamentals
  - Depth of the regional financial market
  - Regional financial linkage and contagion
  - Regional liquidity expansion and low interest rates

• **Domestic (local) factors:** pull factors
  - Macroeconomic indicators
  - Expectation of currency appreciation
  - Structural variables
  - Institutional quality (political stability, quality of regulation)
Data

- **Bond flows:** weekly data compiled by EPFR
  (using percent share of flows out of the total outstanding stock of bonds for an economy)

- **Global factors:** VIX, M2 in US, EU, JP, UK

- **Domestic (local) factors:** interest rate differential, expected appreciation using forward rate

- **Data to be included:** regional factors, country’s structural variables and institutional quality
Capital flow measures in Asia-Pacific

• Prepared a list of capital flow measures taken by Asia-Pacific economies from 2004 to 2013

• Considered measures directly targeting bond flows and bond markets as well as other capital flow measures
  – **By direction:** tightening inflows, loosening inflows, loosening outflows, tightening outflows
  – **By target flows:** bond flows, equity flows, bank flows, real estate inflows, direct investment flows and other flows (remittances, export etc).
  – **By target group:** residents, non-residents

• Sources: IMF AREAERs, national sources, recent publications of the IMF, the BIS and other papers.
Capital flow measures (continued)

• **Consider various types of CFMs**
  - Capital controls (targeting non-residents only): tax, administrative, prudential measures
  - Foreign currency-related prudential measures including reserve requirements on FX liabilities
  - Fiscal and prudential measures on specific asset market investors (non-discriminatory)

• **So far, we have documented 312 distinct measures by 9 Asian economies over 2004–2013 (or latest available)**
  - CN (31), HK (4), IN (93), ID (12), KR (56), MY (45), PH (32), SG (4), TH (35); AU (0), JP (0) and NZ (0).
Summary table of capital flow measures

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Empirical approaches

• **I. Calculate pairwise correlations** of bond flows and bond returns, using multivariate GARCH models.
  - The cross-sectional patterns and movements over time of the correlations are examined to gauge the degree of regional financial linkages and risk sharing.

• **II. Run traditional panel regressions/individual regressions** on the correlation pairs to gauge the impact of specific types of capital flow measures, after controlling for important global and local factors.

• **III. Conduct event study analysis** with the estimation window before (and after) the date of a CFM, and the event window starting on (or before) the date of the CFM.
CFMs are incorporated in the regression by 2 ways:

1. Dummies (1, 0 -1) for each individual policy action implying that the policy action will have only a transitory effect on the dependent variable.

2. An accumulation of past changes implying that the dependent variable will be permanently affected by the tightening of the policy variable in the absence of a subsequent reversal.
I. Bond flow correlation: cross-sectional dimension

- **Overall,** cross market correlation of bond flows among Asia-Pacific economy pairs is relatively high, ranging from 0.35 (HK and NZ) to 0.96 (ID and MY), with the median 0.715.

- **Lowest correlation** between bond flows into completely liberalised capital account counties (e.g. AU, JP and NZ) and bond flows into other Asia-Pacific markets.

- **Relatively weak correlation** between bond flows into open capital account countries e.g. HK (exchange rate peg) and SG (exchange rate target) and bond flows into other emerging Asia.
I. Bond flow correlation: cross-sectional dimension (continued)

- **Relatively weak correlation** between bond flows into extensive capital controls countries (i.e. CN and IN) and bond flows into other emerging Asia.

- **High Correlations** of bond flows among ID, MY, PH and TH are high.

- Similar patterns for the correlations of bond flow percent shares, except higher correlations among AU, NZ, JP, KR.
### Bond flow level, using DCC GARCH, September 2005 - October 2013

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I. Bond flow correlations: time dimension

- EPFR bond flow correlations: level and percent share

- Peak of correlations just after Lehman bankruptcy
- High level of correlation during Eurozone debt crisis
- Sharp rise in correlation since early May 2013
I. Bond flow correlations: time dimension
II. Panel regression

• Correlation: panel regressions
  – on all 66 pairs
  – on 11 pairs for each of 12 economies

\[
\text{Correlation}_{AB} = f(\text{global factor}, \text{local factor}_A, \text{local factor}_B, \text{bond measure}_A, \text{bond measure}_B, \text{bond measure}_\text{Other})
\]

• Bond flow: panel regressions
  – Bond flow into a country (all samples)
  – Country by country regression

\[
\text{Bond flow}_A = f(\text{global factor}, \text{local factor}_A, \text{bond measure}_A, \text{bond measure}_\text{Other})
\]
II. Panel regression: Bond flow correlations, full sample

- **Global factors**: greater global liquidity and higher risk aversion increase the bond flow correlations in the region.
- **Local factors**: expected currency appreciation have significant positive impact on correlation, but interest differentials have significant negative impact on correlation only when we consider cumulative impact of bond flow measure.
- **Policy actions**: bond inflow tightening measure significantly associated with the reduction in bond flow correlations (both the instantaneous impact and cumulative impact).
  - Supports substitution of flows after measure introduced.
II. Panel regression: Bond flow correlations, each economy

- Global liquidity has positive effects on correlations involving ID, JP, MY, NZ, SG and TH.
- Policy actions
  - For IN and KR, tightening change in bond inflow measures significantly reduces bond flow correlation of IN and KR with the other economies.
  - Only for TH, tightening change in bond inflow measures significantly raises bond flow correlation of TH with the other economies.
  - For CN, IN, KR and TH, cumulative variable of changes (degree of tightness in bond inflow policy) reduces the correlations of these economies vs the other economies.
II. Panel regression: Bond flow

- **Global factors:** greater global liquidity and risk aversion reduce percent share of bond flows to each country
- **Local factors:** expected currency appreciation and interest differentials have significant positive impact on bond flow
- **Policy actions:** using country by country regression, country’s own bond measure tend to reduce bond flows to the country, especially in case of CN, IN and MY
III. Event study

Steps:

- Identify discrete events (policy actions) and partition time series into two mutually exclusive subsamples:
  - Event window spanning 3 weeks prior and 2 weeks after event
  - Estimation windows: a forecasting model is fit
- The policy measure’ effects are calculated by subtracting forecast values from actual values during the event window.
### III. Event study

- Bond flow measures over 2004-2013:
- 7 tightening measures → 6 events
- 20 loosening measures → 16 events

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<td>5. KR (Jan 11)</td>
<td>Mixed</td>
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<td>6. PH (Jul 12)</td>
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III. Event study

<table>
<thead>
<tr>
<th>Events (Loosening measures)</th>
<th>Impacts on</th>
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<tbody>
<tr>
<td></td>
<td>Correlation</td>
<td>Flow to country</td>
<td>Flow to other</td>
</tr>
<tr>
<td></td>
<td></td>
<td>institute controls</td>
<td>countries</td>
</tr>
<tr>
<td>1. CN (Sep 09)</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
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<tr>
<td>2. CN (Aug 10)</td>
<td>↑</td>
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<td>3. CN (Dec 11)</td>
<td>↑</td>
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<td>4. IN (Oct 08)</td>
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<td>4. IN (Feb 09)</td>
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<td>5. IN (Mar 10)</td>
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<td>6. IN (Nov 11)</td>
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<td>7. IN (Jun 12)</td>
<td>↑</td>
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<td>8. TH (May 06)</td>
<td>↓</td>
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</tbody>
</table>

**Mixed results for:** IN (Feb 07), IN (Apr 07), KR (May 06), KR (Dec 07), KR (May 09), MY (Apr 07)
Policy implications

- Bond inflow measures can have both positive and negative effects on the bond flow correlation.
  - When an economy’s bond inflow tightening measure discourages foreign investors from investing in bonds in the region as a whole, pairwise correlations increase.
  - When a measure induces investors to switch from one market to the others, pairwise correlations decrease.
- Considering the indirect impact (measure of “other” country not in the correlation pair), other cumulative tightening measure significantly reduce correlation.
- In addition, the cumulative loosening increases (while cumulative tightening reduces) the flow.
Conclusion

• Important to analyse the impact of unilateral bond flow measures by an economy on the correlation of bond flows and returns involving that economy
  – Precondition for discussing the need for cross-border policy coordination in CFMs
• Using panel and individual regressions on correlations as well as event study, we found that after controlling for global and local factors,
  – bond inflow measures by a country tended to reduce bond flow correlations bet itself and other countries,
  – Overall these measures also tended to decrease bond return correlations bet itself and other countries.
Future work

• Going forward, we can also consider cross-policy impact on capital flow correlations.
  – For example, the impact of equity inflow measures on bond inflow correlations.
• Using the daily portfolio flow data for KR and TH, we can conduct a case study on the bond flow correlation of this pair.
  – Considering the active role of Korean (and Thai) investors in Thai (Korean) bond markets over the past several years, it would be interesting to investigate a high-frequency reaction of cross-bond market flows to bond inflow measures.
Cross-asset flow correlations

- We can also consider the correlation of EPFR bond flows and EPFR equity flows within an economy.
- ID, KR and TH bond inflow measures have a significant impact on their cross-asset flow correlations.
  - When KR and TH authorities tightened bond inflows, fund investors shifted their funds from bonds to equities within KR or TH, so that the cross-asset flow correlation became lower or even negative.
  - When ID authorities tightened bond inflows, fund investors decided to withdraw funds from both bond and equity markets of ID, so that the cross-asset flow correlation increased.