Leveraging China’s industrial upgrading and renminbi internationalization

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What motivates us?

• The Chinese yuan has appreciated by nearly 1 percent per quarter on average for eight years consecutively since exchange rate regime reform in July 2005

• Hsu et al. (2014), for instance, find that China’s export structure became more similar to that of the developed countries after the currency appreciation
Yuan appreciation facilitates China’s industrial upgrading...

• Li et al. (2014) evidence that yuan appreciation significantly increases the probability of firm entry and products adding, more in ordinary than processing trade

• China is leveraging appreciation, whether being a deliberate strategy or not, to move up the value chains.
...and the renminbi to go global

• Orderly appreciation which upholds the renminbi as a stable and even increasingly-yielding currency has greased the wheel to make the renminbi goes global.

• Ito and Chinn (2015) predict that the share of renminbi invoicing in China’s exports will rise to above 25% in 2015 and above 30% in 2018.
Questions of interest are...

• How exactly China’s industrial upgrading and renminbi internationalization associated with yuan appreciation would have impacted on neighboring developing economies?

• What’re the underlying mechanisms?

• Any stabilization role for monetary authority?
Previewing what we find

• Developing economies’ industrial upgrading can be favorably coupled to China’s one.

• Three spillover channels: global input-output linkage, dollar pricing channel, and quality competition channel

• Yuan appreciation strategy in the face of a liberalized capital account would instigate drastic capital flows that disrupt industrial upgrading in both regions.
Central bank’s role in upgrading promotion

• Anchoring exchange rates against either yuan or U.S dollar is of little help for developing economies.

• By stabilizing downstream export price inflation, favorable spillovers from China’s industrial upgrading to developing economies can be recouped even in the face of China’s liberalized capital account.

• Even better: entry in developing economies’ skill-based sector expands much stronger, and skill-biased technical progress become more persistent
Our approach: A two-country New Keynesian model

• Expanded with
  – Global upstream-downstream linkage with feedback loop
  – Skill-based vs. non-skill-based sectors in upstream industry
  – Firm entry into upstream sectors are endogenous
  – Path-dependent technical change
  – Currency choice of trade invoicing is endogenous
  – Portfolio balance approach to international capital flows
  – Crawling peg with sterilized intervention
Entry function and business formation function

• Entry into skill-based sector depends on the sector’s expected profit relative to overall industry’s profit

\[
\bar{N}_{e,t} = \bar{V}_t / (\bar{V}_t + \bar{V}_t)
\]

• Entry leads to expanding business formation (Ghironi and Melitz, 2005)

\[
\bar{N}_t = (1 - \delta)(\bar{N}_{t-1} + \bar{N}_{e,t-1})
\]
Facing firm entry is Sutton’s (2012) sunk cost

- Business formation contributes to path-dependent technical progress a-la Acemoglu et al. (2015)

\[ \bar{A}_t = (1 + \gamma \text{prop}\bar{N}_t)\bar{A}_{t-1} \]

- Facing firm entry is Sutton’s (2012) sunk cost

\[ \bar{f}_{e,t} = \zeta(\bar{A}_{t-1})^{\bar{\mu}} \]

- A low value of \( \bar{\mu} \) means that fixed cost outlays, which we may think of as R&D outlays, is effective in raising quality.
Defining industrial upgrading

• A successful entry in a particular upstream sector induced by stronger expected profitability contributes to increasing density that favorably directs quality frontier toward the sector.

• Greater firm density lifts entry barriers for subsequent entrants, allowing only participation of more productive firms subsequently.

• Industrial upgrading is path dependent.
Expected profitability for an entry in skill-based sector can be derived as

\[
V_t(i) = \mathbb{E}_0 \sum_{i=0}^{\infty} (1 - \delta)^i \bar{q}_{t+i} \bar{\Pi}_{t+i}(i) = \mathbb{E}_0 \sum_{i=0}^{\infty} (1 - \delta)^i \bar{q}_{t+i} (\bar{R}_{U,t}(i) - \bar{Y}_t(i)\bar{R}_{U,t}(i)) - \bar{f}_{e,t}
\]

which can be rearranged as

\[
\begin{align*}
\bar{V}_t(i) &= \frac{1}{1 - (1 - \delta)\bar{q}_t} \left\{ \left( 1 - \frac{1 - \theta(1 - \delta)}{1 + \bar{\pi}_{h,t}} \right) \bar{R}_{h,t}(i) \right. \\
&\quad + \left( 1 - \frac{1 - \theta(1 - \delta)}{\bar{\omega}_t \bar{q}_t} \right) \bar{R}_{hf,t}(i) \left\} - \bar{\zeta}(A_{t-1})\bar{\mu}
\end{align*}
\]

where \( \bar{R}_{h,t} \) refers to domestic sales revenue and \( \bar{R}_{hf,t} \) refers to export revenue from home (Developing economies) to foreign (China).
Transmission channels

\[ \bar{V}_t(i) = \mathbb{E}_0 \sum_{i=0}^{\infty} (1 - \delta)^i \bar{Q}_{t+i} \left( \bar{Q}_{\text{hf},t} \bar{X}_{\text{hf},t}(i) - \bar{Y}_t(i) \bar{R}_{U,t}(i) \right) \]

- **Capital flow channel**
- **Pricing channel**
- **Quality competition channel**
- **Global input-output linkage**
Export pricing strategy: dollar pricing...

• Dollar pricing strategy solves the following dynamic pricing problem for developing economies (identical for Chinese exporters)

\[
\max_{Q_{usd}^{\text{Hf},t}(i)} \mathbb{E}_t \sum_{i=0}^{\infty} \theta^i (1 - \delta)^i q_{t+i} \left( S_{\text{Hd},t+i} \frac{\bar{Q}_{\text{usd}}^{\text{Hf},t}(i)}{Q_{\text{Hf},t+i}^{\text{usd}}} - \bar{r}_{U,t+i}(i) \right) \left( \frac{\bar{Q}_{\text{usd}}^{\text{Hf},t}(i)}{Q_{\text{Hf},t+i}^{\text{usd}}} \right)^{-\epsilon} \bar{X}_{\text{Hf},t+i}(i)
\]
...or yuan pricing?

• Yuan pricing is asymmetric

• It is local currency pricing from developing economies exporters’ point of view

\[
\max_{\overline{Q}_{HF,t}(i)} \mathbb{E}_t \sum_{i=0}^{\infty} \theta^i (1 - \delta)^i Y_{t+i} \left( \frac{\overline{Q}_{HF,t}(i)}{Q_{HF,t+i}} - \overline{r}_{U,t+i}(i) \right) \left( \frac{\overline{Q}_{HF,t}(i)}{Q_{HF,t+i}} \right)^{-\epsilon} \overline{X}_{HF,t+i}(i)
\]

• But producer currency pricing from Chinese exporters’ perspective

\[
\max_{\overline{Q}_{HF,t}(i^*)} \mathbb{E}_t \sum_{i=0}^{\infty} \theta^{*,i} (1 - \delta)^i Y_{t+i} \left( \frac{\overline{Q}^*_{HF,t}(i^*)}{\overline{Q}^*_{HF,t+i}} - \overline{r}_{U,t+i}(i^*) \right) \left( \frac{\overline{Q}^*_{HF,t}(i^*)}{\overline{Q}^*_{HF,t+i}} \right)^{-\epsilon} \overline{X}^*_{HF,t+i}(i)
\]
Average export price is weighted by different pricing strategies

- Average export price of high-quality intermediates and downstream output in local currency are, respectively, given by

\[
\bar{Q}_{hf, t} = (1 - \phi_t) S_{hd, t} \bar{Q}_{hf, t}^{usd} + \phi_t S_{hf, t} \bar{Q}_{hf, t}^{rmb}
\]

\[
\bar{P}_{hf, t} = (1 - \phi_t) S_{hd, t} \bar{P}_{hf, t}^{usd} + \phi_t S_{hf, t} \bar{P}_{hf, t}^{rmb}
\]
Defining renminbi internationalization

• Upstream exporters can choose to quote either in U.S dollar or Chinese yuan, as far as the quoted price minimizes loss due to deviation from the optimal frictionless price.

• Speaking differently, exporters will be self-sorting into yuan pricing strategy if it is profit maximizing.
As the past-period profitability of yuan-invoiced trade improves relative to that of the dollar-invoiced trade, exporters are more likely to adopt yuan-invoiced trade.
RMBI also involves capital account liberalization

• Using portfolio balance approach, capital flows into China is

$$K_{h,t}^B = \left( \frac{S_{h,t}B_{p, h,t-1}}{P_t} \right) \left( \frac{1}{\Phi_K} (q_{h,t}^B - 1) + \omega_{K,h}^B \right)$$

• Where $q_{h,t}^B$ is “Tobin’s marginal q” in portfolio investment

$$q_{h,t}^B = E_t \left( \frac{S_{h,t+1}}{S_{h,t}} \right) \left( \frac{1}{1 + r_t} \right) \left( q_{h,t+1}^B (1 + r_t^*) + \Phi_{K,t+1}^B \left( \frac{P_tK_{h,t+1}^B}{S_{h,t+1}B_{p, h,t}^*} - \omega_{K,h}^B \right) \right)$$

• $\Phi_K$ measures degree of capital account convertibility, where $\Phi_K \to 0$ indicates free capital account and $\Phi_K \to \infty$ indicates inconvertible capital account
External balance

• Let PBoC’s foreign exchange intervention $FXI^*$ be defined as

$$FXI_t^* \equiv B_{g,d\bar{f},t}^d - B_{g,d\bar{f},t-1}^d$$

• External balance takes the form

$$\left( S_{d,t}/P_t^* \right)FXI_t^* = r_{t-1}^d \left( S_{d,t}/P_t^* \right)B_{g,d\bar{f},t-1}^d + EX_t^* - IM_t^* + S_{h\bar{f},t}^{-1} \left( P_t/P_t^* \right)GKI_t^* - GKO_t^*$$
Sterilized FXI and crawling peg

• Following Chang et al. (2015), PBoC’s sterilization policy varies the share of foreign-asset purchases (sales) financed by money creation

\[ M_t^* = M_{t-1}^* + \tau^* S_{fd,t} FXI_t^* \]

• to manage a constant rate of appreciation

\[ S_{fd,t} = e^{Z^{*}_{S,t}} S_{fd,t-1} \]
• China’s industrial upgrading associated with yuan appreciation benefits DE through global input-output linkage and pricing effect
• Even when DE faces higher sunk entry cost, DE firms can still be benefited through **quality competition channel**

• Condition is the quality gap between Chinese and DE firms are not too wide
• Capital account liberalization overturns China’s responses to yuan appreciation
DE also responds adversely to yuan appreciation under liberalized China’s capital account as well as unsterilized FXI by PBoC
• Stabilizing exchange rates is of little help to shield DE from adverse effects of persistent yuan appreciation under China’s liberalized capital account.
• **Stabilizing final export price inflation** generates benign spillover effects from China’s industrial upgrading even when China’s capital account is convertible

• Export price inflation targeting stabilizes cost environment for quality upgrading (Bergin and Corsetti, 2015)
Extension for future work

• To incorporate vertical FDI into the model for a more realistic trade-FDI-capital nexus, as trade and MNCs are closely linked

• To incorporate credit friction, as credit policy is important for Chinese industrial development

• Welfare assessment for optimal monetary policy

• Condition for Pareto-improving international policy coordination