Leveraging China's industrial upgrading and renminbi internationalization

Chin-Yoong Wong

Yoke-Kee Eng

Universiti Tunku Abdul Rahman (UTAR), Malaysia

1

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

$$\overline{N}_{e,t} = \overline{V}_t / (\overline{V}_t + \underline{V}_t)$$

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

$$\overline{N}_t = (1 - \delta)(\overline{N}_{t-1} + \overline{N}_{e,t-1})$$

Facing firm entry is Sutton's (2012) sunk cost

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

$$\overline{A}_t = \left(1 + \overline{\gamma}\mathrm{prop}\overline{N}_t\right)\overline{A}_{t-1}$$

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

$$\overline{f}_{e,t} = \bar{\zeta}\left(\overline{A}_{t-1}\right)^{\overline{\mu}}$$

- A low value of $\overline{\mu}$ 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.

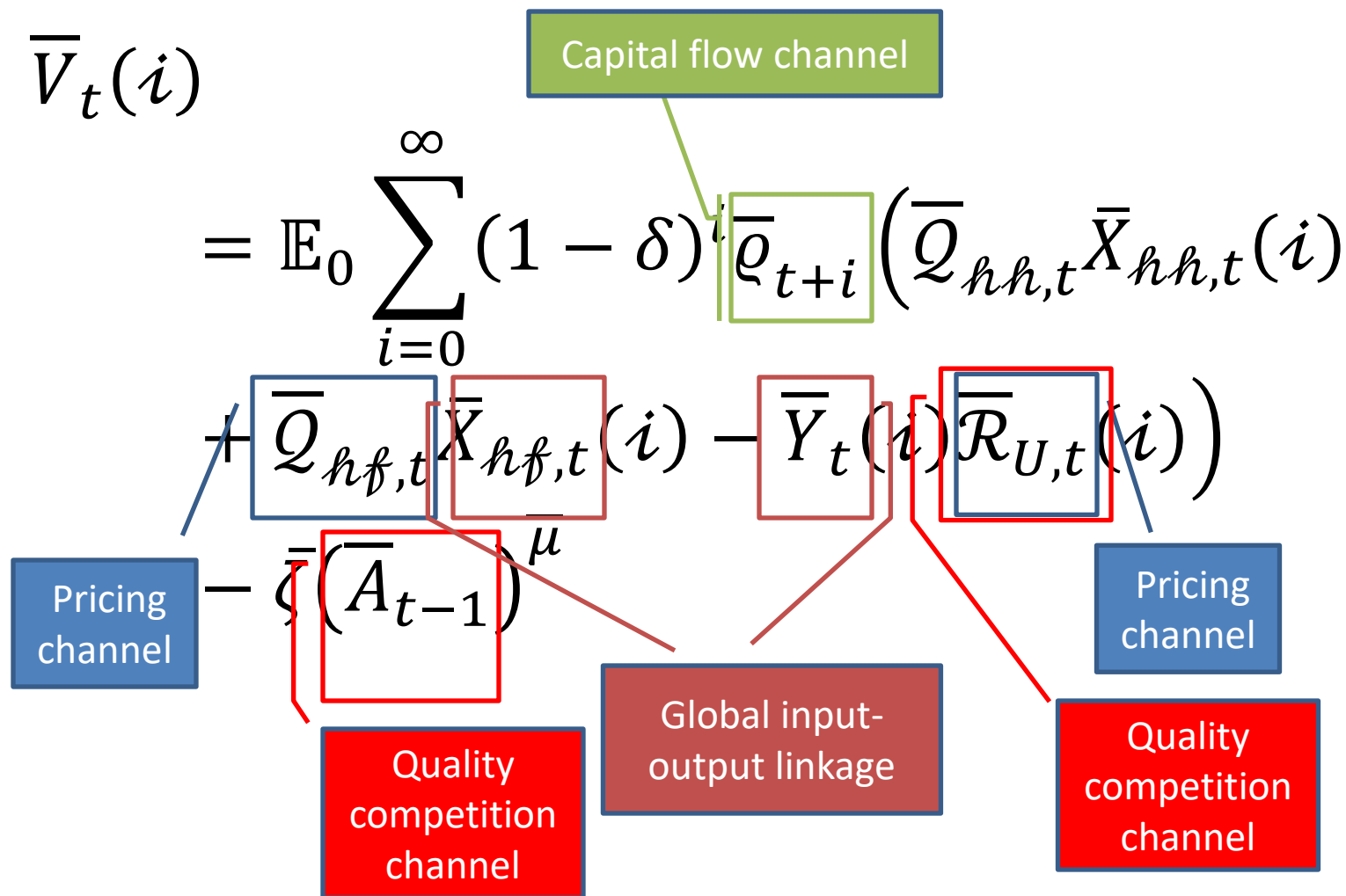# Expected profitability for an entry in skill-based sector can be derived as

$$\overline{V}_t(i) = \mathbb{E}_0 \sum_{i=0}^{\infty} (1-\delta)^i \overline{\varrho}_{t+i} \overline{\Pi}_{t+i}(i) = \mathbb{E}_0 \sum_{i=0}^{\infty} (1-\delta)^i \overline{\varrho}_{t+i} \left(\overline{\mathbb{R}}_{U,t}(i) - \overline{Y}_t(i) \overline{\mathcal{R}}_{U,t}(i) \right) - \overline{f}_{e,t}$$

which can be rearranged as

$$\overline{V}_t(i) = \frac{1}{1-(1-\delta)\overline{\varrho}_t} \left\{ \left(1 - \frac{1-\theta(1-\delta)/\left(1+\overline{\pi}_{\hbar\hbar,t}\right)}{\overline{\omega}_t \overline{\varrho}_t} \right) \overline{\mathbb{R}}_{\hbar\hbar,t}(i) \right.$$
$$\left. + \left(1 - \frac{1-\theta(1-\delta)/\left(1+\overline{\pi}_{\hbar f,t}\right)}{\overline{\omega}_t^* \overline{\varrho}_t} \right) \overline{\mathbb{R}}_{\hbar f,t}(i) \right\} - \bar{\zeta} \left(\overline{A}_{t-1} \right)^{\overline{\mu}}$$

where $\overline{\mathbb{R}}_{\hbar\hbar,t}$ refers to domestic sales revenue and $\overline{\mathbb{R}}_{\hbar f,t}$ refers to export revenue from home (Developing economies) to foreign (China).

Transmission channels

$$\overline{V}_t(i)$$

$$= \mathbb{E}_0 \sum_{i=0}^{\infty} (1-\delta)^i \overline{\varrho}_{t+i} \left(\overline{\mathcal{Q}}_{hh,t} \bar{X}_{hh,t}(i) \right.$$

$$+ \overline{\mathcal{Q}}_{hf,t} \bar{X}_{hf,t}(i) - \overline{Y}_t(i) \overline{\mathcal{R}}_{U,t}(i) \Big)$$

$$- \bar{\varsigma} \left(\overline{A}_{t-1} \right)^{\mu}$$

Capital flow channel

Pricing channel

Pricing channel

Quality competition channel

Global input-output linkage

Quality competition channel

Export pricing strategy: dollar pricing...

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

$$\max_{\overline{\mathbb{Q}}_{\hbar f,t}^{usd}(i)} \mathbb{E}_t \sum_{i=0}^{\infty} \theta^i (1-\delta)^i \varrho_{t+i} \left(S_{\hbar d,t+i} \frac{\overline{\mathbb{Q}}_{\hbar f,t}^{usd}(i)}{\overline{Q}_{\hbar f,t+i}^{usd}} - \overline{r}_{U,t+i}(i) \right) \left(\frac{\overline{\mathbb{Q}}_{\hbar f,t}^{usd}(i)}{\overline{Q}_{\hbar f,t+i}^{usd}} \right)^{-\overline{\epsilon}} \overline{X}_{\hbar f,t+i}(i)$$

…or yuan pricing?

- Yuan pricing is asymmetric

- It is local currency pricing from developing economies exporters' point of view

$$\max_{\overline{\mathbb{Q}}^{rmb}_{hf,t}(i)} \mathbb{E}_t \sum_{i=0}^{\infty} \theta^i (1-\delta)^i \varrho_{t+i} \left(S_{hf,t+i} \frac{\overline{\mathbb{Q}}^{rmb}_{hf,t}(i)}{\bar{\mathcal{Q}}^{rmb}_{hf,t+i}} - \bar{r}_{U,t+i}(i) \right) \left(\frac{\overline{\mathbb{Q}}^{rmb}_{hf,t}(i)}{\bar{\mathcal{Q}}^{rmb}_{hf,t+i}} \right)^{-\bar{\epsilon}} \bar{X}_{hf,t+i}(i)$$

- But producer currency pricing from Chinese exporters' perspective

$$\max_{\overline{\mathbb{Q}}^{*}_{fh,t}(i^*)} \mathbb{E}_t \sum_{i=0}^{\infty} \theta^{*,i} (1-\delta)^i \varrho_{t+i} \left(\frac{\overline{\mathbb{Q}}^{*}_{fh,t}(i^*)}{\bar{\mathcal{Q}}^{*}_{fh,t+i}} - \bar{r}^{*}_{U,t+i}(i^*) \right) \left(\frac{\overline{\mathbb{Q}}^{*}_{fh,t}(i^*)}{\bar{\mathcal{Q}}^{*}_{fh,t+i}} \right)^{-\bar{\epsilon}} \bar{X}^{*}_{fh,t+i}(i)$$

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

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

$$\mathcal{P}_{hf,t} = (1 - \phi_t)S_{hd,t}P_{hf,t}^{usd} + \phi_t S_{hf,t}P_{hf,t}^{rmb}$$

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.

RMBI as increasing use of renminbi as invoicing currency

$$\phi_t = \varsigma \frac{\exp\left(\widehat{\overline{Q}}_{\hbar f,t-1}^{rmb} - \widehat{\overline{\mathbb{Q}}}_{\hbar f,t-1}^{rmb}\right)}{\exp\left(\widehat{\overline{Q}}_{\hbar f,t-1}^{rmb} - \widehat{\overline{\mathbb{Q}}}_{\hbar f,t-1}^{rmb}\right) + \exp\left(\widehat{\overline{Q}}_{\hbar f,t-1}^{usd} - \widehat{\overline{\mathbb{Q}}}_{\hbar f,t-1}^{usd}\right)}$$

- 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

$$\mathbb{K}^B_{hf,t} = \left(\frac{S_{hf,t}B^*_{p,fh,t-1}}{P_t}\right)\left(\frac{1}{\Phi_{\mathbb{K}}}\left(q^B_{hf,t} - 1\right) + \varpi^B_{\mathbb{K},hf}\right)$$

- Where $q^B_{hf,t}$ is "Tobin's marginal q" in portfolio investment

$$q^B_{hf,t} = \mathbb{E}_t\left(\frac{S_{hf,t+1}}{S_{hf,t}}\right)\left(\frac{1}{1+r_t}\right)\left(q^B_{hf,t+1}(1+r^*_t) + \Phi^B_{\mathbb{K},t+1}\left(\frac{P_t\mathbb{K}^B_{hf,t+1}}{S_{hf,t+1}B^*_{p,fh,t}} - \varpi^B_{\mathbb{K},hf}\right)\right)$$

- $\Phi_{\mathbb{K}}$ measures degree of capital account convertibility, where $\Phi_{\mathbb{K}} \to 0$ indicates free capital account and $\Phi_{\mathbb{K}} \to \infty$ indicates inconvertible capital account

19

External balance

- Let PBoC's foreign exchange intervention *FXI** be defined as

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

- External balance takes the form

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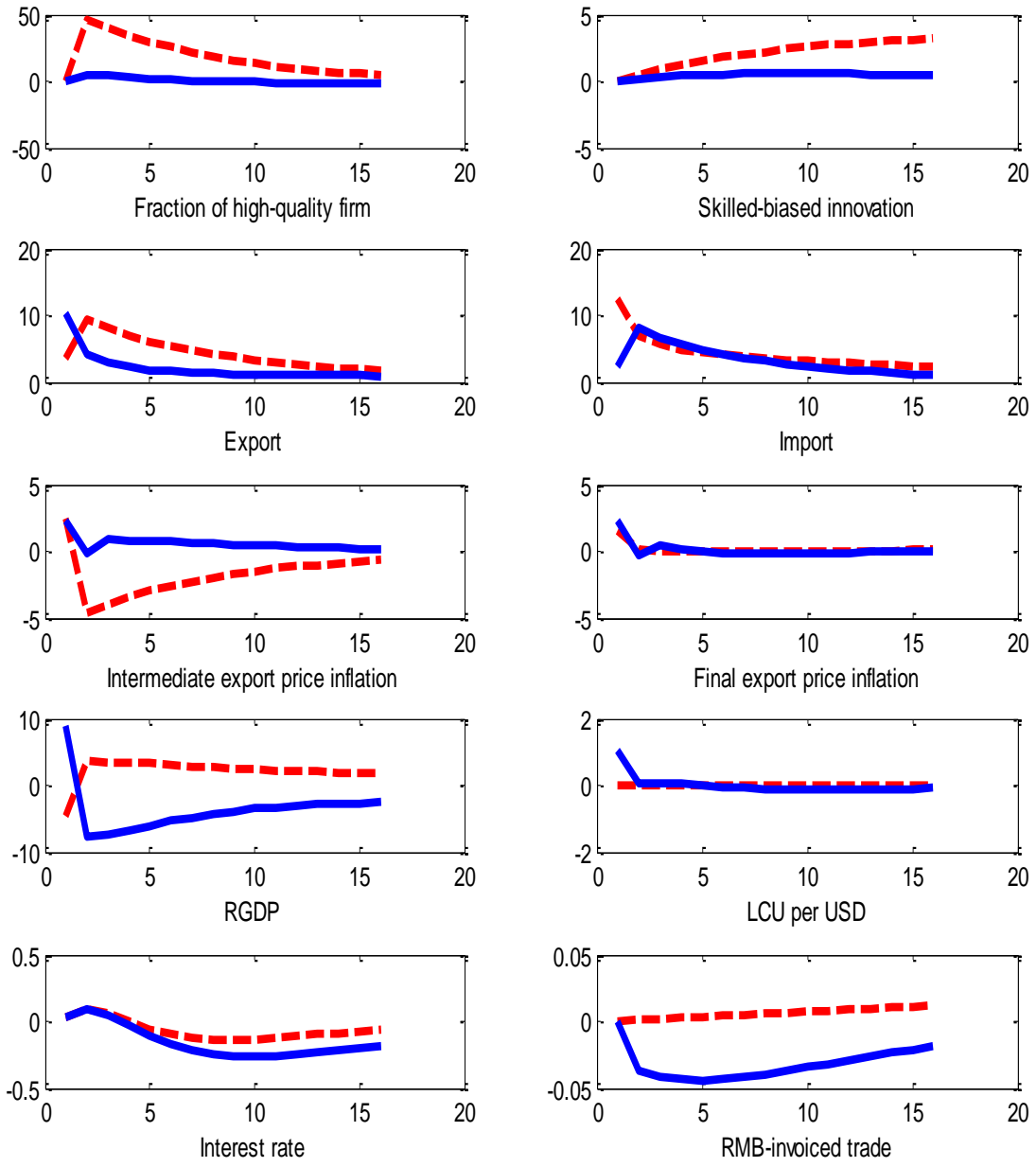
Sterilized FXI and crawling peg

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

$$M_t^* = M_{t-1}^* + \tau^* S_{\!\!f\!d,t} FXI_t^*$$

- to manage a constant rate of appreciation

$$S_{\!\!f\!d,t} = e^{Z_{S,t}^*} S_{\!\!f\!d,t-1}$$

- China's industrial upgrading associated with yuan appreciation benefits DE through **global input-output linkage** and **pricing effect**
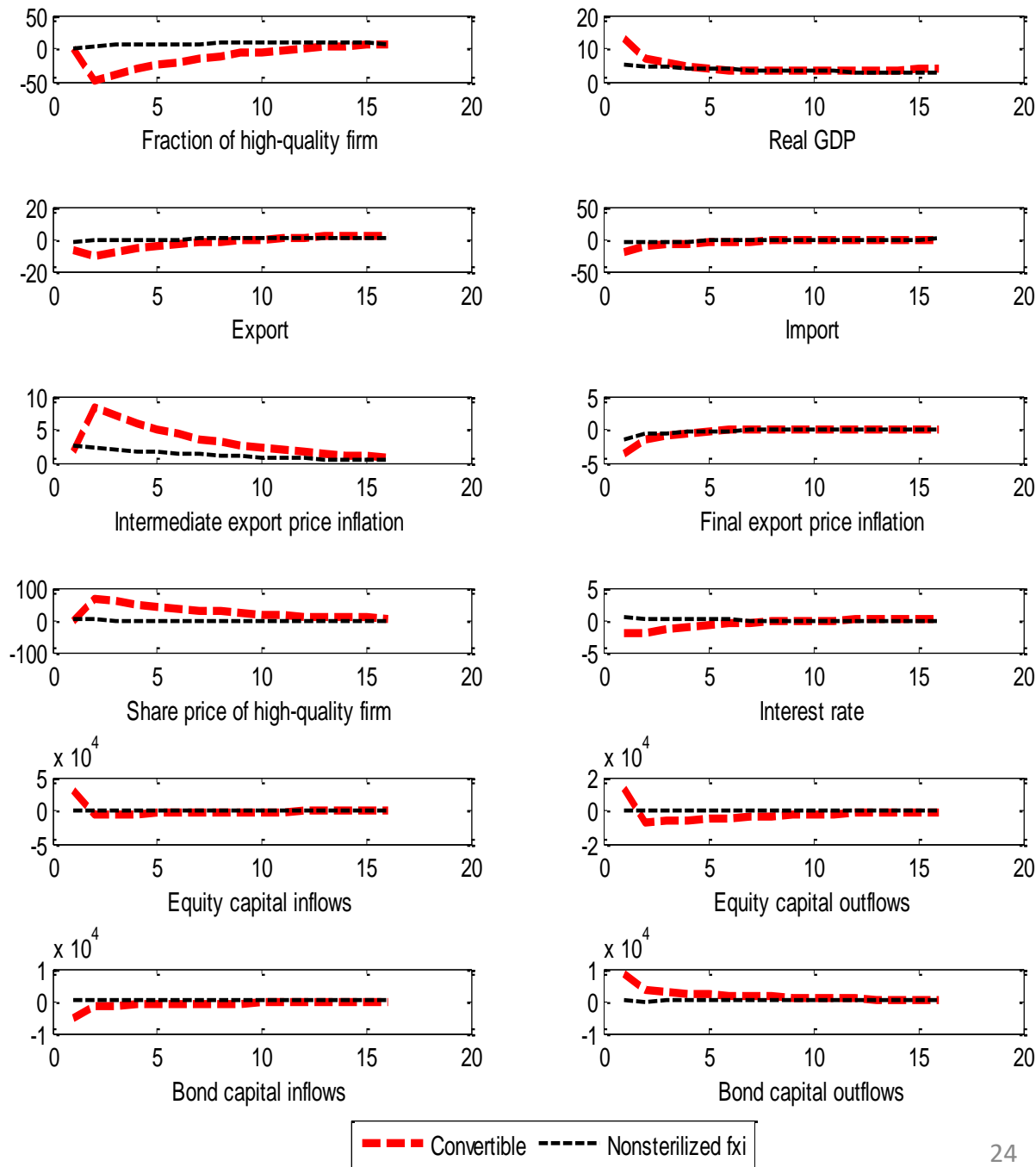

Fraction of high-quality firm

Skilled-biased innovation

Export

Import

Intermediate export price inflation

Final export price inflation

RGDP

LCU per USD

Interest rate

RMB-invoiced trade

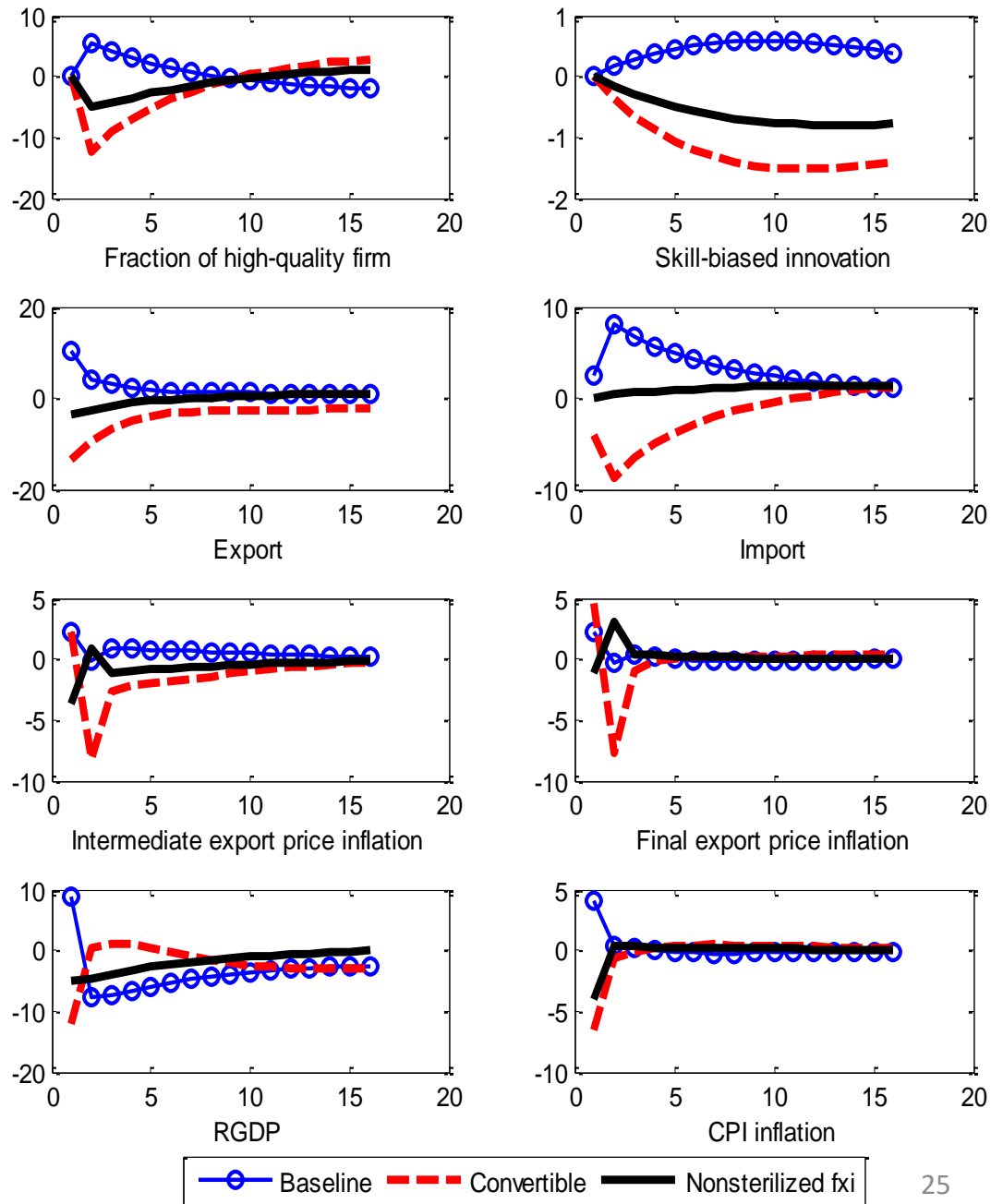- - - China ——— Developing economies DE

22

- 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
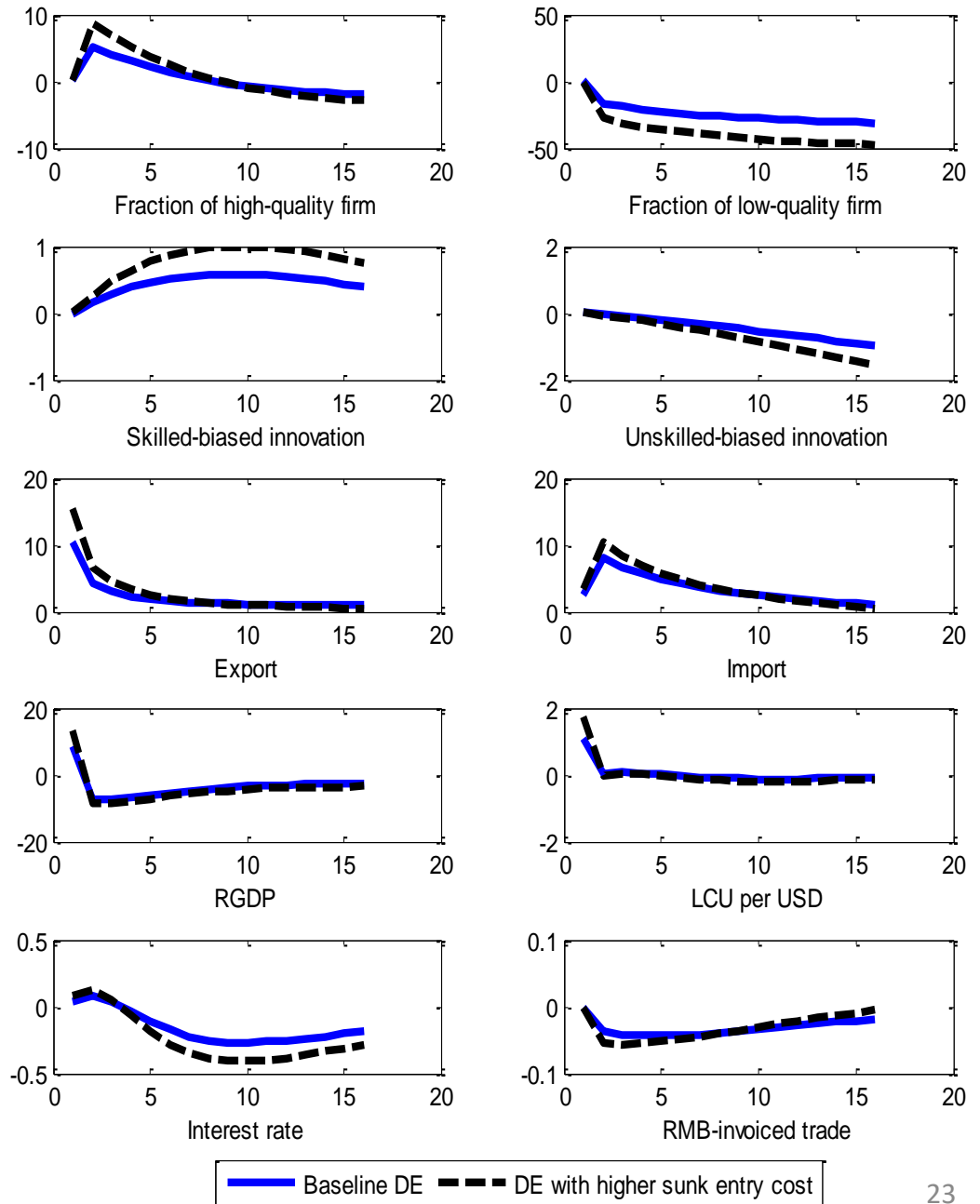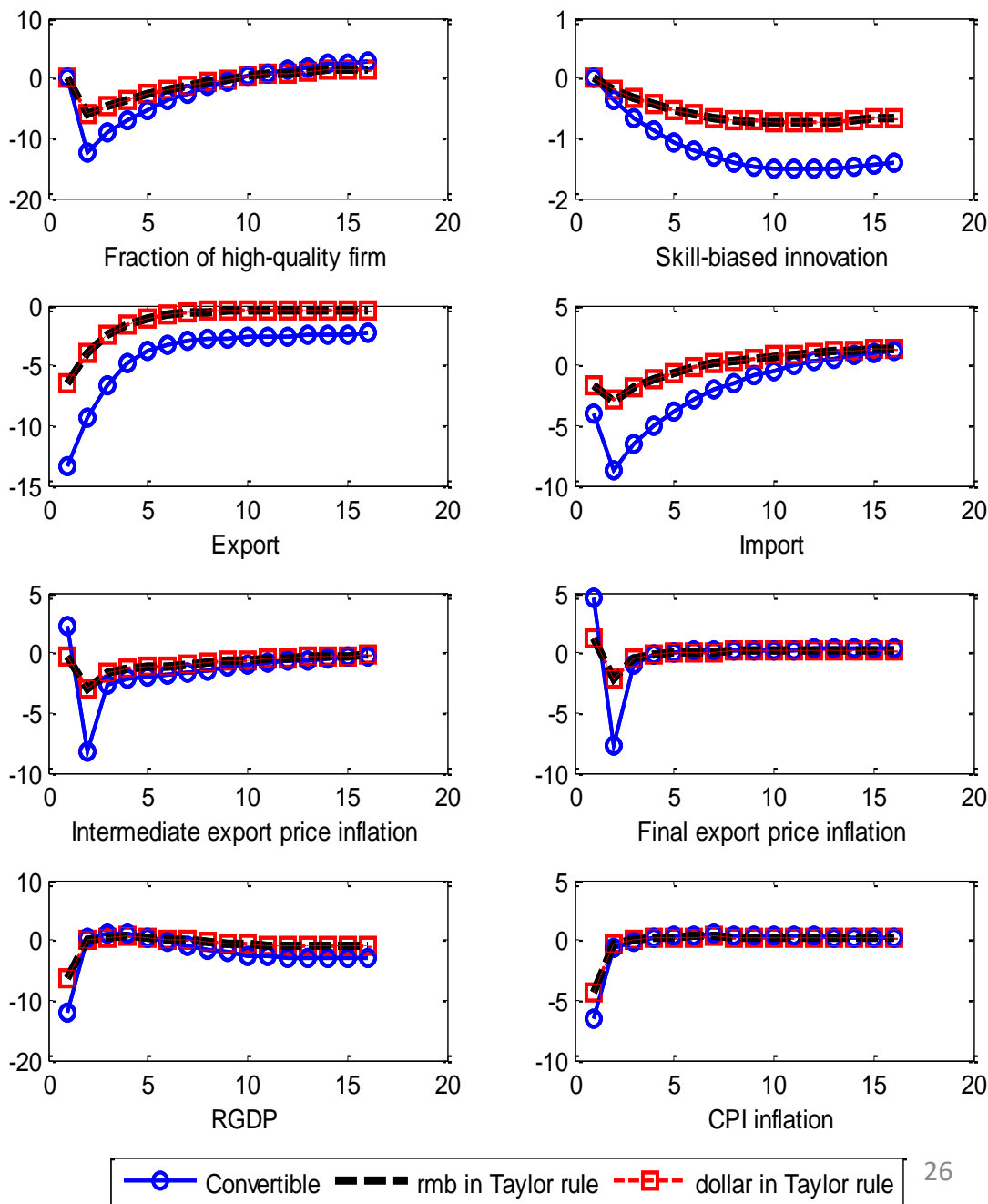
- Capital account liberalization overturns China's responses to yuan appreciation

Fraction of high-quality firm

Real GDP

Export

Import

Intermediate export price inflation

Final export price inflation

Share price of high-quality firm

Interest rate

Equity capital inflows

Equity capital outflows

Bond capital inflows

Bond capital outflows

Convertible ----- Nonsterilized fxi

- DE also responds adversely to yuan appreciation under liberalized China's capital account as well as unsterilized FXI by PBoC

Fraction of high-quality firm

Skill-biased innovation

Export

Import

Intermediate export price inflation

Final export price inflation

RGDP

CPI inflation

Baseline ───o─── Convertible ▬ ▬ ▬ Nonsterilized fxi ▬▬▬

- Stabilizing exchange rates is of little help to shield DE from adverse effects of persistent yuan appreciation under China's liberalized capital account

Fraction of high-quality firm

Skill-biased innovation

Export

Import

Intermediate export price inflation

Final export price inflation

RGDP

CPI inflation

Convertible — rmb in Taylor rule — dollar in Taylor rule

- **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)
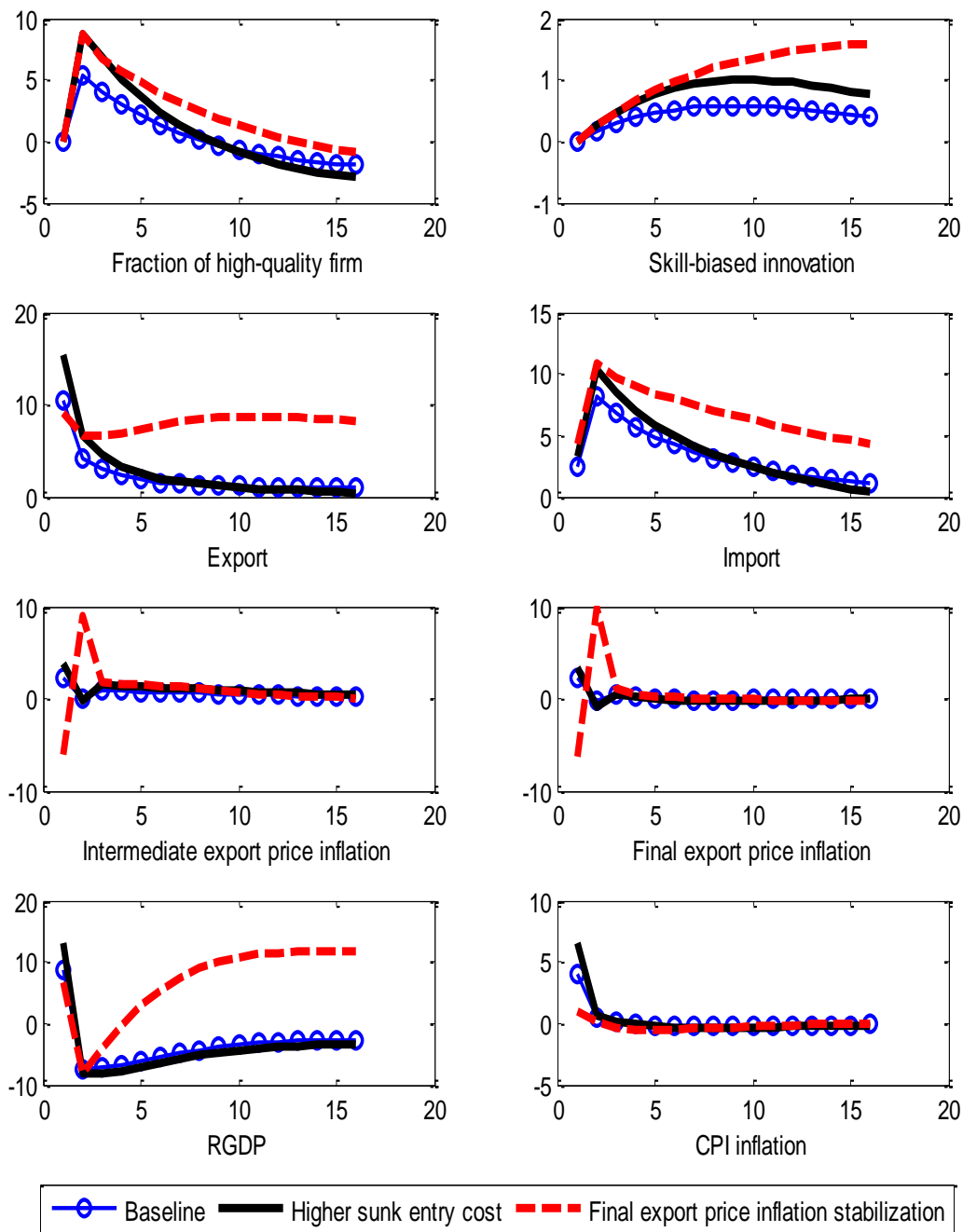
Extension for future work

- 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