Optimal Direct Foreign Investment Dynamics in the Presence of Technological Spillovers

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Overview

- Introduction
- The Investment Problem of a Potential Foreign Investor
- Steady State Analysis
- Transition Dynamics and Sensitivity Analysis
- Conclusions
Motivation

- Worldwide foreign direct investment (FDI) has increased by factor 5 between 1996 and 2000.

- Traditionally market opening considerations have been seen as the main motive for FDI, but cost considerations have gained importance relative to market entry motives (Kinkel and Lay (2004)).

- 15 % of German manufacturing firms have moved (part of their) production abroad between 2004 - 2006.

- About 20 % of foreign investors move production back to Germany within 5 years after the foreign investment.
Motivation

- FDI is considered as one reason for horizontal and vertical technological spillovers towards NICs.

- FDI has two opposite effects:
  - Short term cost reduction;
  - Faster decrease of productivity advantages relative to competitors in the industrializing country.
Research Questions

- How are incentives for FDI influenced by the initial productivity gap between the producers in different countries, the wage differentials and the spillover intensity?

- Can patterns of investments and de-investments in foreign capacity be caused by the intertemporal consideration of spillover effects?
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Literature

- **Empirical work on horizontal spillovers of FDI**: e.g. Aitken and Harrison (1999), Görg and Greenaway (2004), Halpern and Murakozy (2007), Gorodnichenko et al. (2008), Smarzynska and Spatareanu (2008).

- **Theoretical work on FDI as a market entry mode in the presence of technology transfer**: e.g. Das (1987), Wang and Blomström (1992), Lin and Saggi (1999), Petit and Sanna-Randaccio (2000), Mattoo et al. (2001)

- **Theoretical work with focus on cost-reduction motive**: Glass and Saggi (2002)
Basic Features of the Model

- We consider the dynamic foreign investment problem of a firm in the framework of a partial industry model.

- Two countries:
  - developed industrialized country H
  - newly industrializing country F

- $n$ firms compete in a common market: $m$ firms from country F, $n - m$ from country H

- No firm is capacity constrained in its home country

- Firm 1, located in country H, can use FDI to build up production capacity $K_F(t)$ in country F
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Production

- Output is produced with labor as the only variable input.

- Productivity:
  - Domestic firms in country H: \( A_H \)
  - Domestic firms in country F: \( A_F(t) \)
  - Firms from country H producing in F: \( A_{HF} \)

- \( A_F(0) < A_{HF} < A_H \)

- Labor is supplied at constant wages \( w_i, i = H, F \) with

\[ w_H \gg w_F, \quad w_H/A_H > w_F/A_{HF} \]
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Foreign Direct Investment

- Firm 1 located in country H can invest (or disinvest) abroad:
  \[ \dot{K}_F(t) = I(t) - \delta K_F(t), \]

- Maximal quantity in country F: \( Q_1^F(t) = A_{HF} K_F(t) \)
  
  We assume that \( Q_1^F(t) < Q_1(t) \) \( \forall t \)

- Spillovers through FDI (see e.g. Nelson and Phelps (1966), Findlay (1978), Griffith et al. (2002)):
  \[ \dot{A}_F(t) = \lambda K_F(t) (A_{HF} - A_F(t)) \]
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Market Competition

- Oligopoly with quantity competition and inverse demand $P(Q)$ and marginal costs $c_H = w_H/A_H$, $c_F = w_F/A_F(t)$.

- Quantities and the price are determined according to the unique Cournot equilibrium: $Q^*_H(A_F)$, $Q^*_F(A_F)$, $P^*(A_F)$

- $A_F$ denotes the minimal productivity such that foreign firms can compete in the common market, i.e.

$$Q^*_F(A_F) > 0 \iff A_F > A_F$$

- Market profit of firm 1:

$$\pi^*_1(K_F, A_F) = Q^*_H(A_F)(P^*(A_F) - c_H) + K_F A_{HF} \left( c_H - \frac{w_F}{A_{HF}} \right)$$
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Dynamic Foreign Investment Problem of Firm 1

\[
\max_{I(\cdot)} J_1 = \int_0^\infty e^{-\rho t} \left[ \pi_H^*(K_F(t), A_F(t)) - \beta I(t) - \gamma I(t)^2 \right] dt
\]

subject to

\[
\dot{K}_F(t) = I(t) - \delta K_F(t),
\]

\[
\dot{A}_F(t) = \lambda K_F(t) (A_{HF} - A_F(t))
\]

\[
K_F \geq 0
\]

and \( A_F(0) = A_F^{ini} < A_{HF}, K_F(0) = 0 \).

\[
\beta \geq 0, \rho, \delta, \gamma, \lambda > 0
\]
Steady States and Basins of Attraction
Steady States

There exist two types of steady states:

1. For sufficiently small $\beta$ there exists a locally asymptotically stable *catch-up steady state* $(\hat{K}_F, \hat{A}_F)$ with

$$\hat{K}_F > 0, \quad \hat{A}_F = A_{HF}.$$ 

2. For $\lambda > \bar{\lambda}$ there exists a subset $\mathcal{A}$ of the interval $[A_F, \bar{A}_F]$ with positive measure such that for each $\hat{A}_F \in \mathcal{A}$ there is a steady state where $\hat{I} = \hat{K} = 0$. For $\hat{A}_F \in int(\mathcal{A})$ the steady state is neutrally stable.

- For all $A_F(0) > \bar{A}_F$ convergence to the catch-up steady state.

- For all $A_F < A_F$ positive investments are optimal if $K_F = 0$: $I(0, A_F) > 0$
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Capital Accumulation Dynamics Depending on the Technology Gap

(a) $K_F$

(b) $A_F$

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Sensitivity

- If the absorption rate $\lambda$ increases then the 'no-investment' interval $[A_F, \bar{A}_F]$ grows but the foreign capital stock in the catch-up steady state is unaffected.

- If the wage rate $w_H$ in country $H$ decreases then $A_F$ and (for linear demand) $\bar{A}_F$ increase and the foreign capital stock in the catch-up steady state goes down.
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Conclusions

- In the presence of international competition and sufficiently large strong spillovers positive foreign investment is optimal if the productivity gap is sufficiently small.

- Patterns of investment followed by de-investment may be optimal if the initial technology gap is sufficiently large.

- Changes in initial productivity gap and domestic wages have non-continuous impact on FDI, long-run productivity in country F, total output and domestic labor income.
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Extensions

- **Endogenous Absorptive Capacity**

- Endogenous choice of the level of technology to be transferred

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