

Generalities

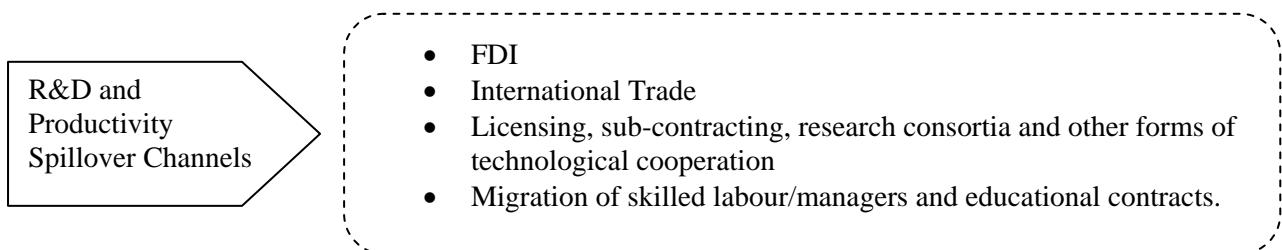
Trade and FDI are alternative (and complementary) explanations for R&D spillovers and productivity gains.

Initial exploration of the subject:

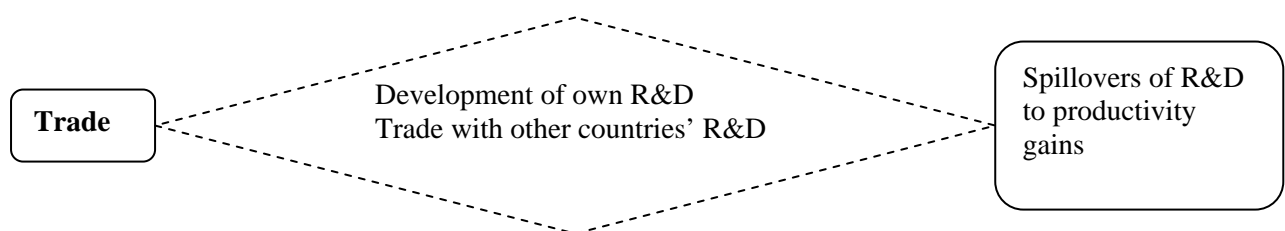
- 6 countries (Italy, Germany, Canada, UK, Japan and USA) are responsible for 84% of the world's stock of R&D and 68% of the world's stock of outward FDI.
- The countries with higher R&D stock also have higher outward FDI stock.
- Hence, FDI may be the dominant form of transfer of technology worldwide, and most spillovers should be through FDI rather than trade.

Determinants of technology spillovers: FDI versus trade

How spillovers may occur:



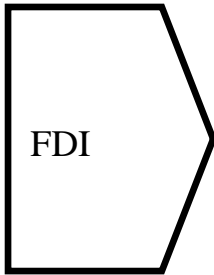
Traditional endogenous growth models literature relates *trade and spillovers* of R&D and gains of productivity in the following way:



Why would *FDI* be a more important channel for technology transfers than trade?

Firms are more efficient at producing and transferring certain types of goods, services and knowledge than the market, because:

- higher returns on firms' specific assets than trade;
- technologies that require learning are transmitted at lower costs through firms directly involved than through third parties;
- non-tradables require local presence.



Host economy:

- acquires new technology, even if this technology already exists in the world;
- who captures spillovers depends on:
 - nature of the capability to be acquired
 - extent to which it is appropriable;
 - linkages with local firms (supply and demand);
 - capabilities of local firms

Home economy:

- initially, MNEs may concentrate R&D at home and returns on R&D may increase because they can sell to subsidiaries;
- R&D may also be decentralised:
 - To take advantages of local technological capabilities
 - Adapt products and processes to local conditions
- M&A are increasingly the dominant form of FDI, and are mainly determined by the desire to acquire technology and vertically and horizontally integrate and specialise.

Cooperative forms of transfer of technology are growing in importance very fast. These include: licenses, subcontracting, joint ventures, research consortia, training contract and other, non-equity contractual arrangements (which include other forms of intra-firm technology collaboration). These forms involve MNEs relating to other MNEs or local firms.

Trade is another form of technology transfers. In addition to providing an incentive to innovation to develop firm specific competitive advantages, trade also provides an incentive to adaptation related to trade with other firms' technology stock. FDI and trade are linked in many ways, not least because the bulk of international trade is intra-firm and/or trade amongst MNEs and between MNEs and other parties. Large trade in components, capital goods and inputs (mostly involving MNEs) is a very important part of transferring embodied knowledge.

However, technology transfers and R&D and productivity spillovers are not simply determined by incentives and opportunities, as specific effort as to be put on it. In other words, usually additional investment is required in learning, communication, adaptation, training, etc, and most of the tacit component of knowledge is acquired by doing rather than seeing. Additionally, FDI may generate supply/demand linkages and competition, both of which are capable of providing more efficient spillover channels than trade alone.

Hence, given that investment and production are required for actual transfers to take place, and that most trade involves MNEs (particularly because of vertical and horizontal integration and specialisation), it seems logical that FDI (and cooperative forms) are the most important spillover channels.

Results

$$Spillovers = \alpha_0 + \alpha_1 FDI + \alpha_2 Coop + \alpha_3 Trade + \varepsilon$$

where $\alpha_1 > \alpha_2 > \alpha_3$ and ... (1.1)

spillovers increase significantly and α_3 declines when FDI is included.

Thus, FDI is more important than trade in the generation of spillovers.