



Bridging the technology gap with limited human capital resources[☆]



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ARTICLE INFO

Article history:
Accepted 25 June 2013

JEL classification:
F23
O33
O40

Keywords:
Technological growth
Foreign direct investment
Contiguous knowledge

ABSTRACT

We study whether restrictions concerning the mode of implantation of multinational firms (MNCs) are desirable for a developing country in terms of its technology acquisition strategy. More precisely, we aim at determining under which conditions domestic equity ownership constraints imposed on MNCs turn out to be beneficial for a country aiming at narrowing its technology gap with the world frontier while facing a limited supply of skilled labor resources. We base ourselves on an extension of the “variety model” of technology-driven growth, and are able to demonstrate that the desirable regulation depends non-monotonically on the overall available amount of skilled human capital. We further find that a positive shock on the pace of technological progress at the world frontier increases the scope of conditions under which ownership constraints become desirable.

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1. Introduction

In industrialized countries, technological change results from innovative research activities conducted at the technology frontier. In developing countries however, firms are often faced with a limited amount of skilled labor resources, constraining them to imitation rather than innovation. For those countries, one of the main identified opportunities for acquisition and diffusion of advanced technologies is the exposure to the state-of-the-art techniques introduced by multinational corporations (MNCs), who are expected to bring along and rely on their proprietary technology in order to compete efficiently with local firms (Glass and Saggi, 1999). In order to optimize the impact of foreign direct investment (FDI), developing countries have often required investors to meet certain specified goals with respect to their operations in the host country (UNCTAD, 2002): if some of those instruments have been progressively prohibited during the last decade in compliance with international commitments,¹ one of the measures still in use in various developing countries consists of imposing “domestic equity ownership constraints”, i.e. requiring the establishment of a joint venture (JV) with domestic participation.

The rationale behind such a requirement is the belief that local participation will facilitate the diffusion of the MNC proprietary technology to the domestic partner.² However, in the presence of such a technology dissipation threat, investors are likely to transfer an older vintage of their technology to the local production facility (Moran, 2002; Saggi and Javorcik, 2004; Takii, 2004). Developing countries are thus facing a trade-off between a higher level of technology being transferred in the case of wholly foreign-owned plants, and facilitated local learning and diffusion of whatever knowledge is transferred in the case of jointly-owned investment projects.

Contrasted empirical results hint at the existence of conflicting effects. While some studies found no difference in the extent of technology transfers stemming from majority- and minority-owned foreign presence (Blomstrom and Sjöholm, 1999), others found higher productivity spillovers to local producers in the case of JVs (Javorcik and Sparateanu, 2008; Takii, 2005). However, the latter studies finding JVs to trigger higher spillovers fail to disentangle two possible effects. The first one is the already previously evoked “knowledge dissipation” effect, i.e. a better access to whatever knowledge is transferred through the actions of the local shareholder. The second effect is linked to the “contiguous knowledge” phenomenon, i.e. the idea that knowledge can only be disseminated at a certain distance (Papageorgiu, 2002). In the case of a developing country, the less sophisticated technologies being transferred to JVs might thus be easier to absorb for the domestic

[☆] I am grateful for the insightful comments of Raouf Boucekkinne, Frédéric Docquier, Matteo Cervellati and one anonymous referee. I also thank participants to the 2nd German Workshop in Macroeconomics, the 10th Jamboree of the European Doctoral Programme in Economics and the 11th T2M Conference for their comments and suggestions. I acknowledge the financial support of the Belgian Research Programmes PAI P5/10 and ARC 03/08-302.

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¹ Some performance requirements, such as local content requirements, have been explicitly prohibited by the WTO Agreement on Trade-Related Investment Measures (TRIMs), being inconsistent with Articles III and XI of GATT (1994) (UNCTAD, 2001).

² The latter may use the knowledge acquired through the partnership with the foreign investor for its own local activities, or hire local personnel the MNC would otherwise not have trusted with key positions, leading to knowledge dissipation through employee turnover (Djankov and Hoekman, 1997).

partner (Javorcik and Sparateanu, 2008). While we deem the “contiguous knowledge” effect to be relevant for developing countries far from the frontier, it might not be the case for developing countries already further up on the development path, that might consider the lower technology level being transferred as a drawback. Hence, the debate on the desirability of ownership constraints would benefit from a clear identification of the different effects at work: does the desirability of JVs stem from the “knowledge dissipation” effect, or from the “contiguous knowledge” one?

The aim of this paper is thus to investigate different technology adoption strategies for a developing country faced with a limited amount of skilled labor resources, and more in particular to determine whether imposing restrictions on the mode of implantation of MNCs can be beneficial even when considering the lower vintage transferred to JVs as being a *drawback*. In other words, can we find ownership constraints to be desirable, when their only advantage is the “knowledge dissipation” effect?

We develop a variant of the Romer (1990) “variety model”, where growth is sustained through an expansion of the number of available products. In our developing country framework, the technology sector does not conduct any innovative R&D activity, but rather strictly resorts to the imitation of innovations coming from abroad through FDI. We furthermore impose a limited technological absorption, i.e. we assume it is never possible to fully bridge the technology gap with respect to the frontier (Nelson and Phelps, 1966). Along Benhabib and Spiegel (1994), we then allow for the fixed level of human capital in the economy³ as well as for the technology level at the frontier to have an impact on the speed and efficiency of the catching-up process.

In this simple framework, developing countries then face two alternatives regarding their technology upgrading strategy: the “full liberalization” option leaves MNCs free of choosing their mode of implantation in the country, while the “ownership constraint” strategy imposes implantation restrictions to entering firms, most often in the form of a joint venture with a local partner. In the “ownership constraint” case, our conjecture is that local participation will then ensure an easier dissipation of the MNC’s proprietary knowledge: we hence assume lower adoption costs in terms of human capital, an important feature in the case of a developing country faced with scarce skilled resources. However, the “frontier” technology level to which local firms have access is then assumed to be strictly lower than the world frontier, exemplifying the fact that when facing JV requirements, MNCs may transfer older vintages to avoid losing their intangible assets. On the other hand, in the “full liberalization” case, local firms will have access to more advanced technologies, but the imitation process will be more intensive in human capital.

We then determine to which extent the two available strategies contribute to narrowing the technology gap, and specify under which circumstances one dominates the other in terms of technology upgrading for the host country. We find that the relevance of imposing ownership constraints depends on the relative strength of the two opposite forces at work in this case, which are a higher human capital efficiency in the technology adoption process, opposed to a lower level of technology being transferred. We show that in most cases,⁴ full liberalization proves itself optimal when the overall available human capital in the economy is either very low or relatively high, while ownership constraints are desirable for intermediate overall human capital levels.

Hence, we demonstrate that the desirable technology upgrading strategy of a developing country facing human capital resource

³ Indeed, the aim of our model is not to provide any endogenous growth mechanism, but rather to model the efficiency of a developing country in catching up and bridging the technology gap; hence, we do not allow for the accumulation of human capital à la (Lucas, 1988), but rather focus on the growth impact of the level of available human capital (Benhabib and Spiegel, 1994; Boucekine et al., 2006).

⁴ More specifically, the technology level transferred by MNCs when facing ownership constraints has to be over a certain level that we fully characterize.

constraints depends non-monotonically on the overall available amount of the limiting factor, and show that even if the lower technology level in the case of domestic equity participation is considered a drawback, ownership constraints can be relevant provided we keep the assumption of a better knowledge diffusion. We then finally demonstrate that in the case of a technological acceleration abroad, an increase in the pace of technological progress broadens the scope of conditions under which domestic equity ownership constraints are found to be desirable.

The question of the optimal mode of entry of MNCs has already been extensively treated, whether it be in terms of the strategy of the entering firm (Eicher and Kang, 2005; Huizinga, 1995; Saggi and Javorcik, 2004; Van Assche and Schwartz, 2013), in terms of policy recommendations for developing countries (Hoekman et al., 2005; Muller and Schnitzer, 2006), or both (Javorcik and Wei, 2009; Sawada, 2010). However, these papers mostly tackle the question in a static, microeconomic framework comparing the costs and benefits associated to each mode of entry. Our model, though similarly aiming at providing strategy recommendations, bears a closer relationship to the dynamic growth theory literature studying the existing link between FDI and economic growth (Berthelemy and Demurger, 2000; Borensztein et al., 1998).⁵ To the best of our knowledge, our model is the first one to allow for different technology levels being transferred *depending* on the constraints imposed to MNCs, i.e. that takes into account some possible strategic behavior of the MNC in a macroeconomic dynamic framework. We further believe that our assumption of a limited technology absorption is not only relevant in a developing country case, but also enables us to analyze the reduction of the technology gap in a straightforward way, while this problem is usually only indirectly tackled through variations in production capacity (Glass and Saggi, 1999).

The rest of the paper is organized as follows. Section 2 presents the model, Section 3 is devoted to deriving the equilibrium conditions and the corresponding balanced growth path, and Section 4 displays our main results through some relevant comparative statics and dynamics. Section 5 concludes.

2. The model

Our model builds upon the horizontal differentiation growth framework introduced by Romer (1990), where technological progress stems from an expansion of the number of product varieties, and the conception of the related designs involves a share of the total human capital. We consider an economy consisting of three sectors: a final good sector, an intermediary good sector and an imitation sector. The final good sector produces a good that serves as numeraire and is either consumed or used in the production of intermediate goods. The sector is perfectly competitive, and the production technology uses a part of the total amount of available human capital, along with a variety of intermediate goods. The intermediate goods sector consists of monopolistic producers of differentiated products, using the final good as an input. Last, the imitation sector supplies the intermediate goods producers with designs, with the imitation of a Northern blueprint requiring a specific amount of human capital.

2.1. Final and intermediate good sectors

The production technology of the final good sector is of the form:

$$Y_t = (H_{Yt})^{1-\alpha} \sum_{j=1}^{A_t} X_{jt}^\alpha \quad (1)$$

⁵ Berthelemy and Demurger (2000) in particular use the Romer (1990) framework to develop an endogenous growth model, where FDI interacts with the long-run growth rate through a dual technology sector.

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