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Leaders, laggards and technology seeking strategies

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ABSTRACT

We analyze the conditions determining optimal technology seeking strategies for leader and laggard firms. We extend existing theories by differentiating leaders and laggards in terms of absorptive capacity and intra-firm technology transfer skills, next to productivity levels. In addition, both Foreign Direct Investment (FDI) as well as exports function as two alternative technology seeking strategies. Our theoretical results demonstrate that for a wide range of parameter settings, leaders optimally seek technology through FDI, whereas laggards do so through exports. Confronting these findings with some original exploratory industry-level analysis complemented by insights derived from case studies, we find broad overall support for our theoretical predictions.

1. Introduction

A large literature in international economics and business has argued that only the most productive (leader) firms engage in Foreign Direct Investment (FDI). This is so because these firms need a competitive or ownership advantage (Dunning, 1977) in order to overcome their *liability of foreignness* (Hymer, 1960; Zaheer, 1995), because they require sufficient knowledge capital to invest abroad (Markusen, 2002), or because they have to be productive enough to cover sunk investment costs (Helpman et al., 2004). In short, high productivity leaders are the ones that become multinationals (MNEs) because they are able to survive abroad. Indeed, there is a large literature confirming that MNEs are more productive than their domestic counterparts (Blomström and Sjöholm, 1999; Helpman et al., 2004; Yeaple, 2009).

Nonetheless, an empirical literature has emerged which demonstrates that also low-productivity (laggard) firms engage in FDI (Kogut and Chang, 1991; Neven and Siotis, 1996; Almeida, 1996). The motivation for these firms to do so appears to be very different. Instead of exploiting a competitive advantage abroad, they invest to seek or source foreign knowledge. According to Chung and Alcacer (2002), a new conventional wisdom has emerged from these studies, which is that "knowledge seeking occurs mainly among technical laggards trying to reduce their gap by investing abroad to acquire the needed knowledge" (2002: 1535).

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In an attempt to unify these insights with the established theoretical predictions on high-productivity MNEs, Fosfuri and Motta (1999) and Siotis (1999) introduce knowledge spillovers into an otherwise standard game theoretic framework for studying the internationalization decisions of firms. Indeed, they find that many equilibria exist with both the high-productivity leader and the low-productivity laggard engaging in FDI. The former does so to exploit its technological advantages abroad, whereas the latter aims to seek foreign technology through knowledge spillovers.

Yet in a recent study, Berry (2006) criticizes this literature. On conceptual grounds, she argues that the theoretical distinction between leaders and laggards is usually restricted to productivity differences, and therefore too limited. One should acknowledge that leaders and laggards differ in other aspects as well, such as their ability to absorb knowledge spillovers, or their skills in transferring knowledge across firm units. On methodological grounds, she argues that most of the empirical research is conducted at the industry-level, and thus unable to properly account for firm-level heterogeneity. Using firm-level data for the US and Japan, she finds that not laggards but leaders engage in FDI to seek foreign technology. Similarly, Cantwell and Janne (1999) demonstrate that firms from leading technical centres in Europe locate R&D labs abroad in order to seek more diverse knowledge.[1]

This literature has thus arrived at a new junction, where we are left with two intuitive but potentially contrasting observations. First, even though productivity laggards have a lot to gain from technology seeking FDI, they are not likely to pursue such a strategy because of a lack of productivity, absorptive capacity, and technology transfer skills. Second, even though productivity leaders are capable enough to engage in technology seeking FDI, they are not likely to gain a lot by doing so because their productivity is already high. To get out of this conceptual deadlock, theory should derive conditions under which either of these two firm types is more or less likely to engage in FDI to seek foreign technology, or possibly pursue an alternative strategy to do so. This is exactly the aim of this paper. Specifically, the question that we address is which conditions drive the optimal technology seeking strategies of leaders and laggards. To answer this question, we first revisit the model developed in Siotis (1999) and extend his definition of leaders and laggards beyond productivity differences. Specifically, following Berry (2006) we allow for additional differences in absorptive capacity and intra-firm technology transfer skills. Additionally, following the literature on learning by exporting, we also introduce exports as an alternative technology seeking strategy to FDI (Salomon and Jin, 2008).

Our main findings are as follows: laggards are generally more likely to engage in technology seeking exports rather than FDI. Specifically, they only prefer FDI over exports to seek technology when knowledge spillovers obtained in this way are relatively high compared to exports, and when they are not too backward in terms of productivity, absorptive capacity, and intra-firm technology transfer skills. The reason is that only in this case laggards are capable enough to absorb spillovers and also transfer them, allowing *the entire firm* to benefit from external knowledge rather than just the foreign subsidiary. Leaders on the other hand are generally more likely to engage in technology seeking FDI when knowledge spillovers obtained through FDI are relatively large compared to those obtained through exports, and when the laggard from which they source technology is not too backward. This latter element is important: the leader is only willing to incur the additional costs of investment if it can benefit sufficiently from its foreign counterpart. These findings fit nicely with the two empirical observations stated above: laggards engage in technology seeking FDI only when they are capable enough in terms of absorptive capacity, technology transfer and productivity, whereas leaders do so only when the firms that they source from have sufficient technology.

The most important result derived from our model is that for a wide range of parameter values, laggards engage in technology seeking exports whereas leaders engage in technology seeking FDI. We illustrate both these results by considering a number of business cases, which also hint at the existence of an evolutionary path of foreign technology seeking strategies. Finally, in our econometric analyses we combine the location of invention as mentioned on patents, with the citations these patents make to other patents as a measure of technology seeking. Our results illustrate that an increase in industry-level R&D intensity of non-US OECD countries relative to the US increases the probability that an invention which builds on US knowledge is actually conducted in the US. Albeit only suggestive, this result is consistent with our model's implications.

2. Theory and model

2.1. Setting the stage

Which conditions drive the optimal technology seeking strategies of leaders and laggards? In order to address this question, we first need a definition of a laggard *vis-à-vis* a leader firm. In the existing theoretical models, a laggard firm is backward in terms of competitive assets or technology relative to the leader. This translates into low productivity for the laggard and high productivity for the leader (Fosfuri and Motta, 1999; Siotis, 1999). However, Berry (2006) argues that two additional aspects should be taken into account.

First, it should be acknowledged that laggards will generally possess less absorptive capacity than leaders, which makes it harder for them to absorb knowledge spillovers (Grünfeld, 2006). Cohen and Levinthal (1989) argue that absorptive capacity is created and enhanced by a firm's existing skills and knowledge stock. Further conceptual refinements of this discussion

[1] Although not primarily concerned with TS FDI, in a study of patents by US subsidiaries of foreign firms, Frost (2001) finds that increased technical leadership of a subsidiary increases the extent to which the subsidiary seeks knowledge in its host location.