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Multinationality, R&D and productivity: Evidence from the top R&D investors worldwide☆

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ABSTRACT

This paper investigates the effects of multinationality on firm productivity, and contributes to the literature in two respects. First, we argue that multinationality affects productivity both directly and indirectly through higher incentives to invest in R&D. Second, we maintain that the multinational depth and breadth have different direct effects on productivity and R&D. Using data from the top R&D investors in the world, we propose an econometric model with an R&D and a productivity equation that both depend on multinationality. We find: i) multinational depth has a positive effect on productivity, while the effect of multinational breadth is negative; ii) multinationality (along both dimensions) has a positive effect on R&D intensity, translating into an indirect positive effect on productivity; iii) the positive indirect effect is however not large enough to compensate the negative direct effect of multinational breadth.

1. Introduction

A large number of recent studies in international economics have shown that initiating production abroad has a positive causal effect on firm productivity.[1] These studies compare the productivity of multinational firms with domestic ones. Yet, they rarely address the degree of multinationality, that is, the extent at which firms operate on a multinational scale. This important aspect is instead widely investigated in the international business literature, which shows that the degree of multinationality can have different effects on firm performance depending on its *depth*, accounted by the share of the multinational activities, and its *breadth*, understood as the geographical dispersion of the multinational activities (Contractor, Kumar, Kundu, & Pedersen, 2010; Hsu, Lien, & Chen, 2015; Sullivan, 1994). International business scholars have mainly analyzed the role of breadth and depth of multinationality with respect to the firm economic and financial performance measured in terms of accounting-based profitability indicators or market-based indicators of the firm value (Bausch & Krist, 2007; Yang & Driffield, 2012). Unlike the international economics literature, international business studies rarely analyse how multinationality affects productivity.[2] Thus there is a gap in the literature, which we intend filling by combining the international economists' focus on productivity with the more elaborated understanding of multinational depth and breadth developed in international business.

Furthermore, both the international economics and business literature have stressed that the effects of multinationality depend

☆ The views expressed are purely those of the author and may not in any circumstances be regarded as stating an official position of the European Commission.

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[1] A positive effect of this kind has been found, for example, by Barba Navaretti & Castellani (2004) and Borin & Mancini (2016) for Italy; Barba Navaretti, Castellani, & Disdier (2010) and Hijzen, Jean, & Mayer (2011) for France; Wagner (2011) for Germany; Hayakawa, Matsuura, & Motohashi (2016) for Japan; Cozza, Rabellotti, & Sanfilippo (2015) for China.

[2] A notable exception can be found in Kafouros et al. (2008, 2012) who use measures of multinationality to explain MNEs productivity. Another exception is Driffield, Love, & Yang (2016), who instead use multinationality as a moderator of the relationship between the productivity of the affiliates and of the parent companies.

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on contextual factors, and have singled out the key role of R&D (Fleming & de Oliveira Cabral, 2016; Kirca et al., 2011). In this perspective, R&D is usually incorporated in the analysis as a moderating factor, possibly magnifying the effect of multinationality on firm performance (Añón Higón, Manjón Antolín, & Mañez, 2011; Garcia Pires, 2015; Morck & Yeung, 1991). Using R&D as a moderating factor treats it implicitly as exogenous, although it is obviously a strategic choice of the firm. To overcome this view, authors in international business have highlighted that some of the effects of multinationality may be mediated through the effect it has on other firm-specific factors and strategies, including choices about R&D (Hult 2011; Verbeke & Brugman, 2009). In this paper we follow this perspective and submit that multinationality increases the incentives to invest in R&D.

In sum, drawing on international business and applied international economics perspectives, this paper provides a novel conceptualization of the relationship between multinationality and productivity by investigating the potentially differential effects of breadth and depth of multinationality on firm productivity, and by investigating the mediating (instead of the moderating) role of R&D.

In our empirical application we use an econometric strategy that allows estimating two separate (though interlinked) productivity and R&D regressions using Seemingly Unrelated Regression (SUR). The resulting model is tested with respect to a sample of more than 2000 of the top R&D investors worldwide.

Our results show that multinational depth has a direct positive effect on productivity, while an increase in multinational breadth is associated with lower productivity. In contrast, both multinational breadth and depth are positively correlated with investments in R&D, but the relationship is stronger for multinational breadth. As R&D intensity positively affects productivity, we uncover a positive indirect effect of both multinational breadth and depth. However, this indirect effect is not large enough to compensate for the negative direct effect of the multinational breadth on productivity.

The rest of the paper is organized as follows. Section 2 articulates our hypotheses. Section 3 presents the empirical analysis by illustrating data and empirical method. The results of the empirical analysis are discussed in Section 4. Section 5 concludes.

2. Hypothesis development

Our hypotheses are developed as follows. First, in Section 2.1 we deal with the role of multinational depth and breadth as determinants of productivity. Then, in Section 2.2 we consider the effect of multinationality on R&D and of the latter on productivity. Addressing this aspect allows us to distinguish between the direct and indirect productivity effects of multinationality. This distinction requires a conceptual clarification. Hult (2011) argues that multinationality affects firm performance only after being converted in some form of behaviour or action. In this perspective, the effects of multinationality are assumed to be only *indirect*, that is operating through the incentives to adopt other strategies. We contend that this view highlights a key issue, which we investigate with reference to R&D investments as a strategic choice. However, it overlooks that, as maintained in a long tradition of studies in international business and economics, multinationality has also positive and negative effects on productivity, even without considering the changes in the incentives to adopt other strategies. In the following Section 2.1 we discuss a variety of these effects which we consider, in this understanding, as *direct*.

2.1. The direct effects of multinationality on productivity

The effects of multinationality on productivity[3] can be both positive and negative and depend on which facets of multinationality are considered. We highlight three different channels through which multinationality can affect firm productivity. First, multinationality may allow firms to achieve a more (a) *efficient organization of production*, mainly through cheaper sourcing of intermediate inputs and better exploitation of economies of scale. Second, multinationality offers to firms (b) *learning opportunities* that can foster innovation in their processes, products and organization. Third, multinationality can impose on firms (c) *costs of organizational complexity,* which can hamper their productivity.

In the following we will discuss the three channels and we will argue that the effects of multinationality are likely to be different depending on whether we consider depth or breadth.

2.1.1. More efficient organization of production

Multinationality allows firms to organize production more efficiently by rationalizing the location of production tasks along the value chain. In particular, firms can exploit gains from the international division of labour and by sourcing cheaper inputs. Firms which organize their multinational structure in order to realize lower costs are said to engage in “efficiency-seeking” foreign direct investments (FDI) (Cuervo-Cazurra & Narula, 2015; Dunning, 1993) and have been labelled vertical multinational enterprises (MNEs) (Barba Navaretti & Venables, 2004). Such vertical MNEs achieve efficiency gains along the value-chain by maintaining a high level of multinational breadth rather than of multinational depth, as the major advantages stem from the ability to exploit lower sourcing costs in a wide variety of locations. However, efficiency gains can also accrue to firms choosing multinational depth over breadth by concentrating production in fewer locations. Concentration of production can lead to higher economies of scale at plant-level, which can boost the firms' efficiency.

2.1.2. Learning opportunities and access to knowledge

Establishing affiliates in many different countries (multinational breadth) or having deeper presence in fewer countries (multinational depth), entail opportunities to access novel sources of knowledge and engaging in new learning processes. Accessing novel sources of knowledge and new learning opportunities however lead to costs and benefits, which may differ between multinational depth and breadth.

In particular, multinational breadth may offer firms the opportunity to add new and different elements to their knowledge set, increasing the likelihood of discovering new valuable combinations of ideas (Kafouros, Buckley, & Clegg, 2012), and integrating them from diverse markets and contexts (Cantwell & Mudambi, 2005; Hitt, Hoskisson, & Kim, 1997). By tapping into different scientific and technological contexts and confronting different consumer preferences or supplier requests, MNEs acquire context-specific knowledge which can be transferred within their organisation and applied in different contexts to obtain a positive productivity impact. The transfer to different contexts can actually increase the innovation activities of the MNE (Zanfei, 2000). The potential to access a variety of (especially tacit) knowledge sources and technological opportunities, which can be leveraged for the

[3] Productivity can be defined as a measure of output obtained from a given set of inputs. A more productive firm is one that with the same quantity of inputs (usually intended as the quantity of labour, physical capital and materials) produces more than another firm. See Syverson (2011) for a synthetic but comprehensive coverage of definitions and determinants of productivity at the firm-level.

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