



Global engagement and the innovation activities of firms[☆]

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ABSTRACT

Globally engaged firms (multinational enterprises or exporters) tend to have higher productivity than their purely-domestic counterparts. We examine a UK firm data set where we have measures of global engagement linked to innovation/knowledge outputs, knowledge investments, and sources of existing knowledge. We find that globally engaged firms innovate more. But this is not just because globally engaged firms use more researchers. It is also because they learn more from their intra-firm worldwide pool of information (consistent with many recent theories of multi-nationals) and from suppliers, customers and universities. We also find that the relative importance of knowledge sources varies systematically with the type of innovation.

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1. Introduction

In recent years researchers have documented a robust correlation between productivity and global engagement: plants and/or firms that export or, even more so, are part of a multinational enterprise tend to have higher productivity than their purely-domestic counterparts.¹ A very active research area is currently attempting to document and

better understand this correlation between global engagement and productivity.²

Our goal is to complement this ongoing effort. We do so not by studying TFP differences, but rather by studying knowledge differences. To do this systematically, we use the “knowledge production function” (KPF) framework (e.g., Griliches, 1979), which suggests that output of new knowledge depends on two inputs: (1) investment in

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¹ Superior productivity of exporters is documented in, e.g., Bernard and Jensen (1995). Multinationals exhibit even higher productivity than exporters: e.g., Doms and Jensen (1998) and Criscuolo and Martin (2003) for U.S. and U.K. data, respectively.

² A variety of new general-equilibrium models assume high productivity leads to global engagement. For example, a now standard trade framework of multinational firms (Markusen, 2002, which builds on Dunning's “OLI” framework) assumes these firms obtain high-productivity knowledge assets that are transferred from home-country parents to host-country affiliates. Bernard et al. (2003), Melitz (2003), and Helpman et al. (2004) model heterogeneity in productivity due to exogenous draws. Firms with better draws can cover the costs of entering export markets or, if especially good, the even higher costs of becoming a multinational by establishing a foreign affiliate. The empirical evidence on global engagement and productivity is currently quite mixed. Some studies have asked whether highly productive firms select into export markets or whether exporting boosts productivity through channels such as learning from foreign markets. Examples include Bernard and Jensen (1999) for the United States and Clerides et al. (1998) for a number of developing countries. There are also many studies of import competition and productivity; Treffer (2004) is a recent example. For many of these issues, see Tybout (2000) for a useful survey. For multinationals, different studies have reached different conclusions about the productivity advantage of globally engaged firms. See, e.g., Aitken and Harrison (1999) and Smarzynska and Javorcik (2004), and also case studies in Hanson (2000) and Moran (2001).

discovering new knowledge—e.g., research and development, and (2) the flows of ideas from the existing knowledge stock—i.e., the knowledge base upon which to innovate. A large IO literature has used this framework to ask, e.g., how firms learn from existing knowledge, either inside or outside the firm and also either via market transactions or spillovers.³

In this paper we estimate the KPF on U.K. firm data drawn from the two waves of the EU-wide Community Innovations Survey (CIS). Each enterprise reports measures of knowledge outputs; and knowledge inputs, namely investments in new knowledge and flows of ideas from the existing knowledge stock. To understand the role of global engagement, we merge into the CIS indicators that identify multinationals (U.K. parents and also U.K. affiliates of foreign parents), non-multinational exporters, and purely-domestic firms.

With these data we investigate three issues. First, on the output side, a basic tenant of recent theory work is that globally engaged firms are more productive. Thus we first ask: do globally engaged firms innovate more than domestic firms do? Second, on the input side, we then use the KPF to examine what the sources of this superior innovation performance are. Since the basis for much recent theory work is that globally engaged firms share knowledge readily, we ask: do globally engaged firms share knowledge to a larger extent and/or do they invest more in knowledge than other types of firms? Finally, we explore the output/input relation: how much of the increased innovation is accounted for by more investment in innovation (such as R&D), increased knowledge sharing and unmeasured factors.

For innovation outputs we have two groups of measures. One is patents. Another is a set of broader measures of innovation output, such as the value of sales of products new to the firm and also indicators of any process or product innovation. These broader measures are of interest since frontier innovations need not be patented⁴ and many innovations are likely movements *towards*—not movements *of*—the world frontier of knowledge (where patented innovations are more likely to feature).⁵

Turning to innovation inputs, enterprises report their use and degree of importance of a range of both internal and external knowledge sources: e.g., elsewhere in the broader enterprise group; customers and suppliers; and universities. We think this can complement existing studies of information flows, such as those based on patent citations and indirect studies based on e.g. proximity of other firms.⁶

³ The KPF literature is very deep and broad. Surveys include Griliches (1990); Griliches (1998), including chapter 11 on spillovers; and Jaffe and Trajtenberg (2002). The KPF is also a key ingredient in many macro growth models, where existing knowledge is often assumed to be a public good equally available to all agents worldwide and the rate of steady-state growth in output of goods and services hinges crucially upon the degree of returns to scale of the KPF inputs. For an overview, see Jones (2004). Klette (1996) suggests that the KPF was first formalized by Uzawa (1969).

⁴ For example, Pakes and Griliches (1980, p. 378) comment that, “patents are flawed measures (of innovations); particularly since not all new innovations are patented and since patents differ greatly in their economic impact.” Additional discussion of the limits of patent data can be found in Griliches (1998) and Jaffe and Trajtenberg (2002, p.3): “There are, of course, important limitations to the use of patent data, the most glaring being the fact that not all inventions are patented ... Exploring the extent to which patents are indeed representative of the wider universe of innovations is an important, wide-open area for research.”

⁵ The importance of non-patented innovations for the large majority of firms is demonstrated by the fact that patent activity is tremendously concentrated in very few firms. For example, Bloom and Van Reenen (2002) report that in their sample of 59,919 U.K. firms, just 12 companies accounted for 72% of all patents. Patenting in our data is similarly skewed.

⁶ Jaffe and Trajtenberg (2002) discuss their research showing that half of all citations do not correspond to any perceived communication or to a perceptible technological relationship between the two inventions. They also report that a sizable share of citations is typically entered by patent-office examiners rather than inventors.

Because the CIS data are self-reported and mainly qualitative, they raise a set of important measurement and estimation issues that we address in several ways. For example, we check our survey data against administrative records and show that our data replicate many patterns of patenting and R&D activity documented elsewhere.

Our analysis yields the following answers to the three key questions above. First, on outputs, globally engaged firms do generate more innovation outputs. Over the 1998–2000 period just 18% of domestic firms report either product or process innovation, with an average of just 0.10 patents applied; but 45% of multinational parents report either product or process innovation, with an average of 10 patents applied for.

Second, on inputs, globally engaged firms do use more inputs to knowledge production. They use more researchers. But they also share knowledge within the firm to a greater extent than other firms. Multinational parents employ on average 26 R&D staff versus on average 0.65 staff for domestic plants; in addition, however, the former are also more than twice as likely to report learning from within the enterprise group to be important than the latter. The finding that MNEs share information more readily supports a large body of theory that assumes this e.g. Dunning (1981).

Third, we calculate that the majority of the innovation-output advantage of globally engaged firms is accounted for by their greater use of the different inputs in our data, with only a minority left explained by global engagement *per se*. Interestingly, we also find that the relative importance of these knowledge sources varies systematically with the type of innovation. For patents, information flows from universities are important, while flows from customers and suppliers are not. For broader process or product innovations, the reverse is true. Previous case-study literature has studied many different sources of knowledge; ours is the first study we are aware of to offer econometric evidence linking different sources with different innovations.

Taken together, we believe our findings also help explain the correlation between productivity and global engagement. Globally engaged firms generate more of the innovations that feed into higher productivity, in large part because these firms learn more from a wider range of sources (rather than they just employ more knowledge workers).

Like many other studies using the CIS data, with our (pooled) cross-section we cannot establish causality (although we do report IV and panel estimates). However, whilst there are number of papers on innovation/global engagement links using exporting status, e.g. Janz and Peters (2002) and Veugelers and Cassiman (1999), there are none to our knowledge on the innovation/global engagement link and knowledge sharing within MNE firms.⁷ Thus we believe the associations we document are of interest.

Our paper has five additional sections. In Section 2 we briefly present the KPF that will guide our empirical work and discuss our work in relation to others. Section 3 presents our data and some motivating summary statistics. Section 4 discusses econometric specifications, and Section 5 discusses estimation results. Section 6 concludes.

⁷ Our paper is about the extent to which (various measures of) innovation can be accounted for by various measures of foreign presence. Cassiman and Veugelers (2002a) look at the probability of entering into a co-operative agreement and find that firms for which incoming spillovers are important are more likely to enter. Cassiman and Veugelers's (2002b) paper look at probability that a firm transfers technology to a local firm, measured as (innovative firms) who report having transferred technology to a firm located in Belgium (see their page 461). This is therefore about spillovers outside the firm, whilst our paper is about spillovers within the firm, how these differ between firms of different global engagement levels and how they are related to innovativeness.

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