How does the labour quality in overseas affiliates affect the productivity of parent companies? An affiliate role perspective

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Abstract

The traditional view of the multinational corporation (MNC) envisages knowledge flowing from the parent company to the overseas affiliates to the benefit of the latter. But recent research has suggested that there may be a reverse knowledge transfer effect through which MNC parent companies may benefit from the activities of their overseas affiliates. In this paper, we consider whether the labour quality in overseas affiliates has an impact upon the productivity of MNC parent companies. We test empirically for this relationship using a firm-level panel of more than 2,800 manufacturing MNCs and over 5,600 overseas affiliates in the period 2008-2015. Our main results indicate that highly-skilled labour in overseas affiliates has a significant impact upon the productivity of parent companies, suggesting the existence of a strong reverse knowledge transfer effect. In addition, we also establish that this knowledge transfer effect is greater (1) when the overseas affiliates are in related, rather than unrelated, industries; (2) when the overseas affiliates are upstream, rather than downstream, in the MNCs global value chains; (3) when the overseas affiliates involve horizontal, rather than vertical, FDI; and (4) when the overseas affiliates are wholly-owned subsidiaries, rather than joint ventures.

Keywords: Labour Quality, Productivity, Knowledge Flows, Global Value Chain, Entry Mode

JEL Codes: F20, F23, F02

1. INTRODUCTION

The traditional view of multinational corporations (MNCs) envisages them as repositories of technological, managerial and organisational knowledge to be shared, as and when appropriate, with their affiliates at home and overseas. There is a huge literature on knowledge inflows to these affiliates from the MNC parents highlighting *inter alia* the characteristics of the knowledge, the characteristics of the actors involved, the characteristics of the relationships between the actors, and the outcomes of the knowledge flows - see Michailova & Mustaffa (2012) for an excellent summary. More recently, however, there has been a recognition that affiliates, particularly those overseas, may also be sources of knowledge and expertise that may be valuable to both the MNC parent and to sister affiliates elsewhere within the MNC (Gupta & Govindarajan, 2000; Eden, 2009). As a result, increasing attention has been given to knowledge outflows, or reverse knowledge transfers, from foreign affiliates to their MNC parents. In particular, attention has been focused on how reverse knowledge transfers impact upon parent innovation (Yamin & Otto, 2004), new product development (Ambos et al, 2006), technical development (Holm & Sharma, 2006), and strategic initiatives (Williams, 2009). Furthermore, overseas affiliates have long been acknowledged as important of (tacit and codified) local knowledge acquisition in host countries (Li et al, 2010).

In this paper, we contribute to this literature by considering how the labour quality in their overseas affiliates impacts upon the productivity of MNC parent companies. Much of the knowledge transferred from affiliates to MNC parents (and vice versa) is tacit, and its effective transfer depends upon the skills and expertise of the labour forces in both the affiliate and the parent. Many authors have emphasised the importance of skilled labour which is capable of identifying and solving problems, discerning and absorbing superior technological capabilities, and disseminating and transferring knowledge within the firm (Minbaeva et al, 2003; Kor & Leblebici, 2005; Sirmon et al, 2007; Liu et al, 2015; Martins & Yang, 2015). Hence we

hypothesise a positive relationship between the labour quality in overseas affiliates and MNC parent productivity. We further hypothesise that the strength of this positive relationship will depend upon the strategic role of the foreign affiliate within the MNC network and, in particular, whether the affiliate is engaged in related or unrelated activities, and whether the related activities are similar to those of the parent MNC (which we term an horizontal affiliate) or involve upstream or downstream activities (which we term a vertical affiliate) within the global factory controlled by the MNC (Buckley & Ghauri, 2004; Buckley & Strange, 2015). Finally, we consider the impact of the equity ownership (wholly-owned subsidiary or joint venture) held by the MNC parent in its overseas affiliate on the relationship between affiliate labour quality and MNC parent productivity, and hypothesise that tacit knowledge transfers are enhanced by full ownership with consequent greater impact on MNC productivity. We estimate our model using a panel dataset containing 2,819 MNC parents and their 5,648 overseas affiliates over the period from 2008-2015. The parent MNCs come from 31 different home countries, and the affiliates are located in 51 different host countries. This multi-country sample allows a robust test of the cross-border effects of affiliate labour quality on MNC productivity.

The remainder of the paper is organized as follows. The next section provides a review of the relevant literature and develops the hypotheses to be tested. Section 3 describes the empirical model and the dataset. The main results are presented in section 4. Section 5 concludes.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

In this section, we put forward four main hypotheses regarding the relationship between affiliate labour quality and MNC parent productivity, together with four additional hypotheses related to the moderating effect of entry mode.

Affiliate Labour Quality and MNC Parent Productivity

MNCs have traditionally been viewed as organizations for the efficient transfer of (in particular) tacit knowledge to foreign countries in search of additional rents on their proprietary assets (Eden, 2009; Michailova & Mustaffa, 2012). But this view has become outdated for two main reasons. On the one hand, many MNCs – and especially, though not exclusively, those from emerging economies (Child & Rodrigues, 2005; Mathews, 2006; Luo & Tung, 2007) – have undertaken asset-augmenting FDI (Makino, 1998; Dunning, 2000) to secure knowledge from overseas and transfer it back to the parent. On the other hand, numerous studies have highlighted the fact that overseas affiliates may have developed capabilities that are of value to their parent companies, and are important sources of reverse knowledge transfer (Kuemmerle, 1997; Birkinshaw & Hood, 2001; Eden, 2009; Michailova & Mustaffa, 2012).

These studies typically focus on distinct, discrete, recorded instances of knowledge transfer, yet affiliate-parent interactions take place in many ways on a continual basis and involve two-way knowledge flows, some of which may be formally registered but most which pass 'under the radar'. We argue that these interactions individually and in combination potentially enhance the productivity of both the affiliate and the parent (Van Wijk et al, 2008) although the transfer of knowledge, particularly when it is tacit, does not happen without many difficulties (Szulanski, 1996; Cantwell & Santangelo, 1999; Jensen & Szulanski, 2004; Ambos et al, 2006). More specifically, these tacit knowledge transfers may be effected through a range of interactions:

- Direct transfers through the employment of expatriates in overseas affiliates, or through the assignment of affiliate staff to the parent company (Eden, 2009).
- Formal communications about new product or process developments, local market opportunities, competitors, and regulators (Jensen & Szulanski, 2004).

- Inter-personal networks involving affiliate and parent company staff (Ghoshal et al, 1994).

Many of the extant studies highlight the importance of various affiliate characteristics (e.g. age, role, international experience, autonomy, entry mode) in the effective knowledge transfer process (Rabbiosi & Santangelo, 2013), but none refer to the importance of the skills and expertise of the labour forces in both the affiliate and the parent. As Welch & Welch (2008: 355) report, the "knowledge transfer literature tends to analyse processes at the organization level … while much of what is transferred occurs at the individual level." Furthermore, Buckley et al (2005: 48) note that "knowledge transfer requires the use of language and communication to enable articulation in order to promote assimilation." The strategic human resource management literature, building on the resource-based view of the firm, suggests that the capabilities of the workforce in the foreign affiliate will be a key factor not only in identifying emerging trends, needs and opportunities in their local economies, but also in formulating potential solutions and in communicating this information to the parent (Wright et al, 1994; Huselid, 1995; Blundell et al, 1999; Bhattacharya et al, 2005). To the extent that these activities are carried out effectively, then there will be a range of productivity benefits for the parent company. Sirmon et al (2007) emphasise the need of a "fit" between the levels of technological sophistication and required investments in human capital in order to realise performance benefits. Similar performance effects are reported by Kor & Leblebici (2005). Our first hypothesis is thus:

H1: The labour quality in foreign affiliates will have a positive impact upon the productivity of parent MNCs.

Affiliate Strategic Role and MNC Parent Productivity

All MNCs typically embrace affiliates undertaking a variety of activities, and there is a burgeoning literature on affiliate typologies (see, for example, Bartlett & Ghoshal, 1986; Jarillo & Martinez, 1990; Gupta & Govindarajan, 1991; Birkinshaw & Morrison, 1995; Taggart, 1997; Birkinshaw, 1997; Birkinshaw et al, 1998; Benito et al, 2003; Rugman et al, 2011) and their strategic roles within the MNC organization. In their seminal contribution, Bartlett & Ghoshal (1986) proposed four different types of subsidiary role, viz: the strategic leader, the contributor, the implementer, and the black hole, Subsequently attention has been directed more towards to notion of subsidiary mandates (Birkinshaw & Morrison, 1995), and to how such mandates might be proactively influenced by subsidiary initiatives rather than simply being allocated by parent companies (Birkinshaw & Hood, 1998). More recently, Rugman et al (2011) have reconfigured the Bartlett & Ghoshal framework by considering the positioning of subsidiaries' activities within the global value chains of their parent companies.

Building on this research on affiliate typologies, we adopt the typology of affiliate strategic roles depicted in Figure 1. We first distinguish between related and unrelated affiliates. Related affiliates are those that undertake activities that are linked in some way to the core businesses of the MNC, whether this is replicating the activities of the parent, providing inputs to the core businesses, or being involved in downstream activities such as marketing and distribution. In contrast, unrelated affiliates undertake quite different activities which involve limited (if any) interactions with the parent MNC. We then further sub-divide the related affiliates into horizontal affiliates that undertake similar activities to their parent firms; and vertical affiliates that undertake activities that are either upstream (e.g. R&D, product development, parts & components manufacture) or downstream (e.g. sales, distribution) of the core businesses. Finally, we distinguish between the upstream and the downstream affiliates.

[Figure 1 about here]

In the cases of unrelated affiliates where knowledge transfer (in both directions) is likely to be limited, we would not expect any systematic relationship between the labour quality in the foreign affiliates and the productivity of the MNC parent. But affiliate-parent interactions, and hence the potential for reverse knowledge transfers, are likely to be both frequent and significant in the cases of related affiliates. In such cases, the affiliates and their parents both stand to gain from mutual knowledge transfers. Furthermore, the likelihood that these will take place, and that they will take place effectively, will depend *inter alia* upon the expertise and quality of the affiliate workforce, especially when tacit knowledge is involved. Hence our second hypothesis is:

H2: The labour quality in related foreign affiliates will have a larger positive impact upon the productivity of parent MNCs than the labour quality in unrelated foreign affiliates.

Related affiliates may be the result of horizontal FDI (i.e. operating within the same industry segment as the parent company) or of vertical FDI (i.e. operating in value-chain segments that are either upstream or downstream of the parent company). The former are typically the result of market-seeking FDI in which MNCs seeks to exploit their firm-specific assets in overseas markets, whilst eschewing exports from their home countries. The latter are typically the result of efficiency-seeking FDI in which the MNCs locate their various value-chain activities to take advantage of factor cost differentials between countries, but with accompanying international flows of intermediate goods and services (Baldwin & Lopez-Gonzalez, 2013). The labour quality in both types of affiliates is likely to have a positive impact upon the performance of the parent companies, but for different reasons. In the case of horizontal FDI, the skills and expertise required of the affiliate workforce will relate primarily to product adaptation, the provision of local market knowledge, and to process innovations (Prahalad & Lieberthal, 1998; Prahalad, 2012). There will thus be ample scope for mutually

beneficial reverse knowledge transfers from the foreign affiliates back to the parent MNCs, with the parent companies eager to obtain and assimilate information. A key issue here is the absorptive capacity (Cohen & Levinthal, 1996: Lane et al, 2001; Zahra & George, 2002; Lane et al, 2006) of the parent company – the ability to assess the potential value of new knowledge and apply it to meet corporate objectives. However, the parent and affiliate workforces are likely to have similar skill sets and cognitive abilities given that they are engaged in broadly similar activities. In contrast, affiliates in vertical value-chains are likely to be involved in dissimilar activities so the scope for gainful knowledge transfer is narrower, and communication difficulties are often apparent between employees undertaking different activities (Shapiro, 1977; Mukhopadhyay & Gupta, 1998; Kim et al, 2010) – difficulties that are likely to be exacerbated when the employees are operating in different countries, with different cultures, languages etc. Our third hypothesis is thus:

H3: The labour quality in horizontal foreign affiliates will have a larger positive impact upon the productivity of parent MNCs than the labour quality in vertical foreign affiliates.

Many contemporary MNCs involve global value chains (Porter, 1985; Gereffi et al, 2005; Buckley & Ghauri, 2004; Buckley & Strange, 2015) in which the parent company sits at the centre of a network of affiliates undertaking upstream activities (e.g. production of intermediate goods and services) and downstream activities (e.g. marketing, distribution and sales), with these activities dispersed in various countries[1]. The parent MNC both coordinates and controls the network's activities, and vertical reverse knowledge transfers may happen either from the upstream affiliates down to the parent, or from downstream affiliates up to the parent. In the case of upstream affiliates, the knowledge developed by the affiliate will typically relate to pre-production activities such as design, R&D, engineering, and/or specification development. Such specialized knowledge may be embedded in the intermediate goods and

services provided to the parent company (Hortascu & Syverson, 2009; Keller & Yeaple, 2013), or transferred directly through detailed specifications, personal communications (Gupta & Govindarajan 2000; Schotter & Bontis, 2009; Rabbiosi & Santangelo, 2013), or intra-MNC employee mobility (Hakanson & Nobel, 2001; Corredoira & Rosenkopf, 2010; Najafi-Tavani et al 2012). The transferred knowledge will enhance the productivity of the parent company, both through the utilization of "better" intermediate goods and services and through the absorption of the specialized knowledge by the parent company. Both methods of transfer will be enhanced the higher the quality of the affiliate labour force. In contrast, downstream affiliates are concerned with post-production activities such as branding, marketing and distribution. The knowledge developed by the affiliate and transferred to the parent company will typically involve local market information in the host country, and possibly some recommendations about product adaptations (Delios & Beamish, 2001). The content and effectiveness of this feedback will depend in large part upon the skills and expertise on the affiliate's workforce, and its ability to collect, filter, appreciate, and transmit relevant information to the parent company. The quality of the affiliate labour force will thus be important to the effective transfer of this knowledge, but the knowledge transfer will typically impact more on sales and profitability than on parent company productivity (the focus of this study). Our fourth hypothesis is thus

> *H4: The labour quality in upstream foreign affiliates will have a larger positive impact upon the productivity of parent MNCs than the labour quality in downstream foreign affiliates.*

Entry Mode and MNC Parent Productivity

Our final consideration is about the entry modes chosen by the MNC for its overseas affiliates (i.e. whether the overseas affiliate is a joint venture or a wholly-owned subsidiary),

notwithstanding whether the affiliates are categorised as horizontal or vertical, upstream or downstream. We have argued that the efficacy of tacit reverse knowledge transfers depends *inter alia* upon the quality of the labour force in the overseas affiliates. But, drawing upon internalisation theory (Buckley & Casson, 1976) arguments, it is likely that the extent of these transfers will also depend upon whether the overseas affiliates are wholly-owned subsidiaries or joint ventures with independent companies. The higher the equity ownership, the greater will be the internal embeddedness of the affiliate within the MNC (Dharanaj et al, 2004; Figueiredo, 2011; Meyer et al, 2011; Song et al, 2011), the more knowledge will be internalised, and the greater will be the facilitation of knowledge transfer. This is especially the case when the knowledge is tacit and valuable, and the readiness of the affiliate to affect the transfer to a parent is likely to be greater if that parent holds 100% of the equity than if the affiliate is a joint venture with 50-50 (or even minority) ownership. Furthermore a parent with 100% ownership of its overseas subsidiary is in a better position to insist upon transfer of the knowledge (Yang et al, 2008). In other words, the equity ownership held by the parent MNC in its overseas affiliate will enhance the relationship between the affiliate labour quality and the productivity of the MNC parent. Our final set of hypotheses are thus:

H5a: The positive impact of labour quality in horizontal affiliates upon the productivity of parent MNCs is larger in wholly-owned subsidiaries than in joint ventures.

H5b: The positive impact of labour quality in upstream affiliates upon the productivity of parent MNCs is larger in wholly-owned subsidiaries than in joint ventures.

H5c: The positive impact of labour quality in downstream affiliates upon the productivity of parent MNCs is larger in wholly-owned subsidiaries than in joint ventures.

3. EMPIRICAL MODEL AND DATA

Our aim is to examine the impact of reverse knowledge transfers from overseas affiliates to their parents. Our theoretical discussion suggests that higher levels of labour quality in the overseas affiliates should facilitate these reverse knowledge, and thus enhance productivity in the parent companies. In contrast to much of the extant literature on reverse knowledge transfers, we estimate a reduced-form model which directly relates the antecedent (affiliate labour quality) to the outcome (MNC productivity) thus:

$$TFP_{it} = \beta_0 + \beta_1 ALQ_{it} + \beta_2 PLQ_{it} + \beta_3 X_{it} + FE_i + Y_t + \varepsilon_{it} \qquad (1)$$

$$where\ TFP_{it} = total\ factor\ productivity\ of\ parent\ company\ i\ in\ year\ t$$

$$ALQ_{it} = labour\ quality\ in\ affiliate\ i\ in\ year\ t$$

$$PLQ_{it} = labour\ quality\ in\ parent\ company\ i\ in\ year\ t$$

$$X_{it} = parent\ firm - specific\ control\ variables\ in\ year\ t$$

$$FE_i = parent\ company\ i\ fixed\ effects\ (industry, country)$$

$$Y_t = year\ fixed\ effects$$

Following the existing literature on the determinants of firm productivity (see for example Fare et al, 1994; Sirmon & Hitt 2009; Driffield et al 2014), equation (1) includes a variety of parent firm-specific control variables (X_{it}), including capital per employee (PKL), intangible assets per employee (PINT), gearing (PGEAR), profitability (PPROF), age (PAGE), and the level of home country economic development (PGDP). The key parameter is β_1, which denotes the marginal effect of affiliate labour quality on the productivity of the associated parent company.

3.1 The Measurement of Parent Company Productivity

The most common way to measure firm productivity – but also the most difficult to compute, given its data requirements - is total factor productivity (TFP) (Martins & Yang 2009).

We employ the measure of total factor productivity developed by Levinsohn & Petrin (2003), and explained in detail by Petrin et al (2004). Production technology is assumed to be Cobb Douglas, but allowed to vary by industry:

$$OUT_{it} = \delta_0 + \delta_1 LAB_{it} + \delta_2 CAP_{it} + \delta_3 INP_{it} + \omega_{it} + \tau_{it} \qquad (2)$$

$$where\ OUT_{it} = output\ of\ the\ parent\ company\ i\ in\ year\ t$$

$$LAB_{it} = labour\ input\ of\ parent\ com\ pany\ i\ in\ year\ t$$

$$CAP_{it} = tangible\ capital\ assets\ of\ parent\ company\ i\ in\ year\ t$$

$$INP_{it} = expenditure\ on\ intermediate\ inputs\ by\ parent\ company\ i\ in\ year\ t$$

All variables are measured in logarithms. The error term includes two components, namely the transmitted productivity component (ω_{it}) and an error term (τ_{it}) that is uncorrelated with input choices. The intermediate inputs (INP) variable is included to control for unobservable productivity shocks (Petrin et al, 2004). Total factor productivity (TFP) is then estimated[2] using the predicted values of the transmitted productivity component, viz:

$$TFP_{it} = exp(\widehat{\omega}_{it}) = exp\left(OUT_{it} - \widehat{\delta_1} LAB_{it} - \hat{\delta}_2 CAP_{it} - \hat{\delta}_3 INP_{it}\right) \qquad (3)$$

3.2 The Measurement of Labour Quality

To measure labour quality (both in the affiliates and in the parent companies), we estimate the following fixed-effects model:

$$WAGE_{it} = \gamma_0 + \gamma_1 P_{it} + \gamma_2 KL_{it} + \gamma_3 INT_{it} + \gamma_4 GDP_{it} + FE_i + Y_t + LQ_i \qquad (4)$$

The model assumes that more profitable firms (P_{it}) will pay systematically higher wages to their employees (Budd et al, 2005; Martins & Yang 2015), as will firms with high capital-labour ratios (Fare et al, 1994). We also control for knowledge of the firm (INT) and country economic development (GDP). Our estimates of labour quality – both for the affiliate (ALQ) and the parent company (PLQ) – are given by the residuals (LQ) from estimating the two models.

3.3 The Strategic Roles of the Affiliates

The core business of all the MNC parent companies in our dataset is manufacturing. As regards the possible strategic roles of their affiliates, we define the upstream, downstream and horizontal affiliates as follows. We define upstream affiliates as those that are mainly engaged in R&D activities, or that produce components and intermediate inputs, or that source raw materials (Mudambi, 2008; Driffield et al, 2016). For each industrial sector, the input-output table from the UK Office for National Statistics provides very detailed information as to what intermediate inputs are needed and how much of each intermediate input is needed[3]. We flag as downstream affiliates those affiliates whose primary activities are selling and marketing activities (Anand & Delios, 1997; Mudambi & Puck, 2016). The upstream and downstream affiliates are both cases of vertical affiliates. In contrast, affiliates who share the same 3-digit industries as their parents are regarded as horizontal affiliates (Martins & Yang, 2015). All other affiliates, that are not classified as either horizontal or vertical, are flagged as unrelated affiliates.

Our dataset includes 5,648 affiliates, of which 12% have been classified as upstream, 32% as downstream, and 31% as horizontal affiliates. Thus 74% of the affiliates are related in some way to the core businesses of their MNCs, whilst the remaining 26% operate in unrelated sectors. Seventy percent of the affiliates are wholly-owned subsidiaries.

3.4 Data

Our data are drawn from Orbis, a dataset with detailed accounting and financial information for the largest firms across the world. The data are collected and made available by Bureau van Dijk, an international consultancy firm[4]. The records of each company include information on whether the company has ownership stakes in its affiliates (defined as a minimum 25.01% shares control over its overseas subsidiary) and each affiliate's location.

These affiliates are identified by company name and country. We are therefore able to find matches between multinational parents and their matched foreign affiliates.

The financial and operational information on the firms in the Orbis dataset is generally available for the period 2008-2015. Not all affiliates report ownership information (e.g., wholly-owned affiliate or joint venture) for each year, and therefore we remove those parent-affiliate observations. We consider firms that have information available on expenditure on wage, sales, capital, profit, intermediate inputs, intangibles, firm age and the number of employees. Firms without at least one of these variables are excluded from our sample. This criterion leads to the exclusion of several firms in some countries, but it is not a major problem for the overwhelming majority of countries. In addition, we also drop outliers in average wages and capital per worker. A large linkage dataset could still be created, covering a total of 2,819 multinational parents and 5,648 of their foreign affiliates during the period from 2008 to 2015: in total there are 14,914 observations (each observation corresponds to a unique parent-affiliate-year combination).

3.5 Descriptive Statistics

Our sample includes affiliates in 51 host countries, including many OECD countries and also some developing nations. The majority of the overseas affiliates are found in Austria, Belgium, the Czech Republic, France, Germany, Hungary, Italy, Poland, Portugal, Romania, Serbia, Slovakia, Spain, and the United Kingdom: these host countries together account for 85.4% of all the overseas affiliates included in our dataset. The parent MNCs come from 31 home countries, mostly developed countries: Austria, Belgium, Finland, France, Germany, Italy, and Spain account for 82.9% of all parents (See Appendix A for the country distribution of the samples, along with some key variables)

Table 1 presents the definition of the key variables along with the descriptive statistics. As one would expect, we find that parent companies have more tangible per worker (85.2 vs 62.1 thousand USD) and intangibles per worker (42.1 vs 11.4 thousand USD), and pay higher wages (65.5 vs. 54.8 thousand USD) than foreign affiliates. Labour are more skilled (6.63 vs.4.33) in parent companies than foreign affiliates. On average, home countries have a much higher GDP per capita (42.6 vs 29.7 thousand USD) than host countries. On average, total factor productivity of parent company is 4.95 with a standard deviation of 3.59. Parent company are 57 years old, with profit margin of 8.26% and gearing ratio of 93%.

[Table 1 about here]

Table 2 provides a comparison of different types of subsidiaries. Most affiliates (4178 out of 5648) are related in some way to the core business of their MNCs, and most affiliate samples are wholly-owned by their parent companies. 73% of downstream affiliate samples are wholly owned by their MNCs. Labour quality of the affiliates varies significantly by different affiliate types.

[Table 2 about here]

Table 3 provides correlation coefficients for the key variables included in the regression models. The correlations between all the explanatory variables range between -0.179 to 0.246, suggesting no serious issues of multicollinearity.

[Table 3 about here]

4. EMPIRICAL RESULTS

Table 4 reports our first set of estimates. All columns control for firm fixed effect and business circle effect. In column one, we include all our control variables. We find an expected positive

effect from parent company labour quality on its productivity, which remains significant in all other specifications in columns 2-4. In column two, when including affiliate labour quality, we find a positive and significant effect from affiliate labour quality on parent company productivity improvement, and therefore our hypothesis H1 is supported.

[Table 4 about here]

We now consider the position of affiliates on MNCs' global value chain, and report the effect of reverse knowledge transfer in columns three and four in Table 4. Columns three and four are the results of sub-sample analysis based on related and unrelated subsidiaries. As shown in the table, the impact from affiliate labour quality on parent productivity is 0.036 and at the significance level of 1% for related affiliates (column three), and the effect becomes virtually zero and insignificant for unrelated affiliates (column four), and therefore our hypothesis two is supported.

Our next interest is to explore different labour skills effects on different types of affiliates, and we report our results in Table 5. When comparing vertical foreign affiliates (column 1) and horizontal foreign affiliates (column 2), we find that the labour quality effect is bigger in the latter affiliate type, showing that our hypothesis three is supported. Two remaining columns show that the impact of labour quality upon the parent productivity from upstream affiliates is bigger than downstream affiliates. In qualitative term, the size of the effect for upstream affiliates is over three times than the effect for the downstream ones, thus our hypothesis four is confirmed.

[Table 5 about here]

Next, we split our data sample in terms of wholly-owned subsidiaries and joint venture (including majority- and minority-owned controlled affiliates). The results in table 6 are overall consistent with our hypotheses 5, showing that affiliate entry strategy (wholly-owned

versus other type of control) moderates the reverse knowledge effects, although the estimate is not at significant level for the downstream affiliates (column 3).

[Table 6 about here]

Robustness exercises: a falsification test

One may argue that the effect from affiliate labour quality upon parent productivity may be problematic due to exogenous issues, such as economic fluctuation and industrial technology development. In other words, an external shock (such as a rising in a new technology) may improve labour skills and enhance firm productivity simultaneously. If this is the case, our earlier interpretation of reverse knowledge transfer needs to be revisited. We use a falsification exercise, and for each parent company, we try to find a matched parent company (such as Dell and HP) that are in the same country and sector. We re-run Eq. 1 by using a matched (or fake) parent information. In order to find precise matches, we include a number of firm characteristics including gearing ratio, intangibles, age, tangibles per worker, revenue, employee number, material costs, sales per worker and profit margin, as well as their interaction terms and squared and cubic terms in the matching exercises. In order to present a better feeling of our matching quality, we depict the propensity score difference between a parent company and its matched parent in Figure 2, and we find the difference centres around 0 demonstrating a good matching quality.

[Figure 2 about here]

We require each matched parents are in the same country and the industry. Table 7 present the quality of matches, and we calculate the difference between the two means divided by the average of two means for each given firm characteristics, so the range of the differences fall between -2 and +2. Overall, we find that the difference between matched parent pair is very small, suggesting good matches obtained.

[Table 7 about here]

Table 8 presents our falsification test results. In order to give greater importance to better matched parent companies, columns two and four weight each observation inversely to the absolute difference in the propensity score of the parent and its match. In columns three and four, we also match on parent company total factor productivity during the matching exercise. Across all columns, we find that affiliate labour quality virtually has no effect on matched parent company productivity, suggesting that our interpretation of our earlier results in table 4 is correct.

[Table 8 about here]

5. CONCLUSIONS

The literature on reverse knowledge transfer is almost exclusively based on firm-level data from specific home countries (typically the G8) and a period of time focused on the late 1990s and early 2000s. A review paper on economic geography and multinational firm performance by Beugelsdijk et al. (2010) explains that one of the major remaining weaknesses in the convergence of the economics, geography, strategy and international business literatures is the lack of focus on how a firm's organizational characteristics relate to its geographical characteristics.

Firms are willing to pay higher wages to high quality workers (Stigler 1962, Weiss 1980). The attractiveness of locations in which there is high quality of labour has been characterized in terms of their technological or knowledge advantage, and in terms of managerial capability that allows an extension of the value chain of foreign MNCs into this market (host countries with market conditions similar to the home market are preferable), or allows technological acquiring especially in merger and acquisition investment among

developed countries. As such, multinational firms may self-select or choose the location of FDI, and the motivation of technology sourcing of mergers and acquisitions and FDI activities between Western countries has hitherto been ignored in the literature on multinationality and firm performance. Driffield et al. (2010), for example, highlight that MNCs are sources of international technological flows, and explain how the location choice of FDI activities and technology sourcing relate to subsequent performance. This kind of investment may lead to growth in the size and technological capacity of firms, while it may not lead to higher firm profitability.

Knowledge of the reverse knowledge transfer within MNCs is often limited to case studies (for example, Kuemmerle 1997) or analysis of a single country (for example, Driffield & Love 2003, Griffith et al. 2006, Nair et al 2017). This paper fills these research gaps by examining a firm-level panel of more than 2,800 multinationals and more than 5,600 of their overseas affiliates from a large number of countries (51) over a recent period (2008-2015).

We examined the extent to which multinational affiliates transfer knowledge to their parents abroad in terms of higher productivity, considering a wide variety of home and host countries. Many of these parent-affiliate pairs are located in different continents and in very different country settings, along several dimensions. We can therefore not only assess how general the international technology transfer within multinationals is, but also understand some of its determinants, namely in terms of the contrast among affiliate different positions in parent global value chain, the contrast between wholly owned and joint venture entry mode.

Why do multinationals seek lower labour quality locations for operations when it is likely to reduce firm efficiency? We argue that while the search for lower labour costs is an important motivation for a firm to go abroad in order to optimise the production processes by moving production to locations that offer advantages in terms of costs, this kind of reallocation of productivity activities to low labour quality locations is likely to decline average firm

efficiency at home. We find considerable evidence that affiliates transfer their knowledge to their parents, by increasing productivity of the parent, and this occurs when affiliates have high labour quality. In other words, our estimates indicate that multinational parents leverage their knowledge and technology across dispersed overseas subsidiaries in order to improve their competitive performance. We also find that the affiliate position in MNCs value chain plays an important role on the reverse knowledge transfer. The effects are higher when the overseas affiliates are upstream, rather than downstream, in the MNCs global value chains. The knowledge transfer effect is higher when the overseas affiliates involve horizontal, rather than vertical FDI. The greater control on affiliates will also facilitate the knowledge transfer from overseas affiliates to their parents. One limitation of our analysis is that we do not have information on employee-level data, such as average level of education and/or work experience of the labour force. Our samples largely come from Europe, and some analyses based on other regions would be useful. We leave these topics for future research.

Endnotes:

[1] Which affiliates are classified as upstream and which are classified as downstream activities will depend crucially upon the core business of the parent MNC. The dataset for the empirical analysis in this paper just includes parent companies whose core business is manufacturing.

[2] The calculation of the total factor productivity is performed in STATA using the 'Levpet' package code provided by Petrin et al (2004) that utilises the LP approach.

[3] In the absence of input-output tables for all the countries which are included in the empirical analysis, we use the sectoral input-output coefficients for the United Kingdom and assume that these are constant across countries

[4] Orbis also contains further details such as news, market research, ratings and country reports, scanned reports, ownership and mergers and acquisitions data. There are also many additional reports per company, in particular about banks, insurance and other listed companies, as well as other large private companies. See Ribeiro et al. (2010) for more information on the Orbis dataset and Bhaumik et al. (2010) and Yang, Martins & Driffield (2013) for other papers that use this dataset.

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Figures

Figure 1: Affiliate Strategic Roles

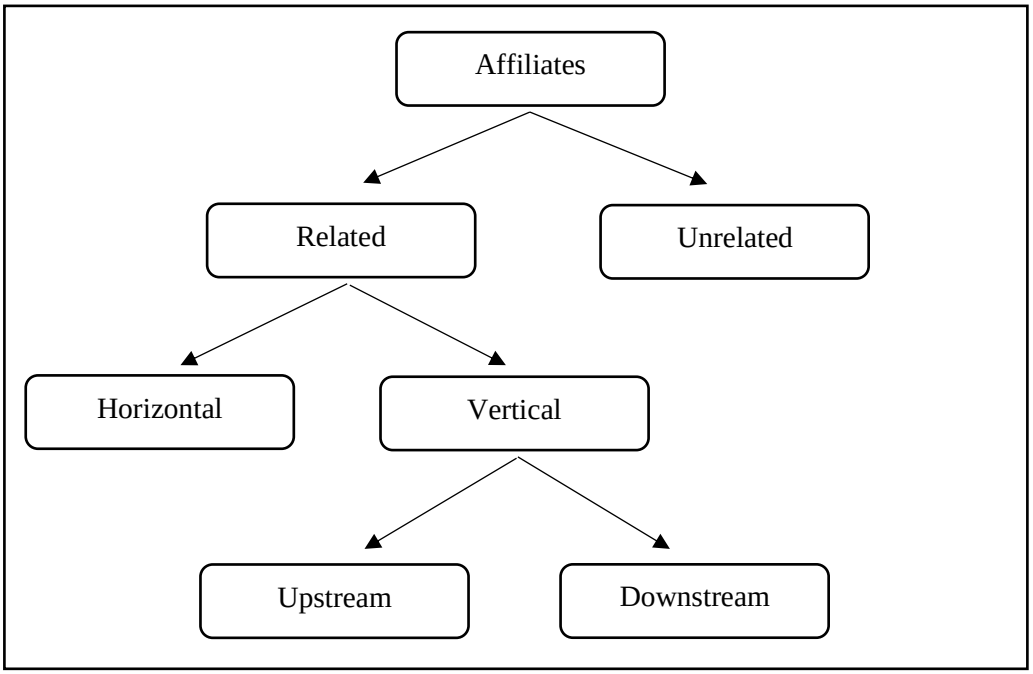

Figure 2: Propensity score difference

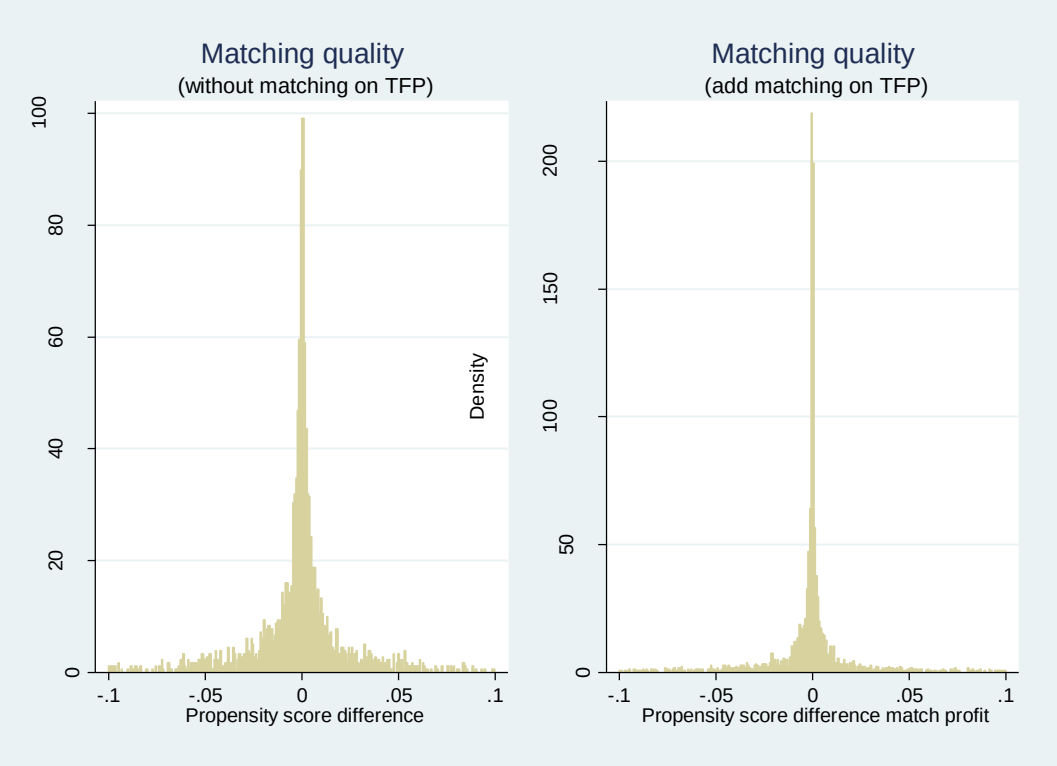

Table 1: Definitions and Descriptive Statistics of the Variables

Variable	Definition	Mean	Standard deviation
Affiliates			
ALQ†	Estimated labour quality in affiliate (using equation 4)	4.33	1.81
AW*	Annual wages per employee in affiliate ($'000)	54.75	33.81
AP*	Annual net profits before tax per employee in affiliate ($'000)	34.13	59.26
AKL*	Capital-labour ratio for the affiliate ($'000)	62.07	97.08
AINT*	Intangible assets per employee in affiliate at end year ($'000)	11.35	43.13
Parents			
TFP†	Estimated total factor productivity (using equation 3)	4.95	3.59
PLQ†	Estimated labour quality in parent company (using equation 4)	6.63	3.57
PAGE†	Age of parent company (years since establishment)	56.7	50.3
PGEAR†	Gearing ratio of parent company = ratio of long-term debt to total assets at end year	0.93	0.95
PPROF†	Profitability of parent company = profit before tax as % of operating revenue	8.26	8.02
PW^{+}	Annual wages per employee in parent company ($'000)	65.5	23.9
PP^{+}	Annual net profits before tax per employee in parent company ($'000)	34.9	53.0
PKL$^{+\dagger}$	Capital-labour ratio for the parent company at end year ($'000)	85.2	87.9
PINT$^{+\dagger}$	Intangible assets per employee in parent company at end year ($'000)	42.1	93.4
OUT$^{\times}$	Annual operating turnover of the parent company ($'000 000)	2642	5564
CAP$^{\times}$	Tangible capital assets of the parent company at end year ($'000 000)	895	2358
LAB$^{\times}$	Total labour employed by the parent company at end year	8743	17034
INP$^{\times}$	Expenditure on intermediate inputs by the parent company ($'000 000)	1131	2657
Country			
PGDP$^{+\dagger}$	GDP per capita in MNC home country ($'000)	42.6	16.5
AGDP*	GDP per capita in MNC host country ($'000)	29.7	15.2

Notes: (1) The mean values of each variable are calculated by first calculating the means for each parent company (affiliate) over the time period, and then calculating the means for all parent companies (affiliates).
(2) * indicates the variables used in the estimation of affiliate labour quality (ALQ)
(3) $^{+}$ indicates the variables used in the estimation of parent company labour quality (PLQ)
(4) $^{\times}$ indicates the variables used in the estimation of total factor productivity (TFP)
(5) † indicates the variables used in the estimation of reverse knowledge transfer effect

Table 2: Composition of the Sample of Affiliates

Affiliate Type	Number of affiliates	Affiliate Labour Quality (ALQ)	% that are WOEs	TFP in parent companies
Related	4178	4.32	70%	4.80
*** Vertical**	2438	4.83	72%	5.08
+ Upstream	655	4.24	68%	4.95
+ Downstream	1783	5.04	73%	5.13
*** Horizontal**	1740	3.64	66%	4.40
Unrelated	1470	4.36	68%	5.42
All affiliates	5648	4.33	69%	4.95

Notes: (1) The values of affiliate labour quality are averages over the years for which data are available
(2) The values of parent company TFP are averages weighted by the numbers of affiliates.
(3) There are 14914 parent-affiliate-year combinations

Table 3: Correlation Matrix of the Variables in the Estimation of Parent Company Productivity

	TFP	ALQ	PLQ	PGEAR	PINT	PAGE	PTAN	PPROF	GDP
1 TFP	1.000								
2 ALQ	0.178***	1.000							
	(0.000)								
3 PLQ	-0.097***	-0.013	1.000						
	(0.000)	(0.111)							
4 PGEAR	0.004	-0.051***	-0.029***	1.000					
	(0.649)	(0.000)	(0.000)						
5 PINT	-0.039***	0.008	-0.131***	0.124***	1.000				
	(0.000)	(0.305)	(0.000)	(0.000)					
6 PAGE	-0.076***	-0.041***	-0.065***	-0.051***	0.163***	1.000			
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)				
7 PTAN	-0.224***	-0.151***	-0.104***	0.048***	0.246***	0.149***	1.000		
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)			
8 PPROF	0.025***	0.035***	-0.150***	-0.179***	0.050***	0.009	0.021**	1.000	
	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.286)	(0.012)		
9 PGDP	0.085***	0.025***	0.037***	-0.057***	0.123***	0.165***	-0.027***	0.019**	1.000
	(0.000)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.024)	

Notes: (1) The dependent variable in the regression analysis is total factor productivity (TFP).
(2) See Table 1 for detailed definitions of all the variables.
(3) The values in parentheses are p-values. Significance levels are as follows: ***: 0.01; **: 0.05; *: 0.10.

Table 4: The Relationship between Affiliate Labour Quality and MNC Parent Productivity

	H1	H2		
	All	All	Related	Unrelated
	(1)	(2)	(3)	(4)
ALQ		**0.021****	**0.036*****	**-0.012**
		(0.010)	**(0.012)**	**(0.015)**
PLQ	0.208***	0.208***	0.181***	0.308***
	(0.027)	(0.027)	(0.031)	(0.041)
PGEAR	-0.013***	-0.013***	-0.014***	-0.007
	(0.004)	(0.004)	(0.004)	(0.006)
PINT	0.011***	0.011***	0.011***	0.011***
	(0.003)	(0.003)	(0.003)	(0.004)
PAGE	-0.034**	-0.035**	-0.024	-0.058***
	(0.015)	(0.015)	(0.019)	(0.019)
PKL	-0.069***	-0.069***	-0.057***	-0.096***
	(0.014)	(0.014)	(0.017)	(0.021)
PPROF	0.004***	0.004***	0.004***	0.006***
	(0.000)	(0.000)	(0.001)	(0.001)
PGDP	0.069**	0.069**	0.071*	0.071
	(0.031)	(0.031)	(0.038)	(0.055)
Year fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
No. observation	14914	14914	11181	3733
F statistics	29.170	27.345	17.935	16.567
Adjusted R-squared	0.115	0.116	0.090	0.238

Notes: Dependent variable: Parent TFP, total factor productivity of multinational parents. Values in parentheses are robust standard errors. All columns are controlled for year fixed effects and firm fixed effects. See Table 1 for detailed explanations of each variables. Significance levels: *: 0.10; **: 0.05; ***: 0.01.

Table 5: The Impact of Affiliate Strategic Role on the Relationship between Affiliate Labour Quality and MNC Parent Productivity

	H3		H4	
	Vertical	Horizontal	Upstream	Downstream
	(1)	(2)	(3)	(4)
ALQ	**0.027***	**0.043****	**0.069***	**0.019**
	(0.014)	**(0.019)**	**(0.040)**	**(0.015)**
PLQ	0.197***	0.159***	0.115	0.244***
	(0.043)	(0.050)	(0.070)	(0.039)
PGEAR	-0.007	-0.019***	-0.014	-0.001
	(0.007)	(0.006)	(0.013)	(0.005)
PINT	0.014**	0.008**	0.009	0.014**
	(0.005)	(0.004)	(0.011)	(0.006)
PAGE	-0.042	-0.011	-0.037	-0.049
	(0.030)	(0.024)	(0.031)	(0.041)
PKL	-0.037	-0.078***	-0.015	-0.046*
	(0.023)	(0.026)	(0.045)	(0.026)
PPROF	0.005***	0.003***	0.005***	0.005***
	(0.001)	(0.001)	(0.002)	(0.001)
PGDP	0.038	0.110*	0.019	0.054
	(0.048)	(0.062)	(0.127)	(0.054)
Year fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
No. observation	6465	4716	1693	4772
F statistics	9.991	13.265	4.410	10.753
Adjusted R-squared	0.074	0.126	0.083	0.081

Notes: Dependent variable: Parent TFP. Values in parentheses are robust standard errors. All columns are controlled for year fixed effects and firm fixed effects. See Table 1 for detailed explanations of each variables. Significance levels: *: 0.10; **: 0.05; ***: 0.01.

Table 6: The Impact of Entry Mode on the Relationship between Affiliate Labour Quality and MNC Parent Productivity

	Horizontal		Downstream		Upstream	
	Wholly	JV	Wholly	JV	Wholly	JV
	(1)	(2)	(3)	(4)	(5)	(6)
ALQ	**0.077*** **	**0.008**	**0.018**	**0.011**	**0.129** **	**-0.041**
	(0.027)	**(0.025)**	**(0.016)**	**(0.047)**	**(0.053)**	**(0.038)**
PLQ	0.160***	0.185	0.286***	0.149*	0.093	0.214***
	(0.039)	(0.114)	(0.042)	(0.086)	(0.084)	(0.066)
PGEAR	-0.017***	-0.040***	-0.004	0.005	0.001	-0.038*
	(0.006)	(0.014)	(0.006)	(0.010)	(0.014)	(0.021)
PINT	0.012***	0.002	0.013**	0.019	0.006	0.012
	(0.004)	(0.007)	(0.005)	(0.016)	(0.012)	(0.015)
PAGE	0.011	-0.138	-0.043	-0.041	-0.027	-0.109*
	(0.025)	(0.097)	(0.042)	(0.112)	(0.031)	(0.065)
PKL	-0.080***	-0.087	-0.058**	-0.034	0.006	-0.022
	(0.020)	(0.075)	(0.026)	(0.054)	(0.069)	(0.032)
PPROF	0.003***	0.004**	0.005***	0.002	0.005**	0.007***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
PGDP	-0.006	0.331**	0.084	-0.161	-0.055	0.101
	(0.062)	(0.159)	(0.056)	(0.204)	(0.186)	(0.136)
No. observation	3127	1589	3536	1236	1176	517
F statistics	10.308	5.593	8.678	4.182	3.256	6.168
Adjusted R-squared	0.158	0.115	0.087	0.095	0.067	0.279

Notes: Dependent variable: Parent TFP. Values in parentheses are robust standard errors. All columns are controlled for year fixed effects and firm fixed effects. See Table 1 for detailed explanations of each variables. Significance levels: *: 0.10; **: 0.05; ***: 0.01.

Table 7: Falsification exercise: matching quality

Variable	Mean	Std. Dev.	Obs.
Matching without parent TFP			
TFP difference	-0.008	0.490	2,269
Sales Per Worker difference	0.006	0.705	2,269
Age difference	-0.009	0.741	2,269
Profit Margin difference	-0.006	1.051	2,269
Labour Quality difference	0.000	0.106	2,269
Intangibles difference	-0.012	1.395	2,269
Gearing difference	-0.002	1.129	2,267
Tangibles Per Worker difference	0.020	0.947	2,269
Sales difference	-0.010	0.978	2,269
Employees difference	-0.017	0.864	2,269
Material Costs difference	0.001	1.107	2,269
Same Sector	1	0	2,269
Same Country	1	0	2,269
Same Year	0.260	0.439	2,269
Propensity score difference	-0.001	0.024	2,269
Matching with parent TFP			
TFP difference	-0.007	0.536	2,326
Sales Per Worker difference	-0.009	0.711	2,326
Age difference	-0.012	0.747	2,326
Profit Margin difference	-0.008	1.055	2,326
Labour Quality difference	0.000	0.117	2,326
Intangibles difference	-0.014	1.407	2,326
Gearing difference	0.003	1.131	2,324
Tangibles Per Worker difference	-0.015	0.940	2,326
Sales difference	-0.029	0.988	2,326
Employees difference	-0.025	0.883	2,326
Material Costs difference	-0.028	1.116	2,326
Same Sector	1	0	2,326
Same Country	1	0	2,326
Same Year	0.259	0.438	2,326
Propensity score difference	-0.002	0.022	2,326

Table 8: Falsification Test Results

	(1)	(2)	(3)	(4)
	Without matching on parent TFP		With matching on parent TFP	
	FE	FE	FE	FE
ALQ	**-0.010**	**-0.010**	**-0.004**	**-0.004**
	(0.014)	**(0.014)**	**(0.015)**	**(0.015)**
PLQ, Fake Parent	0.280***	0.279***	0.349***	0.348***
	(0.068)	(0.068)	(0.062)	(0.062)
PGEAR, Fake Parent	-0.002	-0.002	-0.019*	-0.019*
	(0.009)	(0.009)	(0.011)	(0.011)
PINT, Fake Parent	0.014*	0.014*	0.009*	0.009*
	(0.007)	(0.007)	(0.005)	(0.005)
PAGE, Fake Parent	-0.035	-0.033	-0.049	-0.050
	(0.122)	(0.122)	(0.054)	(0.054)
PKL, Fake Parent	-0.012	-0.012	-0.022	-0.022
	(0.032)	(0.032)	(0.029)	(0.029)
PPROF, Fake Parent	0.006***	0.006***	0.006***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)
PGDP, Fake Parent	0.039	0.039	0.001	0.000
	(0.109)	(0.110)	(0.080)	(0.081)
No. observation	5437	5437	5491	5491
F statistics	6.2352	6.2237	9.4561	9.4156
Adjusted R-squared	0.0587	0.0585	0.2770	0.2774

Notes: Dependent variable: Total factor productivity of matched parent company . Values in parentheses are robust standard errors. Columns 3 and 4 add more weighting on those highly matched pairs. See Table 1 for detailed explanations of each variables. Significance levels: *: 0.10; **: 0.05; ***: 0.01

Appendix A: Country Composition of the Sample

	Affiliates		Parents							
Country	No.	ALQ	No.	TFP	PLQ	PGEAR	PINT	PAGE	PKL	PPROF
Austria	110	4.5	121	5.2	6.81	0.72	0.25	51.5	46.88	7.42
Bangladesh	3	1.33	0							
Belgium	178	8.22	158	6.95	8.17	0.01	1.33	29	8.63	9.08
Bosnia and Herzegovina	43	5.03	7	8.42	3.91	0.02	0.07	10	17.17	0.43
Bulgaria	65	5.21	12	4.01	8	0.78	0.91	17.5	54.08	8.5
China	1	4.77	0							
Croatia	82	5.73	27	1.86	7.28	2.55	0.11	16.5	21.51	4.03
Cyprus	1	0.88	0							
Czech Republic	375	2.22	70	4.74	8.82	0.05	9.64	20	88.72	27.49
Denmark	35	3.98	5	5.02	6.62	0.44	9.59	39	30.5	2.17
Estonia	53	5.03	1	11.22	-1.06	0.07	0.51	9	15.17	13.38
Finland	72	4.88	104	2.96	8.75	1.61	4.4	19.33	19.83	1.51
France	699	5.02	399	4.55	5.29	1.4	31.94	35.5	85.11	8.74
Germany	424	6.9	532	6.23	12.32	0.42	28.19	42	46.64	9.76
Ghana	1	5.23	0							
Greece	1	4.69	0							
Hungary	138	4.76	26	4.9	6.16	0.02	0.2	25	75.09	3.73
Iceland	1	3.98	0							
India	10	6.16	33	-2.31	1.52	0.71	67.85	33	39.13	24.16
Indonesia	2	5.23	0							
Ireland	4	4.86	3	-1.79	9.75	1.05	137.68	29	64.98	7.07
Italy	481	2.1	771	10.53	8.31	0.62	5.92	64	257.05	4.06
Japan	15	4.91	0							
Korea	40	2.19	6	2.79	6.55	0.3	0.29	11.5	156.1	2.72
Latvia	1	0.43	0							
Liechtenstein	0		1	5.31	6.61	0.52	16.78	52	38.17	5.87
Luxembourg	15	4.65	6	5.3	7.3	0.6	0.5	141.5	58.21	8.08
Macedonia	13	3.2	0							
Malaysia	6	3.96	0							
Malta	1	5.6	0							
Montenegro	6	5.16	1	6.32	-8.29	0.15	0.02	53	115.14	6.14
Namibia	1	5.23	0							
Netherlands	28	4.07	20	4.55	7.57	0.72	76.9	32.5	51.66	5.52
Nigeria	3	6	0							
Norway	50	2.38	24	-1.09	10.09	0.36	15.05	27	92.67	14.22
Pakistan	1	4.7	0							
Poland	309	4.61	11	1.66	7.43	0.2	0.53	19	42.05	2.99
Portugal	207	5.49	34	-1.27	9.17	0.72	2.18	43	619.33	2.81
Romania	435	0.98	8	4.91	10.6	0.25	0.03	16	11.49	8.81
Rwanda	1	5.23	0							
Serbia	124	1.99	11	-1.06	7.87	0.02	0.03	53	54.18	2.83
Singapore	1	6.83	0							
Slovakia	205	4.03	19	2.8	7.84	0.43	1.62	9	105.85	3.41
Slovenia	70	2.51	42	1.81	8.5	0.17	0.37	35.5	31.26	1.84
Spain	619	0.83	251	11.54	7.31	0.99	150.44	27.8	71.37	6.72
Sri Lanka	3	3.96	0							
Sweden	99	5.09	56	5.92	4.62	0.02	0.56	67.67	250.73	4.44
Switzerland	2	4.93	39	4.17	9.82	0.28	3.1	41.33	631.27	3.6
Tanzania	2	1.33	0							
Turkey	11	1.33	0							
Ukraine	37	0.73	0							
United Kingdom	253	4.83	21	7.29	4.01	2.29	835.5	16	85.95	10.14

Notes: All monetary variables are in US $. ‘TFP’-total factor productivity. Refer Table 1 for detailed explanations of each variables.