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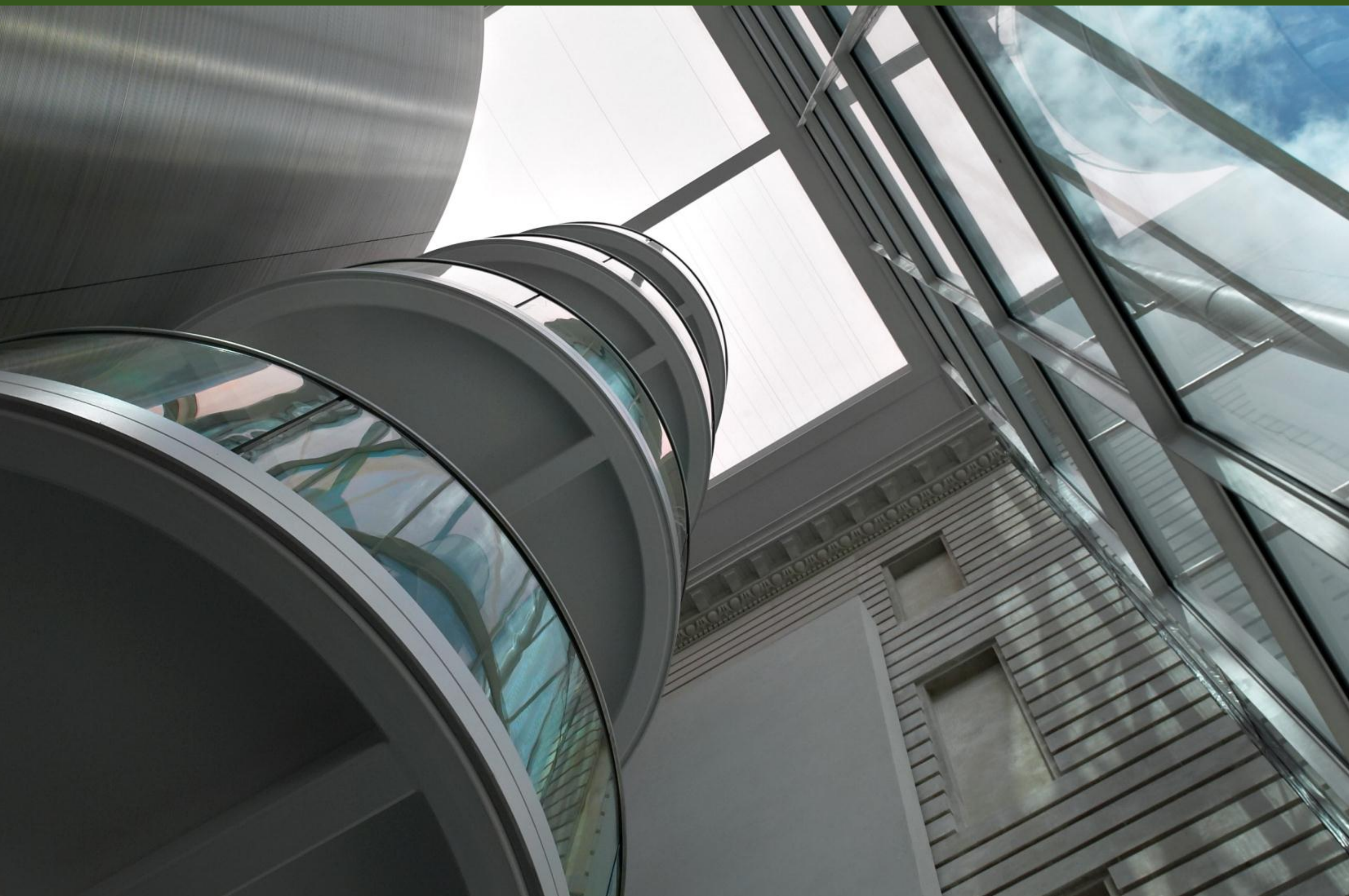

Knowledge-bases, places, spatial configurations and the performance of knowledge-intensive professional service firms

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Knowledge-Bases, Places, Spatial Configurations and the Performance of Knowledge-Intensive Professional Service Firms

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Abstract

In recent years both economic geographers and innovation scholars have paid considerable attention to knowledge-intensive-business-services (KIBS) and professional service firms (PSFs). Both communities have also shown a strong interest in knowledge, and 'knowledge-bases'. Considering architecture to be based on symbolic and synthetic knowledge, and engineering to be based on analytical and synthetic knowledge, and using a panel dataset, this paper examines the different geographies of performance amongst architecture practices and engineering consultancies active in the UK construction industry. We find that architecture practices are significantly more concentrated in inner London, whereas the engineering consultancies are much more dispersed. Locating in inner London provides significant financial benefits to the architects, but not for engineers. Ultimately various the drivers of performance are rather different, with a Christallerian logic applying to architects but not to engineers. We consider that different knowledge bases are fundamental to understanding these differences between architects and engineers.

Key Words: Knowledge bases, professional service firms, knowledge intensive business services, head-quarters location, spatial configuration, competitiveness

1. Introduction

For some time before they started attracting interest from innovation and management scholars (and indeed economists), economic geographers were taking a keen interest in producer- or business-services (e.g., Gillespie and Green, 1987; Daniels, 1991; Daniels and Moulaert, 1991; Keeble et al., 1991; Wood, 1991; Marshall and Wood, 1992; Bryson et al, 1993). From the mid-1990s, and following pioneering studies by Bessant and Rush (1995) and Miles et al. (1995), these firms also started attracting interest from innovation scholars. Miles and colleagues introduced the neologism 'knowledge intensive business services' (or KIBS) to identify a particularly significant subset of firms, which Bettencourt et al. (2002, pp. 100-101) later defined as "enterprises whose primary value-added activities consist of the accumulation, creation or dissemination of knowledge for the purpose of developing a customised service or product solution to satisfy a client's needs". These firms are particularly interesting, not only because they are highly innovative, growing rapidly, and typically provide highly paid and stimulating work, but also because they are important actors in regional and sectoral innovation systems, helping their clients to innovate and/or participate in the production and transmission of knowledge within these systems (e.g., Gann and Salter, 2000; Muller and Zenker, 2001; Wood, 2002; Tether and Tajar, 2008). Also in the mid-1990s, and to some extent building on prior work on professions (e.g., Parsons, 1954; Abbott, 1988), management and organisational scholars began to examine 'professional service firms' (PSFs) (e.g., Maister, 1993; Greenwood et al, 1994; Greenwood and Lachman, 1996; Cooper et al., 1996; Hitt et al., 2001; von Nordenflycht, 2010). This literature, which is largely rooted in sociology rather than economics, is more critical, and highlights the role of professions/PSFs in the creation and maintenance of institutions which uphold professional privileges and which distort markets (Scott, 2008). The period since the mid-1990s has also seen an upturn in interest in knowledge, and the 'knowledge-based firm' (e.g., Nonaka and Takeuchi, 1995). Indeed, drawing especially on the resource- (Penrose, 1959; Wernerfelt, 1984; Barney, 1991) and capabilities-based views (Teece et al, 1997; Eisenhardt and Martin, 2000; Winter, 2003), Grant (1996), Spender (1996) and others (e.g., Nickerson and Zenger, 2004) have developed a 'knowledge-based theory of the firm'. As fundamentally knowledge-based businesses, this theory is most clearly applicable to KIBS/PSFs.

Many of these ideas have been picked up and developed by geographers. In particular, geographers have developed the literature on KIBS, innovation and urban/regional development (e.g., Muller and Zenker, 2001; Bryson and Rusten, 2005; Koch and Stahlecker, 2006; Sunley et al., 2008; Shearmur and Doloreux, 2009; Doloreux et al., 2010; Doloreux and Shearmur, 2012). Other geographers have drawn mainly on the literature on professions/PSFs, focusing on the role of institutions, on internationalisation and globalisation, and the significance of 'global cities' (e.g., Beaverstock et al, 1999; Beaverstock, 2004; Beaverstock et al., 2010; Faulconbridge, 2006, 2007, 2008, 2009). And then there is a third community, which is especially interested in geographies of knowledge, and the extent to which knowledge can be effectively communicated over space with the aid of advanced information communication technologies (ICTs) (e.g., Hepworth, 1989; Warf, 1995; Antonelli, 1998; Howells, 2002; Amin and Cohendet, 2004).

Because they are growing rapidly, knowledge-intensive, and intense users for ICTs (which may reshape the opportunity costs of geographical proximity), KIBS/PSFs provide a fascinating arena for both theoretical and empirical research. But while much has been learnt, much also remains to be understood. For example, to what extent are KIBS/PSFs an 'industry' or 'sector', within which firm behaviours are relatively undifferentiated, or can they be divided along relatively simple lines, for example between technology-producing “t-KIBS” and professional “p-KIBS” (e.g., Miles, 2008; Shearmur, 2010). Several recent quantitative studies of KIBS and the geography of innovation either treat them as one industry (e.g., Doloreux and Shearmur, 2012) or apply this simple distinction. Yet the more qualitative literature on the geography of PSFs tends to study one specific ‘industry’ at a time, and to emphasize variation within, rather than between, industries. Meanwhile the work on knowledge and ICTs argues strongly that some ‘knowledge bases’ are rather more easily shared over distance than are others.

In this paper we are interested in the behaviours and performance of KIBS/PSFs which are differentiated by the ‘types of knowledge’ at the heart of these firms, and by their locational and spatial choices. Empirically, we focus on KIBS/PSFs located in the UK and active in the construction industry, placing particular emphasis on the behaviours and competitiveness of architecture practices and engineering consultancies. We consider that these firms are differentiated by their knowledge bases – with architects oriented to symbolic and synthetic knowledge (SSK), whilst engineers are oriented to analytical and synthetic knowledge (ASK). We are interested in how these firms differ in their locational choices (especially in relation to their sole or main UK office location; hereafter UK-HQ) and in their spatial configurations, both of which we conjecture relate to their participation in different sub-markets. We are also interested in linking these placial and spatial ‘choices’ to firms’ financial performance. The rest of the paper is structured as follows. In section 2 we draw on the literature to discuss the geography of KIBS/PSFs, ‘knowledge bases’ and the performance of these firms. Section 3 outlines the dataset and measures we use to examine the relationship between ‘knowledge bases’, UK-HQ location, spatial configurations and performance amongst construction-related KIBS/PSFs. In section 4 we discuss our methods, whilst section 5 reports our findings, dividing these between (5.1) descriptive findings and (5.2) econometric findings. Section 5 concludes the paper with a summary of our contribution and some considerations for future research.

2. Literature Review

2.1 Place, Space and KIBS/PSFs

The growth of KIBS/PSFs raises numerous interesting questions. Here we are particularly interested in their geographical presence and linking this to ‘knowledge bases’ and sub-markets. In his ‘central place theory’, Christaller (1933) posited that there are services of different ‘orders’, from low, through intermediate, to high-order services. Because they are used frequently, the skills required to provide them are relatively abundant across space and clients are reluctant to travel long distances to engage with them, low-order services tend to be spatially dispersed, with each service provider aiming to satisfy a geographically-restricted, local market. At the other extreme, there is little overall demand for high-level services. They are used infrequently, and clients are often prepared to travel to the service provider. Moreover, the labour force with the specialist skills required to provide these services tends to cluster, as this increases their chances of finding interesting and fulfilling work that takes advantage of and rewards their expertise. All of this encourages the providers of high-level services to concentrate in one central place, usually a large city, which maximises accessibility to all potential clients.

Although ‘knowledge intensive’ and/or ‘professional’ by definition, KIBS/PSFs are not all equally ‘high-order’. For example, general practice law firms, or accountants that mainly audit the accounts of small businesses, are not as ‘high-order’ as specialist corporate law firms, or accountants that specialise in international taxation. This highlights the importance of different sub-markets amongst KIBS/PSFs that are distributed unevenly across space, with the highest order firms tending to locate in the largest, most centralised, and prestigious cities. For the UK, this means London.

Air travel and high-speed land transport have increased the reach of service providers, as they have lowered the monetary and time cost required for travel, at least for businesses located close to major transport hubs and motorways. They allow service providers to serve larger territories, and are disproportionately beneficial to the highest-order service providers. For example, air travel has in particular effectively facilitated a global market for the services of the world’s most renowned ‘starchitects’ (McNeil, 2009). Meanwhile, and in keeping with a Weber’s location theory (Weber, 1909) in which the service provider seeks to minimise costs, advanced ICTs have allowed some dispersal of service activities, particularly where it is possible to break apart ‘front office’ services which generally involve face-to-face interactions with clients (and other uncodified, and uncodifiable inputs), and ‘back office’ services which do not (and which rely on more codified inputs). ‘Front office’ services may also be provided by people with specialist skills and/or knowledge (including ‘know who’), whilst the latter may be able to utilise skills and knowledge that are more dispersed. Thus, whilst front office activities may remain in city centre locations (with city choices appropriate to their service-level), back office activities can be decentralised to places where labour costs and office rents are lower.

Developments in transportation and communications technologies also raise interesting questions about the optimal scale of KIBS/PSFs. On the one hand, these developments allow firms to develop a dispersed network of offices which can all support one another over space. Experts normally based in one office can be called upon to support activities in another, and firms can thereby leverage their reputational assets and competences over a larger territory. They may also be able to achieve economies of scale by co-locating back-office functions. On the other hand, KIBS/PSFs frequently fracture, as individual experts break away to set up on their own (Kloosterman, 2008). The use of ICTs arguably reduces transaction costs (Langlois, 2003), and can favour flexible networks of individuals and small firms (often located outside of major cities), over larger, integrated, and centrally located businesses (Dyer and Singh, 1996).

Thus KIBS/PSF firms have choices to make regarding both places and spaces (Sorenson and Baum, 2003). Most firms are “place takers” rather than “place makers”. That is, the presence or absence of an individual firm rarely changes a place fundamentally. For example, Wall Street survived the trauma of the demise of Lehman Brothers, a major firm, just as the City of London survived the collapse of Barings Bank 13 years earlier. With few exceptions (e.g., Fiat and the city of Turin; Whitford and Enrietti, 2005), the characteristics of most places are, at least in the short run, essentially exogenous to the actions or behaviours of any individual firm. In keeping with the general economics of urbanisation and agglomeration (Gordon & McCann, 2005), firms may therefore prefer to locate in a particular place in order to gain location specific advantages which arise from place-specific, or place-‘sticky’ resources. Locating in large central cities aids access to key transport nodes, such as major international airports (Simmie, 1998), but this is also important where the resources are uncodified, such as place-based social networks which can increase access to particular clients or experts (Zucker et al., 1998; Laursen et al., 2011). And apart from 'knowledge spillovers', locating in particular places can also have reputation or image benefits (Massey et al, 1992). However, places can have drawbacks. Given that demand to locate in particular places can exceed the available space, labour costs, office rents and other associated costs can be considerably higher. Ultimately, the costs of being located in a particular place may outweigh the benefits. Some firms also deliberately avoid locating in clusters to avoid 'group think' and other problems (Suarez-Villa and Walrod, 1997), and the benefit of locating in clusters is disputed (Baptista and Swann, 1998; Shearmur and Doloreux, 2009).

Spatial considerations, by contrast, concern how the firm structures itself within and across places. These choices range from 'micro' issues such as who, or which departments, to locate next to one another (e.g. Allen and Henn, 2005) through to 'macro' issues such as whether to centralise all activities into one plant or office, or to decentralise to multiple sites, possibly including internationalisation. Spatial considerations will be influenced by exogenous factors, such as the quality of transport- and telecommunications networks, but how the firm chooses to use these infrastructures, technologies and other resources to organize its activities over space is largely endogenous to its strategy (Sorenson and Baum, 2003). So whereas places are taken as given, firms can potentially manage or mould their spatial configuration to maintain or enhance their competitiveness. Whether it is better to concentrate production spatially, or to disperse it is likely to depend on several internal and external factors, including the desirability of face-to-face interactions, the use of interdisciplinary or cross-departmental working, the spatial distribution of clients, and the effectiveness of ICTs in permitting distributed working.

An interesting issue then is the extent to which these placial and spatial choices relate to differences amongst KIBS/PSFs. We have already argued, following Christaller (1933) that higher-order KIBS/PSFs will tend to locate in the most centralised cities, whilst lower-order KIBS/PSFs will be more dispersed, but does this hold equally across all KIBS/PSFs? Von Nordenflycht (2010) recently developed a typology of professional services and PSFs, which he considers have three central characteristics: knowledge intensity; low capital intensity; and a (highly) professionalised workforce. By a 'professionalised workforce' he refers to two institutional features of professionalisation: ideology and self-regulation.[1] Professionalisation sets limits on where individuals can practice. For example, in the UK Scottish Law differs from that in England and Wales, which bolsters Edinburgh as a centre for legal services, and makes it more difficult for UK-wide law firms to develop and centralise activities in London. Similarly, the responsibilities of architects differs between the UK and France (Winch and Sneijder, 1993), which makes it more difficult for a single firm to operate in both markets. von Nordenflycht refers to firms that are not regulated by a professional body (e.g., management consulting and advertising agencies) as 'neo-PSFs', in contrast to regulated 'classic PSFs', which include legal services, accounting services, architecture and engineering. The lack of mainly nationally based regulatory bodies which pertain to geographical jurisdictions means that it is easier for neo-PSFs to internationalise than classic-PSFs (e.g., Faulconbridge et al., 2011; Jones, 2003; McKenna, 2006).

[1] "A professional ideology consists of a set of norms, manifested both in explicit ethical codes enforced by professional associations and ... often developed during professional training. ... Self-regulation means that professionalised occupations have strong control over the practice of the occupation. A central association (typically) certifies membership into the profession, based on demonstrated expertise and adherence to the ethical code." (von Nordenflycht, 2010, p. 163).

2.2 Knowledge Bases

Another important differentiator is likely to be the 'type of knowledge', or 'knowledge base', at the heart of these firms, an aspect of PSFs that von Nordenflycht does not consider. Both geography and innovation studies have recognized that knowledge is not undifferentiated, and much has been made of Polanyi's (1966) distinction between tacit and codified knowledge (e.g., Lissoni, 2001; Howells, 2002; Foray and Steinmueller, 2003; Gertler, 2003; Dosi and Grazzi, 2010). Tacit knowledge relates to Polanyi's observation that "we can know more than we can tell". It is personal, 'articulated' through actions and practical skills, and largely accumulated through experience. Moreover, it is imbued with meaning which arises from the social and institutional context within which it is produced. It cannot be reduced to numbers, graphs, maps, diagrams, texts, formulas, etc., and is therefore difficult to store and transmit using ICTs (Nonaka and Takeuchi, 1995). This makes it is hard to communicate and spatially 'sticky' (Gertler, 2003). Codified (or explicit) knowledge, by contrast, is not embodied in individuals and can be externalised and communicated over long distances. Tacit knowledge is however typically required to understand, produce and make use of codified knowledge. And tacit knowledge also underlies firms' routines and capabilities, which are their source of differentiation and competitive advantage (Nelson and Winter, 1982; Teece et al., 1997). Furthermore, tacit and codified knowledge typically co-exist and inter-play (Nonaka and Takeuchi, 1995; Nightingale, 1998), although in different mixes with different 'types' of knowledge.

Drawing on Kant's distinction between analytics and synthetics, Asheim and colleagues (Asheim and Gertler, 2005; Asheim and Coenen, 2005) identified two 'knowledge bases': analytical and synthetic, which, they claim, "entail different mixes of tacit and codified knowledge, as well as different codification possibilities and limits. ... [They also] imply different qualifications and skills, reliance on different organisations and institutions, as well as contrasting innovation challenges and pressures" (Asheim and Gertler, 2005, p. 295). More specifically, 'analytical knowledge' is more codified, or codifiable, and geared to understanding and explaining features of the natural world. Knowledge-generation is based on widely shared, structured and understood principles and methods, such that meaning is relatively consistent and sharable across space. It is considered to dominate economic activities based on formal models, codified science and rational processes (Asheim and Gertler, 2005).[2] By contrast, 'synthetic knowledge' is largely experiential, less abstract, and oriented to solving problems in the human world, largely through trial-and-error experimentation and learning by-doing, by-using and by-interacting (Rosenberg, 1982; Johnson et al., 2002). It is considered to prevail in settings where innovation takes place through the application of, or recombinations of, existing knowledge. Frequently, it is applied to solve specific problems that arise during user-producer interactions, especially where meanings or understandings are context specific (e.g. von Hippel, 1988; Tether and Metcalfe, 2003).[3]

In other work, Asheim and colleagues (Asheim et al., 2007, Asheim and Hansen, 2009; c.f., Lash and Urry, 1994) extended this typology to a third 'knowledge base': "symbolic knowledge", which relates to the creation and manipulation of cultural meanings, as applied to images and experiences, and to aesthetic and cultural artefacts. Engaging in this requires artistic abilities in symbol creation,

[2] Note that Asheim and Gertler's 'analytical knowledge' has strong similarities with the 'Mode 1 Knowledge' previously identified by Gibbons and colleagues (1994).

[3] Asheim and Gertler's 'synthetic knowledge' has strong similarities with the inter-disciplinary, problem-focused 'Mode 2 Knowledge' previously identified by Gibbons et al. (1994).

interpretation and manipulation, with the knowledge produced incorporated into and transmitted through aesthetic and cultural products, including images, artefacts, sounds and narratives. Many symbolic products are strongly identified with the individuals or small groups of people that produce them, or are credited with producing them, including artists, musicians, product designers and architects.[4] Table 1 provides a summary of the characteristics of these different 'knowledge bases'.

--- INSERT TABLE 1 ABOUT HERE ---

2.3 Architecture Practices and Engineering Consultancies

Having discussed these matters in general, we now consider the specific case of architecture and engineering consulting. Under standard industrial classifications these are usually classified to the same industry. For example, under the European NACE classification, 'Architectural and engineering activities and related technical consultancy' are classified as M71.1 (previously K74.2). Although this can be sub-divided into M71.1.1 "Architectural activities" and M71.1.2 "Engineering activities and related technical consultancy", data is very rarely available at this level of disaggregation. Meanwhile, the standard North American Industrial Classification also combines these two activities, only allowing them to be disaggregated at the 5-digit level (54131 = Architectural Services; 54133 = Engineering Services). More conceptually, 'architecture and engineering consulting' is universally recognised as a KIBS sector and, where the distinction is made, usually as a T-KIBS activity. However, in the UK and most other countries, both architecture and engineering are regulated professions, and therefore 'classic PSFs' as identified by von Nordenflycht (2010). They are also project, rather than case-based actitivities (Gann and Salter, 2000; Grabher, 2004a&b).

But while they are usually grouped together, they are grounded in different knowledge-bases, which reflect divisions of both knowledge and labour in the provision of expertise within the construction industry. That a well established textbook providing *Simplified Engineering for Architects* (Ambrose and Tripeny, 2010) exists only reinforces this point. Architecture (in the UK) is rooted in art and design, and aspiring architects will normally have an orientation to the creative arts. The Royal Institute of British Architects, the UK's professional association for architects, for example provides the following advice to secondary school pupils considering studying architecture at university: "Although it is not always necessary to study art, you should enjoy drawing freehand and have an interest in design and making 3D work; most schools will require you to present a portfolio at interview." Engineering, by contrast, places strong emphasis on the calculative sciences, especially mathematics and physics, and 'hard', deductive reasoning. The Royal Academy of Engineers, for example, advises prospective university students that a strong grounding in maths and sciences is "the basis of engineering".[5] These differences reflect different 'thinking styles' – an intuitive-

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[4] Others, however are not: e.g. few people outside of the advertising industry would know which company, let alone which individual(s) are responsible for particular adverts. It seems that sometimes symbolic knowledge is highly personalised and thus 'sticky' to a person or small group, whilst sometimes this is not the case.

[5] See http://www.tomorrowsengineers.org.uk/students.cfm. Some engineering institutions also emphasize art. The Institution for Structural Engineering for example highlights design, technology and art, alongside mathematics, physics and 'other sciences' and states: "Remember structural engineering is an art and a science". Whilst true, a structural engineer will be expected to be competent in mathematics whilst this is not a requirement of architects, who will refer to structural engineers if have concerns about structural issues.

expressive-style versus an analytical-rational-style, that have roots in different cognitive abilities which are further amplified by differences in education and training. Architectural education is oriented to 'symbolic knowledge', whilst the education of engineers focuses primarily on 'analytical knowledge' (Vincenti, 1988; Boland and Callopy 2004; Cross, 2007). Both architects and engineers are however pragmatic, and reflective (Schön, 1983), and practicing architects and engineers will develop synthetic knowledge, not only to get buildings built, but also to work together (Brusoni, et al., 2001). Thus we consider that architecture is primarily a blend of symbolic and synthetic knowledge (SSK), whilst engineering mainly blends analytical and synthetic knowledge (ASK). In the empirical study that follows we divide firms wholly or primarily specialised in architecture from those wholly or primarily specialised in engineering.

Whilst empirical studies of KIBS, several of which are based on large datasets, have not tended to differentiate between architects and engineering consultancies, a number of qualitative studies of PSFs have considered these as individual industries, with architects receiving much more attention. Indeed, engineering consultancies seem to have attracted remarkably little attention amongst geographers and innovation/management scholars. But in a wide ranging exploratory study, Rimmer (1991) examined the location of engineering consultancies' head and branch offices, and their extent of internationalisation. In this he highlights the role of ICTs, stating: "This evidence suggests that a 'superclass' of cities is emerging facilitated by global electronic networks which are allowing information to be centralized in London, Paris, Tokyo and New York and transmitted to branch offices around the world" (op cit., p. 104). Later, Baark (1999) also recognised the importance of ICTs in reshaping engineering consultancies both in what they do (i.e., specialisation versus diversification) and where they do it (concentration versus dispersion). Interestingly, neither of these studies highlights the role of individual engineers: both focus on firms and their internal and external networks (see also Dodgson et al., 2007).

Architects, by contrast, have attracted significant attention from economic geographers and other social scientists. Winch and Schneider (1993) examined the management of architectural practices as an example of managing the knowledge-based organisation. And Knox and Taylor (2005) studied the globalisation of architectural practice, focusing on the global strategies of leading firms and how these relate to the evolving network of world cities. They find London to be 'by far the leading city' for the location of global architecture practices. McNeill (2009) investigates *The Global Architect*, considering amongst other issues the globalisation of architectural practice, designing at a distance, and architectural celebrity and 'starchitects', who are both the author of the design and the ultimate arbiter of quality. Particular individuals are central (Iredale, 2004),[6] and this emphasis on individual (star)architects as personifications of brands and the work of entire firms stands in marked contrast to the anonymous work of engineers. It also has implications for the organisation of the firm, for clearly individuals can only be in one place at a time, and this, coupled with the subtle, difficult to communicate nature of subjective 'symbolic knowledge', suggests these firms will tend to concentrate their design activities in one or perhaps two locations. More generally, and with regard to place and space, McNeill states: "The challenge for [architecture] firms is to work out how best to

[6] Renzo Piano, for example, reassures his clients that: "I personally lead each project from conception through schematic and design stage. My daily direct involvement continues until I am personally satisfied that the design proposals and concepts have been successfully achieved through close collaboration and development with the client." www.architonic.com/aiabt/renzo-piano-building-workshop/5202186

organize themselves to be proximate to clients while having the reach to operate in several geographical markets simultaneously" (p. 8).

Faulconbridge's (2009) study relates to this, as it considers how global architects can ensure that the buildings they design in one place are 'in place' and appropriate for the contexts in which they are built. This highlights the spatial separation of design activities and construction/contextualisation activities. Meanwhile, Faulconbridge (2010) notes that: "despite widespread interest in the cultural industries, few questions have been asked about the geographies of learning and innovation in architecture". He investigates how communities of practice (Wenger, 1988) connect individuals, firms, and regions into networks of learning that 'perforate' different spatial scales, and shows that global architects participate in 'local' communities of practice that rely on face-to-face interaction, talk, and 'buzz', but that these 'local' communities are connected to 'global constellations of practice' by architects travelling the globe and by the circulation of (encoded) texts and images in the media. Kloosterman (2008) adds further to this understanding by showing that while the 'superdutch' architectural practices are concentrated in Amsterdam and Rotterdam (and some even share open-plan office spaces), they tend to work independently, afraid that collaboration will dilute their designs and signatures, and blur authorship and identity (p. 558). Thus face-to-face and "buzz" are different means of communication (Asheim et al., 2007). The lack of formal structures within the design studios is highlighted by Brown and colleagues, who claim that this is because 'any formal office structure or defined routines would restrict creativity and interaction' (Brown et al, 2010, p. 533): such informality is hard to replicate across space and in multiple places, and will again encourage architectural practices to minimise their number of design studios.

So in contrast to engineering consultants, there is a substantial literature on architects and the geography of architectural practices. But this literature is very largely qualitative and moreover has tended to focus very heavily on 'global practices', iconic architecture (e.g., Sklair, 2005), and 'starchitects' (Brown et al., 2010; Sudjic 2006) rather than more mundane practices, architects and buildings.[7] In fact most architectural practices, even those that are relatively large, are not 'globalised': of the Top 100 practices with offices in the UK as identified by the Architects Journal (2012), only 14 earned more income overseas than in the UK, whilst 28 earned all of their income in the UK. The literature therefore provides a somewhat distorted view of architects, architectural practices and their extent of globalisation.

2.4 A Note on Performance, and its Neglect in Studies of the Geography of KIBS/PSFs

Finally, we note that whilst the literature architectural practices in particular, and KIBS/PSFs in general, has flourished, surprisingly little explicit attention has been paid to the financial performance of these firms, and the influence of innovation, location, globalisation, etc. on their performance.[8] It is almost as if the fact these are businesses, which exist to make money, is forgotten. But the fact that they are businesses intended to make money is central to their behaviours, including geographical questions of location choices and organisational design. For example, whilst locating in major world cities provides benefits such as "buzz" and eases face-to-face

[7] In other words, the literature has tended to focus on 'strong-idea' practices, rather than 'strong service' or 'strong delivery' practices (Winch and Sneijder, 1993; Sklair, 2005).

[8] For a few exceptions, see Greenwood et al., 2005; Greenwood et al., 2007; Hitt et al., 2001; McClean and Collins, 2011; Murray et al., 2009; von Nordenflycht, 2007).

interactions, it will also typically impose costs, because office rents and salaries are typically higher. The balance between these costs and benefits is likely to be critical to the economic geography of firms' activities. In the analysis which follows we are therefore interested in comparing and contrasting the locational choices of (various) architecture practices and engineering consultancies, particularly with reference to these firms' UK-HQ, as well as differences in firm-size and office networks, both in the UK and overseas. We also consider the extent to which these firms are professionalised, and specialised in one of the construction related professions. But ultimately we examine how firms' choices pertaining to professionalisation, specialisation, UK-HQ location and the size of their office networks in the UK and overseas relate to their financial performance, as measured by income-per-head to UK offices.

3. Dataset and Measures

This paper is based on quantitative analyses of a dataset compiled from listings of the "Top Consultants" in the UK construction industry published annually by *Building* magazine.[9] Every year since 1988, *Building* has published a ranking of the largest consulting firms working in the UK construction industry. The ranking is based on the total number of UK based 'chartered' staff. Chartered staff are those that are full members of a recognised professional institution, for example architects registered with the Architects Registration Board (ARB), surveyors that are members of the Royal Institute of Chartered Surveyors (RICS), and engineers who are members of the Institute of Civil Engineers (ICE), the Institute of Mechanical Engineers (IMechE), or the Institute of Structural Engineers (IStructE).

In 1995 the format of the reporting changed, but, except for the number of firms listed, it has remained consistent ever since: each year the magazine publishes a main table, plus supplementary tables for architects, surveyors, engineers, and, more recently, project managers. In 1995, the main table included 100 firms, in 1996 150, and in all other years 200 or 250. In recent years *Building* has contacted around 500 firms, inviting them to participate and providing them with a survey form. For a variety of reasons firms sometimes decline to participate.

Apart from details of chartered staff by profession, *Building's* survey asks the firms for: their total UK fee income, and total world-wide fee income (although the latter is not consistently reported in the tables); their total UK and world-wide employment; their number of staff in some other categories;[10] their number of offices in the UK and world-wide; and to provide a telephone number for their main (or sole) UK office. No other information is available about the specific location of offices either in the UK or world-wide.

Starting with these various 'league tables', we joined the records for the various firms appearing on them to form an unbalanced panel dataset: for the period 1995-2010, the whole dataset contains 537 individual firms and 3,416 firm-year records. However, because our regression models include

[9] First published in 1843, and with an average weekly circulation of 20,000+, *Building* which is now published by UBM plc claims to reach 'over 125,000 professionals every week', and to be the UK's best-read magazine for professionals within the UK construction industry.

[10] This includes the number of UK based non-chartered (part-qualified) technical staff (e.g. architectural technologists, or Part 2 and Part 3 student architects), and the number of UK based administrative and finance staff. No detailed breakdown of non-UK based staff is provided.

lagged variables from the previous year and after excluding observations with missing information on core variables, the dataset analysed in the regressions includes 471 firms and 2,604 firm year observations.

In utilising a trade journal that provides annual rankings of firms within an industry to create a panel dataset we follow a methodology similar to that of Greenwood et al. (2005), who studied the 100 largest accounting firms in the U.S. over the period 1991-2000 using the listings published by *Public Accounting Report*, and Hitt et al (2006), who analysed the 100 largest U.S. law firms over the period 1992–1999 by exploiting the annual lists in the *American Lawyer*. And in geography, Knox and Taylor (2005) have made use of the lists of firms published annually in *Engineering News Record* and *World Architecture* for their study of architecture practices.

We use this dataset to derive the following continuous and categorical variables:

Professionalisation: Following von Nordenflycht (2010), professionalisation is defined as the extent to which the firm's UK workforce is comprised of people holding professional status. Specifically, it is the share of the total UK workforce that holds chartered status: i.e., the sum of chartered architects, surveyors, engineers and 'other chartered or qualified professionals', divided by the total UK workforce. We have no information on the employment of professionals and non-professionals outside of the UK. For the dataset as a whole, just under half of UK staff were professionals, whilst this ranged from 4% to 100% of employees (s.d. 15%).

Specialisation: Specialisation is defined as the extent to which the firm specialized in one of the construction related professions, or was multidisciplinary. To calculate specialisation we used a normalised Herfindahl (H*) index, defined as follows:

$$H = \sum_{i=1}^{N} p_i^2 \quad and \quad H^* = \frac{H - {}^{1}/_{N}}{1 - {}^{1}/_{N}}$$

Here, p_i is the share of UK chartered staff belonging to each of the four construction related professions which *Building* specifically asks about (N = 4): architects, surveyors, engineers and project managers. If only one profession is present (e.g., $p_1 = 1$, $p_{2,3,4} = 0$), H* is 1; if all professions are equally represented ($p_{1,2,3,4} = 0.25$) H* = 0. After calculating H*, we sub-divided the sample based on this measure. When H* is less than 0.5, we considered the firm to be multidisciplinary. Where H* ≥ 0.5, we considered the firm to be specialized, and then further divided these by their largest professional group, i.e., specialist architecture firms (hereafter 'Architects'), specialist engineering firms (hereafter 'Engineers'), specialist surveying firms, and specialist project managers. Most of the firms in our dataset are 'specialized', as the mean value of H* is 0.75 (median = 0.86);[11] which reflects the traditional divisions of both knowledge and labour amongst PSFs in construction related activities. Due to space constraints, and to simplify our analysis, we do not consider specialist surveyors or specialist project managers in detail here, and nor do we discuss the multi-disciplinary

[11] For a few firms H* was not consistently above or below 0.5. For these, we categorised them as being specialized or multidisciplinary on the basis of their modal classification. For example, if the firm appears in our dataset seven times, and three times H* is above 0.5 and four times it is below, the firm would be considered multidisciplinary. Note that because most firms were highly specialised, this reclassification was rarely used.

firms in any detail. Instead, to highlight differences in 'knowledge bases' and to keep the analysis relatively simple, we focus on Architects and Engineers.

Firm size: We use both categories and a continuous variable to measure firm size. In our descriptive analyses we divide firms by their total world-wide employment into Small (<50 employees: 23% of the whole dataset); Medium-sized (50-249 employees: 49%); Large (250-999 employees: 15%); and Very Large (1,000+ employees: 13%) firms. In the regressions, and in keeping with a widely used strategy to normalise the skewed distribution of firms by size, we use the natural log of world-wide employment to measure firm size.

UK offices: This is the number of offices that the firm has in the UK. We divided this into categories, identifying firms with one office (21% of the dataset); firms with 2 or 3 UK offices (30%); firms with 4 or 5 UK offices (17%) and firms with 6 or more UK offices (32%). No further information on the precise location of these offices is available from *Building*.

However, *Building* does provide a telephone number for each firm. We presumed that these numbers were (primarily) those of each firm's head or principal UK office. Internet searches confirmed this to be overwhelmingly the case. In the UK, as in most countries, the first part of a fixed-line telephone number is an area code (e.g., Manchester is 0161). We used these codes to identify the (presumed) location of each firm's UK-HQ. We sought to identify locations within the urban hierarchy, but also to identify firms located in arguably more prestigious or important locations, and pragmatically categorised firms to the following locations:

UK head office location:

1. **Inner (or Central) London**: London is by far the largest city in the UK. It is also widely recognised as being amongst an elite group of world cities. London can be subdivided in various ways, and is often divided into 'inner' and 'outer' London. Normally this is done on the basis of boroughs, the local administrative areas within London of which there are 33, plus "the City". In our case we began with telephone dialling codes. Prior to the year 2000 a separate code was used for "Inner" (0171) and "Outer" (0181) London. From 2000 a single code (020) was adopted for the whole city. However, most numbers inherited the 7 from their 0171 (becoming 0207) or the 8 from 0181 (becoming 0208).[12] Although this coding does not match the conventional distinction between 'inner' and 'outer' London, these classifications are likely to be very highly correlated, not least because research at Loughborough University has shown that architecture practices and engineering consultancies are highly clustered in "inner London", being mainly located in Westminster, (south) Camden, Islington and Hackney.[13] When in doubt we double checked the office's location using internet searches. Overall, nearly 40% of our firms' UK-HQs were in 'inner London'.
2. **Outer London Urban Area (OLUA)**. As defined by the Office for National Statistics, "The Greater London Urban Area" (2001 pop^{n}. 8.28m) extends beyond the administrative area of Greater London to include some adjacent places. We therefore included in this category all businesses

[12] The situation is complicated further by the introduction of 0203 numbers for London, and by number portability, which allows customers to retain their number whilst changing location.
[13] See http://www.lboro.ac.uk/gawc/visual/lon_arc.html

whose UK-HQ was within the Greater London Urban Area (GLUA) but not already classified as being in 'Inner London': 14% of our firms were so classified.

3. **Oxford and Cambridge** are where the UK's most prestigious universities are located. There is some suggestion that knowledge-based firms can benefit from having their main office in these cities, as this may: 1. Ease access to specialist, place-'sticky' resources; 2. Allow them to gain reputational spillover benefits from these prestigious locations. However, only 2% of the firms in our dataset were found to have their UK-HQ in these cities.
4. The rest of the **Home Counties**. Whilst not officially defined, "The Home Counties" conventionally refers to the counties of the South and East of England which encircle London. Essentially, this is London's hinterland and commuter belt, and for our purpose includes Hertfordshire, Bedfordshire, Cambridgeshire, Essex, Kent, East and West Sussex, Hampshire, Berkshire, Buckinghamshire and Oxfordshire (excluding places already classified in 2 and 3 above). The largest urban areas within this area are Reading (pop^{n}. 0.37m) and those on the south coast centred on Southampton (pop^{n}. 0.30m), Portsmouth (pop^{n}. 0.46m) and Brighton (pop^{n}. 0.46m). Around 15% of our dataset is in this category.
5. **Other Southern England**. A line between the Severn estuary in the west and the Wash in the East conventionally divides England between 'the South' and 'the Midlands and North'. We define as 'Other Southern England' locations not already classified above which are within the four 'Regions of Southern England'. This therefore includes the South West and the outer East of England (Norfolk and Suffolk), with Bristol being the largest city (pop^{n}. 0.55m). This category includes around 5% of our dataset.
6. For firms whose UK-HQ was in the Midland and Northern England, Scotland or Wales,[14] we first identified those located in **Edinburgh and Cardiff**. As the capitals of Scotland and Wales respectively, these two cities may be regarded as prestigious locations. Furthermore, since 1999 greater powers have been devolved from the UK's central government to the Scottish and Welsh Assembly Governments which are based in these cities. This devolution may have been especially beneficial to firms located in these cities. However, only 2.5% of our sample was based in Edinburgh or Cardiff.
7. The **Major Northern Conurbations**. After London (2001 pop^{n}. 8.28m), the UK has four major conurbations: the West Midlands, centred on Birmingham (pop^{n}. 2.28m), Greater Manchester (pop^{n}. 2.24m), West Yorkshire, including Leeds (pop^{n}. 1.5m) and Greater Glasgow (pop^{n} 1.2m). No other urban areas have populations over 1 million. We therefore identified firms whose UK-HQ was based in one of these four major conurbations. This category includes around 13% of the firms in our dataset.
8. **Other Northern Britain**, including the English Midlands. Finally, we classified (the 9% of) firms not already classified above as being located in 'Other Northern Britain'.

Overseas offices: *Building* provides data on the number of overseas offices that the firm has. Overall, the majority (58%) of our sample had no overseas offices. After classifying these, we also identified those with one overseas office (10%); those with 2 or 3 (9%) and those with 4 or more (23%). *Building* does not provide any further information on the location of these offices and to date we have not gathered this additional information. Note that some firms have very extensive office networks, with hundreds of offices worldwide.

[14] None of our firms had their UK-HQ in Northern Ireland, the Channel Islands, or Isle of Man.

In relation to financial performance, we use **income per head**, or more specifically total annual income to UK offices divided by UK employment deflated by the Service Producer Price Index (indexed to 2005). Income per head is a simple but widely used measure of performance amongst PSFs (e.g., Maiser, 1993; Lorsch and Tierney, 2002). It is used by accountants (e.g., Kingston Smith W1, 2012) as a measure of performance, and has been used in both academic studies (as a measure of productivity or efficiency) and in trade journals (e.g., *Architects Journal*, *Building*). It is also known to correlate strongly with other financial measures of performance. Kingston Smith W1 (2012) for example show that in the UK employment costs typically account for around 60% of gross income across a variety of professional services, and that this share has been broadly stable for a number of years. This high share reflects PSFs labour intensity. Their other major costs are office rents and investments in ICTs. Firms with high gross incomes per head can therefore typically afford to pay their staff higher salaries, and are usually more profitable.

Some concern has been raised that this figure may be distorted, especially amongst firms with international operations, who can to some extent manipulate their reported incomes to UK offices, especially with the aim of reducing UK corporation tax. They instead report incomes in lower tax jurisdictions. Certainly there are cases of PSFs doing this; the advertising giant WPP being a prominent example. In 2008 WPP moved its tax base from the UK to the Republic of Ireland after complaining about the UK's 'uncompetitive' taxes. The overall extent of this practice is not known to us. However, we note that 58% of our sample had no overseas offices, and we control for the number of overseas offices in the regressions. If widespread, this behaviour could lead to, or contribute to, a negative effect of having overseas offices on 'performance'. This said, and for a number of reasons (outlined in the footnote[15]), we suspect that such behaviour is not widespread, even amongst firm with overseas offices.

[15] Firstly, we rely on firms' self reported total UK incomes (as recorded in *Building*). Although these may not be as accurate as those recorded in audited accounts, a senior member of the company (e.g., the CEO, managing director, senior partner or chairman) is required to sign as to the veracity of this information when making the submission to *Building*, and these figures are unlikely to have been manipulated for tax purposes (Meanwhile, company accounts often do not report the income of smaller firms). Secondly, 80%+ of gross incomes is typically spent on outgoings including salaries, office rents, and investments in equipment. Companies have no incentive to underreport these. Potentially, firms can move work to people located abroad where labour costs and/or other costs are lower, but this is different from deliberately altering income for tax purposes. Third, although regarded as 'uncompetitive' by WPP, the UK taxes on business profits are and have been amongst the lowest in the developed world for the last quarter century (Devereux and Loretz, 2011). Compared with other leading economies the incentive to use tax havens is relatively low. Moreover, the savings achieved by using tax havens are likely to grow roughly in proportion to firm size, whilst engaging in this has some (largely fixed) costs. The net benefits are likely to be greatest for very large and highly profitable firms like WPP. But WPP is vastly bigger than almost all of the firms in our sample, only 13% of which had 1,000 or more employees. Although we cannot rule it out entirely, for all these reasons we suspect that the extent of tax avoidance in our sample is likely to be relatively low, and that this behaviour does not fundamentally undermine the face validity of income per head to UK offices as a measure of performance.

4. Methods

We analyse the dataset in two different ways. First, we use simple descriptive statistics. We do this to reveal and further examine the different locational preferences and spatial structures of architecture and engineering consulting firms. We then use econometric methods to examine how specialisation, professionalisation, firm-size, UK-HQ location, number of UK offices and number of overseas offices impact on firm performance, as measured by income-per-head in UK offices. We do this for the whole sample, and then subdivide it between specialist architects and engineers, with the former further sub-divided between firms whose UK-HQ is in inner London and those whose UK-HQ is located elsewhere.

With regard to econometric methods, in order to exploit the panel nature of our dataset, we employed the Generalized Method of Moments (GMM) system estimator (Arellano and Bover, 1995; Blundell and Bond, 1998) to estimate dynamic panel models of performance. The system GMM method is sufficiently flexible to allow for a first-order autoregressive error term in the models. It produces estimates of short-run effects from which long-run effects are subsequently calculated. Since the long-run effects indicate the steady-state equilibrium results, which are generally of more interest, we only report and discuss the long-run estimates. For the full sample we first included all of the variables outlined above (in their current values and lagged by one year),[16] plus the lagged dependent variable (i.e., income-per-head at *t*-1) to estimate performance in the current year (*t*). We also estimated models with interactions between the number of UK offices and specialisation. And because our descriptive analyses also revealed important differences between the UK-HQ locations and spatial structuring of architecture practices and engineering consultants, we also estimated models for these sub-samples. The size of the architecture sub-sample was also sufficiently large to allow a further disaggregation between those whose UK-HQ is in inner London and those located elsewhere.

Table 2 provides the descriptive statistics for the whole dataset, while Table 3 provides the correlation matrix. Generally, the correlations are low and not of concern. Previously, the highest correlations were found between firm size (world-wide employment) and the number of offices. We addressed this by taking the log of firm size and categorising the number of UK and overseas offices.

--- INSERT TABLES 2, 3 & 4 ABOUT HERE ---

5 Analyses and Findings

5.1 Descriptive Analysis and Findings

We begin with a simple descriptive analysis of dataset, focusing especially on the specialist architecture practices and specialist engineering consultancies (i.e., firms where H* ≥ 0.5 and for which architects and engineers were respectively the largest professional groups). To examine these firms, we take two years, one near the start of our dataset (1998 – Table 6) and one near the end (2008 – Table 7) and compare the firms.

[16] Note that to ease interpretation, professionalisation and specialization have been ‘standardised’, such that they have a mean of zero and standard deviation of one.

--- INSERT TABLES 6 & 7 ABOUT HERE ---

Three things are immediately apparent. First, the Engineers are much larger businesses than the Architects. In 1998 mean worldwide employment amongst the Architects was 138, whilst by 2008 this had grown to 247, but Engineering firms were much larger in both years: 1,010 and 2,985. Put another way, in 1998 28% of the Architects were 'small' firms (<50 employees), whilst 3% were 'very large' (1,000+ employees worldwide). By 2008 these proportions had become 18% and 6%. Meanwhile, amongst the Engineers, just 4% were small in 1998, whilst 27% were very large. By 2008 the proportion of small Engineers had grown dramatically to 19%, whilst 26% were very large. The growth in the proportion of small Engineers reflects considerable acquisition activity amongst Engineers (which has been rare amongst Architects), with the 'very large firms' acquiring the large and (to a lesser extent) medium-sized firms.

To some extent these differences in size are reflected in the number of both UK and overseas offices. In 1998 more than a third of the Architects had just one UK office, compared with just 5% of the Engineers, 58% of which had six or more offices, compared with 5% of Architects. By 2008 the proportion of single UK office Architects was still around a third, whilst 11% now had 6+ offices. But nearly half the Engineers still had at least 6 UK offices, and only 12% had just one. Meanwhile, in both 1998 and 2008 two-thirds of the Architects had no overseas offices, compared with a third of the Engineers in 1998, and half in 2008. And those Architects with overseas offices typically had a small number whilst the Engineers typically had extensive overseas office networks.

Second, there are pronounced differences in the locations of the UK-HQs of Architects and Engineers. In 1998, 43% of the Architects had their main office in Inner London, compared to 29% of the Engineers. By 2008 these proportions had both risen to 51% and 33% respectively. Whilst Architects were more likely to favour Inner London (Edinburgh and Cardiff, and 'Other Northern Britain'), Engineers were more likely to favour the Outer London Urban Area; the rest of the Home Counties; and the Major Northern Conurbations.

Third, that if we divide both these subsamples – Architects and Engineers – between those whose UK-HQ is in Inner London and those located elsewhere we notice that for the Engineers being in Inner London does not seem to have financial advantages. In both 1998 and 2008 performance (income per head) is very similar on average for Engineers with their UK-HQ in Inner London and those located elsewhere. Given that locating in Inner London implies higher costs (including higher salaries and office rents) this apparent lack of advantage helps explain why relatively few Engineers are located there. Apart from the fact that these firms tend to be smaller (and possibly active in more specialized sub-markets), there are few other differences between Engineers based in Inner London and those based elsewhere. By contrast, for the Architects being based in (or having their UK-HQ in) Inner London appears to provide significant benefits, with income-per-head typically 20% higher in 1998 and nearly 30% higher in 2008 than firms based elsewhere. Although some of this will be accounted for by higher rents and wages, the difference is substantial, and helps explain why such a large proportion of Architects (or certain types of architects) favour being in Inner London.

5.2 Econometric Results and Findings

We now examine further the relationship between these variables and firm's financial performance, as measured by income-per-head within UK offices. We start with our models for the whole sample (Table 8), and sub-divide our reporting between findings that relate to non-geographical and geographical variables.

--- INSERT TABLE 8 ABOUT HERE ---

In relation to non-geographical matters, we anticipated that performance would increase with professionalisation (not least because professionals tend to be paid more), and find support for this. We also find that overall performance increases, albeit not dramatically, with firm-size. This indicates that overall there are some advantages to scale in these activities, advantages which are likely to lie in greater depth and breadth of knowledge and expertise, as well as reputational advantages which typically accrue to scale. There is also an interesting relationship between specialisation and performance. On the one hand specialist Architecture and Engineering Firms both typically achieve lower incomes-per-head than other firms, including multi-disciplinary firms, but the effect of specialisation on performance is positive. This suggests that overall there is a non-linear relationship between specialisation and performance which will require further investigation.[17]

In relation to geographical matters, we find (unsurprisingly) that firms located in Inner London tend to achieve higher performance than firms located elsewhere, with Oxford and Cambridge being the 'next best' location for financial performance, followed by the Outer London Urban Area. The 'worst' locations for financial performance are the Major Northern Conurbations and Other Southern England. However, we should stress that these difference in productivity are not large and may well be more than compensated for by lower employment costs and office rents in these locations. In relation to overseas offices, we anticipated that these would be associated with higher incomes-per-head to UK offices for two reasons. First, an overseas presence implies a stronger reputation, and second the capacity to offshore work to overseas locations where costs are lower, leaving higher value added work to be undertaken in the UK. In fact we find a mixed picture. Having one, two or three overseas offices is associated with marginally lower performance in the UK than having no overseas offices. One possibility is that this is associated with tax avoidance behaviour, although we doubt this is widespread. Having 4 or more overseas offices is associated with slightly higher performance in the UK. Possibly this is due to the aforementioned reputation effects and/or having the capacity to offshore lower value-added work. In relation to the number of UK offices, we find that firms with one office tend to perform best (all else equal), whilst having two or three offices is associated with a slight decline in performance. Having four or more offices is associated with a substantial reduction in performance. This last finding is interesting, as it suggests that these multi-office firms may be engaged in the provision of less specialized, lower-order, or lower value-added services, probably performed by more junior personnel. Interestingly, the models which include interaction terms between the number of offices and (1) professionalisation and (2) specialisation indicate that higher levels of professionalisation and specialisation to some extent mitigate for the

[17] We have also examined whether specialist Surveying and Project Management firms achieve higher or lower performance than 'expected', all else equal. This finds that, like Architects and Engineers, these firms typically achieve lower incomes per head, reinforcing the idea that there is indeed a non-linear relationship between specialization and performance.

reduced performance amongst multi-office firms, but that this mitigation is much weaker amongst firms with six or more offices.

We then subdivided the sample into Architects and Engineers and estimated separate models on these sub-samples (Table 9). Taking Engineers first, it is remarkable how few of the variables had any significant impact on the financial performance of these firms. Surprisingly, neither Professionalisation nor Specialisation had any significant impact, nor did the location of the firm's UK-HQ or the number of offices it has overseas. In fact, only two things impacted on performance: firm size (there are returns to scale) and the number of UK offices. Performance amongst Engineers is higher amongst firms with one to three offices, and markedly lower amongst those with four or more offices, which may suggest these multi-office firms may be engaged in less specialized, lower-order and lower-value added activities.

--- INSERT TABLE 9 ABOUT HERE ---

By contrast, most of our variables contributed to 'explaining' the variation in financial performance amongst Architects. Professionalisation and Specialisation are both positive and significant, whist main UK-HQ location also matters: firms in Inner London typically achieve the highest incomes per head, followed by those in the Outer London Urban Area (OLUA), those elsewhere in the Home Counties, and those in 'Other Northern Britain'. Lower performance was found amongst firms whose main office was in 'Other Southern England' or in a Major Northern Conurbation. Lower salaries and office rents in these regions may compensate for these differences, however. As amongst the Engineers there is a benefit to size, but the number of UK offices has little effect. In fact, firms with 2-3 offices perform slightly better, but firms with four or more offices don't differ significantly from those with one. This is somewhat surprising, as we had anticipated that firms with one office would perform better, all else equal. Meanwhile having one overseas offices does not typically alter performance compared to having none, having two to three is associated with lower performance whilst having four or more (which may indicate both a stronger reputation and the capacity to offshore lower value work) is associated with higher performance.

Because the Architects sample is split roughly in half between those whose main office is in inner London and those with this elsewhere, and because our analyses (both descriptive and econometric) have indicated that, unlike the Engineers, there is a performance difference between Architects whose UK-HQ is in Inner London Architects and those headquartered elsewhere, we estimated separate models for each of these sub-samples. This revealed new findings; whereas for Architects as a whole most of the variables were significant, for both subsamples few of them were. But, for firms headquartered outside Inner London, only Specialisation (and not Professionalism) had a positive impact, and the magnitude of this was lower than for Architects as a whole. And with the exception of having a single overseas office being detrimental to performance (possibly due to set-up, transaction and learning costs, and/or tax avoidance behaviour) the number of offices both in the UK and overseas had no significant impact on performance; nor did firm size. Amongst locations, our results indicate that (perhaps surprisingly) firms whose main office is in Edinburgh or Cardiff typically achieved lower performance, whilst there is weaker evidence that being based in one of the Major Northern Conurbations is also detrimental to performance. By contrast, both Professionalisation and Specialisation were significant determinants of performance for Architects in Inner London, with the magnitude of these effects much larger than for Architects as a whole.

Meanwhile world-wide firm size was also important, indicating benefits to scale, but the number of offices both in the UK and overseas had no significant impact on income per head amongst Architects based in Inner London.

6. Discussion and Conclusions

Economic geographers pioneered much of the research on business- or producer-services, and more recently they have taken considerable interest in particular subsets, including knowledge intensive business services (KIBS) and professional service firms (PSFs), two categories that very largely overlap. But interestingly the geographers who have studied KIBS and PSFs have tended to follow different methodologies and these literatures are largely separate, despite their interest in essentially the same phenomenon. Studies of KIBS are typically quantitative, covering a range of service activities, and have sought to understand the extent to which they innovate, where they innovate, and how KIBS contribute to wider, often regional, systems of innovation. Studies of PSFs, meanwhile, which cover both 'classic PSFs' such as law firms and architecture firms, as well as 'neo-PSFs', such as advertising agencies and executive search agencies (von Nordenflycht, 2010), have tended to focus on one specific service activity, have been largely qualitative, and have been primarily concerned with the globalisation of these firms, and how their globalisation relates to the urban hierarchy. Interestingly, neither of these literatures has examined the financial performance of KIBS/PSFs. This study, which focuses on architecture practices and engineering consultancies, connects with both of these traditions. Like many studies of KIBS, ours is quantitative, based on a large dataset. But unlike those studies we examine a narrow range of activities, splicing between architects and engineers that many KIBS studies would consider to be only a part of a wider set of T-KIBS. We consider that this may be a mistake, for using broad classifications such as T-KIBS and P-KIBS hides considerable variation, as indeed do many standard industrial classifications. We also examine how firm characteristics and behaviours relate to financial performance, a major gap in the extant literature.

Economic geographers have taken a keen interest in knowledge, and the extent to which it can be communicated over space. Asheim and colleagues' work on 'knowledge-bases' is a particularly useful starting point for our study, as we consider that engineering consulting is essentially based on a combination of analytical and synthetic knowledge (ASK) whilst architectural practice is based on a mix of symbolic and synthetic knowledge (SSK). Thus although often classified as being within the 'same industry' the knowledge bases of these professional, project-based firms are rather different.

Empirically, we show that these two sets of firms behave very differently, and that firm-size, professionalisation, specialisation, UK headquarters location and the size of the office networks in the UK and overseas all contribute to 'explaining' differences in financial performance. Architects are much more likely to locate in inner London, presumably becuse there they can take advantage of 'buzz' and other interactions, including face-to-face interactions. And amongst Architects there are financial benefits to professionalisation and specialisation, to having the firm's UK-HQ in inner London (with performance essentially declining with distance from that city) and having a large (but not small) international network of offices. However, when split between firms based in inner London and those headquartered elsewhere, professionalisation and firm-size both mattered for inner London firms but not those headquartered elsewhere, whilst specialisation was much more important for the inner London firms, indicating that the most 'thoroughbred' architecture practices located in inner London perform best of all. These findings are not all easily understood, but for architects seem to reaffirm the Christaller's ideas of central places and higher- and lower-orders of service providers. Certainly it is notable that UK based 'starchitects' all have their main offices in inner London, whilst more 'mundane practices' are often headquartered elsewhere. As Weber (1909) observed a century ago, firms locate where they can maximise the difference between income and costs: for 'more mundane' architects (and engineering consultants) this is not inner London: sub-markets have different geographies!

In contrast to the architects, engineering consultants tend to be much larger firms, both in employment size and in their office networks, both at home and abroad. Interestingly, in our separate analysis of Engineers we found a financial benefit to greater worldwide employment size but no benefit to specialisation or professionalisation, and no benefit to locating the main UK office in inner London (or indeed any other location). Given that locating in Inner London will increase costs (of labour and office rents), this helps explain why these firms are more dispersed than the architects. But it is interesting that whilst UK-HQ location does not matter, the number of UK offices does impact on performance, with engineers with four or more offices performing less well than those with one to three. This could be because these more dispersed firms are typically engaged in lower-order services, but it could also be that there are benefits from consolidating engineering in a few offices, which would enhance the sharing of tacit knowledge through face-to-face interactions. Ultimately, engineers do benefit from some centralisation, but not a place-based centralisation. In other words, they can perhaps generate and access any "buzz" they require in their larger offices and to a lesser extent over electronic networks, rather than needing to be physically present in particular locations in 'the real world'.

Certainly there are interesting differences between Architects and Engineers which require further investigation, but this is an important contribution, for, as Asheim and colleagues (2007, p. 660) state: "the literature remains silent about whether and how face-to-face and buzz-mediated interaction vary for different industries. It is assumed to be a basic characteristic of all industries." We consider that at least part of the answer lies in differences in the 'knowledge-base' of different activities, and the ease or otherwise of communicating knowledge over space. Thus whilst locating in inner London and some other 'world cities' may pay-off financially for firms engaged in certain sub-markets within architecture and some other creative sectors highly oriented to symbolic knowledge, these cities may not provide the same benefits to other creative activities oriented to analytical knowledge. Further research is needed to shed light on these fascinating questions.

As with all studies ours has limitations, some of which can be addressed in future research. First, on the choice of our measure of firm performance, we appreciate that not all firms are looking to maximise income per head, especially within their UK offices. However, this is a widely used measure of performance both within academia and industry. Gathering further data on the costs of locating in different places would shed light on the financial costs and benefits to locating there. We will also seek to obtain more precise data on office locations, including HQs, other UK offices and overseas offices. Whilst some firms have only one or a small number of offices, others have extensive office networks, so this is not an easy task. Ideally we should obtain the size and resource-base of each office, but that will be very difficult, especially if the time element is to be maintained. Ideally we would also like to know the extent to which the different offices in the same firm work together, and indeed their wider engagement with other firms, near and far, domestic and international. How firms set up new offices in new places is also of interest: do they establish offices de novo, enter into partnerships with existing firms, or acquire existing practices? Indeed, the wider role of mergers and acquisitions in KIBS/PSFs firm growth also requires further investigation, particularly amongst engineers, a sector which has seen considerable M&A activity in recent years.

For the wider literature on KIBS, our analysis suggests it may be rather hazardous to undertake analyses which ignore issues of place and space in examining the behaviours of these firms. And the extent to which KIBS are (dis)aggregated should also be considered with more care. Several studies have divided KIBS rather crudely between T-KIBS and P-KIBS, which does not really grapple with the knowledge-bases at the heart of these firms. Other studies use standard industrial classifications (e.g. Shearmur and Doloreux, 2009; Doloreux and Shearmur, 2012), but these too can hide important differences, and not only in between architecture and engineering consultancies as examined in this paper. For example, 'law firms' are typically undifferentiated, and yet in the UK this category will include barristers' chambers and firms of solicitors, both of which will be more or less specialised, with different geographical distributions, patterns of innovation and performance (Blacksell and Fussell, 1994). Spatial differences have been found for other KIBS: for example Shearmur and Alvergne (2002) found that in the Paris region high-tech computer services tend to locate in suburban rather than central locations, whereas maintenance activities are more central; again, this relates to both performance and patterns of innovation. As Doloreux and Shearmur (2010) state there are clear differences in innovation profiles amongst the firms in different KIBS sectors: "which suggests that KIBS cannot be analysed as an undifferentiated group of establishments ... there are also important within-sector differences that call for further investigation" (p. 605). We could not agree more!

In relation to the geography of professional services, economic geographers have perhaps over emphasised the glamorous 'globalised firms', but many firms are not international, let alone global. A basic question which remains unanswered is does 'globalisation' pay off in terms of financial performance? It is not obvious that it always does, so a more complex question is under what conditions does 'globalisation' amongst PSFs pay off? And examining the interplay between different types of firms may also be fruitful, and greater consideration could be given to the similarities and differences between regulated 'classic PSFs' and unregulated 'neo-PSFs'.

But our main interest (and contribution) is in how 'knowledge-bases' relate to what firms do, where they do it, and how this relates to firms' financial performance. These inter-relationships are not simple, but overall our findings reinforce and deepen those of others, such as Winch and Schneider (1993), Løwendahl (2005) and Sklair (2005), who emphasize the differences amongst firms within knowledge-intensive service industries. This also raises questions as to whether there are other, as yet unrecognised forms of knowledge, or 'knowledge-bases', the geographies of these, and how they relate to firm performance. Of those recognised, symbolic knowledge requires further examination. How do certain styles and symbols come to dominate, whist others are suppressed, and how do geographies of place and space impact on the legitimation of symbolic knowledge and its economic value. There is always more to do, but these are fascinating questions.

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Table 1: "Knowledge-Bases" and their Characteristics

	Analytical	Synthetic	Symbolic
Innovations and Solutions	Fundamental innovation by the creation of new knowledge. Solutions found by applying scientific models or equations	'Local' solutions developed by applying or combining existing knowledge. Occasionally these become general purpose 'killer applications'	Solutions based on hard to explain tacit insights. Major innovations often recognised ex post (as value is socially constructed)
Codified or Tacit?	Predominantly codified and "Scientific", based on deductive processes and formal models	Predominantly tacit and "applied, problem related". Largely practical, and often developed through inductive processes	Predominantly tacit and "Artistic". Importance of building and challenging conventions: the 'power of persuasion' matters.
Locus of new knowledge production	R&D departments and collaborations, including with the 'science base'	Interactive learning, especially with clients, but also in the community of practice	'Studio' projects, and learning through interaction with the professional/artistic community, and wider cultural interactions.
Exemplar industry	Biotechnology and other 'science based' industries (Pavitt, 1984)	'Low-tech.' engineering based industries and other 'specialist suppliers' (Pavitt, 1984)	Film directors and other 'cultural industries' (Scott, 1999)
Means of Sharing and Diffusing Knowledge	Patents, publications and the Internet, but also scientific conferences	Attending to 'field problems' (von Hippel, 1988), mainly through face-to-face interactions	Hard to share or diffuse. Developed in practice over time and 'possessed' by key individuals.
Applied to architecture & engineering consulting?	Highly analytical engineering services are here: e.g., fire and earthquake engineering. Others less so, but all have an analytical base.	Needed to get buildings built, & for different professions to coordinate. 'Low-order' architects and engineers are mainly here.	'Starchitects' are the 'high priests' of this. 'Strong idea' architectural practices are here. Strong delivery and service less so.

Adapted from Asheim et al. (2007: Table 1) and Faulconbridge et al. (2011: Table 2.5)

Table 2: Descriptive Statistics, Whole Sample

Variable	Var.	Mean	S.D.	Min	Max
Productivity	Pd	62.1	44.7	0	1753.3
Professionalisation	Pr	0.49	0.15	0.04	1
Specialisation	Sp	0.75	0.28	0.02	1
Staff no. worldwide	Sn	782	2956	6	55,000
Single UK office	U1	0.21	0.40	0	1
2-3 UK offices	U2	0.30	0.46	0	1
4-5 UK offices	U3	0.17	0.38	0	1
6+ UK offices	U4	0.32	0.47	0	1
No overseas office	O1	0.58	0.49	0	1
1 overseas office	O2	0.10	0.30	0	1
2-3 overseas offices	O3	0.09	0.28	0	1
4+ overseas offices	O4	0.23	0.42	0	1

Table 3: Correlation Matrix for Whole Sample

Var.	Pd	Pr	Sp	Sn	U1	U2	U3	U4	O1	O2	O3
Pr	0.13*										
Sp	-0.04	-0.12*									
Sn	0.08*	-0.03	-0.10*								
U1	0.01	0.02	0.12*	-0.11*							
U2	-0.01	0.03	0.12*	-0.15*	-0.33*						
U3	-0.05	-0.10*	-0.06*	-0.09*	-0.23*	-0.30*					
U4	0.04	0.04	-0.18*	0.32*	-0.35*	-0.45*	-0.31*				
O1	-0.09*	-0.10*	0.12*	-0.28*	0.19*	0.20*	0.08*	-0.42*			
O2	0.00	0.03	0.03	-0.07*	0.01	0.02	-0.01	-0.02	-0.39*		
O3	0.01	0.03	0.00	-0.04	-0.06*	-0.03	0.09*	0.01	-0.37*	-0.10*	
O4	0.10*	0.06*	-0.16*	0.40*	-0.20*	-0.22*	-0.14*	0.50*	-0.65*	-0.18*	-0.17*

Bonferroni adjusted Pearson correlation coefficients. * indicated significant at the 1% level

Table 4: Distribution of firms by UK Main Office Locations and Category of Firms, 1998 and 2008

Place / Geographical Area	**All firms**		**Architects**		**Engineers**	
	1998	**2008**	**1998**	**2008**	**1998**	**2008**
Inner London	40.1%	36.7%	43.2%	50.6%	29.1%	33.3%
Outer London Urban Area	13.2%	13.7%	8.1%	5.9%	21.8%	18.1%
Oxford & Cambridge	1.5%	3.0%	1.4%	3.5%	1.8%	4.2%
Home Counties ex. LMA	14.2%	15.6%	12.2%	9.4%	18.2%	19.4%
Other Southern England	5.1%	6.7%	6.8%	7.1%	5.5%	4.2%
Edinburgh & Cardiff	2.5%	3.0%	4.1%	3.5%	1.8%	0.0%
Major Northern Conurbations	14.2%	12.2%	10.8%	8.2%	16.4%	15.3%
Other Northern Britain	9.1%	9.3%	13.5%	11.8%	5.5%	5.6%
# of Firms by Category	197	270	74	85	55	72

Table 5: Descriptive statistics by Category, all years combined (1995-2010)

Variable (means unless otherwise stated)	All firms	Architects	Architects – HQ in Inner London	Architects – HQ in the Rest of UK	Engineers	Engineers – HQ in Inner London	Engineers – HQ in the Rest of UK
Productivity	62.2	61.9	69.8	54.9	56.4	58.0	55.6
---- median	58.0	58.4	66.2	54.5	55.4	56.7	54.7
Professionalisation	0.49	0.51	0.52	0.50	0.40	0.40	0.40
---- median	0.49	0.50	0.51	0.49	0.38	0.37	0.38
Specialisation	0.75	0.89	0.93	0.85	0.85	0.89	0.83
---- median	0.86	1.00	1.00	0.96	0.92	0.98	0.89
1 – 49 staff WW	0.23	0.27	0.20	0.33	0.10	0.10	0.11
50-249 staff WW	0.49	0.61	0.62	0.60	0.43	0.45	0.43
250 - 999 staff WW	0.15	0.09	0.13	0.06	0.21	0.19	0.22
1,000+ staff WW	0.13	0.03	0.06	0.01	0.25	0.27	0.24
Staff no. worldwide	778	166	234	107	1,757	1,312	1,964
Single UK office	0.21	0.39	0.51	0.29	0.10	0.13	0.08
2-3 UK offices	0.30	0.41	0.39	0.43	0.21	0.27	0.18
4-5 UK offices	0.17	0.12	0.06	0.17	0.17	0.12	0.20
6+ UK offices	0.32	0.08	0.04	0.10	0.52	0.48	0.54
No overseas office	0.58	0.68	0.56	0.79	0.47	0.42	0.50
1 overseas office	0.10	0.14	0.18	0.11	0.07	0.10	0.06
2-3 overseas offices	0.09	0.08	0.10	0.06	0.09	0.11	0.09
4+ overseas offices	0.23	0.10	0.16	0.04	0.36	0.37	0.35
# of Firm Year Obs.	3,416	1,134	532	602	896	284	612

Table 6: Descriptive statistics by Category for 1998

Variable (means unless otherwise stated)	All firms	Architects	Architects – HQ in Inner London	Architects – HQ in the Rest of UK	Engineers	Engineers – HQ in Inner London	Engineers – HQ in the Rest of UK
Productivity	53.5	53.8	59.8	49.3	48.4	49.8	47.8
---- median	49.7	50.8	56.0	49.0	48.2	46.3	48.2
Professionalisation	0.49	0.50	0.53	0.48	0.39	0.42	0.38
---- median	0.48	0.49	0.55	0.46	0.38	0.39	0.38
Specialisation	0.73	0.88	0.92	0.85	0.79	0.87	0.76
---- median	0.84	0.96	1.00	0.92	0.85	0.90	0.80
1 – 49 staff WW	0.20	0.28	0.19	0.36	0.04	0.13	0.00
50-249 staff WW	0.49	0.65	0.69	0.62	0.35	0.31	0.36
250 - 999 staff WW	0.17	0.04	0.06	0.02	0.35	0.31	0.36
1,000+ staff WW	0.14	0.03	0.06	0.00	0.27	0.25	0.28
Staff no. worldwide	525	138	224	72	1010	1038	998
Single UK office	0.22	0.36	0.47	0.29	0.05	0.13	0.03
2-3 UK offices	0.30	0.41	0.38	0.43	0.20	0.31	0.15
4-5 UK offices	0.16	0.18	0.13	0.21	0.16	0.13	0.18
6+ UK offices	0.33	0.05	0.03	0.07	0.58	0.44	0.64
No overseas office	0.52	0.66	0.53	0.76	0.35	0.31	0.36
1 overseas office	0.13	0.19	0.22	0.17	0.07	0.13	0.05
2-3 overseas offices	0.09	0.11	0.16	0.07	0.09	0.13	0.08
4+ overseas offices	0.27	0.04	0.09	0.00	0.49	0.44	0.51
# of Firms	199	74	32	42	55	16	39

Table 7: Descriptive statistics by Category for 2008

Variable (means unless otherwise stated)	All firms	Architects	Architects – HQ in Inner London	Architects – HQ in the Rest of UK	Engineers	Engineers – HQ in Inner London	Engineers – HQ in the Rest of UK
Productivity	68.6	69.4	78.3	60.3	62.8	62.9	62.8
---- median	65.9	65.6	77.8	61.1	61.6	62.0	61.6
Professionalisation	0.48	0.49	0.49	0.50	0.39	0.37	0.40
---- median	0.47	0.47	0.47	0.49	0.37	0.38	0.35
Specialisation	0.76	0.90	0.96	0.84	0.89	0.92	0.87
---- median	0.90	1.00	1.00	1.00	1.00	1.00	1.00
1 – 49 staff WW	0.25	0.18	0.12	0.24	0.19	0.13	0.22
50-249 staff WW	0.46	0.59	0.58	0.60	0.45	0.42	0.47
250 - 999 staff WW	0.12	0.18	0.21	0.14	0.10	0.13	0.08
1,000+ staff WW	0.16	0.06	0.09	0.02	0.26	0.33	0.22
Staff no. worldwide	1171	247	321	172	2985	2002	3466
Single UK office	0.20	0.35	0.49	0.21	0.12	0.13	0.12
2-3 UK offices	0.33	0.45	0.42	0.48	0.24	0.29	0.22
4-5 UK offices	0.16	0.09	0.05	0.14	0.18	0.08	0.22
6+ UK offices	0.31	0.11	0.05	0.17	0.46	0.50	0.44
No overseas office	0.62	0.65	0.56	0.74	0.51	0.38	0.58
1 overseas office	0.09	0.15	0.14	0.17	0.09	0.08	0.10
2-3 overseas offices	0.05	0.06	0.09	0.02	0.05	0.08	0.04
4+ overseas offices	0.23	0.14	0.21	0.07	0.34	0.46	0.28
# of Firms	274	85	43	42	74	24	50

Table8: Dynamic Panel Data Model of Performance for Whole Sample, Long-Run Estimates, 1995-2010

Dependent variable *ln* productivity / Independent variable	Baseline		Interactions		Interactions	
	$\hat{\beta}$	SE	$\hat{\beta}$	SE	$\hat{\beta}$	SE
Professionalisation	0.20***	0.01	-0.04***	0.01	0.22***	0.01
Specialisation	0.01**	0.01	0.05***	0.01	-0.10***	0.02
ln staff worldwide	0.04***	0.00	0.03***	0.00	0.03***	0.00
2-3 UK offices $	-0.05***	0.00	-0.19***	0.01	-0.28***	0.02
4-5 UK offices $	-0.23***	0.01	-0.30***	0.01	-0.36***	0.02
6+ UK offices $	-0.22***	0.01	-0.24***	0.01	-0.17***	0.02
Professionalisation x2-3 UK offices	–	–	0.37***	0.02	–	–
Professionalisation x 4-5 UK offices	–	–	0.33***	0.02	–	–
Professionalisation x 6+ UK offices	–	–	0.15***	0.02	–	–
Specialisation x2-3 UK offices	–	–	–	–	0.36***	0.02
Specialisation x 4-5 UK offices	–	–	–	–	0.30***	0.02
Specialisation x 6+ UK offices	–	–	–	–	0.06***	0.02
Single overseas office £	-0.03***	0.00	-0.01***	0.00	-0.02***	0.00
2-3 overseas offices £	-0.02***	0.00	0.00	0.00	-0.01**	0.00
4+ overseas offices £	0.03***	0.00	0.04***	0.01	0.05***	0.01
Architects (firms)#	-0.08***	0.00	-0.08***	0.00	-0.07***	0.00
Engineers (firms) #	-0.09***	0.00	-0.11***	0.00	-0.12***	0.00
Outer London Urban Area*	-0.08***	0.00	-0.06***	0.00	-0.05***	0.00
Oxford & Cambridge*	-0.03***	0.01	-0.04***	0.01	-0.03***	0.01
Home Counties excl. London, Oxford & Cambridge *	-0.12***	0.00	-0.12***	0.00	-0.11***	0.00
Other Southern England*	-0.15***	0.00	-0.17***	0.00	-0.16***	0.00
Edinburgh & Cardiff*	-0.12***	0.01	-0.13***	0.00	-0.13***	0.00
Major Northern Conurbations*	-0.14***	0.00	-0.15***	0.00	-0.13***	0.00
Other Northern Britain*	-0.10***	0.00	-0.10***	0.01	-0.10***	0.01
Year dummies included	Yes		Yes		Yes	
Number of observations (Number of firms)	2,604	(471)	2,604	(471)	2,604	(471)
Sargan test of over identifying restrictions (chi-square)	407.8		410.4		402.4	
Arellano-Bond test for autocorrelation (1) z-stat.	-8.52***		-8.47***		-8.37***	
Arellano-Bond test for autocorrelation (2) z-stat.	0.58		0.44		0.50	

Notes: $ reference category is Single UK office; £ reference category is No overseas office (i.e. uninternationalised); # reference category is Other Firms (i.e. Multidisciplinary, Project Managers, Surveyors); * reference category is Inner London Area. 2-step system Generalized Method of Moments (GMM) estimator used. Dynamic long-run results calculated using the ‘delta method’. ***Significant at 1%, ** significant at 5%, *significant at 10%.

Table 9: Dynamic Panel Data Model of Performance for Specialist-Firm Sub-sample, By Headquarter Locations, Long-Run Estimates, 1995-2010

Dependent variable *ln* productivity / Independent variable	All Specialist Architecture firms		Architecture firms with UK HQ in Inner London		Architecture firms with UK HQ not in Inner London		All Specialist Engineering Firms	
	$\hat{\beta}$	SE	$\hat{\beta}$	SE	$\hat{\beta}$	SE	$\hat{\beta}$	SE
Professionalisation	0.35***	0.11	0.95*	0.54	0.20	0.18	-0.12	0.15
Specialisation	0.38***	0.07	1.18***	0.43	0.27*	0.15	0.04	0.16
ln staff worldwide	0.08***	0.02	0.25***	0.09	0.10	0.07	0.09**	0.04
2-3 UK offices	0.06**	0.03	-0.01	0.12	-0.02	0.08	-0.09	0.09
4-5 UK offices	0.02	0.04	0.11	0.24	-0.06	0.12	-0.27***	0.09
6+ UK offices	-0.01	0.06	-0.13	0.54	-0.23	0.18	-0.32***	0.11
Single overseas office	0.01	0.03	-0.09	0.17	-0.13*	0.07	-0.01	0.08
2-3 overseas offices	-0.12***	0.05	-0.20	0.24	0.03	0.10	-0.02	0.07
4+ overseas offices	0.15***	0.04	-0.16	0.29	0.11	0.12	-0.13	0.11
Outer London Urban Area	-0.07***	0.02	–	–	– $	–	0.00	0.02
Oxford & Cambridge	-0.13***	0.05	–	–	-0.03	0.07	0.08	0.06
Home Counties excl. London, Oxford & Cambridge	-0.09***	0.02	–	–	0.00	0.03	0.02	0.03
Other Southern England	-0.20***	0.03	–	–	-0.05	0.04	0.05	0.04
Major Northern Conurbations	-0.19***	0.02	–	–	-0.07*	0.04	-0.02	0.03
Edinburgh & Cardiff	-0.16***	0.02	–	–	-0.12***	0.03	-0.11	0.07
Other Northern England, Scotland and Wales	-0.09***	0.02	–	–	-0.02	0.04	-0.03	0.05
Year dummies included	Yes		Yes		Yes		Yes	
Number of observations (Number of firms)	882	(149)	407	(73)	475	(83)	718	(111)
Sargan test of over identifying restrictions (chi-square)	113.7		40.2		42.4		73.7	
Arellano-Bond test for autocorrelation (1) z-stat.	-5.30***		-3.37***		-3.60***		-4.17***	
Arellano-Bond test for autocorrelation (2) z-stat.	0.72		0.37		1.44		1.24	

Notes: Refer to Table 8 above. $ reference category is Outer London Urban Area.

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