DISCUSSION PAPER SERIES

No. 9598

CREATIVITY, CITIES AND INNOVATION

Neil Lee and Andrés Rodríguez-Pose

INTERNATIONAL TRADE AND REGIONAL ECONOMICS

Centre for Economic Policy Research

www.cepr.org

Available online at: **www.cepr.org/pubs/dps/DP9598.php**

ISSN 0265-8003

CREATIVITY, CITIES AND INNOVATION

Neil Lee, London School of Economics
Andrés Rodríguez-Pose, London School of Economics and CEPR

Discussion Paper No. 9598
August 2013

Centre for Economic Policy Research
77 Bastwick Street, London EC1V 3PZ, UK
Tel: (44 20) 7183 8801, Fax: (44 20) 7183 8820
Email: cepr@cepr.org, Website: www.cepr.org

CEPR Discussion Paper No. 9598

August 2013

ABSTRACT

Creativity, cities and innovation*

The creative industries have long been seen as an innovative sector. More recent research posits that creative occupations are also a fundamental, but overlooked, driver of innovation. Theory also suggests cities are important for both creative industries and occupations, with urban environments helping firms innovate. Yet little empirical work has considered the links between creative industries, occupations, cities and innovation at the firm level. This paper addresses this gap using a sample of over 9,000 UK SMEs. Our results stress that creative industries firms are more likely to introduce original product innovations, but not those learnt from elsewhere. Creative occupations, however, appear a more robust general driver of innovation. We find no support for the hypothesis that urban creative industries firms are particularly innovative. However, creative occupations are used in cities to introduce product innovations learnt elsewhere. The results suggest future work needs to seriously consider the importance of occupations in empirical studies of innovation.

JEL Classification: O31, O38, R11 and R58
Keywords: cities, creative industries, creative occupations, innovation and learning

Neil Lee
Department of Geography and Environment
London School of Economics
Houghton Street
London WC2A 2AE

Email: n.lee1@lancaster.ac.uk

For further Discussion Papers by this author see:
www.cepr.org/pubs/new-dps/dplist.asp?authorid=176188

Andrés Rodríguez-Pose
Department of Geography and Environment
London School of Economics
Houghton Street
London WC2A 2AE

Email: a.rodriguez-pose@lse.ac.uk

For further Discussion Papers by this author see:
www.cepr.org/pubs/new-dps/dplist.asp?authorid=158972

*This research has benefited from the generous financial support of the European Research Council under the European Union‟s Seventh Framework Programme (FP7/2007-2013)/ERC grant agreement nº 269868

Submitted 31 July 2013

1. Introduction

Creativity is considered highly important for innovation and economic success (Andari et al. 2007; Huggins and Clifton 2011; Cooke and De Propris 2011). Firms in the creative industries, such as design, publishing, software or the arts, are normally seen as particularly innovative (DCMS 2001; Miles and Green 2008; Bakshi and McVittie 2009; Müller et al. 2009). Cities are important for these relationships: creative industries tend to be urban industries, which take advantage of shared knowledge and of a density of specialised customers, suppliers and workers to create new products (Therrien 2005; Pratt 2006; Asheim et al. 2007; Reimer et al. 2008; Stam et al. 2008). Firms benefit from both the diversity of urban environments, which may provide a range of stimuli, and the specialisation urban locations allow. Furthermore, recent research posits that such externalities will be related to city size: larger cities provide greater externalities, making firms in large cities more innovative (Duranton and Puga 2004; Stolarick and Florida 2006).

Yet, beyond case studies, there is little empirical evidence that the creative industries are more innovative than other sectors, that urban creative industries are particularly so, and that these effects are amplified in larger cities. A small number of studies have considered the geography of innovation in the creative industries in the UK and produced descriptive results which often run contrary to theoretical expectations (De Propris et al. 2009; Chapain et al. 2010). For example, Chapain et al (2010) show that the creative industries in London are less innovative than creative industries elsewhere. Despite the fact that creative industries have significantly crept up in governments' development policy agendas (Jayne, 2005; Evans 2009), the evidence base on the creative industries, innovation, and development is surprisingly weak (Sunley et al. 2008; Lee and Drever 2012).

Moreover, creativity is not limited to particular *industries*, and research has suggested that creative *occupations* may also be key drivers of innovation (Vinodrai 2006; Bakshi et al. 2008; Cunningham and Higgs 2009; Cunningham 2010; Lee and Drever 2012). Creative workers 'embedded' in other sectors, such as designers in manufacturing, may be part of the innovation strategy of firms (Cunningham and Higgs 2009; Cunningham 2011). Firms may site the innovative aspects of their activity in cities, to take advantage of the specialised labour markets, inputs and exchanges of knowledge they offer (Duranton and Puga 2001). Yet a second gap in the literature relates to the link between creative occupations and innovation.

This paper investigates these issues for the first time using a dataset of over 9,000 UK SMEs in 2007/8. Our results show that while creative industries firms are more likely to introduce original product innovations, there is no 'urban effect'. Moreover, creative industries firms are no more (or less) likely to introduce process innovations. However, the link between creative occupations and innovation in firms is considerably stronger. Creative occupations are used by both urban and rural firms to develop entirely new products ('original innovations'). Moreover, urban firms use creative occupations to help modify and reintroduce products from elsewhere ('learnt innovations'). Alongside this, we show that creative occupations are a key driver of learnt process innovations.

These are important issues for both academic research and government policy. The UK government provides support including advice, finance and tax relief for creative industries firms.[1] Such policies lead to questions such as whether these should be spatially targeted at urban areas, or whether focus is instead needed in encouraging firms to employ creative individuals.

The paper makes a number of contributions to the emerging literature on the links between the creative industries, occupations, innovation and cities. There have been longstanding concerns about the limitations of research on the creative industries and innovation (Jayne 2005; Sunley et al. 2008). The size of our dataset and the coverage for both creative and non-creative firms represents an improvement on previous work in this area which has tended to focus exclusively on creative industries firms (Müller et al. 2009). In addition, while past work has linked creative occupations to innovation in an econometric framework (Bakshi et al. 2008), our research improves on this measure by introducing regional as well as sectoral variation, finding a positive and significant result. Finally, this paper adds to the literature by considering using econometric methods the interactions between the creative industries, creative occupations and cities. In doing so, it builds on work investigating the geography of the creative industries in the UK (Chapain et al. 2010), but links this to other work on the innovation performance of urban firms.

The paper is structured as follows. In section two we consider the literature on innovation, creative industries, occupations and cities and develop hypotheses for the links between them. In section three we outline the main sources of data for this paper and present the descriptive statistics on innovation in the creative industries. In section four we introduce a model of firm level innovation and use it to address our hypotheses. In section five we conclude with implications for theoretical work in this area and policy.

2. Creative industries, occupation and innovation

The supposed innovativeness and dynamism of creative industries in advanced economies has attracted considerable attention in recent years (Power 2002, 2010; Turok 2003; Andari et al. 2007; Evans 2009). Creative industries are a diverse set of industries, defined by the Department for Culture, Media and Sport in the UK as: Advertising; Architecture; Art and Antiques; Designer Fashion; Video, Film and Photography; Music and the Arts; Publishing; Software, computer games and electronic publishing; Radio and TV; Craft, and; Design. One reason for their importance is innovation (Bakshi et al. 2008). While there is considerable diversity in innovative performance between sub-sectors, the creative industries are considered as relatively innovative (Müller, Rammer and Trüby 2009; Chapain et al. 2010). As they are by definition reliant on the production of new goods, the creative industries are likely to produce more product innovations. Moreover, the creative industries operate

[1] For example, the Arts Council runs the Creative Industries Finance programme which provides loans and advice for growth oriented creative firms (Arts Council 2012). In June 2012, the UK government announced tax-breaks for firms in some creative sectors (HM Treasury 2012). Such policies are often city-specific, such as the European Regional Development Fund's London Fusion programme which provides mentoring, advice and University linkages for creative firms (Lancaster University 2012).

in a rapidly changing environment where project teams are modified and reconfigured to respond to the market (Pratt 2006). This may result in more process innovations.

Empirical work has tended to support the perception of product and process innovation rich industries, with the exception of studies of London where the creative industries appear less innovative than elsewhere (Chapain et al. 2010; Lee and Drever 2012). Yet there are a number of reasons why the creative industries may be less innovative than at first appear. Firms may innovate in subtle ways which cannot be captured in innovation surveys (Chapain et al. 2010). Or creative industries firms may simply not be as innovative as other parts of the economy. The overall expectation, however, is that firms in the creative industries are more innovative than others. Our first hypothesis is:

> H_1 SMEs in the creative industries are more likely to introduce product and process innovations than firms in other sectors

While the creative industries have been well studied, relatively less research has considered the link between creative occupations and innovation (Vinodrai 2006; Bakshi et al. 2008; Cunningham and Higgs 2009; Comunian et al. 2010; Cunningham 2011; Marrocu and Paci 2012). Yet these occupations have been growing rapidly in many cities: in London, for example, while employment in the creative industries grew by 40 percent between 1995 and 2007, the number of workers in creative occupations grew by over 70% (Freeman 2010). Most research on this area has considered Richard Florida's ideas of the creative class, a set of workers in 'creative occupations' in the knowledge economy (Florida 2002; 2005; Florida et al. 2008). This has come under considerable criticism (Huggins and Clifton 2011), not least from Anne Markusen (2006) suggesting that it is a convenient label for a group of workers with high human capital.

A few studies have tested the link between creative occupations and innovation. For example, Marrocu and Paci (2012) find that across regions of the European Union highly educated individuals in creative occupations have an important effect in overall production efficiency. Bakshi et al. (2008), using Community Innovation Survey data and an industry level indicator of creative employment, test for a relationship between creative employment and innovation. They find no relationship with product innovations overall, but a weak positive relationship for new (novel, rather than new to the firm) product innovations. Lee and Drever (2012) investigate similar linkages in London's firms. They find no link between creative occupations and process innovation, but significant positive relationships with both new product innovation and modifications to existing products. However, both studies have limitations. Bakshi et al. (2008) consider only sectoral variation in creative occupations, Lee and Drever (2012) only consider the exceptional city of London. No study has yet considered variation at a sectoral and regional level. From this we take hypothesis two:

> H_2 SMEs employing staff in creative occupations are more likely to introduce product and process innovations

A wealth of papers have suggested that cities may aid innovation amongst creative firms (e.g. Asheim et al. 2007; Huggins and Clifton 2011), making creativity a

fundamentally urban phenomenon. Spillovers of knowledge are regarded as important in aiding innovation. Cities provide a diverse environment which may stimulate innovation (Nathan and Lee 2011). The density of labour markets they provide will allow complex reconfigurations of teams, and this will create new ways of working and processes (Grabher 2001; 2002). This will result in a creative city effect, with urban creative industries firm innovating more. This forms the basis of hypothesis three:

> H_3 Urban creative industries firms or those employing creative occupations will be more likely to introduce product and process innovations than other firms

Alternatively, however, urban firms may be no more innovative than others. Firms may sort into particular areas based on their relative competitive advantage, and would otherwise not survive. Those producing genuinely original innovations may not want to co-locate near other firms and so will protect their innovations with rural locations. The innovative performance of firms in rural areas may be underestimated, with isolated firms accessing knowledge from elsewhere and innovating in alternative ways (Fitjar and Rodríguez-Pose 2011a). Research on London, for example, has suggested that international linkages are more important for innovation than local knowledge spillovers (Gordon and McCann 2005). While some high profile 'innovative cities' may appear innovative, whether this is because of local linkages or more prosaic access to international markets is unclear (Shearmur 2012). The importance of cities for innovation may be exaggerated (Asheim et al. 2007).

Similarly, the relationship between creative occupations and cities may not be simple. Vinodrai (2006) argues that because of the tacit and embodied nature of knowledge in many creative fields, career moves of highly skilled workers provide an important mechanism through which firms acquire the knowledge to innovate. She suggests that designers play a role in the innovation processes of other firms, and move from firm to firm to share new innovations. Other creative occupations, as they are reliant on exchanges of subtle, tacit and context specific knowledge may also see similar effects. Such moves are likely to happen in a city, and evidence suggests that staff moves are an important driver of agglomeration economies, as they enable the sharing of best practice between firms (Eriksson and Lindgren 2009). From this perspective, creative industries and occupations are likely to be more effective in larger cities. This is the final hypothesis:

> H_4 Urban size matters for the innovative capacity of creative industries and occupations

Hence creative firms/occupations in a city like London are likely to lead to greater innovation than those located elsewhere in the United Kingdom. If so, this may provide one explanation for the uneven geography of creative occupations in the UK, and their uneven wages (Comunian et al. 2011).

3. Data and methodology

The Data

The data for this study come from the Annual Small Business Survey (ASBS), 2007/8, conducted by the UK Department for Business, Innovation and Skills (see Williams and Cowling 2009). It is a telephone survey of Small and Medium Sized Enterprises (SMEs), defined as employing fewer than 250 employees. Firms are sampled randomly from Dun & Bradstreet data, but are stratified by size. Booster samples are included for particular groups (these are dealt with through weighting). We exclude firms where variables are missing, giving a sample of 9,158 SMEs.

Creative Industries

We derive our definition of the creative industries from the UK Department for Culture, Media and Sport (DCMS). This divides the creative industries into eleven sectors: Advertising; Architecture; Arts and Antique Markets; Crafts; Design; Designer Fashion; Film, Video and Photography; Software, Computer Games and Electronic Publishing; Music and the Visual and Performing Arts; Publishing, and; Television and Radio. Here, we use a tighter definition which only includes sectors in which at least 25 per cent of firms can be seen as in the creative industries. This makes us drop Arts and Antique Markets; Crafts; Design; and Designer Fashion from the sample. Full details of the classification are included in table 1. Applying this definition to the ASBS gives a sample of 727 creative industries firms (7.3 per cent).[2]

Table 1 around here

The DCMS definition is not without controversy (Hesmondalgh and Pratt 2005; Pratt 2008). It includes a highly diverse range of sectors, including both technical work (software) and the traditional arts (Hesmondalgh and Pratt 2005; Freeman 2010). Two sectors, Design and Crafts cannot be matched to the standard SIC codes. Fortunately, they also do not meet our 25% threshold of overall firms in the creative industries and are not included in our data. However, the definition is widely used within the academic community and generally accepted by policy- and decision-makers.

Creative occupations

Creativity is not limited to particular sectors, and many of those performing creative work do so outside the creative industries. DCMS (2009) estimate that in 2009 there were almost two million (1,978,200) people working in 'creative employment' in the UK. Of this, 1,15 million were employed in the creative industries themselves (i.e. working in firms in the creative industries), and 830,000 working in creative occupations but outside of the creative industries, such as graphic designers in manufacturing.

Our measure of the creative occupations is the proportion of employment in creative occupations in each industry in each region. The definition of creative occupations comes from the DCMS, and consists of the same sub-sectors as the creative industries measure (DCMS 2007). Each sub-sector consists of occupations rather than specific industries. For example, the category of Designer Fashion occupations includes two

[2] Note that this definition is subject to periodic change. For example, DCMS launched a consultation on this point in April 2013. See DCMS (2013).

occupations: “Product, clothing and related designers” and “Weavers and Knitters”. Full details are given in table 2.

Table 2 around here

As the ASBS does not include a variable for creative occupations, ours is constructed using a separate survey, the Annual Population Survey (APS). The APS is a sample survey with valid occupational data for 159,003 workers. Following previous work in this area (Bakshi et al. 2008; Lee and Drever 2012), we use this to construct a variable for the proportion of employment in creative occupations in each industry (using 2 digit SIC codes), in each region. This gives 706 industry/region combinations, and should allow us to test both geographical and sectoral differences in innovation performance.[3] Our variable can be understood as the share of creative occupations in each industry in each region.

There is some overlap between the creative industries and creative occupations variables, as those working in the creative industries are more likely to employ those working in creative occupations. The pairwise correlation between the two variables is 0.29 ($p<0.001$).

Innovation in the creative industries

Innovation in the creative industries is complex, and has been the subject of relatively little research (Miles and Green 2008; Brandellero and Kloosterman 2010). Novelty is important for creative industries firms, which are by definition based on subtle production and reproduction and symbolic changes to existing products (Sunley et al. 2008). The emphasis on creative industries products is normally subjective and focused on experience value rather than use value (Throsby 2001). Because of this, Stoneman (2009) argues that creative industries produce ‘soft innovations’ which may be aesthetic or involve new content production. The methods of innovation will also differ for creative industries firms, with less emphasis on R&D and more on face to face interaction and learning by doing (Chapain et al. 2010; Martin and Moodysson, 2011).

The standard definition of innovation is the commercial exploitation of new ideas (Fagerberg 2005). This is normally broken into two types: *product innovation*, or the introduction of new products and services and *process innovation*, or new techniques and processes of production. For example, a new product might be a game introduced by a software company; a process might be a new project management process used in the production of this game. This distinction is important for the creative industries. As they are defined by the production of new content, it is important to consider new product innovation as creative industries firms will innovate more on this measure. Similarly, process innovation may be important for creative industries firms, as they are seen as operating in a rapidly changing environment, with new teams and processes being assembled on a project-by-project basis (Jaw et al. 2012). However, one limitation is that considering only product and process innovation means missing innovation in other areas, such as branding or user experience (Brandellero and Kloosterman 2010).

A second key distinction is between *original innovations* that are entirely new, and *learned innovations* which are 'new to the firm' but copied from an original innovator (Müller et al. 2009). There are, of course, some ambiguities in this distinction: innovations often involve complex reconfigurations of existing products or processes and so entirely original innovations may be rare. We cannot account for the significance of innovations, and the SBS has only a 12-month timescale. Because of this, our data may miss significant but rare innovations but include regular but trivial ones. But controlling for whether innovations are original or learnt helps assess whether results are driven by the production of differentiated content or new applications of content taken from elsewhere (Jaw et al. 2012).

The SBS contains information on six measures of innovation, reflecting the distinctions between product and process and original and learned innovations. Details are set out in Table 3. The first three measures are for product innovation. These are: (1) whether firms have introduced *any* new product or service in the previous 12 months, (2) whether firms have introduced an *entirely new* product or (3) whether they have introduced a product which was *new to the firm*. 47.5 per cent of creative industries' firms have introduced a new product, compared to only 36 per cent of other firms. This advantage is far stronger for entirely new products (20.2 per cent of creative industries firms compared to 9.3 per cent of others) and those which are new to the firm (27.2 per cent compared to 26.8 per cent). Firms in the creative industries are more innovative on all measures. Other work has found similar results, with Chapain et al. (2010) further suggesting that the creative industries are particularly likely to introduce new service products, rather than tangible physical products.

Table 3 around here

We also consider three measures of process innovation. These are (4) whether a firm has introduced *any* new process in the past 12 months, (5) whether this was an *entirely new* process or (6) a process which is *new to the firm*. There is less evidence that creative industries firms are more likely to introduce new processes, however: 26.6 per cent of creative industries firms have introduced new processes, only slightly more than other firms. They, by contrast, appear more prone to introduce processes which are only new to the firm (22.0 compared to 16.6 per cent).

The complexity of innovation in the creative industries means there are inevitable limitations to the measures used here. Innovation in the creative industries may include subtle improvements to existing products, which are so subtle that they are not counted in the SBS. Moreover, other forms of innovation may be important for creative industries firms. For example, Brandellero and Kloosterman (2010) argue that in the cultural industries experience and user-interface innovation may be important. These problems provide important caveats on the interpretation of any innovation survey.

Innovation is complex, and no measure is perfect. Innovation in the creative industries rarely relies on formal R&D or is expressed in patenting (Miles and Green 2008). Using a survey avoids this source of bias, and is broad enough to capture innovation across sectors. Moreover, the results of these data are intuitively consistent with other

theoretical views about innovation, with innovation correlated with better firm management and growth.[4] In the absence of any feasible alternatives, and given the need to compare innovation across sectors, survey based measures are the best possible way of identifying innovative firms.

4. Model & Results

4.1 The Model

To test the links between the creative industries, occupations and innovation we use a firm level innovation production function (Fitjar and Rodríguez-Pose 2011a). The model is estimated as a probit where the dependent variable is the introduction of new innovation by a firm:

$$INNOV_i = \alpha + \beta_1 CI_i + \beta_2 COCC_i + \beta_3 URBAN_i + \beta_4 CI*URBAN_i + \beta_5 COCC*URBAN_i + \beta_6 FIRM_i + \beta_7 ACTIVITY_i + \beta_8 REG_i + \varphi + \varepsilon \quad (1)$$

where,

INNOV is whether firm *i* introduces one of six types of product or process innovation in the previous 12 months;

CI is a variable for whether the firm is in the creative industries;

COCC is the proportion of employees in the sector / region in creative occupations;

URBAN is a variable for whether a firm is located in an urban area; with

CI*URBAN and COCC*URBAN interaction terms between the creative industries and creative occupations variables and the urban variable,

FIRM is a vector of variables to account for the basic characteristics of the firm, these being whether the firm is a sole trader, three firm size dummies, three age dummies, whether the firm is a Public Limited Company (PLC) and whether it has Multiple Sites;

ACTIVITY is a set of variables that control for the innovation related activities of the firm. These are whether the firm takes advice from elsewhere, exports and aims to grow;

REG includes 11 dummy variables for the Government Office Regions alongside dummies for Wales and Scotland;

[4] For example, the pairwise correlation between any measure of product innovation and a firm experiencing growth is 0.1639 ($p<0.0000$).

finally ‘φ’ are sectoral controls (15, of which the CI variable is one) and ‘ε’ is the error term.

Further details on the variables and their sources are given in table 4. The model is estimated using robust standard errors.

Control variables

The first set of control variables accounts for the basic characteristics of firms. As the likelihood of innovating is very different for sole traders relative to other firms, a variable is included for this (Higón and Driffield 2012). We expect sole traders to be less likely to innovate, as they have fewer resources to devote to innovative activity. In contrast, larger companies will have greater resources for innovation (while innovative firms are likely to grow). We include size dummies for whether firms are micro (1 – 9 employees) or small (9 – 49). The reference category is medium sized enterprises (50 – 249 employees).

Firm age will also matter. Younger firms may be more innovative as they introduce new products when they enter existence, and because they will have fewer existing products on the market. We control for this with three age dummies: age 1–4, 5–10 and 11 years or older. The reference category is firms in their first year.

We also control for the legal structure of the firm, through a variable for whether a firm is a PLC or not. PLCs will face pressure from outside owners or shareholders to innovate (Nathan and Lee 2011), and may be more innovative. Finally, firms with multiple sites will have access to a wider range of external knowledge sourcing and will often be better managed.

The second set of controls, ACTIVITY, are for the firm’s activities. As firms which source knowledge externally should be more innovative we include a variable for whether a firm takes advice from elsewhere (Fitjar and Rodríguez-Pose 2011a). A similar logic applies with exporting firms, although there are causality issues with whether firms import first or innovate first (Higón and Driffield 2012). Finally, firms should be more likely innovate where they aim to grow and so we control for this (Lee 2011).

Finally, we include sets of dummy variables for sector and region. The sector dummies are 11 dummies for the UK Government Office Regions and country dummies for Scotland, Wales and Northern Ireland. As patterns of innovation clearly vary by sector, we also include 15 sectoral dummies, one of which is the creative industries variable.

4.2 Product innovation

Table 5 gives the results of the models for product innovation, original product innovation and learned product innovation in turn. The diagnostic plots are reasonable, although there is minor evidence of collinearity in the model, which mainly concerns the age category 2 (VIF = 10.16). However, the key results remain unchanged when the age variable is excluded from the analysis, underlining the robustness of the coefficients. The results for the controls are as expected.

First, we consider the innovation potential of firms in the creative industries. The results of the analysis show that, contrary to what was stated in our hypothesis 1, the creative industries are no more likely to produce any type of product innovation than firms in other sectors. Column 1 gives the basic regression without interaction effects. The effect is positive but not significant. This result probably reflects a relatively high diversity of innovation performance between firms in different sub-sectors of the creative industries. It may also be because of the measure of innovation. Chapain et al. (2010) distinguish between new tangible product innovations and new service innovations, and find that creative industries, relative to other firms, are more likely to introduce new service innovations (although they do not control for other characteristics).

However, creative industries firms are more prone to introduce original product innovations (column 4), but not learned product innovations (column 7). The coefficient for original product innovations is positive but only significant at the 10% level. The creative industries have an advantage in completely original product innovations, rather than those introduced from elsewhere. This suggests that hypothesis 1 – that the creative industries were more likely to introduce product and process innovations – is at least partially true.

There is stronger evidence to support our hypothesis 2: that creative occupations drive innovation. Creative occupations are positively related to product innovations overall, with the effect driven by their role in original product innovations. Workers in creative occupations are used in firms regardless of geography to create new products. Hence, creative occupations seem to be more important for innovation than creative industries.

In columns 3, 6 and 9 we consider whether there is a city effect – are creative industries firms in urban environments more innovative? This is tested using an interaction term between the creative industries and the urban variable. However, there appears to be no evidence for this effect. Urban creative industries are no more (or less) innovative than firms in other sectors, allowing us to dismiss our third hypothesis – urban creative industries firms are not more likely to introduce innovations.

However, there is a highly significant and positive effect from creative occupations and product innovation in cities (columns 2, 5 and 8). This effect is not driven by the interaction between creative occupations and original product innovation, but from learned product innovation. In short, creative occupations are used in cities to introduce product innovations from elsewhere. This effect supports previous work suggesting that exchanges of knowledge between creative workers in dense urban labour markets may be an important driver of innovation.

4.3 Process innovation

Table 6 gives the results for process innovation. As before, there is some evidence of collinearity in the age categories, but this does not affect the key results. Creative industries SMEs appear no more (or less) likely to introduce process innovations than firms in other sectors. This result applies for all three types of innovation, and

regardless of whether controls are used. The view of the creative industries as making complex organizational changes in response to market changes does not appear warranted by our results. Hypothesis 1, that the creative industries are more innovative, does not apply in the case of process innovation.

In contrast, there is – as with product innovation – a significant positive relationship between creative occupations and any type of process innovation. However, the result is driven by process innovations which are learnt, rather than original. Creative occupations are used by firms to introduce new processes from outside the firm. Hypothesis 2 is again supported as creative occupations are important for innovation, but only partially.

Turning to the results with the urban interaction, there is no relationship between the creative industries and process innovation in cities. Again, hypothesis three is not supported. Our general result – that there is no link between the creative industries and process innovation – stands.

4.4 London effects

Our fourth hypothesis is that the creative industries will be more innovative in large cities. The data do not have geographical identifiers at a lower level than region. However, we can isolate firms in London – traditionally seen as a highly creative city. Although, from a more theoretical point of view, research has tended to support the idea that urban externalities in large cities may act as a catalyst for innovation, especially in the case of start-ups and SMEs (Duranton and Puga 2001), which feature prominently in the creative industries sector, past research has noted that the creative industries in London may be less innovative than the creative industries elsewhere (Chapain et al. 2010; Lee and Drever 2012).

Table 7 gives results for the interaction terms (models also include the full set of controls). While the effect is not significant, creative industries SMEs in London are, if anything, less likely to introduce new product innovations. There seems to be no specific effect from creative occupations in London. Instead, the use of creative occupations to introduce innovations to firms from elsewhere appears valid to all cities, regardless of size. In short, in London, creative occupations are used for entirely new innovations rather than for copying firms from other sectors. This result corroborates previous research which suggests that innovation in London is somehow different to that in other cities (Wood 2009). It also posits that the link between urban scale and innovation in the creative industries is not as clear as sometimes portrayed. Creative occupations are still a robust driver of innovation in the capital, but this is not a London specific effect.

Overall, these results run counter to our initial hypothesis 4 that urban size is important for innovation. We find no support that creative industries firms or those employing creative workers are more innovative in the largest city in the UK than elsewhere. One explanation is that measures of innovation in surveys may not account for the subtle and often tacit nature of innovation in London (De Propris et al. 2009). However, other research suggests that the importance of geography and local linkages for the creative industries may have been exaggerated (Turok 2003; Gordon and McCann 2005).

5. Conclusions

There is a widespread view that firms in the creative industries sector are more innovative than those in other sectors. The very creativity which defines this heterogeneous collection of firms is considered to be at the root of innovation. Moreover, there is a wide literature suggesting that the creative class is a driver of economic growth in cities or regions (Marlet and van Woerkens 2007; Florida et al. 2008; Boschma and Fritsch 2009). However, in spite of these claims, there is limited empirical evidence which proves that creative industries are more innovative and that urban environments encourage innovation in this type of firms. In this paper we test whether creativity is indeed linked to innovation at firm level in the UK. We use two measures of creativity, distinguishing between the more traditional measure of creative industries and the often overlooked creative occupations.

The results of the analysis suggest that creative industries may not be as innovative as expected. Our results indicate that firms in the creative industries are more likely to introduce entirely new products than firms in other sectors, but that there is no overall link with innovation more generally. Creative occupations, by contrast, appear a more important driver of innovation generally, and are used to develop entirely new and learned innovations in both urban and rural locations. In some respects this result is unsurprising and is in line with recent research underlining the importance for innovation and positivity of educated individuals working in creative occupations (e.g. Marrocu and Paci, 2012). While innovation research has moved beyond a narrow focus on a linear model based on a scientific perception of innovation (Freel and Harrison 2006), studies still tend to collect data on R&D but not on creative inputs. Yet employing a worker in a creative occupation is an innovation input in a similar manner to employing a scientist. This is particularly the case given that new product innovation in some science-based fields may be based on large-scale discoveries, such as new drugs. For the majority of firms a more common innovation may be the design of a new service product. The economic importance of creative occupations in this sense may help explain the resilience of some creative occupations in the recent global downturn (Vinodrai 2013).

We also find no evidence that creative industries are more innovative in cities, meaning that, at least in the case of the UK, the role of externalities in driving innovation amongst creative firms in cities may be overstated. The UK is a small and relatively densely populated country, and the types of knowledge links required for innovation in the creative industries may apply even in rural areas (see, for example, the success of creative places such as Falmouth in Cornwall). This finding may also reflect the increasing importance of digital business models in the creative industries. Moreover, the composition of local economies may be more important than their scale – the benefits of cities generally may be less important than the benefits of particular city characteristics which are only possessed by certain cities. However, creative occupations do appear important in introducing ‘learned’ product innovations in cities. The exchange of knowledge between economic actors is commonly cited as a reason urban firms are more innovative. One way this takes place is through staff transfers (Erikson and Lindgren 2009). Creative workers moving from firm to firm

may be able to share knowledge about products, and help introduce them to new firms.

Finally, we find no evidence that the creative industries are more innovative in large cities. Firms employing creative occupations are no more (or less) innovative in London, while creative industries firms tend to be less innovative, once controlling for their characteristics. This supports other research which suggests that the creative industries in London are actually less innovative than those elsewhere (Chapain et al. 2010). Firms which are not located in large cities may develop alternative strategies to innovate (Fitjar and Rodríguez-Pose 2011b), while local links may be overstated as a driver of innovation in creative firms (Turok 2003). It may alternatively be because of our measures of innovation, with urban creative firms specialising in intangible and subtle modifications to existing products which are not captured in the innovation measure used here (Lee and Drever 2012). The results support other research which has argued for a more nuanced link between city size and the creative industries (Waitt and Gibson 2009).

Overall, the results overall raise questions about current perceptions of the creative industries as an 'innovative' sector. At the very least, theory and policy in this area needs to be more specific – there are many forms of innovation, and the creative industries only have an advantage in one. The papers also has a number of policy implications. The first is that schemes, such as those funded by the European Regional Development Fund, which are designed to help innovation in the creative industries may need to be better targeted. Indeed, aiding firms to take workers in creative occupations may be a more efficient way of stimulating innovation. A second implication is that policies for firms in creative industries may not be best targeted at urban firms only or specific geographical areas. Our results suggest that firm characteristics are more important than location in determining the likelihood of innovation.

The results open up important avenues for future research. First, our variable for creative occupations for industry / region is an improvement on previous research. Our results also imply that future surveys should incorporate a creative occupations variable. Second, our outcomes on the role of the urban dimension for creativity and innovation may be affected by the use of measures of 'urban' and urban scale which remain relatively blunt. Processes may operate differently in cities with high shares of creative occupations relative to those with fewer. Research using more advanced data may want to tease this out.

Finally, and perhaps most importantly, our results are limited to the measures of innovation in the ASBS. These are the best available indicators, and they are broad enough to capture innovation in a range of sectors. There is no single measure of innovation, and our results – like those using patents or other questions – are inevitably limited. However, innovation in the creative industries is particularly complicated and our results need to be considered with this interpretation in mind. Subtle processes of marginal design improvement, which are important in the creative industries, may not seem as distinct from minor changes in other products in the SBS. Moreover, we cannot investigate the significance of innovations (Coad and Rao 2008). Future research should consider using a fuller set of innovation indicators to address the limitations outlined above.

References

Andari, R. Bakshi, H, Hutton, W. O'Keefe, A. and Schneider, P. (2007) *Staying ahead? The economic contribution of the creative industries.* London: Department for Culture, Media and Sport.

Arts Council (2012) "Arts Council England launches Creative Industry Finance programme" Press Release from the Arts Council. [Accessed 1st January 2013] http://press.artscouncil.org.uk/Press-Releases/Arts-Council-England-launches-Creative-Industry-Finance-programme-67c.aspx

Asheim, B. T., Coenen, L. and Vang, J. (2007) Face-to-face, buzz and knowledge bases: Socio-spatial implications for learning, innovation and innovation policy. Environment and Planning C: Government and Policy, 25 (5), pp. 655 – 670.

Bakshi, H., McVittie, E. and Simmie, J. (2008) Creating innovation: Do the creative industries support innovation in the wider economy? London: National Endowment for Science, Technology and the Arts.

Bakshi, H. and E. McVittie (2009) Creative supply chain linkages and innovation: Do the creative industries stimulate business innovation in the wider economy? Innovation: Management, Policy and Practice, 11 (2): 169-189.

Boschma, R. A. and Fritsch, M. (2009) Creative class and regional growth: Empirical evidence from seven European countries. Economic Geography, 85 (4): 391 – 423.

Brandellero, A. and Kloosterman, R. C. (2010) Keeping the market at bay: exploring the loci of innovation in the cultural industries. Creative Industries Journal, 3 (1): 61-77.

Chapain, C., Cooke, P., De Propris, L., MacNeill, L. and Mateos-Garcia, J. (2010) Creative clusters and innovation: Putting creativity on the map. London: National Endowment for Science, Technology and the Arts.

Coad, A. and Rao, R. (2008) Innovation and firm growth in high-tech sectors: a quantile regression approach. Research Policy, 37: 633 - 648

Cooke, P. and De Propris L. 2011. A policy agenda for EU smart growth: The role of the creative and cultural industries. Policy Studies, 32 (4): 365 – 375.

Comunian, R., Faggian, A. and Li, C. Q. (2010) Unrewarded careers in the creative class: The strange case of bohemian graduates. Papers in Regional Science, 89 (2): 389-410.

Comunian, R., Faggian, A. and Jewell, S. (2011) Winning and losing in the creative industries: an analysis of creative graduates' career opportunities across creative disciplines. Cultural Trends, 20 (3-4): 291-308

Cunningham, S. and Higgs, P. 2009. Measuring creative employment: Implications for innovation policy. Innovation: Management, Policy and Practice. 11 (2): 190 – 200.

Cunningham, S. (2011) Developments in measuring the "creative" workforce. Cultural Trends, 20 (1): 25-40.

Department for Culture, Media and Sport [DCMS] (2001) Creative industries economic estimates. London: DCMS.

Department for Culture, Media and Sport [DCMS] (2007) Creative industries economic estimates 2006 - Statistical Bulletin. London: DCMS.

Department for Culture, Media and Sport [DCMS] (2009) Creative industries economic estimates 2007 - Statistical Bulletin. London: DCMS.

Department for Culture, Media and Sport [DCMS] (2013) Classifying and Measuring the Creative Industries - Consultation on Proposed Changes. Accessed 21st June 2013. Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/203296/Classifying_and_Measuring_the_Creative_Industries_Consultation_Paper_April_2013-final.pdf

De Propris, L., Chapain, C., Cooke, P., MacNeill, S. and Mateos-Garcia, J. (2009) The geography of creativity. NESTA Working Paper, May 2009.

Duranton G. and Puga D. (2001) Nursery cities: Urban diversity, process innovation and the life cycle of products. American Economic Review, 91 (5): 1454 – 1477.

Duranton, G. and Puga, D. (2004). Micro-foundations of Urban Agglomeration Economies. In J.V. Henderson and J.F. Thisse (eds) *Handbook of Regional and Urban Economics*, Vol. IV, , North-Holland, Amsterdam: 2063-2117

Evans, G. (2009) Creative cities, creative spaces and urban policy. Urban Studies, 46 (5-6): 1003-1040.

Eriksson, R. and Lindgren, U. (2009) Localized mobility clusters: impacts of labour market externalities on firm performance. Journal of Economic Geography, 9 (1): 33 - 53

Fagerberg, J. (2005) Innovation: A guide to the literature. In Fagerberg, J., Mowery, D. and Nelson, R. (eds.) Oxford Handbook of Innovation. Oxford University Press, Oxford: 1-27.

Fitjar, R.D. and Rodríguez-Pose, A. (2011) Innovating in the periphery: Firms, values and innovation in southwestern Norway. European Planning Studies, 19 (4): 555 - 574.

Fitjar, R.D. and Rodríguez-Pose, A. (2011) When local interaction does not suffice: sources of firm innovation in urban Norway. Environment and Planning A, 43(6): 1248-1267.

Florida, R. (2002) The rise of the creative class, Basic Books, New York.

Florida, R. (2005) The flight of the creative class, Basic Books, New York.

Florida, R. Mellander, C. and Stolarick, K. (2008) Inside the black box of regional development - human capital, the creative class and tolerance. Journal of Economic Geography, 8(5): 615 - 649.

Freel, M. and Harrison, R. (2006) Innovation and cooperation in the small firm sector. Regional Studies, 40 (4): 289-305.

Freeman, A. (2010) London's creative workforce: 2009 update. GLA Economics Working Paper. GLA, London.

Gordon, I. R. and McCann, P. (2005) Innovation, agglomeration and regional development. Journal of Economic Geography, 5 (5): 523 – 543.

Grabher, G. (2001) Ecologies of creativity: The village, the group and the heterarchic organisation of the British advertising industry. Environment and Planning A, 33: 351-274.

Grabher, G. (2002) The project ecology of Advertising: Tasks, talents and teams. Regional Studies, 36 (5): 245-262.

Hesmondalgh, D. and A. C. Pratt (2005) Cultural industries and cultural policy. International Journal of Cultural Policy, 11(1): 1-13.

Higón, D. A. and Driffield, N. 2012. Exporting and innovation performance: Analysis of the Annual Small Business Survey in the UK, International Small Business Journal, 29 (1): 4 – 24.

Huggins, R. and Clifton, N. (2011) Competitiveness, creativity and place-based development. Environment and Planning A, 43: 1341-1362.

HM Treasury (2012) "UK to get world class creative tax credits", HM Treasury Press Release. Available from: http://www.hm-treasury.gov.uk/press_48_12.htm [Accessed 1st Jan 2013]

Jayne, M. (2005) Creative industries: The regional dimension? Environment and Planning C: Government and Policy, 23 (4): 537 – 556.

Lancaster University (2012) London Creative and Digital Fusion. http://www.theworkfoundation.com/Impact/London-Creative-and-Digital-Fusion [Accessed 1st January 2013]

Lee, N. (2011) Free to grow? Assessing the barriers faced by actual and potential high growth firms. NESTA Working Paper, London.

Lee, N. and Drever, E. (2012) Creative industries, occupations and innovation in London. Big Innovation Centre Working Paper, University of Lancaster.

Markusen A (2006) Urban development and the politics of a creative class: evidence from a study of artists. Environment and Planning A, 38: 1921 – 1940.
Marlet G. and van Woerkens C. (2007) The Dutch creative class and how it fosters urban employment growth. Urban Studies, 44 (13): 2605 – 2626.

Martin, R. and Moodysson, J. (2011) Innovation in symbolic industries: The geography and organisation of knowledge sourcing. European Planning Studies, 19 (7): 1183 – 1203.

Marrocu, E. and Paci, R. (2012) Education or Creativity: What Matters Most for Economic Performance? Economic Geography. 88: 369–401.

Miles, I. and Green, L. (2008) Hidden innovation in the creative industries. National Endowment for Science, Technology and the Arts, London.

Müller, K., Rammer, C. and Trüby, J. (2009) The role of creative industries in industrial innovation. Innovation: Management, Policy & Practice, 11 (2): 148-168.

Nathan, M. and N. Lee (2011) Does cultural diversity help innovation in cities? Evidence from London's firms. Spatial Economics Research Paper Working Paper 69, LSE.

Power, D. (2002) The 'Cultural Industries' in Sweden: an assessment of their place in the Swedish economy. Economic Geography, 78 (2): 103-128.

Power, D. (2010) The difference principle? Shaping competitive advantage in the cultural product industries. Geografiska Annaler: Series B, Human Geography, 92 (2): 145-158.

Pratt, A. C. (2006) Advertising and creativity, a governance approach: A case study of creative agencies in London. Environment and Planning A, 38 (10): 1883-1889.

Pratt, A. C. (2008) Creative cities: The cultural industries and the creative class. Geog*rafiska Annaler: Series B, Human geography*, 90 (2): 107-117.

Reimer, S., Pinch, S. and Sunley, P. (2008) Design spaces: Agglomeration and creativity in British design agencies. Geografiska Annaler: Series B, Human Geography, 90 (2): 151-172.

Shearmur, R. (2012) Not being there: Why local innovation is not (always) related to local factors. In Westeren, K. I. (ed.) Foundations of the knowledge economy: Innovation, learning and cities. Cheltenham, Edward Elgar: pp. 117 – 139.

Stam, E., de Jong, P. J. and Marlet, G. (2008) Creative industries in the Netherlands: Structure, development, innovativeness and effects on urban growth. Geografiska Annaler: Series B, Human Geography, 90 (2): 119-132.

Stoneman, P. (2009) Soft innovation: Towards a more complete picture of innovative change. London: National Endowment of Science, Technology and the Arts.

Sunley, P., Pinch, S., Reimer, S. and Macmillen, J. (2008) Innovation in a creative production system: The case of design. Journal of Economic Geography, 8 (5): 675-690.

Stolarick, K. and Florida, R. (2006) Creativity, connections and innovation: a study of linkages in the Montreal region. Environment and Planning A, 38: 1799-1817.

Therrien, P. (2005) City and innovation: Different size, different strategy. European Planning Studies, 13 (6): 853 - 877.

Turok, I. (2003) Cities, Clusters and Creative Industries: The Case of Film and Television in Scotland. European Planning Studies, 11 (5): 549–565.

Vinodrai, T. (2006) Reproducing Toronto's design ecology: Career paths, intermediaries and local labour markets. Economic Geography, 82(3): 237-263.

Vinodrai, T. (2013) Design in a downturn? Creative work, labour market dynamics and institutions in comparative perspective. Cambridge Journal of Regions, Economy and Society. 6 (1): 159-176.

Waitt, G. and Gibson, C. (2009) Creative small cities: Rethinking the creative economy in place. Urban Studies, 46 (5-6): 1223 – 1246.

Williams M. and Cowling M. (2009) The Annual Small Business Survey 2007/9, London: Department for Business, Innovation and Skills.

Wood P. (2009) Service competitiveness and urban innovation policies in the UK: Implications of the 'London paradox'. Regional Studies, 43 (8): 1047 – 1059.

Tables

Table 1. Creative industries

Creative Industries	Industries included in this category	Codes (SIC 2003)
Advertising	Advertising	74.40
Architecture	Architecture & Engineering	74.20
Video, Film & Photography	Reproduction of video recording; Photographic activities; Motion picture and video production; Motion picture and video distribution; Motion picture projection.	22.32, 74.81, 92.11, 92.12, 92.13
Music and the visual and performing arts	Publishing of sound recordings; Reproduction of sound recording; Artistic and literary creation and interpretation; Operation of arts facilities; Other entertainment activities not elsewhere classified; Other recreation activities not elsewhere classified.	22.14, 22.31, 92.31, 92.32, 92.34, 92.72
Publishing	Publishing of books; Publishing of newspapers; Publishers of journals and periodicals; Other publishing; News agency activities.	22.11, 22.12, 22.13, 22.15, 92.40
Software, computer games and electronic publishing	Reproduction of computer media; Publishing of software; Other software consultancy and supply.	22.33, 72.21, 72.22
Radio and TV	Radio and television activities.	92.20

Note: No occupations match the Art & Antiques, Design sector or the Digital and Entertainment media. We do not include Art and Antiques and Designer Fashion as only a small share of firms in these industries are considered 'creative industries'. No industry codes match Crafts and Design.

Table 2. Definition of creative occupations

Creative Occupations	Occupations included in the category	Codes (SOC 2000)
Advertising	Advertising and public relations managers; Public relations officers; Marketing associate professionals	1134; 3433; 3543
Architecture	Architects; Town Planners; Architectural technologists and Town Planning Technicians	2431; 2432; 3121
Crafts	Glass and Ceramics makers, decorators and finishers; Furniture makers, other craft woodworkers; Pattern makers (moulds); Musical Instrument makers and tuners; Goldsmiths, Silversmiths, Precious Stone workers; Floral arrangers, Florists; Hand Craft occupations not elsewhere classified; Glass and Ceramics process operatives; Labourers in Building and Woodworking trades	5491; 5492; 5493; 5494; 5495; 5496; 5499; 8112; 9121
Design	Design and development engineers; Artists; Graphic Designers; Product, Clothing and related Designers.	2126; 3411; 3421; 3422
Designer fashion	Product, clothing and related designers; Weavers and knitters	5411
Video, film & photography	Photographers and audio-visual equipment operators	3434
Music & the visual and performing arts	Authors, Writers; Actors, entertainers; Dancers and choreographers; Musicians; Arts officers, producers and directors	3412; 3413; 3414; 3415; 3416
Publishing	Journalists, newspaper and periodical editors; Originators, compositors and print preparers; Printers; Bookbinders and print finisher; Screen printers	3431; 5421; 5422; 5423; 5424
Software & electronic publishing	Information and communications technology managers; IT strategy and planning professional	1136; 2131
Radio & TV	Broadcasting associate professionals; TV, Video and Audio engineers	3432; 5422

Source: DCMS (2009).

Table 3. Innovation in the creative industries

	Firm has introduced any new product in the past 12 months:			Firm has introduced any new process in past 12 months:		
	Any	Original: Entirely new	Learned: New to the firm	Any	Original: Entirely new	Learned: New to the firm
CI Firm	47.5	20.2	27.2	26.6	4.5	22.0
Non CI Firm	36.1	9.3	26.8	22.0	5.4	16.6
Total	37.4	10.5	26.9	22.5	5.3	17.2

Sample size: 9,362 firms of which 727 (7.3 per cent) are creative industries and 8,431 (92.06 per cent) are not. Weights applied.

Table 4. Variables and definitions

	Variable	Description
Creativity	Creative industries	Whether firm is one of the creative industries
	Creative occupations (%)	Percentage of employment in sector / region in creative occupations
Urban	Urban	Whether firm is located in an urban area or not
	Creative industries * urban	Interaction term – Urban creative industries = 1
	Creative occupations * urban	Interaction term – Urban firm X Creative Occupation share
Firm	Sole	Whether firm is a sole trader
	Micro firm	Firm has been 1 and 9 employees
	Small firm	Firm has between 10 and 49 employees
	Medium firm	Firm has between 50 and 249 employees
	PLC	Whether the firm is a Public Limited Company (1 if so)
	Business Plan	Whether the firm has a business plan (1 if so)
Activity	Exports	Whether the firm exports (1 if so)
	Advice	Whether the firm seeks advice from external sources (1 if so)
	Multiple sites	Whether the firm has more than one location (1 if so)
	Aims to grow	Whether firm aims to grow (1 if so)
Age	Age 1 -3 Age 4 – 10 Age 11 +	Set of three dummy variables for firm age which are one if a firm is aged between 1 and 3, 4-10 and 11 +, reference category is for firms less than a year old
Region	Regional Dummies	A set of regional dummies for the nine government office regions, Wales, Scotland and Northern Ireland.
Sector	Sector Dummies	Twelve sector dummies, for the following: A - Agriculture, hunting and forestry; D - Manufacturing; F - Construction; G - Wholesale and retail trade; H - Hotels and restaurants; I - Transport, storage and communication; J - Financial intermediation; K - Real estate, renting and business activities; L - Public administration and defence; M – Education; N - Health and social work; O - Other community, social and personal services. Note that the creative industries dummy is separate.

Source for variables: Small Business Survey (SBS) 2010 or Annual Population Survey

Table 5. Product innovation: Probit regression models

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	Any product innovation			Original product innovation			Learned product innovation		
Creative Industries	0.00875	0.00427	0.0346	0.189*	0.190*	0.137	-0.123	-0.127	-0.0500
	(0.0802)	(0.0802)	(0.115)	(0.0974)	(0.0974)	(0.137)	(0.0816)	(0.0817)	(0.117)
Creative Occupations (%)	0.512**	0.0212	0.513**	0.358	0.504	0.355	0.257	-0.304	0.260
	(0.200)	(0.335)	(0.200)	(0.227)	(0.388)	(0.227)	(0.201)	(0.337)	(0.201)
Creative Occupations * Urban		0.654*			-0.192			0.735**	
		(0.354)			(0.411)			(0.358)	
Creative Industries * Urban			-0.0353			0.0705			-0.0989
			(0.112)			(0.130)			(0.115)
Urban	-0.0110	-0.0532	-0.00836	-0.0235	-0.00972	-0.0302	0.00368	-0.0438	0.0111
	(0.0312)	(0.0386)	(0.0324)	(0.0403)	(0.0503)	(0.0423)	(0.0316)	(0.0391)	(0.0328)
Sole trader	-0.348***	-0.348***	-0.348***	-0.00848	-0.00880	-0.00806	-0.368***	-0.368***	-0.368***
	(0.0583)	(0.0583)	(0.0583)	(0.0741)	(0.0741)	(0.0741)	(0.0591)	(0.0591)	(0.0591)
Micro firm	-0.139***	-0.137***	-0.139***	0.00646	0.00573	0.00649	-0.146***	-0.144***	-0.146***
	(0.0480)	(0.0481)	(0.0480)	(0.0594)	(0.0594)	(0.0594)	(0.0479)	(0.0480)	(0.0479)
Small firm	-0.110**	-0.108**	-0.110**	0.0352	0.0344	0.0350	-0.126***	-0.124***	-0.125***
	(0.0448)	(0.0448)	(0.0448)	(0.0540)	(0.0540)	(0.0540)	(0.0446)	(0.0446)	(0.0446)
PLC	-0.0221	-0.0225	-0.0221	0.115***	0.115***	0.115***	-0.0846***	-0.0850***	-0.0846***
	(0.0312)	(0.0312)	(0.0312)	(0.0402)	(0.0402)	(0.0402)	(0.0316)	(0.0317)	(0.0316)
Exports	0.434***	0.433***	0.434***	0.445***	0.445***	0.445***	0.161***	0.160***	0.161***
	(0.0334)	(0.0334)	(0.0334)	(0.0391)	(0.0391)	(0.0391)	(0.0336)	(0.0336)	(0.0336)
Takes Advice	0.277***	0.276***	0.277***	0.126***	0.126***	0.125***	0.211***	0.210***	0.211***
	(0.0306)	(0.0306)	(0.0306)	(0.0379)	(0.0379)	(0.0379)	(0.0306)	(0.0306)	(0.0306)
Multi Site	0.100***	0.102***	0.100***	0.0944**	0.0939**	0.0947**	0.0480	0.0495	0.0478
	(0.0358)	(0.0358)	(0.0358)	(0.0436)	(0.0436)	(0.0436)	(0.0360)	(0.0360)	(0.0360)
Aims to Grow	0.384***	0.384***	0.384***	0.238***	0.238***	0.238***	0.298***	0.298***	0.299***
	(0.0315)	(0.0315)	(0.0315)	(0.0435)	(0.0435)	(0.0435)	(0.0326)	(0.0326)	(0.0326)
Age 1 -3	-0.0542	-0.0549	-0.0540	-0.125	-0.125	-0.125	0.00951	0.00873	0.00994
	(0.0621)	(0.0622)	(0.0621)	(0.0785)	(0.0785)	(0.0785)	(0.0630)	(0.0630)	(0.0630)
Age 4 – 10	-0.162***	-0.164***	-0.161***	-0.138*	-0.138*	-0.139*	-0.0947	-0.0971	-0.0936
	(0.0588)	(0.0588)	(0.0588)	(0.0745)	(0.0746)	(0.0746)	(0.0597)	(0.0597)	(0.0597)
Age 11 +	-0.326	-0.324	-0.325	-0.00120	-0.00135	-0.00222	-0.325	-0.323	-0.324
	(0.275)	(0.275)	(0.275)	(0.388)	(0.388)	(0.388)	(0.292)	(0.292)	(0.292)
Constant	-0.180	-0.142	-0.183	-1.540***	-1.553***	-1.534***	-0.340***	-0.296**	-0.347***
	(0.118)	(0.120)	(0.119)	(0.151)	(0.154)	(0.151)	(0.119)	(0.121)	(0.119)
Sectoral Dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Regional Dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	9,158	9,158	9,158	9,154	9,154	9,154	9,158	9,158	9,158
Pseudo R2	0.0767	0.0770	0.0767	0.0646	0.0646	0.0646	0.0383	0.0387	0.0384

Models estimated as probit regressions. All regressions include 15 sector dummies and 13 regional dummies. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 6. Process innovation: Probit regression models

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	Any process innovation			Original process innovation			Learned process innovation		
Creative Industries	0.0147	0.0140	0.139	-0.0567	-0.0554	-0.0191	0.0345	0.0332	0.160
	(0.0831)	(0.0831)	(0.119)	(0.120)	(0.120)	(0.176)	(0.0859)	(0.0860)	(0.122)
Creative	0.303	0.224	0.307	-0.338	-0.101	-0.337	0.462**	0.323	0.466**
Occupations (%)	(0.204)	(0.345)	(0.204)	(0.293)	(0.500)	(0.293)	(0.209)	(0.349)	(0.209)
Creative		0.105			-0.311			0.183	
Occupations * Urban		(0.366)			(0.534)			(0.371)	
Creative Industries *			-0.168			-0.0506			-0.170
Urban			(0.116)			(0.172)			(0.118)
Urban	0.0265	0.0194	0.0395	0.0373	0.0591	0.0414	0.0152	0.00286	0.0285
	(0.0325)	(0.0404)	(0.0338)	(0.0488)	(0.0611)	(0.0508)	(0.0334)	(0.0415)	(0.0347)
Sole trader	-0.672***	-0.672***	-0.673***	-0.0188	-0.0191	-0.0187	-0.720***	-0.719***	-0.720***
	(0.0612)	(0.0612)	(0.0612)	(0.0914)	(0.0914)	(0.0914)	(0.0630)	(0.0630)	(0.0630)
Micro firm	-0.415***	-0.415***	-0.415***	-0.000429	-0.00161	-0.000239	-0.431***	-0.431***	-0.431***
	(0.0485)	(0.0485)	(0.0485)	(0.0713)	(0.0713)	(0.0713)	(0.0490)	(0.0490)	(0.0490)
Small firm	-0.200***	-0.200***	-0.200***	0.0406	0.0395	0.0409	-0.218***	-0.217***	-0.217***
	(0.0448)	(0.0448)	(0.0448)	(0.0638)	(0.0637)	(0.0638)	(0.0450)	(0.0450)	(0.0450)
PLC	0.0679**	0.0679**	0.0680**	0.123**	0.123**	0.123**	0.0315	0.0314	0.0315
	(0.0324)	(0.0324)	(0.0324)	(0.0479)	(0.0479)	(0.0479)	(0.0334)	(0.0334)	(0.0334)
Exports	0.185***	0.185***	0.185***	0.231***	0.232***	0.231***	0.0966***	0.0963***	0.0967***
	(0.0339)	(0.0339)	(0.0339)	(0.0471)	(0.0471)	(0.0471)	(0.0348)	(0.0348)	(0.0348)
Takes Advice	0.366***	0.366***	0.367***	0.178***	0.179***	0.178***	0.317***	0.316***	0.317***
	(0.0309)	(0.0309)	(0.0309)	(0.0447)	(0.0446)	(0.0446)	(0.0314)	(0.0315)	(0.0315)
Multi Site	0.104***	0.105***	0.104***	0.122**	0.121**	0.122**	0.0635*	0.0639*	0.0632*
	(0.0364)	(0.0364)	(0.0364)	(0.0514)	(0.0514)	(0.0514)	(0.0370)	(0.0370)	(0.0370)
Aims to Grow	0.439***	0.439***	0.439***	0.218***	0.218***	0.218***	0.410***	0.410***	0.411***
	(0.0336)	(0.0336)	(0.0336)	(0.0533)	(0.0533)	(0.0533)	(0.0350)	(0.0350)	(0.0350)
Age 1 -3	-0.0897	-0.0897	-0.0890	-0.0345	-0.0347	-0.0343	-0.0872	-0.0874	-0.0865
	(0.0642)	(0.0642)	(0.0643)	(0.0940)	(0.0940)	(0.0940)	(0.0661)	(0.0661)	(0.0661)
Age 4 – 10	-0.188***	-0.189***	-0.187***	-0.141	-0.141	-0.141	-0.150**	-0.150**	-0.148**
	(0.0611)	(0.0611)	(0.0612)	(0.0909)	(0.0910)	(0.0909)	(0.0626)	(0.0626)	(0.0626)
Age 11 +	-0.0645	-0.0643	-0.0612	0.256	0.256	0.257	-0.157	-0.157	-0.153
	(0.298)	(0.298)	(0.299)	(0.375)	(0.375)	(0.375)	(0.327)	(0.327)	(0.327)
Constant	-0.438***	-0.432***	-0.451***	-1.911***	-1.929***	-1.915***	-0.520***	-0.508***	-0.533***
	(0.121)	(0.123)	(0.121)	(0.194)	(0.198)	(0.195)	(0.123)	(0.125)	(0.124)
Sectoral Dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Regional Dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	9,154	9,154	9,154	9,141	9,141	9,141	9,154	9,154	9,154
Pseudo R2	0.0986	0.0986	0.0988	0.0434	0.0435	0.0434	0.0815	0.0815	0.0817

Models estimated as probit regressions. All regressions include 15 sector dummies and 13 regional dummies. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 7. London effects: Probit regression models for product and process innovation

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Any product innovation	Original product innovation	Learned product innovation	Any process innovation	Original process innovation	Learned process innovation
Creative Industries	0.0190	0.188*	-0.109	0.0277	-0.0650	0.0517
	(0.0818)	(0.0992)	(0.0831)	(0.0845)	(0.123)	(0.0873)
Creative Occupations	0.575***	0.440*	0.284	0.380*	-0.223	0.499**
	(0.216)	(0.245)	(0.215)	(0.220)	(0.311)	(0.225)
Creative Occupations * London	-0.247	-0.480	-0.00277	-0.305	-0.744	-0.0383
	(0.506)	(0.569)	(0.511)	(0.517)	(0.790)	(0.526)
Creative Industries * London	-0.101	0.0471	-0.158	-0.118	0.144	-0.181
	(0.191)	(0.210)	(0.196)	(0.201)	(0.292)	(0.204)
Constant	-0.186	-1.548***	-0.343***	-0.446***	-1.921***	-0.525***
	(0.118)	(0.151)	(0.119)	(0.121)	(0.194)	(0.124)
Firm controls	YES	YES	YES	YES	YES	YES
Regional dummies	YES	YES	YES	YES	YES	YES
Sector dummies	YES	YES	YES	YES	YES	YES
Observations	9,158	9,154	9,158	9,154	9,141	9,154
Pseudo R2	0.0768	0.0647	0.0384	0.0987	0.0436	0.0816

Models estimated as probit regressions. All regressions include 15 sector dummies and 13 regional dummies. Firm controls are: urban, sole trader, size, PLC, exports, takes advice, multiple sites, aims to grow and firm age. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1