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Design Economics Chapter Two:

Registered Designs & Business Performance – Exploring the Link

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Design Economics Introduction

The design industry continues to make a significant contribution to the UK's growth and innovation. A conservative estimate of £23 billion¹ on spending in design, equating to 1.6% of GDP, demonstrates the value that it brings to the economy. However, we believe that this is not the true picture and if all design activity was included it would be much higher. Various entities define what is included in the "design industry" in different ways, for the purpose of this report the design industry is defined in Table 1 of Chapter 1. To maintain and build on this success, policy makers need to better understand how the Intellectual Property (IP) framework supports this dynamic sector. Policy makers need to know:

- How has the UK built up such a successful design sector with such a low level of registered rights?
- Is the design sector successful because it does not register rights?
- Is the intellectual property work framework too complex?
- Why is the number of domestic design rights issued each year about a quarter of the number of patents or trademarks?

The propensity for UK businesses to register designs rights both domestically and through Office for Harmonization of Internal Markets (OHIM) seems to be significantly lower than its EU counterparts. Yet the Government has no evidence to explain this. One of the barriers to understanding this is that gauging the aggregate number of unregistered design rights is difficult, as by their nature they are not on any official registry. It is very possible that many businesses are consciously protecting their designs using an unregistered intellectual property right.

The current Intellectual Property Right (IPR) framework for design is perceived to be something of a patchwork, with many different options for protecting designs in the UK. An overview of the routes available and how they differ is provided in the table of rights below. Each user will value every option differently, depending upon their makeup. Each right covers different dimensions including time, geographical area and the features of a design it will protect, as well as being priced differently. Most bodies who issue registered design rights do not examine for prior art or novelty, this includes the UK Intellectual Property Office (IPO) and OHIM.

The Hargreaves Review of Intellectual Property and Growth and the subsequent Government Response identifies a gap in the knowledge base and calls for more research in this area to ensure that government policies to support UK design are based on evidence. As a first step towards answering these questions the IPO and the Design Council have commissioned Imperial College and BOP Consulting to research specific areas and create this report.

This research has been commissioned in four chapters, which can be read individually or together:

- ▶ **Chapter One provides a map of where design activity takes place in the UK, how it is purchased (bought externally or created internally) and how registered rights are used.**
- ▶ **Chapter Two analyses the impact registered design rights have on business performance, given a UK or EU design registration.**
- ▶ **Chapter Three is a survey looking at the reasons for the behaviour of firms when interacting within the IP framework for design.**
- ▶ **Chapter Four is an international comparison of design systems in the UK, France and Germany.**

The IPO and Design Council would like to thank all of the researchers involved in the project for their hard work in creating this report. We would also like to thank the Trade Mark and Design Rights Expert Advisory Group, and its chair Phillip Johnson, for their input to the research.

Intellectual Property Office, 2011

Table of rights available to design entities in the UK

Name of right	Right Provider	Cover	Term	What's covered?	Cost ¹
Registered Design	UK Intellectual Property Office	UK	25 years (subject to renewal fees)	The overall appearance of a novel design which has individual character (excluding features dictated by function and designs contrary to public policy). No requirement of copying.	1 design: £60 4 designs £180 100 designs: £4,060
Design Right	UK law (unregistered) Some private initiatives such as ACID provide private registries.	UK	15 years from made or, if earlier, 10 years from making available. Last five years subject to licence of right.	An original (and not commonplace) design any aspect of the shape or configuration (whether internal or external) of the whole or part of an article. Excludes must fit, must match and surface decoration). Protection only extends to copying.	Free as copyright, private registries may charge.
Registered Community Design	OHIM	EU	25 years (subject to renewal fees)	The overall appearance of a novel design which has individual character (excluding features dictated by function and designs contrary to public policy). No requirement of copying.	1 design: €350 4 designs €875 100 designs €9125
Unregistered Community Design	EU regulation (unregistered)	EU	3 years	The overall appearance of a novel design which has individual character (excluding features dictated by function and designs contrary to public policy). Protection only extends to copying.	Free as copyright, private registries may charge.
The Hague Industrial design	The World Intellectual Property Organisation	Can designate up to 58 signatories including the EU	Between 15-25 years depending on jurisdiction	The protection depends on the national laws in the respective members of the Hague system.	1 design and all states covered: Sfr ² 3753 1 design just in the EU: Sfr 503 4 designs and all states covered: Sfr 6912 4 designs just in the EU: Sfr 878 100 designs and all states covered: Sfr 106272 100 designs in just the EU: Sfr 12878

Name of right	Right Provider	Cover	Term	What's covered?	Cost ¹
Copyright (in relation to artistic works – copyright extends much further)	National laws in each country	In every country in the WTO or member of the Berne Convention (artistic works)	At least the life of the author plus 50 years (25 years for industrial articles).	Original artistic works (or works of artistic craftsmanship).	Free
Trade Mark	UK Intellectual Property Office	UK	No limit	Any sign capable of being represented graphically which is capable of distinguishing goods or services of one undertaking from those of other undertakings. A trade mark may, in particular, consist of words (including personal names), designs, letters, numerals or the shape of goods or their packaging (numerous exclusions, in particular functional trade marks are not permitted).	1 registration £170 4 registrations £680 100 registrations £17,000 (plus renewal fees, and extra charges for additional classes)
Community Trade Mark	OHIM	EU	No limit	Any sign capable of being represented graphically which is capable of distinguishing goods or services of one undertaking from those of other undertakings. A trade mark may, in particular, consist of words (including personal names), designs, letters, numerals or the shape of goods or their packaging (numerous exclusions, in particular functional trade marks are not permitted).	€900 for one registration (covers three classes) 4 registrations €3600 100 registrations €90,000 (plus renewal fees, and extra charges for additional classes)

1 The costs can vary in various regions due to the nature of the application for a number of reasons, e.g. number of words in the description, area it covers (for the Hague). Four designs is the average number of rights held by firms. This comparison does not take account of renewal fees. This table is a rough guide to give a broad comparison of the costs involved in protecting a design, they are subject to change.

2 Swiss Francs – these figures were compiled using the WIPO fee calculator.

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1.1 Executive Summary

This study examines whether there is any performance impact associated with holding designs registered in the UK or in Europe. The answer is a cautious “there was, but....”

The strongest evidence for a performance benefit (measured in terms of sales per employee) is found for holding designs registered in the UK with the then Patent Office, now Intellectual Property Office (IPO), in the late 1990s and early 2000s. In most of the years studied between 1997 and 2005 there was a significant performance premium associated with holding designs registered in the UK. The magnitude of this effect varied, but averaged at around 17 per cent.

We find more limited evidence of a performance benefit associated with holding European design rights, especially in the mid-2000s. However, in more recent years, there is no significant performance benefit for holders of registered (European) Community Designs.

Lastly, we find that holding UK-IPO registered designs was associated with underperformance in the late 2000s.

We stress that this study has *associated* performance differences between firms with and without registered designs. This is very different from saying that these differences are *caused by* holding registered designs. Whilst it is possible that holding registered designs may have had some direct impact on the performance differences observed – particularly if firms holding registered designs were able to sell or licence them for substantial fees - overall, we suspect the results should be interpreted much more cautiously.

Rather than registered designs directly causing performance differences, it is more likely that holding registered designs is symptomatic of other behaviours that are themselves the underlying causes of the differences. For example, firms with registered designs are more likely to hold patents and/or trade marks, whereas those without registered designs are less likely to do so. In principle, if we incorporated information on these assets, the effect of holding registered designs might well diminish, if not disappear.

Holding registered designs may also reflect other, difficult to observe, differences between firms. For example, firms that register designs may be better at managing design, innovation or the business as a whole. But it is impossible to obtain evidence on this.

The changing landscape of design protection in the UK and Europe over the period of our study may also have had an impact. Before 2001 (and the implementation of the European Design Directive), the difference between registered and unregistered design protection in the UK appears to have been substantial, with registration providing significant additional benefits over unregistered designs. After 2001, the gap was much diminished, and was reduced further from 2003, when European registration became available, offering similar protection to UK registration but across the whole of Europe (albeit for a higher fee). As one expert informed us:

The only advantages of registration in the UK (under the 1949 Act), or in Europe through the Community Design Register, over an unregistered Community Design are that there is no need to prove copying and that the term can be extended to 25 years (by paying renewal fees) whereas unregistered Community Designs last for only three years.¹ [Hence] many “designers” who are well advised might accept the commercial life of their design is less than three years and so it is not worth registering in the first place. Without registration they have almost exactly the same protection automatically and without any cost. Thus, prior to 2003, a “commercially sensible” firm might have registered but, post-2003, the commercially sensible thing to do (in respect of most designs with short commercial lives) is to not register as the benefits of a registered design are not sufficiently greater than those for an unregistered design.

This fits well with our findings. Until the early 2000s, when there was a significant benefit to registering designs, well-managed, judicious firms were likely to have registered their valuable designs in the UK. With the introduction of Community Design registration in 2003, many switched away from the UK system to register in Europe, or chose not to register at all. Less commercially-oriented, less astute or just poorly advised firms continued to register in the UK, so that what was once a marker of well-managed firms became a marker of less well-informed and less well-managed firms. Meanwhile, over time, firms have learned that, for the most part, Community Design registration does not offer significant advantages over non-registration. Thus, holding registered Community Designs is no longer a sign that firms that are better managed. As a result, the productivity premium associated with registration has disappeared.

1 Meanwhile, to complicate matters further, unregistered design protection also exists in the UK. An unregistered UK Design Right gives an exclusive right to the design for 5 years and lasts for 10 years after the design is first marketed, up to an overall limit of 15 years from the creation of the design. (Source: IPO leaflet “Designs: Basic Facts”: <http://www.ipo.gov.uk/d-basicfacts.pdf>)

1.2 Introduction

The aim of intellectual property rights (IPRs) is to encourage creative and inventive activity by allowing the creator or inventor to protect their ideas - or the expression of their ideas - as property for a defined period of time. Once protected, the inventor has time-limited monopoly rights and is, in principle, able to prevent others from using their ideas (through litigation if necessary). He or she may also sell or license it to another party. Once the protection has lapsed, the idea becomes available to all, and anyone can use it. So, for example, the E-Type Jaguar was first introduced in 1961, some 50 years ago. Any design protection will now have lapsed, meaning that anyone can manufacture a replica E-type, although they would not be able to call it a Jaguar, or an E-Type, as both names are protected trade marks.²

Economists have paid a great deal of attention to IPRs and to patents (for inventions), in particular. There is also a substantial literature on the effectiveness of patenting as a means of both encouraging and protecting inventions: the question most often asked is whether patents encourage invention and enable the patent holder to appropriate the returns to invention? Other forms of intellectual property protection, including trade marks and copyright, have received less attention. The same is true of design rights, the focus of this report.

Designs are the visible appearance or physical form of a product or component.³ Normally, designs may be protected if they are novel – they are not identical to designs already made public, and if they have ‘individual character’ – such that an “informed user” would find it different from other designs which are already available to the public.

In the UK, designs can be protected by registering a design with the Intellectual Property Office (IPO), formerly the Patent Office. Unregistered design rights also exist. The complexity of the system is demonstrated in the IPO’s Design Economics Introduction (2011). One recent case which has reached the UK’s Supreme Court is a dispute relating to whether the Stormtrooper mask used in the *Star Wars* films (from 1977) is a work of art – and therefore protected under copyright (which continues), or merely functional, and therefore protectable under design rights (which have now lapsed). This David versus Goliath case pitched a British prop designer Andrew Ainsworth against Hollywood’s George Lucas and Lucasfilm.

The cost of registering a design in the UK is currently £60 (excluding any professional fees). This provides protection for five years.⁴ Escalating renewal fees are payable every five years – reaching £450 for protection after 20 years. No protection is available after

2 In December 2010 Jaguar filed Trade Mark 2566196 claiming rights over the name ‘E-type’. Note that this also assumes that Jaguar do not claim the E-Type is a “work of art” and thus protectable by copyright – see below for a brief discussion of the dispute pertaining to the *Star Wars* stormtroopers’ helmet.

3 More precisely, a design is “the appearance of the whole or a part of a product resulting from the features of, in particular, the lines, contours, colours, shape, texture and/or materials of the product itself and/or its ornamentation”.

4 Discounts are available for registering several designs at once (e.g., 100 design costs £4,060).

25 years. Unregistered design protection is more limited in scope (see the introduction to this report for details), is exclusive for five years,⁵ and lasts for ten years after the design is first marketed, or fifteen years from its creation, whichever is the earlier. UK design protection, registered or unregistered, only applies in the United Kingdom.

Since 2003, designs can also (or alternatively) be registered as a (European) Community Design with the European Union's Office for Harmonisation of the Internal Market (OHIM). The European Union (EU) also provides protection for unregistered designs. The cost of registering a single design with the OHIM is €350⁶ Renewal fees are payable every five years, and the right has a maximum life of 25 years. The European Union also provides more limited protection for unregistered community designs, which last three years after the design is made available to the public.

Neither designs registered with the IPO nor those registered with OHIM are examined for their novelty as happens with patents. Thus, designs registered in the UK and Europe are assumed to be novel (unless this is contested) rather than their novelty having been tested by independent examiners, who perform such a test on patents.

In this chapter, we analyse whether firms that hold one or more designs registered in the UK or Europe are more productive than firms that do not hold any registered designs.⁷ For this analysis, we do not know whether or not the firms without registered design rights actually had any potentially protectable designs (although presumably most did), nor do we know whether either group of firms held other protected intellectual property, such as patents, trade marks, or copyright.

5 After 5 years anyone is entitled to gain a licence from the design owner to make and sell products that copy the design.

6 Reduced fees are charged for second and subsequent designs. 100 costs €9125. These figure excludes the cost of any professional advice and associated fees that may be incurred.

7 We use labour productivity – sales per employee – as our measure.

1.3 Aims and Methods

The aim of this study is to assess the relationship between holding registered designs and business performance, looking at designs registered in the UK and in Europe. We are not able directly to examine the impact of holding unregistered designs.

Table 1. Firms' use of Innovation Protection: Evidence from UK Innovation Survey of 2009

	SMEs (10 – 249 employees)	Large Enterprises (250+ employees)	All Enterprises
Registered an industrial design	1%	3%	1%
Registered a trade mark	5%	10%	5%
Applied for a patent	3%	7%	3%
Produced copyrightable materials	6%	7%	6%

Source: Table 4 in Stephanie Robson and Martin Kenchatt (2010) 'First findings from the UK Innovation Survey 2009' Economic & Labour Market Review, 4.3, pp 28-35.⁸

Evaluating the relationship between holding registered designs and business performance presents some considerable empirical challenges. The first is related to the fact that registering designs is relatively rare across the economy. Indeed, registering designs is much less common than applying for patents or registering trade marks (See Table 1.1: Robson and Kenchatt, 2010).⁹

A second problem is related to the estimation of company performance, which is influenced by a very large number of factors. The available data simply does not allow us to take into account all these factors at once. Ultimately, what we can examine is whether holding registered designs is *associated with* superior (or even inferior performance); or, indeed, whether it makes no difference. What we cannot say with any certainty is that holding registered designs *causes* superior (or inferior) performance.

⁸ http://www.statistics.gov.uk/elmr/03_10/downloads/ELMR_Mar10_Robson.pdf

⁹ In 2009, the UK Innovation Survey – a large scale survey of firm in the UK, which asks about their innovation activities and investments - asked firms about their “protection of innovations” (Question 22). They were asked to report whether they had: applied for a patent; registered an industrial design; registered a trade mark; and/or produced materials eligible for copyright. Although in each case, only a “yes” or “no” answer is given, this question allows us to evaluate the extent of use of the registered design (and other forms of IP at the industrial level). Note the question did not ask whether the designs were registered in the UK or with the OHIM for Europe-wide protection.

To minimise these problems, we use a matched sample approach. Put simply, this approach takes each firm known to hold one or more registered designs and searches in a large dataset for another 'matched' firm with very similar characteristics. More specifically, we undertake our analysis in three steps. First, we identify the industrial sectors in which firms are most likely to register designs (see Table 1.2 for details). We focus our analysis on these particular sectors. Second, we match firms that hold registered designs to otherwise similar firms without registered designs. Finally, by using the matched sample, we can evaluate the difference in performance between the two sets of firms, and hence estimate the performance difference associated with holding registered designs.

1.3.1 Step 1: Identifying design intensive sectors

Before our econometric analysis of the productivity effects of holding registered designs, we first identify the industries where design registrations are most widely used. This evaluation used the 2009 UK Innovation Survey (UKIS-2009), a large scale survey of firms in the UK conducted by the Office for National Statistics (ONS) on behalf of the Department for Business Innovation and Skills (BIS).

Only 249 of the 11,693 firms that responded to UKIS-2009 indicated that they had registered an industrial design – 2.1 per cent.¹⁰ To evaluate the propensity to register designs, we calculate the proportion of the firms that had registered an industrial design, according to the standard industrial classification (SIC) of economic activities, at the 2-digit level. We identify as 'design-intensive' those sectors where more than five per cent of firms registered an industrial design. Table 2 presents these sectors, and the proportion of firms registering one or more industrial designs.

The sectors identified are largely unsurprising. They include office equipment and computers; electronics; machinery and instrumentation. They also include rubber and plastic products, and other non-metallic mineral products, such as products made from glass, ceramics, concrete, plaster or cement. Also present are Research and Development (R&D) enterprises, and chemicals and chemical product firms. Whilst design rights will not protect the chemicals themselves, they can be used to protect the packaging in which chemicals are contained. Interestingly, this process did not identify any clothing or furniture industries, where design registration could protect fashionable goods.

¹⁰ The total number of observations in the UKIS of 2009 is 14,281, but of these there are 2588 that did not provide answers to this question. The analysis is therefore based on the 11,693 firms.

Table 2. Design-Intensive Sectors: Evidence from UKIS 2009

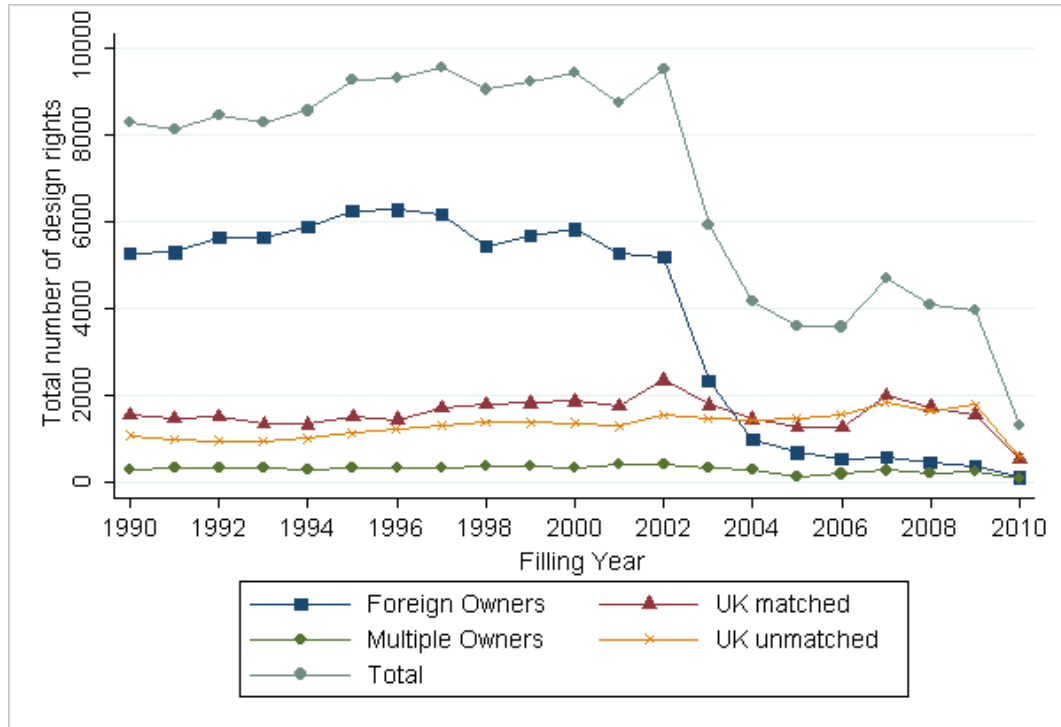
UK SIC Code (2003)	Description	% of Firms Registering an Industrial Design
30	Manufacture of Office Machinery and Computers	13.6 %
32	Manufacture of Radio, television and communication equipment and app.	9.7 %
29	Manufacture of Machinery and equipment n.e.c.	9.1 %
24	Manufacture of chemicals and chemical products	8.8 %
33	Manufacture of Medical, precision and optical instruments, watches and clocks	8.4 %
25	Manufacture of rubber and plastic products	8.1 %
73	Research and Development	7.8 %
26	Manufacture of other non-metallic mineral products	5.3 %

Source: Authors' calculation from ONS Data

1.3.2 Step 2: Developing a Dataset and Matching Firms With and Without Registered Designs

Having identified the 'design-intensive' sectors in which firms are the most likely to register designs, we then develop a sample of firms which held one or more 'live' registered designs. For designs registered in the UK, the IPO has a dataset of all the designs registered between 1975 and 2010, which identifies the names of the design owners. At the request of the IPO, the Office for National Statistics (ONS) 'matched' the names of these owners to the names of enterprises held on their register of businesses. For example, the IPO's dataset includes designs registered to Dyson Appliances. The ONS's register of businesses includes Dyson Appliances Ltd. By matching these records, we created a new, combined dataset which – with further record matching – included information about both the number of live design rights held by a company and its other characteristics, such as its sales and employment in any given year.

Figure 1.1 Total number of designs registered in the UK by type of owner



Source: Authors' calculation from IPO and ONS Data

This exercise reveals that the largest share of IPO-registered designs is owned by foreign enterprises and individuals from outside the UK (See the blue 'Foreign Owners' line in Figure 1.1). At least, this was the case until 2003, when the European design registration system became available. The second largest share (until 2003) was registered designs which could be matched to UK-based businesses in the ONS's business register (See the red 'UK matched' line in Figure 1.1). A third group (almost as large as the second) is comprised of designs known to belong to UK based owners, but the records for which could not be matched to any firm on the ONS's business register¹¹ (See the orange 'UK unmatched' line in Figure 1.1). The great majority of these designs were probably held by individuals or very small businesses for which the ONS does not maintain records. The final and smallest group of registered designs are identified as having belonged to more than one owner – these are designs where the ownership has been transferred over time, possibly because the design itself has been sold, or because the original owner has been acquired by another business.

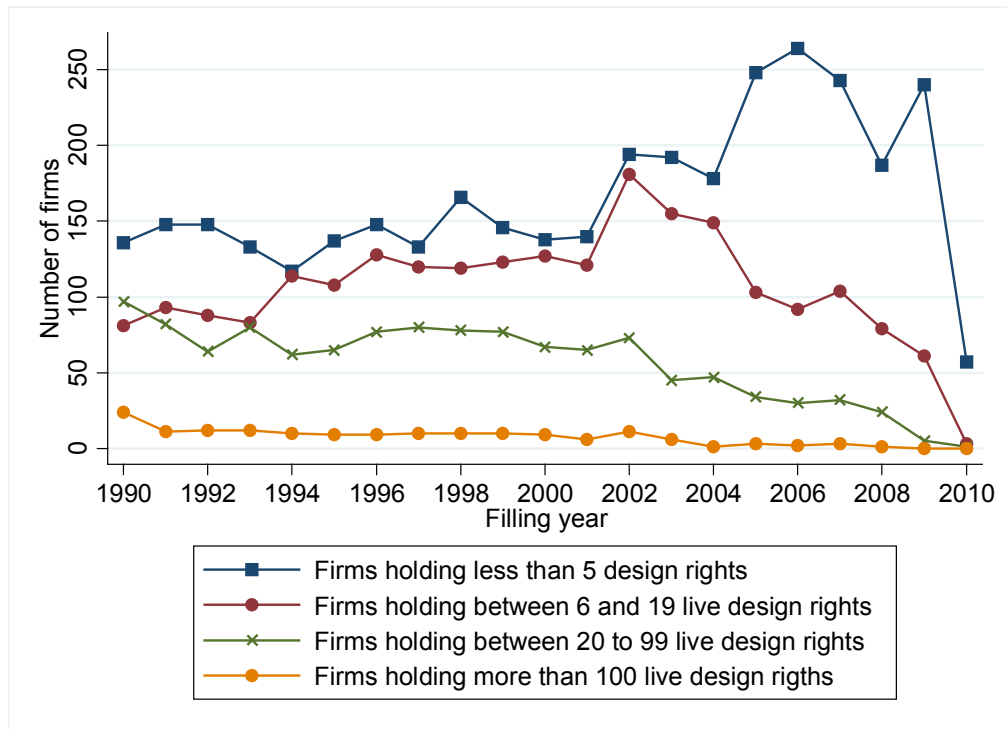
11 i.e., the Government's inter-departmental business register (IDBR)

To keep things simple, we conducted our analysis on the 'UK matched' sample of firms that held one or more registered designs that were 'live' over the period 1997 to 2009. The total number of 'UK matched' firms is 9,367, and over the whole period these firms held a total of 42,396 registered designs. Although this provides a mean number of registered designs per firm of around four, more than half (55 per cent) of these firms only ever held one registered design, whilst a minority (17 per cent) held more than five.

As mentioned in the introduction, registered designs are initially protected for five years, and the protection can be renewed every five years (for an escalating fee) up to four times the original, providing a maximum life of 25 years. If we take 1975-1985 as a benchmark (as there is no truncation problem for this period), we see that 20 per cent of the registered designs are protected for only five years, 28 per cent are protected for ten years, and 51 per cent for fifteen years, but none are maintained for more than twenty years. In fact, over the whole period, many of the rights were not renewed after the initial five years, and very few are maintained for the full 25 years. The share of five-year registrations is 58 per cent in 1995, 59 per cent in 2000, and 73 per cent in 2005, indicating that the average lifespan of designs is shortening.¹² As the aim of this study is to assess the impact of holding a 'live' registered design on a firm's performance, we need to identify what live registered designs firms had at particular points in time (and indeed the number of registered designs in their portfolio). Figure 1.2 shows the number of firms with various portfolio sizes of live design rights in each year. The average number of live registered designs increases over time, until 2003, after which it begins to decline. This decline appears to be associated with fewer firms holding large portfolios, perhaps because UK-based firms began switching to European Community Designs.

12 The share of twice renewed designs (i.e., those with 15 years of protection) has declined from 8% in 1995 to 6% in 2000

Figure 1.2. Number of live UK-IPO registered designs held in each year by 'UK Matched' firms



Source: Authors' calculation from IPO and ONS Data

We identify firms in the design-intensive sectors that held one or more 'live' UK IPO registered designs in 1997, 2002 and 2007. We also calculate the size of each firm's portfolio of live registered designs in each of these years.

Table 3- Distribution of Number of Live Designs

Year	Firms holding between:				Total
	1 to 2 live design rights	3 to 5 live design rights	6 to 20 live design rights	More than 20 live design rights	
1997	21	112	120	90	343
2002	26	168	181	86	461
2007	18	225	104	44	391
Total	65	405	405	220	

Source: Authors' calculation from IPO and ONS Data

Having identified firms active in the 'design-intensive sectors' with at least one 'live' registered design, we next add more information on these firms, including their employment size, age, sales and industrial activity.¹³ To this end, we extract information from the ONS's Business Structures Database (ONS-BSD), a version of the Inter-Departmental Business Register (IDBR) which contains information on company demographics (birth, death, ownership, and size in terms of sales and employment). The firms holding live registered designs represent a very small proportion of all the firms on the ONS-BSD dataset. However, they are not necessarily a representative sample of firms in this dataset (just as people living in any one location in the UK, such as Kensington and Chelsea, or Moss side in Manchester, are not necessarily a representative sample of people living in the country as a whole).

13 The IPO's records on the owners of registered designs were matched by the ONS to the names of firms recorded in the Government's inter-departmental business register (IDBR). The addition of further business information to these records was undertaken by the project team working within the ONS's micro data laboratory and using ONS data sources.

We therefore have to ‘control for’ the differences between firms that held live registered designs and other firms. To do this, we pair (for 1997, 2002 and 2007) each firm with at least one live registered design to its ‘nearest neighbour’, another firm, most similar in size (number of employees), age (years since being established) and industrial activity (using the Standard Industrial Classification).¹⁴

This provides us with two sets of firms: the ‘treatment group’ with one or more live registered designs, and a ‘control group’. Figures 1.3 shows the kernel density estimations of firm size by employment, before and after matching. Before applying the matching procedure, the distributions were very different; after matching, the two groups are very similar.

14 Matched or paired samples and matching estimators are often used to assess the impact of a policy tool (or “treatment”), such as R&D subsidies. They are also used in medical research. The idea is to investigate the question: “How would a treated firm with given characteristics have performed if it had not been treated?”; where the treatment is the particular policy tool to be analyzed (Heckman et al., 1998). In this study, we do not use the matching estimator to evaluate a policy measure, but rather to compare the difference in performance between firms that have registered one or more designs and firms that have not, based on their observable characteristics (Criscuolo et al., 2009; Czarnitzki, 2005). A significant advantage of this technique is that it does not require the specification of any functional form or a selection mechanism (Aerts and Czarnitzki, 2004). There are different approaches to matching, including nearest neighbour and propensity score matching. For this analysis, we used nearest neighbour matching rather than propensity score matching because the number of firms that have registered an industrial design is very small relative to the number without registered designs (Criscuolo et al., 2009). Although the propensity score matching method is simpler to estimate, no clear advantage of one method over the other has been found in the literature (Heckman et al., 1998). To implement nearest neighbour matching, we first have to identify the firms that we’d like to match (i.e. the members of treatment group) and then chose the vector of covariates (that is the set of characteristics) that will be used to match this set of firms to another group of otherwise similar firms. This set of characteristics is limited to the set for which there is information available. For example, in our case, it may have been interesting to match firms not only on whether they held design rights, but also on whether or not they held patents. However, this information was not available to us. Other information, such as the number of potentially registerable designs was also not available.

Figure 1.3a. Distribution of Firm Sales Before and After Matching

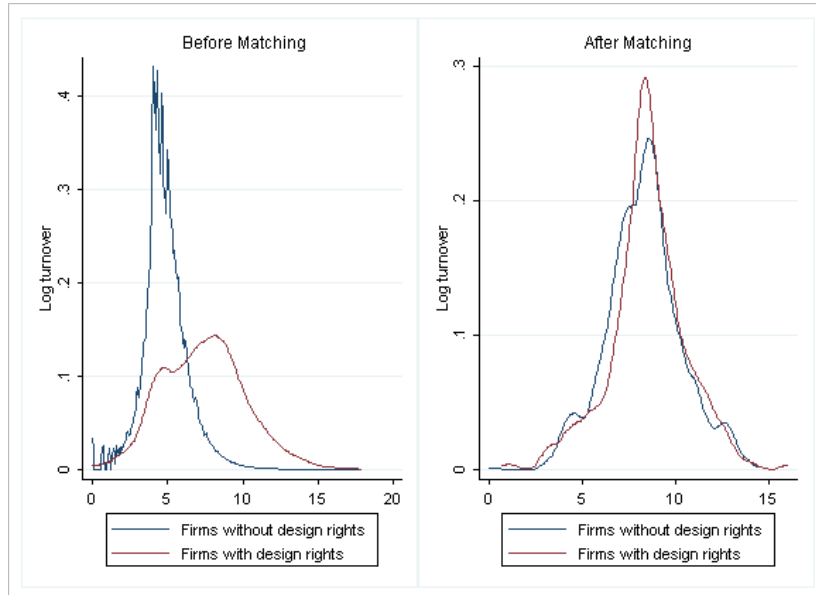
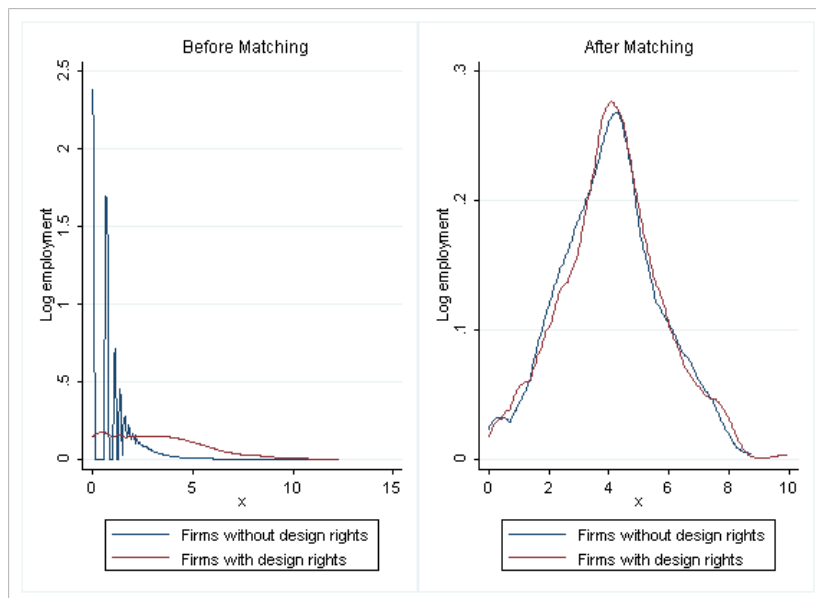


Figure 1.3b. Distribution of Firm Size Before and After Matching



Source: Authors' calculation from ONS Data

We have described how we constructed a sample of firms with UK IPO-registered designs and a comparison sample of similar firms. We used the same procedure with the records obtained on European registrations (from 2003 onwards) with the Office of Harmonisation for the Internal Market (OHIM). These data were provided by OHIM to the IPO, who asked the ONS to match these to records on UK businesses.

Figure 1.4a Distribution of Firms by Sales Before & After Matching (OHIM)

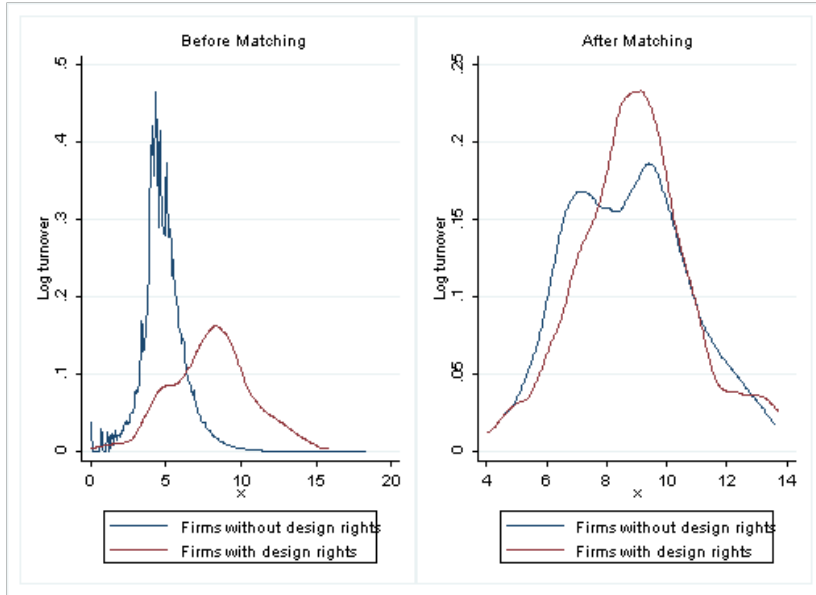
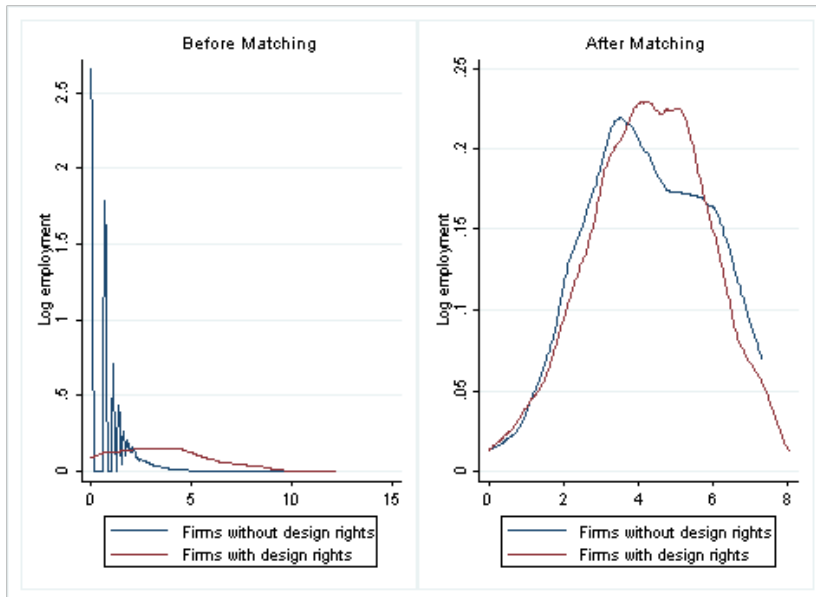


Figure 1.4b – Distribution of Firms by Size Before & After Matching (OHIM)



Source: Authors' calculation from ONS Data

Next, we construct a sample of firms active in the 'design-intensive' sectors that held one or more 'live' European registered designs.¹⁵ We focus particularly on UK-based firms with one or more 'live' registered designs in 2004 and 2007, and pair them to otherwise similar UK-based firms without live European registered designs in those years. Finally, we again add additional information to both the 'treatment' and 'control groups', such as their size, age and ownership, drawing on the ONS's Business Structures Dataset.

Figure 1.4 shows the size distribution of firms before and after this pairing procedure. As before, the profile of firms with registered European design rights is initially dissimilar to the profile of all UK firms. After pairing, the profile becomes very similar, allowing us to examine more accurately the performance impact associated with holding registered designs.

15 And indeed calculated the size of their 'live' portfolio of live European registered designs

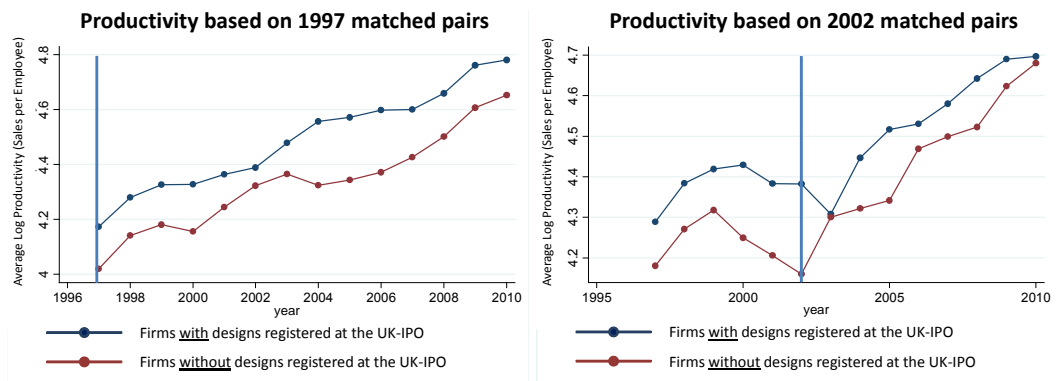
1.4. Analysis

1.4.1 Part 1: UK-IPO registered Designs

Having constructed our datasets, we can now evaluate the impact on company performance associated with holding one or more ‘live’ design registrations. We examine this for the ‘base year’ and the subsequent years.

Figure 1.5 shows the productivity levels for the 1997 cohort, comparing the average sales per employee achieved by the firms with one or more live IPO-registered designs in 1997 with the ‘control group’ of firms without live IPO-registered designs. We can see that firms with live registered designs always outperform the group without; that is, they consistently achieve higher sales per employee. Moreover, the performance difference between two groups is reasonably consistent over time, only narrowing somewhat around 2002, before widening again in the mid 2000s. This provides preliminary evidence that holding live UK IPO registered designs in the late 1990s is associated with superior performance, not only in the late 1990s, but through the 2000s.

Figure 1.5: Productivity and Holding UK IPO-registered Designs



Source: Own analysis on the basis of ONS data

Whilst the matching ensures that each firm with one or more live UK IPO-registered designs is matched to another, similar firm, characteristics are not identical. To ‘control out’ the remaining differences in the observed characteristics,¹⁶ we pool the two samples and estimated productivity (strictly the natural log of productivity) for the base year (1997, 2002 and 2007), plus the three subsequent years (e.g., for the 1997 cohort, 1998, 1999 and 2000). We included an indicator (or ‘dummy’) variable which is coded 1 for firms with one or more live registered designs and 0 for firms without these. The full regression

16 We “control for” firm employment size, firm age, and the sectoral specialization (at 2-digit level). We also “control for” location by regions, although the details of this are not reported in the regressions because we never found any significant effect of location on performance. To “control for” means allowing the regressions to take account for differences that can be attributed to these characteristics.

results, which were estimated by Ordinary Least Squares (OLS), are provided in the appendix to this report. As a caveat, we note the explanatory power of these models is generally quite low – the variables included in the model tend to ‘explain’ only a small proportion of the total variation in the productivity data.

The variable of interest is whether or not the firm had one or more live registered design in the base year. For the estimation based on 1997, we find the coefficient on this variable is always positive, and that for 1997, 1998 (BY+1) and 2000 (BY+3) it is sufficiently above zero for us to be confident at the 90 per cent level¹⁷ (and in the case of 2000, at the 95 per cent level¹⁸) that there was indeed a performance premium associated with holding registered designs in those years. For 1999, whilst positive, the difference is insufficient to achieve the conventionally used 90 per cent confidence limit; so, following convention, we would say that for that year there is no significant performance difference.¹⁹ Also notable is the magnitude of these effects – for 1997, there is an average performance premium (all else being equal) of holding registered design rights of 17 per cent, for 1998 this is 18 per cent, whilst for 2000 it is a very substantial 28 per cent. Overall, taking a simple average of these premiums over the four years provides a substantial estimated premium of nearly 19 per cent.

17 In other words, there is a less than one-in-ten chance that this difference is due to chance.

18 i.e., there is less than a one in twenty chance that this difference is due to chance.

19 In other words, we cannot be very confident that the difference is not due to chance.

Table 4: Summary of Productivity Differences associated with holding UK IPO-registered designs

Base Year		Base Year	Base Year + 1	Base Year + 2	Base Year + 3
1997	Lower 95% confidence interval	-2%	-1%	-6%	5%
	Estimated mean difference	17%*	18%*	12%	28%**
	Upper 95% confidence interval	39%	40%	34%	56%
	Portfolio size effect	Yes*	No	No	Yes*
2002	Lower 95% confidence interval	4%	-21%	1%	-6%
	Estimated mean difference	25%**	-3%	25%**	14%
	Upper 95% confidence interval	49%	17%	55%	39%
	Portfolio size effect	No	No	No	No
2007	Lower 95% confidence interval	-24%	-32%	-30%	-26%
	Estimated mean difference	-11%	-19%**	-14%	-8%
	Upper 95% confidence interval	5%	-3%	4%	14%
	Portfolio size effect	no	no	no	no

* indicates statistically significant at 10%, ** significant at 5%, *** significant at 1%. Source:ONS

The results for the 2002 cohort of firms holding and not-holding UK IPO- registered designs are similar to those for 1997. Here, we find that holding one or more registered designs is associated with superior performance within the 95 per cent confidence interval for both 2002 (the base year) and 2004 (BY+2). There is no performance premium in 2003 (BY+1), whilst for 2004 (BY+3) the effect is positive, but not sufficiently large for us to be confident that it is significantly different from zero. Extrapolating the results, we find an average performance premium associated with holding UK IPO-registered designs of 25 per cent in 2002 and 2004, or an average of around 15 per cent across the four years.

Different results are found for the study based on 2007. Here, we find a consistent negative effect on productivity of holding UK IPO-registered designs, indicating that firms that held designs in the late 2000s achieved lower sales per employee on average than firms without IPO-registered designs. In each year except 2008 (BY+1), the size of this effect is not sufficiently large to be confident that it is significantly different from zero. For 2008, it is sufficiently large to conclude that there is a negative effect (to the tune of an average underperformance of 19 per cent). Taking the four years together, the average underperformance of firms with IPO-registered designs relative to those without is 13 per cent.

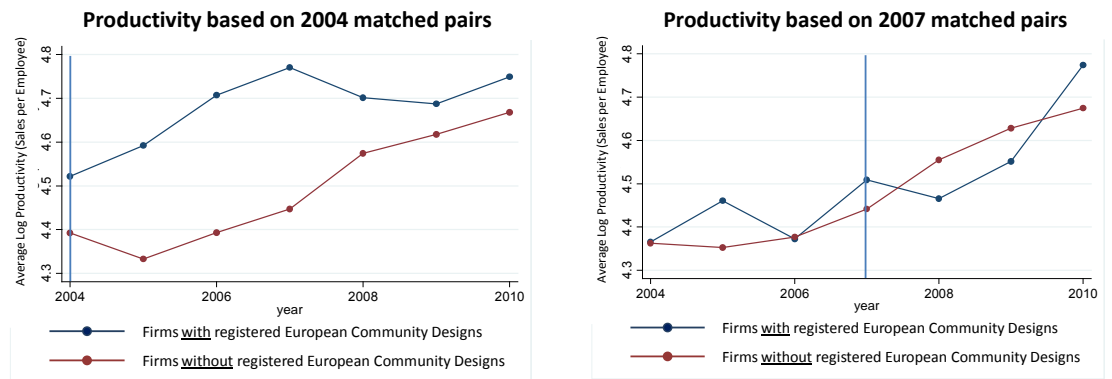
In addition to examining whether or not the possession of IPO-registered designs is associated with differentials in productivity, we also examine whether the number of registered designs had an impact on performance. We find a weak (significant at the ten

per cent level) positive portfolio size effect only for 1997 and 2000 (i.e., $BY_{1997} + 3$). For all other years, the number of designs held in the portfolio do not have a significant impact on productivity.

1.4.2 Part 2: Designs Registered in Europe with the OHIM

Repeating this exercise for designs registered in Europe after 2003, Figure 1.6 shows the average productivity levels achieved by firms with and without live design registrations in 2004, over the period from 2004 to 2010. This shows that, on average, the firms with live registered designs achieve higher sales per employee than those without. Moreover, the gap widens in the mid-2000s before narrowing considerably in the late 2000s. At no point is the average performance of the firms with designs registered in Europe below those without EU-registered designs.

Figure 1.6: Productivity and Holding European Registered Designs



Source: Own analysis based on the ONS Data

Using regressions to control out differences in firm size, age, sector of activity and geographic location, we can again examine the extent to which holding one or more EU-registered Community Design is associated with differences in performance.

Taking 2004 as the base year, we find the effect of holding registered European designs to be positive in three of the four years between 2004 and 2007. However only in 2006 is it sufficiently large to be considered significantly different from zero (at the 95 per cent confidence level); for all the other years, we cannot reject the possibility that the difference is due to chance, and hence there is no performance premium associated with holding live European registered design.²⁰ Taking a simple average of these effects suggests a premium of around 19 per cent, rather similar to that found for designs registered with the UK IPO in 1997. In separate regressions, we find that, although the effect of portfolio size is usually positive, it is not significantly different from zero, and hence we cannot say that

²⁰ A note of caution here is that these results are based on a rather small dataset, which becomes smaller as years pass from the base year.

a larger portfolio of EU registered designs has a significant impact on business performance (as measured by sales per employee).

Table 5: Summary of Productivity Differences associated with European Registered Designs

Base Year		Base Year	Base Year + 1	Base Year + 2	Base Year + 3
2004	Lower 95% confidence interval	-10%	-12%	3%	-36%
	Estimated mean difference	15%	18%	47%**	-2%
	Upper 95% confidence interval	49%	58%	109%	52%
	Portfolio size effect	No	No	No	No
2007	Lower 95% confidence interval	-17%	-20%	-15%	-39%
	Estimated mean difference	7%	7%	16%	-15%
	Upper 95% confidence interval	38%	43%	59%	19%
	Portfolio size effect	No	No	No	No

* indicates statistically significant at 10%, ** significant at 5%, *** significant at 1%.
Source:ONS

Finally, taking 2007 as the base year, we find that, in three of the four years, the effect of holding European registered designs is positive, but all of these coefficients are small and none is significantly different from zero at the level of 90 per cent confidence or higher. This indicates that, by 2007, there is no performance premium associated with holding Community Designs registered in Europe. Again, separate regressions indicate the size of a firm's portfolio of EU registered designs had no significant bearing on its performance.

1.4.3 Part 3: Firms with registered designs in both the UK IPO and OHIM

Finally, in order to analyse whether firms have switched from registering with the UK-IPO to registering in Europe with OHIM, we match the two databases. Over 936 enterprises appear in both datasets. Of these, 67 per cent switch from UK IPO to OHIM to register their designs, whilst 24 per cent register with both the UK IPO and OHIM between 2003 and 2010.

To evaluate the productivity effects associated with these "switching" firms, we identify those firms in the 2002 cohort that later applied to register their designs at OHIM. Table 5 presents the results of the productivity estimations where we identify firms that have applied to register designs in both the UK and Europe. We have information on only 50 firms, but we find that the firms that later switched to register their design rights with OHIM are indeed substantially more productive. This effect is positive in the whole of the 2002-2005 period. Furthermore, in 2002 and 2003, the effect is large enough that we can be confident that there is less than a one-in-a-hundred chance that it is due to chance.

Note, however, that the performance premium associated with holding UK design rights in 2002 and 2004 remains significant. This suggests that some of the most highly productive firms did indeed switch away to registering their designs in Europe, but it also suggests this is not the full story behind the disappearance of the productivity premium associated with holding designs registered in the UK. Another possibility is that firms increasingly realised that they could obtain most of the benefits, particularly with short-life designs, through unregistered European Community Designs.

Table 6: Productivity effects for firms that have registered their designs both at OPI and at OHIM

	Productivity 2002 b/se	Productivity 2003 b/se	Productivity 2004 b/se	Productivity 2005 b/se
Hold a live UK. Design	0.205**	-0.0156	0.181*	0.0730
Implied average premium	23%	-2%	20%	8%
Later registered with OHIM	0.423***	0.327**	0.188	0.113
Implied average premium	53%	39%	21%	12%
N	293	240	227	212
R-Squared	0.21	0.18	0.20	0.21

Firm size, sector and age are controlled for but these coefficients are not reported.
Source:ONS

1.5. Conclusion

The aim of this paper is to examine whether there is any performance impact associated with holding UK and/or EU registered designs. We find the following:

- There was a performance benefit (measured as sales per employee) associated with holding designs registered with the UK's Patent Office, now Intellectual Property Office (IPO), in the late 1990s and early 2000s. The magnitude of this effect was also a substantial 19 per cent over the four years between 1997 and 2001, whilst it was slightly lower, at around 15 per cent, between 2002 and 2006.
- There was also a more limited performance premium associated with holding designs registered in Europe as Community Designs in the mid-2000s. However, only in 2006 was the size of the performance premium sufficiently large to be considered statistically different from zero. Over the four years between 2002 and 2006 the performance premium averaged 19 per cent.
- We find no performance benefit associated with holding designs registered in Europe from 2007 to 2010.
- We also find that holding designs registered with the UK IPO in the late 2000s was associated with lower sales per employee than otherwise similar firms. Although in only one of the four years between 2007 and 2010 was the effect statistically significant, taking the four years together, holding UK-IPO registered design rights is associated with an underperformance of around 13 per cent in sales per employee.

We stress that this study has *associated* performance differences between firms with and without designs registered in the UK and Europe. This is very different from saying that these differences are *caused by* holding registered designs. Whilst it is possible that holding registered designs may have had some direct impact on the observed performance differences, particularly if firms holding these rights were able to sell or license them for substantial fees, we believe that the results should be interpreted much more cautiously.

Rather than registered designs directly causing differences in performance, it seems more likely that holding registered designs is symptomatic of other behaviours that are themselves the underlying cause of the difference in performance. For instance, firms registering designs may be manufacturers of better quality, longer-life products. Registering designs allows the firm to protect its ideas beyond three years, which is the duration of protection available to firm through unregistered European Community Designs. Firms with registered designs are probably also more likely to hold patents or trade marks, whereas those without registered designs are less likely to do so. In principle, we could control for this by incorporating into our dataset other intellectual property (IP) indicators, though it would be difficult in practice, which could diminish the observed effect of holding registered designs.

Holding registered designs may also reflect other, very difficult to observe differences between firms. For instance, those that register designs may have a better approach to managing design, innovation or the business as a whole.

Interesting also is the changing landscape of design protection in the UK and Europe. Before 2001 (and the implementation of the European Design Directive), the difference between registered and unregistered design protection in the UK was substantial. After 2001, the gap diminished considerably, and it was further reduced after 2003 when the registration of European Community Designs became available, offering similar protection to registration with the IPO in the UK, but across the whole of the EU (albeit for a higher fee). As one expert informed us:

The only advantages of registration in the UK (under the 1949 Act) or the Community Design Register over an unregistered Community Design are that there is no need to prove copying and that the term can be extended to 25 years (by paying renewal fees) whereas unregistered Community Designs last for only three years. [Hence] many “designers” who are well advised might accept the commercial life of their design is less than three to five years and so it is not worth registering in the first place. Without registration they have almost exactly the same protection automatically and without any cost. Thus, prior to 2003, a “commercially sensible” firm might have registered, but post 2003 the commercially sensible thing to do (in respect of most designs with short lives) is to not register as the benefits of a registered Community Design are not sufficiently greater than those for an unregistered Community Design.

This fits well with our findings. Until the early 2000s there was a benefit to registering designs in the UK and well-managed, judicious firms were likely to have registered their commercially valuable designs with the UK IPO. With the introduction of Community Design registration in 2003, we suspect that many switched away from the UK to register in Europe, or indeed chose not to register at all. Indeed, in further analysis we found some evidence that amongst the firms that held UK-registered designs in 2002, the firms that later switched to registering designs in Europe were even more productive than the typical firm holding UK-registered designs. This indicates that the most productive firms may have switched their registration to Europe. Meanwhile, other perhaps less commercially astute firms have continued to register in the UK, so that what was previously a marker of well-managed firms became instead a marker of less well-informed or less commercially-oriented firms. Meanwhile, over time, firms have learned that for the most part Community Design registration does not offer significant advantages over non-registration, and so more leave their designs unregistered. The result is that holding registered Community Designs is no longer a marker for firms that are better managed and thus the productivity premium associated with registering designs in Europe has disappeared.

Ultimately, this suggests that the UK Government and IPO may need to reconsider the purpose and positioning of the UK's own design registration system.²¹ We understand that the UK is obliged to maintain a national register of designs outwith the European register, so abolition is not an option. One option would be to examine whether the rights associated with registering designs in the UK can be substantially enhanced so as to increase the benefits of registered over unregistered designs (perhaps for a substantially higher fee than the current registration fee of £60). A detailed discussion of these matters is beyond the scope of this study.

21 The European authorities may also wish to examine whether there are sufficient benefit to registration. This does not necessarily imply enhancing the benefits of registration by reducing the protection afforded to unregistered designs. Again, a full consideration of these matters is beyond the scope of this report.

Appendix 2A : Full Regression Results

Table 7: Productivity estimates. UK Registered Designs, 1997 Cohort

	Baseline (1997)	Productivity at 1997	Productivity at 1998	Productivity at 1999	Productivity at 2000
	b/se	b/se	b/se	b/se	b/se
Size	0.0391 (0.03)	0.0389 (0.03)	0.0760** (0.04)	0.122*** (0.04)	0.0650 (0.04)
Age	0.0256 (0.04)	0.0268 (0.04)	-0.0177 (0.04)	-0.0145 (0.04)	-0.0219 (0.05)
Age squared	-0.0009 (0.00)	-0.0009 (0.00)	0.0004 (0.00)	-0.0001 (0.00)	0.0003 (0.00)
Sector:25	-0.360** (0.18)	-0.360** (0.18)	-0.192 (0.19)	-0.545*** (0.18)	-0.656*** (0.19)
Sector:26	-0.807*** (0.22)	-0.806*** (0.22)	-0.733*** (0.25)	-0.973*** (0.25)	-1.169*** (0.27)
Sector:29	-0.429** (0.19)	-0.435** (0.19)	-0.161 (0.20)	-0.532*** (0.20)	-0.729*** (0.21)
Sector:30	-0.0707 (0.28)	-0.0781 (0.28)	0.167 (0.27)	-0.0312 (0.26)	-0.0082 (0.28)
Sector:32	-0.368 (0.31)	-0.368 (0.31)	-0.104 (0.30)	-0.199 (0.28)	-0.789** (0.31)
Sector:33	-0.437* (0.23)	-0.437* (0.23)	-0.382 (0.25)	-0.508** (0.23)	-0.638** (0.26)
Sector:73	0.162 (0.42)	0.165 (0.42)	-0.0802 (0.45)	-1.593*** (0.42)	-0.212 (0.52)
Hold a live reg. Design		0.153* (0.09)	0.162* (0.09)	0.115 (0.09)	0.247** (0.10)
Constant	4.162*** (0.33)	4.077*** (0.34)	4.332*** (0.36)	4.552*** (0.36)	4.888*** (0.43)
N	284	284	221	204	183
R-Squared	0.08	0.09	0.12	0.22	0.21

Source: ONS

Table 8: Productivity and the stock of UK registered designs; 1997 Cohort

	Baseline	Productivity	Productivity	Productivity	Productivity
	1997	at 1997	at 1998	at 1999	at 2000
	b/se	b/se	b/se	b/se	b/se
Size	0.0391	0.0286	0.0689*	0.109***	0.0513
	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)
Age	0.0256	0.0226	-0.0205	-0.0228	-0.0307
	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)
Age squared	-0.000857	-0.000727	0.000499	0.000246	0.000612
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Sector:25	-0.360**	-0.372**	-0.216	-0.572***	-0.705***
	(0.18)	(0.18)	(0.19)	(0.18)	(0.19)
Sector:26	-0.807***	-0.847***	-0.761***	-1.033***	-1.176***
	(0.22)	(0.22)	(0.25)	(0.25)	(0.27)
Sector:29	-0.429**	-0.434**	-0.182	-0.557***	-0.749***
	(0.19)	(0.19)	(0.20)	(0.20)	(0.21)
Sector:30	-0.0707	-0.0767	0.157	-0.0437	-0.0405
	(0.28)	(0.28)	(0.27)	(0.26)	(0.28)
Sector:32	-0.368	-0.372	-0.119	-0.220	-0.805**
	(0.31)	(0.31)	(0.30)	(0.28)	(0.31)
Sector:33	-0.437*	-0.451*	-0.379	-0.510**	-0.629**
	(0.23)	(0.23)	(0.25)	(0.23)	(0.26)
Sector:73	0.162	0.158	-0.0768	-1.615***	-0.155
	(0.42)	(0.42)	(0.45)	(0.42)	(0.53)
Stock of designs		0.000327*	0.000231	0.000221	0.000443*
		(0.00)	(0.00)	(0.00)	(0.00)
Constant	4.162***	4.207***	4.465***	4.727***	5.147***
	(0.33)	(0.33)	(0.36)	(0.35)	(0.43)
N	284	284	221	204	183
R-Squared	0.08	0.09	0.11	0.22	0.19

Source: ONS

Table 9: Productivity Estimates, UK Registered Designs, 2002 Cohort

	Baseline 2002	Productivity 2002	Productivity 2003	Productivity 2004	Productivity 2005
Size	0.116***	0.117***	0.0680*	0.120***	0.126***
	(0.04)	(0.03)	(0.04)	(0.04)	(0.04)
Age	0.0266	0.0278	0.0452	0.0702	0.0362
	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)
Age squared	-0.00102	-0.00104	-0.00137	-0.00190*	-0.00116
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Sector:25	-0.295*	-0.288*	-0.274	-0.284	-0.526***
	(0.17)	(0.17)	(0.19)	(0.20)	(0.17)
Sector:26	-0.521**	-0.504**	-0.467**	-0.412*	-0.778***
	(0.20)	(0.20)	(0.23)	(0.23)	(0.21)
Sector:29	-0.238	-0.226	-0.196	-0.296	-0.435**
	(0.17)	(0.17)	(0.19)	(0.20)	(0.18)
Sector:30	0.104	0.130			
	(0.61)	(0.60)			
Sector:32	0.172	0.183	0.166	-0.0340	-0.0344
	(0.26)	(0.25)	(0.28)	(0.28)	(0.27)
Sector:33	-0.238	-0.231	-0.242	-0.383*	-0.360*
	(0.20)	(0.20)	(0.22)	(0.23)	(0.20)
Sector:73	-0.804***	-0.789***	-1.801***	-0.988***	-1.526***
	(0.29)	(0.29)	(0.32)	(0.35)	(0.31)
Hold a live reg. design		0.220**	-0.0348	0.222**	0.131
		(0.09)	(0.10)	(0.11)	(0.10)
Constant	4.016***	3.877***	4.204***	3.573***	4.086***
	(0.33)	(0.33)	(0.38)	(0.41)	(0.35)
N	293	293	240	227	212
R-Squared	0.10	0.12	0.17	0.13	0.22

Source: ONS

Table 10: Productivity & the stock of UK registered designs, 2002 Cohort

	Baseline 2002	Productivity 2002	Productivity 2003	Productivity 2004	Productivity 2005
	b/se	b/se	b/se	b/se	b/se
Size	0.116***	0.105***	0.0684*	0.113***	0.112***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Age	0.0266	0.0322	0.0449	0.0782*	0.0468
	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)
Age squared	-0.00102	-0.00113	-0.00136	-0.00209*	-0.00139
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Sector:25	-0.295*	-0.291*	-0.272	-0.313	-0.539***
	(0.17)	(0.17)	(0.19)	(0.20)	(0.17)
Sector:26	-0.521**	-0.510**	-0.461**	-0.436*	-0.780***
	(0.20)	(0.20)	(0.23)	(0.24)	(0.21)
Sector:29	-0.238	-0.222	-0.195	-0.312	-0.428**
	(0.17)	(0.18)	(0.19)	(0.20)	(0.18)
Sector:30	0.104	0.124			
	(0.61)	(0.61)			
Sector:32	0.172	0.201	0.165	-0.0364	0.00740
	(0.26)	(0.26)	(0.28)	(0.29)	(0.27)
Sector:33	-0.238	-0.228	-0.239	-0.405*	-0.360*
	(0.20)	(0.20)	(0.22)	(0.23)	(0.20)
Sector:73	-0.804***	-0.774***	-1.799***	-1.015***	-1.485***
	(0.29)	(0.29)	(0.32)	(0.36)	(0.31)
Stock of Designs		0.000165	-0.00000157	0.0000668	0.000168
		(0.00)	(0.00)	(0.00)	(0.00)
Constant	4.016***	3.980***	4.186***	3.660***	4.089***
	(0.33)	(0.33)	(0.38)	(0.41)	(0.35)
N	293	293	240	227	212
R-Squared	0.10	0.10	0.17	0.11	0.22

Source: ONS

Table 11: Productivity – 2007 Cohort

	Baseline 2007	Productivity 2007	Productivity 2008	Productivity 2009	Productivity 2010
Size	0.148***	0.146***	0.153***	0.122***	0.160***
	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)
Age	-0.0135	-0.0135	0.0306	0.00958	0.0335
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
Age squared	0.000245	0.000246	-0.000807	-0.000398	-0.00107
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Sector:25	-0.419**	-0.421**	-0.416**	-0.331	-0.411*
	(0.17)	(0.17)	(0.17)	(0.20)	(0.22)
Sector:26	-0.609**	-0.616**	-0.740***	-0.532*	-0.529*
	(0.24)	(0.24)	(0.25)	(0.29)	(0.30)
Sector:29	-0.373**	-0.377**	-0.375**	-0.362*	-0.488**
	(0.17)	(0.17)	(0.17)	(0.21)	(0.22)
Sector:30	0.0996	0.104	-0.410	-0.0119	-0.0531
	(0.29)	(0.29)	(0.30)	(0.34)	(0.37)
Sector:32	-0.424**	-0.429**	-0.415**	-0.391*	-0.373
	(0.18)	(0.18)	(0.19)	(0.22)	(0.24)
Sector:33	-0.731***	-0.729***	-1.254***	-0.590**	-1.181***
	(0.24)	(0.24)	(0.25)	(0.29)	(0.31)
Hold a live reg. Design		-0.112	-0.205**	-0.155	-0.0870
		(0.08)	(0.09)	(0.10)	(0.11)
Constant	4.405***	4.478***	4.123***	4.450***	4.213***
	(0.28)	(0.29)	(0.31)	(0.36)	(0.42)
N	265	265	249	224	206
R-Squared	0.16	0.17	0.23	0.09	0.16

Source: ONS

Table 12: Productivity Estimates: OHIM Registered Designs, 2004 Cohort

	Baseline 2004	Productivity 2004	Productivity 2005	Productivity 2006	Productivity 2007
	b/se	b/se	b/se	b/se	b/se
Size	0.0926*	0.0905*	0.124**	0.169**	0.317***
	(0.05)	(0.05)	(0.05)	(0.07)	(0.09)
Age	-0.0818*	-0.0814*	-0.104**	-0.246***	-0.233***
	(0.04)	(0.04)	(0.05)	(0.06)	(0.07)
Age squared	0.00199*	0.00199*	0.00267**	0.00586***	0.00496***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Sector:25	-0.396*	-0.410**	-0.373*	-0.304	-0.237
	(0.20)	(0.20)	(0.21)	(0.28)	(0.31)
Sector:26	0.141	0.137	0.0726	-0.315	0.587
	(0.36)	(0.36)	(0.48)	(0.74)	(0.82)
Sector:29	-0.487**	-0.487**	-0.605***	-0.855***	-0.623*
	(0.22)	(0.22)	(0.22)	(0.29)	(0.34)
Sector:30	-0.454	-0.452	0.0855	-0.190	-0.393
	(0.37)	(0.37)	(0.38)	(0.46)	(0.62)
Sector:32	-0.278	-0.278	-0.218	-0.0870	-0.979**
	(0.27)	(0.27)	(0.30)	(0.34)	(0.43)
Sector:33	-1.942***	-1.937***	-1.518***	-2.883***	-2.665***
	(0.48)	(0.47)	(0.47)	(0.55)	(0.61)
Hold a live reg. Design		0.144	0.163	0.384**	-0.0152
		(0.13)	(0.15)	(0.18)	(0.22)
Constant	5.072***	5.001***	5.111***	6.290***	5.942***
	(0.39)	(0.39)	(0.50)	(0.63)	(0.75)
N	82	82	66	54	45
R-Squared	0.30	0.31	0.39	0.59	0.58

Source: ONS

Table 13: Productivity – cohort 2007

	Baseline 2007	Productivity 2007	Productivity 2008	Productivity 2009	Productivity 2010
Size	0.100*	0.0999*	0.198***	0.0534	0.0141
	(0.06)	(0.06)	(0.07)	(0.07)	(0.07)
Age	-0.0384	-0.0382	0.0562	0.0617	0.235***
	(0.04)	(0.04)	(0.06)	(0.06)	(0.06)
Age squared	0.000844	0.000840	-0.00117	-0.00126	-0.00471***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Sector:25	-0.311	-0.315	-0.293	-0.554*	-0.451
	(0.24)	(0.24)	(0.28)	(0.30)	(0.31)
Sector:26	0.131	0.130	0.270	0.240	0.212
	(0.46)	(0.46)	(0.55)	(0.54)	(0.53)
Sector:29	-0.178	-0.179	-0.285	-0.247	-0.402
	(0.26)	(0.26)	(0.30)	(0.32)	(0.34)
Sector:30	0.350	0.337	0.141	0.583	0.464
	(0.54)	(0.54)	(0.58)	(0.66)	(0.64)
Sector:32	-0.595*	-0.596*	0.0624	-0.534	-0.0520
	(0.35)	(0.35)	(0.39)	(0.39)	(0.42)
Sector:33	-0.349	-0.353	-0.300	-0.525	-0.183
	(0.27)	(0.27)	(0.31)	(0.32)	(0.34)
Sector:73	-0.205	-0.207	-0.750*	-0.526	-1.457***
	(0.32)	(0.32)	(0.38)	(0.40)	(0.41)
Hold a live reg. Design		0.0675	0.0665	0.151	-0.158
		(0.13)	(0.15)	(0.16)	(0.17)
Constant	4.661***	4.626***	3.277***	3.922***	2.302***
	(0.53)	(0.53)	(0.70)	(0.71)	(0.73)
N	163	163	134	113	93
R-Squared	0.08	0.08	0.16	0.12	0.43

Source: ONS

Table 14: Productivity and stock of OHIM registered designs – 2004 cohort

	Baseline 2004	Productivity 2004	Productivity 2005	Productivity 2006	Productivity 2007
	b/se	b/se	b/se	b/se	b/se
Size	0.0926*	0.0721	0.115*	0.159**	0.329***
	(0.05)	(0.05)	(0.06)	(0.07)	(0.09)
Age	-0.0818*	-0.0754*	-0.107**	-0.257***	-0.236***
	(0.04)	(0.04)	(0.05)	(0.06)	(0.07)
Age squared	0.00199*	0.00185*	0.00269**	0.00598***	0.00505***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Sector:25	-0.396*	-0.408**	-0.377*	-0.236	-0.248
	(0.20)	(0.20)	(0.22)	(0.29)	(0.31)
Sector:26	0.141	0.135	0.0578	-0.0642	0.590
	(0.36)	(0.36)	(0.49)	(0.76)	(0.80)
Sector:29	-0.487**	-0.481**	-0.595**	-0.806**	-0.628*
	(0.22)	(0.22)	(0.23)	(0.30)	(0.34)
Sector:30	-0.454	-0.445	0.0454	-0.245	-0.393
	(0.37)	(0.37)	(0.38)	(0.47)	(0.61)
Sector:32	-0.278	-0.260	-0.220	-0.0253	-0.995**
	(0.27)	(0.27)	(0.30)	(0.36)	(0.43)
Sector:33	-1.942***	-1.933***	-1.554***	-2.954***	-2.673***
	(0.48)	(0.47)	(0.48)	(0.57)	(0.60)
Stock of designs		0.00351	0.00127	0.00410	-0.00197
		(0.00)	(0.00)	(0.00)	(0.00)
Constant	5.072***	5.062***	5.265***	6.604***	5.934***
	(0.39)	(0.38)	(0.48)	(0.64)	(0.73)
N	82	82	66	54	45
R-Squared	0.30	0.31	0.38	0.56	0.58

Source: ONS

Table 15: Productivity and stock of OHIM registered designs – 2007 cohort

	Baseline 2007	Productivity 2007	Productivity 2008	Productivity 2009	Productivity 2010
Size	0.100*	0.0825	0.193***	0.0228	-0.0290
	(0.06)	(0.06)	(0.07)	(0.07)	(0.08)
Age	-0.0384	-0.0358	0.0578	0.0644	0.238***
	(0.04)	(0.04)	(0.06)	(0.06)	(0.06)
Age squared	0.000844	0.000786	-0.00120	-0.00132	-0.00476***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Sector:25	-0.311	-0.279	-0.285	-0.493	-0.358
	(0.24)	(0.24)	(0.28)	(0.30)	(0.32)
Sector:26	0.131	0.177	0.266	0.274	0.396
	(0.46)	(0.46)	(0.55)	(0.54)	(0.53)
Sector:29	-0.178	-0.150	-0.280	-0.203	-0.283
	(0.26)	(0.26)	(0.30)	(0.32)	(0.34)
Sector:30	0.350	0.350	0.145	0.589	0.551
	(0.54)	(0.54)	(0.58)	(0.65)	(0.64)
Sector:32	-0.595*	-0.575*	0.0655	-0.510	0.0435
	(0.35)	(0.35)	(0.39)	(0.40)	(0.42)
Sector:33	-0.349	-0.315	-0.290	-0.466	-0.0385
	(0.27)	(0.27)	(0.31)	(0.33)	(0.34)
Sector:73	-0.205	-0.172	-0.739*	-0.485	-1.366***
	(0.32)	(0.32)	(0.38)	(0.40)	(0.41)
Stock of designs		0.00466	0.000938	0.00519	0.00624
		(0.00)	(0.00)	(0.00)	(0.00)
Constant	4.661***	4.649***	3.305***	4.031***	2.200***
	(0.53)	(0.53)	(0.70)	(0.70)	(0.72)
N	163.000	163.000	134.000	113.000	93.000
R-Squared	0.08	0.09	0.16	0.12	0.44

Source: ONS

Table 16: Productivity and stock of OHIM registered designs – 2007 cohort

	Baseline 2007	Productivity 2007	Productivity 2008	Productivity 2009	Productivity 2010
Size	0.148***	0.154***	0.160***	0.134***	0.161***
	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)
Age	-0.0135	-0.0137	0.0313	0.00982	0.0342
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
Age squared	0.000245	0.000252	-0.000822	-0.000417	-0.00108
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Sector:25	-0.419**	-0.433**	-0.416**	-0.357*	-0.403*
	(0.17)	(0.17)	(0.17)	(0.21)	(0.22)
Sector:26	-0.609**	-0.623**	-0.727***	-0.561*	-0.528*
	(0.24)	(0.24)	(0.25)	(0.29)	(0.30)
Sector:29	-0.373**	-0.393**	-0.379**	-0.393*	-0.483**
	(0.17)	(0.17)	(0.18)	(0.21)	(0.23)
Sector:30	0.0996	0.0826	-0.418	-0.0417	-0.0602
	(0.29)	(0.29)	(0.31)	(0.35)	(0.38)
Sector:32	-0.424**	-0.442**	-0.415**	-0.420*	-0.369
	(0.18)	(0.19)	(0.19)	(0.23)	(0.25)
Sector:33	-0.731***	-0.746***	-1.260***	-0.618**	-1.188***
	(0.24)	(0.24)	(0.25)	(0.29)	(0.31)
Stock of Designs		-0.000214	-0.000143	-0.000279	0.0000102
		(0.00)	(0.00)	(0.00)	(0.00)
Constant	4.405***	4.407***	3.981***	4.357***	4.153***
	(0.28)	(0.28)	(0.31)	(0.36)	(0.41)
N	265.000	265.000	249.000	224.000	206.000
R-squared	0.16	0.16	0.21	0.09	0.16

Source: ONS

Appendix 2A : Nearest Neighbourhood Matching Estimation

The following equation illustrates the average ‘treatment effect’ on the ‘treated firms’ – i.e., the mean performance effect of holding a registered design right::

$$E(\alpha_{TT}) = E(YT | D= 1) - E (Yc | D = 1)$$

where YT is the outcome variable; performance. D refers to firms to the group, so D=1 is the group of firms that registered an industrial design and D=0 is those that do not. Yc is the potential performance of the firms with design rights (D=1) if they had not registered one. The problem is therefore quite straightforward: while we observe the performance of firms with design rights ($E(YT | D= 1)$), we do not know their potential performance had they not registered one ($E (Yc | D = 1)$). The latter is a counterfactual situation which is not observable and that we have to estimate, by using the matching estimator approach. The unobservability of the potential outcome is solved by the construction of a control group, hence balancing the sample of firms that have a design right with a comparable set of firms that do not. The remaining differences in the performance between both groups are thus attributed to registering a design right (Heckman, 1998).

Let X be a vector of exogenous observable characteristics that are similar between design-based firms and the others. The average treatment effect, conditional on X, is therefore given by:

$$E(\alpha_{TT}) = E(YT | D= 1, X) - E (Yc | D = 0, X)$$

Conditioning on X allows us to take into account the selection bias due to observable differences between the two groups of firms. In this study, we use a Nearest Neighbour Matching procedure, as implemented by Abadie et al. (2004). For each firm that has a design right, we select the nearest firm (i.e. the most similar firm) that does not. Therefore, for each firm with a design right, we have two outcomes of performance: one outcome that is observed and the other, estimated given the outcomes of other similar firms.

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