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What hampers innovation? Evidence from the UK CIS4

Pablo D'Este[°*], Simona Iammarino[*], Maria Savona[•*], Nick von Tunzelmann[*]

([*] SPRU, University of Sussex, [°] School of Management, Cranfield University, [•] Faculty of Economics & Social Sciences, University of Science & Technology Lille)

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University of Sussex
SPRU – Science & Technology Policy Research

The Freeman Centre, University of Sussex,
Falmer, Brighton BN1 9QE, UK
Tel: +44 (0) 1273 678175
E-mail: p.d-este-cukierman@sussex.ac.uk
http://www.sussex.ac.uk/spru/

What hampers innovation?
Evidence from the UK CIS4[1]

Pablo D'Este [°*]
Simona Iammarino [*]
Maria Savona [•*]
Nick von Tunzelmann [*]

[*] SPRU - Science and Technology Policy Research (SPRU)
University of Sussex
[°] School of Management
Cranfield University
[•] Faculty of Economics and Social Sciences
University of Science and Technology Lille1

Abstract
A large proportion of firms do not manage to introduce new products to the market, or are simply indifferent to innovative activities altogether. Despite that, little is known about firms that do not innovate, and in particular, about the role of barriers to innovation. In this paper it is argued that, by looking in more detail at non-innovative firms, we are likely to gain a richer picture that helps to uncover the heterogeneous nature of non-innovators, and the distinct factors that affect their assessment of barriers to innovation. In particular, by using data from the UK Community Innovation Survey (CIS4), the paper sheds light on two issues: the characteristics and behaviours that distinguish different groups of non-innovative firms, and whether differences among groups of firms exist in relation to their assessment of how important the barriers are.

JEL Classification: **O31, O32, O33**
Keywords: **barriers to innovation, innovative firms, non-innovators.**

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What hampers innovation?
Evidence from the UK CIS4

1. Introduction

A large proportion of firms does not manage to introduce new products to the market, or are simply indifferent to innovative activities altogether. The UK Community Innovation Survey (CIS4) for example shows that while about 37% of firms do not engage in any type of innovative activities, of those that do so 45% introduce neither new nor significantly improved products (i.e. goods or services) or processes. Despite that, little is known about firms that do not innovate, and in particular, about the role of barriers to innovation, the extent to which such barriers actually hamper or slow down innovation, or the factors affecting firms' perceptions of how important barriers to innovation are.

In this paper it is argued that, by looking in more detail at non-innovative firms, we are likely to gain a richer picture that helps to uncover the heterogeneous nature of non-innovators, and the distinct factors that affect their assessment of barriers to innovation. In particular, this study aims to bring the characteristics of non-innovative enterprises to the fore. In this sense, the paper sheds light on two neglected issues: the characteristics and behaviours that distinguish different groups of non-innovative firms, and whether differences among firms groups exist in relation to their assessment of how important the barriers are.

The structure of the paper is as follows. Section 2 reviews the empirical contributions that have focussed on the nature and relevance of barriers that prevent or slow down innovation activities. Section 3 explains how the information from the UK CIS4 has been used in order to examine whether different groups of non-innovators can be identified. Section 4 provides a description of these groups of non-innovators, characterising their differences and comparing them with innovative firms. Section 5 examines in detail the behaviours of the different groups of firms in terms of their degree of experience of barriers to innovation, and their assessment of how important barriers are. Section 6 takes a close look at the relationship between the degree of engagement in innovative activities and the assessment of the importance of barriers. Section 7 concludes with a discussion of the results and future research directions.

2. The empirical evidence on barriers to innovation

In this section we review two broad streams of research dealing with barriers to innovation. On the one hand, we focus on the empirical literature based on innovation surveys; on the other hand, we report on the strategic management literature that has addressed the subject of barriers to innovation.

2.1 Innovation surveys: a story of 'revealed' barriers to innovation

The empirical literature drawing on the evidence provided by innovation surveys, such as the European CIS, and exploring the nature and characteristics of technological innovation across firms and sectors, is large and consolidated. However, rather few contributions have analysed the role of barriers to innovation, the extent to which they actually hamper or slow down innovation, and the factors affecting their perception, at least as (qualitatively) assessed by the firms themselves. Most of this work focuses on differences in firms' characteristics that may affect the perception of barriers, and the extent of complementarities among individual obstacles, which are claimed to be crucial in drawing policy implications (Arundel, 1997; Mohnen and Rosa, 2000; Mohnen and Röller, 2001; Baldwin and Lin, 2002; Galia and Legros, 2004; and Tourigny and Le, 2004). A more recent work on the Italian CIS has focussed on whether the perception of obstacles to innovation varies among types of firms (i.e. foreign multinationals versus Italian groups and single domestic firms) and sub-national regions (Iammarino et al., 2007).

The empirical evidence provided by these contributions is surprisingly unanimous in showing that the more a firm is involved in research and development (R&D) and innovative activities, the greater the importance it is likely to attach to the obstacles to innovation. For instance, Baldwin and Lin (2002) examined whether the proportion of firms that experience obstacles differs between innovators and non-innovators (and between adopters of advanced technologies *vis-à-vis* non-adopters) for a representative sample of Canadian manufacturing firms. They found that a larger proportion of innovators and adopters of advanced technologies reported impediments to technology adoption as compared to non-innovators and non-adopters of advanced technologies.

Mohnen and Rosa (2000) carried out a similar empirical analysis in the case of Canadian services over the period 1996-1998, confining their test to innovators only, and using R&D intensity as a proxy for innovation intensity. Galia and Legros (2004) conducted their

analysis on the basis of CIS2 data for French manufacturing firms in order to identify complementarities amongst obstacles and derive policy implications regarding sets of obstacles. These contributions also point to a positive association between the propensity/intensity of innovation and the likelihood of perceiving the obstacles to innovative activities as important.

This stream of literature offers a 'revealed barriers' interpretation of the relationship between innovation activities and obstacles. That is, carrying out innovation activity increases firms' awareness of the difficulties associated with innovation, without necessarily preventing firms from pursuing innovation or even being innovative. In other words, this stream of research converges on an interpretation of barriers to innovation as *revealed* (i.e. increasing awareness of factors constraining innovation) as opposed to one interpreting barriers as *deterrents* (i.e. preventing firms from undertaking innovative activities or being successful innovators).

Such an interpretation of the obstacles to innovation is likely to be influenced by the scant attention devoted to non-innovative firms. Indeed, the innovation-survey literature on barriers to innovation has either focused on innovative-active firms only (e.g. Galia and Legros, 2004; Mohnen and Rosa, 2000)[2] or it has treated all non-innovative firms as an undifferentiated group (e.g. Baldwin and Lin, 2002; Iammarino et al., 2007). Our contention here is that an in-depth analysis of non-innovators would provide a more nuanced picture of the relationship between barriers to innovation and engagement in innovative activities.

2.2 Innovation management: a story of heterogeneity of non-innovators

The innovation management literature has devoted a great deal of attention to the factors that influence innovation failure – in addition to the factors that drive innovative success. More specifically, this stream of research has investigated how different types of companies are likely to confront different types of barriers to innovation. One of the most frequent distinctions in this stream of research is that of large, established firms versus small, new firms. There is a wide consensus in the innovation management literature that while large, established firms are better suited to developing incremental innovations, new firms are better suited to developing radical ones (Hamilton and Singh, 1992; Henderson, 1993; Christensen and Bower, 1996). These two groups of firms differ in their innovation profiles largely as a consequence of the different types of obstacles to innovation that they face.

[2] For instance, Galia and Legros (2004) only consider in their study firms that have been involved in innovation projects (including postponed and abandoned projects) but exclude those firms that did not initiate any innovative project over the period of the survey.

On the one hand, large established firms confront barriers to innovation as a result of firms' path dependence and their consequent resistance to modifying competencies or organisational practices that have proved successful in the past (see Ferriani et al., 2007, for a detailed summary of such obstacles). These include, for instance, organisational inertia and structured routines that may limit the ability of incumbent firms to identify new opportunities and adapt to environmental changes (Nelson and Winter, 1982; Hannan and Freeman, 1984; Dougherty, 1992); lack of incentives to engage in radical innovation to avoid cannibalising existing products or destabilizing core competencies (Tushman and Anderson, 1986; Henderson, 1993); or narrow commitment to a few main customers (Christensen, 1997).

On the other hand, new firms face different types of obstacles to innovation. These are principally related to the lack of resources and to market conditions. The former include difficulties in knowledge and organizational routines, such as the lack of the necessary expertise about technologies in manufacturing-intensive sectors (Gort and Klepper, 1982; Katila and Shane, 2005), and scarcity of financial resources, since new firms often lack sufficient capital to finance innovation (Schoonhoven et al., 1990; Katila and Shane, 2005). Additionally, market conditions impose serious obstacles to new firms in terms of degree of competition and firm size (Katila and Shane, 2005). New firms are likely to face stronger barriers to innovation in larger and less competitive markets, since in such conditions incumbents are more likely to capitalize on the capabilities necessary to coordinate complementary assets that new firms rarely possess (Schoonhoven et al., 1990; Tripsas, 1997; Dean et al., 1998).

Finally, an increasing number of studies examine organizations' experiential learning from their own failures (Miner et al., 1999; Haunschild and Sullivan, 2002; Denrell, 2003) and from the failures of other organizations (Kim and Miner, 2007; Baum and Dahlin, 2007). From this literature it emerges that the path to innovation is almost invariably punctuated by setbacks and failures (Ferriani et al., 2007), and that failure can be far more valuable than success for learning (Miner et al., 1999; Baum and Dahlin, 2007). Insofar as failure to innovate may provide a fertile ground for learning and enhancing the potential for innovation success, it is crucial that we pay due attention to the features of firms that fail to innovate, as well as to the obstacles impeding innovation.

However, this attention to non-innovating firms, trying to sample underperformers (say, non-innovators) appropriately, must also distinguish between those organisations that have an aspiration or purpose to innovate from those that do not. That is, those organisations that

attempt to undertake or have already undertaken innovative activities must be distinguished from those that have no aspiration or purpose to innovate (or to engage in innovative activities altogether). Firms that have aspirations to innovate but have not generated new products or processes are likely to perceive failure to innovate as a motivation to change, since actual performance is not meeting their aspirations (Baum and Dahlin, 2007). Conversely, for those firms that do not consider it necessary to engage in innovative activities (and thus are not innovation-active), the lack of innovative outcomes is unlikely to trigger any change in their learning strategies.

In line with the above observations, we argue that by paying increasing attention to the analysis of non-innovating firms, we will gain a better understanding of how barriers to innovation are perceived among different types of firms. Moreover, by investigating the factors that influence firms' assessment of barriers, we will shed light on the conditions that lead firms to confront *revealed* versus *deterring* barriers to innovation.

3. Innovators and non-innovators: a taxonomy from the UK Innovation Survey

3.1 Definition of innovators and non-innovators

This paper uses data from the UK Innovation Survey 2005 (as part of the fourth iteration of the wider Community Innovation Survey – CIS4 – covering EU countries), which refers to the period 2002-2004. The survey sampled over 28 thousand UK enterprises with 10 or more employees, had a wide sectoral coverage including both manufacturing and service sectors, and was stratified by Government Office Region in England, and by Scotland, Wales and Northern Ireland. The final data consist of a representative sample of 16,445 firms.

In this paper, as in most of the previous literature on CIS, we use a strict (output-based) definition of innovators and non-innovators, based on the characterisation of innovation as the market introduction of a new product or the implementation of a new process. More precisely, an enterprise is defined as an *innovator* if, during the period 2002-04, the enterprise introduced a new or significantly improved product (either a good or service) and/or any new or significantly improved processes for producing or supplying products new to the enterprise.

Consistently, if the enterprise did not introduce a new or significantly improved product and/or process over the period 2002-04, we classify the enterprise as a *non-innovator*. There are several reasons why the use of this strict definition is appropriate. First, it helps to

separate invention from innovation by requiring new products and processes to be of economic value, as shown by the commercialisation requirement (i.e. introduction to market). Second, it is consistent with the standard definition of innovation provided by the Oslo Manual (OECD, 2005). Third, it helps to separate the firm's efforts in innovative activities (as measured by its investment in R&D-related activities) from the outputs of those activities (as reflected by the market introduction of new products).

This third point is of particular importance in the context of our study of barriers to innovation. It is crucial in fact to distinguish clearly between measures of input and output regarding innovation activities. Thus we need to discriminate between firms that have introduced new products and/or new processes and *may* have engaged in other innovative activities (our innovators), from those that *may* have undertaken only the latter activities (our non-innovators).[3] Our group of innovators is composed of 5,820 firms, while our group of non-innovators includes 9,330 firms.[4]

3.2. Distinct groups of non-innovators

In order to identify different groups of non-innovators, we have examined the patterns of responses in the two sections of the questionnaire that ask respondents about barriers to innovation: that is, questions 19 and 20. In question 19 respondents are asked to report on whether they have experienced any of 11 barrier items, and to assess how important those barriers are in terms of constraining the enterprise innovation activities (i.e. whether the barrier item is of 'low', 'medium' or 'high' importance). Question 19 is addressed to all respondents.

In question 20, which is only addressed to those enterprises with no innovation activity, firms are asked to indicate why it has not been necessary or possible to innovate according to the

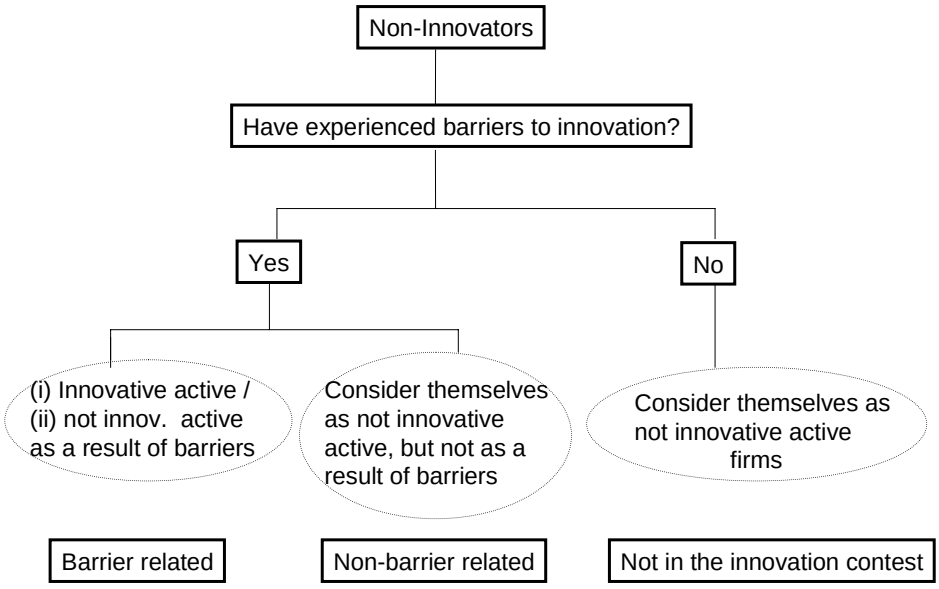
[3] Another reason why the strict definition of innovators and non-innovators is helpful is in order to reduce the impact of inconsistent responses in the questionnaire. The CIS survey uses a very broad definition of innovation (input-based definition), which includes any spending on innovation activities. Thus, if an enterprise spends on machinery, equipment, or training related to the development of new products, this enterprise is classified as 'innovation-active'. We found that 30% of firms that answered question 20 (on barriers to innovation) had been innovation-active, though this question was supposed to be answered only by enterprises with no innovation activity at all. By contrast, only 19 firms responding to question 20 were defined as strict innovators. Therefore, using a strict definition provides a more consistent pattern of responses to the survey.

[4] The fact that these two figures do not add up to 16445 is due to missing values with respect to the information on product and process innovation, and to the inconsistent responses of 772 cases that were removed from the analysis. These latter firms responded that 'factors constraining innovation' were among the factors making innovation not necessary or possible, but also indicated that they did not experience any of the barrier items in question 19. Though one possible explanation may be that the list of barrier items in question 19 was not sufficiently comprehensive to include the barriers to innovation that these firms may have encountered, we opted to exclude them from the analysis as an inconsistent pattern of response.

following (not mutually exclusive) options: a) no need due to prior innovations; b) no need due to market conditions; and c) factors constraining innovation.

Using the responses to these two questions, we classified non-innovator firms in three groups: a) barrier related; b) non-barrier related; and c) firms not in the innovation contest. The overall rationale for this grouping is depicted in Figure 1, followed by a detailed explanation of the definition for each of the three groups.

Figure 1



a) Barrier related non-innovators

This group of non-innovators is composed of 3,401 firms that have experienced barriers (i.e. all having experienced at least one of the 11 barrier items in question 19), and it is formed of two sub-groups: a) firms that consider themselves as innovative-active and therefore did not answer question 20 (i.e. they have engaged in innovative activities) – composed of 2,036 firms; and b) firms that consider themselves as not innovative-active and indicate in question 20 that factors constraining innovation made innovation not possible – made up of 1,365 firms. The firms in this group have all experienced barriers to innovation and have an 'aspiration' to innovate, even though their actual engagement in innovative activities may vary substantially from one to another. Consequently, we have labelled this group as 'barrier related' non-innovators.

b) Non-barrier related non-innovators

This group of non-innovators is composed of 2,334 firms that have experienced barriers (again, all having experienced at least one of the 11 barrier items in question 19) and all consider themselves as not innovative-active, therefore answering question 20. The difference with the first group is that firms in this group indicate in question 20 that the factors that made innovation not necessary or possible have nothing to do with barriers to innovation, but rather with either 'no need to innovate due to prior innovations' or 'no need due to market conditions' or a combination of these two. Nevertheless, the fact that these firms have experienced barriers to innovation to some degree (as indicated by their positive responses to question 19), entitles them for inclusion as firms with an 'aspiration' to innovate,[5] even though their actual engagement in innovative activities may be, according to their responses to question 20, rather marginal. Consequently, we have labelled this group as 'non-barrier related' non-innovators.

c) Non-innovators not in the innovation contest

This group of non-innovators is composed of 3,595 firms with the common feature that they have not experienced any of the innovation barriers listed in question 19. The large majority of these firms considers itself as not innovation-active.[6] They also consistently reported in question 20 that 'factors constraining innovation' were not among the reasons why the enterprise did not innovate. Finally, about 60% of these companies indicate that 'no need due to market conditions' was among the reasons why innovation was not necessary or possible. As a result of these characteristics, we have classified these firms as non-innovators that are 'not in the innovation contest', in the sense that they seem to have no aspiration to innovate or to engage in innovative activities (at least, for the period considered in the survey).

4. Firm characteristics: innovators and non-innovators

In this section we describe the main characteristics of the three groups of non-innovators with respect to: a) firm size; b) sectoral composition; and c) degree of engagement in innovative

[5] That is, only firms that have a purpose to engage in innovative activities are likely to experience barriers related to innovation activities.

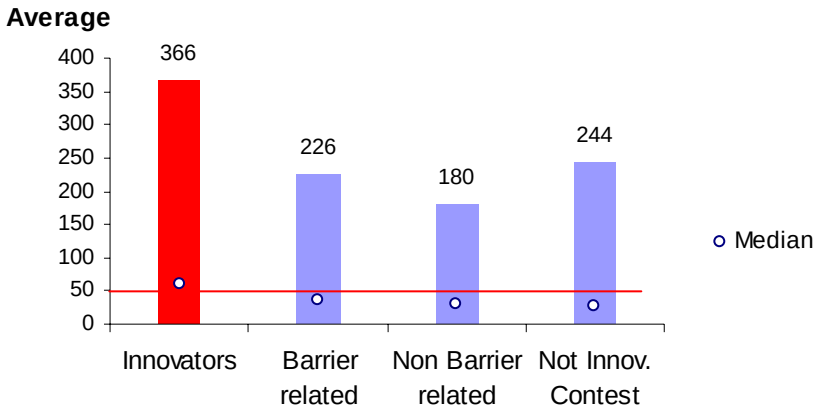
[6] 13% of these firms, though, considered themselves as innovation-active (on the basis of their missing answer to question 20). We have opted to include them in this group as they share the characteristics of not having experienced any of the barrier items listed in question 19.

activities (i.e. being 'innovation-active'). In comparing the three groups, we use the profile shown by the group of firms strictly classified as innovators as a benchmark for comparison (5,820 firms).

Firm size

By using the number of employees as a measure of firm size, Figure 2 compares the average (and median) firm size for the three groups of non-innovators and the group of innovators. This latter is composed of firms that are significantly larger than non-innovators. Moreover, while 'non-barrier related' shows the lowest values, with an average firm size of 180 employees (as compared to 244 for the 'not in the innovation contest' group), differences are statistically significant only with respect to the group of innovators. Indeed, the three groups of non-innovators display very little differences in terms of size when looking at the median: 35 for 'barrier related', 29 for 'non-barrier related' and 28 for those 'not in the innovation contest'.[7]

Figure 2. Characteristics of firm groups in terms of size



Sectoral profile

With respect to the sectoral profile, two different levels of aggregation are considered. Firstly, we explore whether groups differ in terms of the proportion of firms in manufacturing and services (Figure 3.1). Secondly, we consider the 7 sectors of activity in accordance with the clustering criteria used by DTI (2006): primary sector; engineering-based manufacturing; other manufacturing; construction; retail and distribution; knowledge-intensive services; other services (Figure 3.2).

[7] While the median number of employees for innovators is 59, almost twice the value of non-innovators.

Figure 3.1. Firm groups by sector: manufacturing versus services

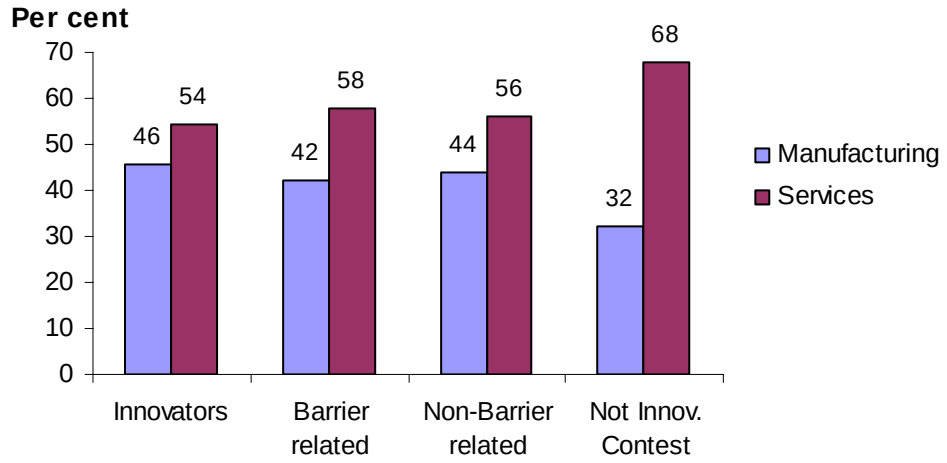
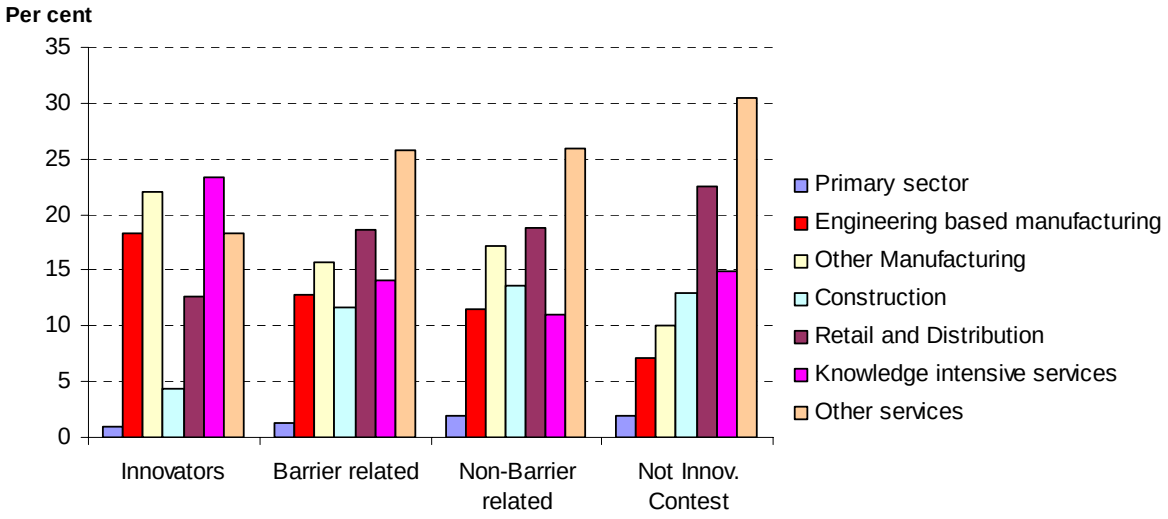


Figure 3.2. Firm groups by disaggregated sector



As Figure 3.1 shows, the group of firms 'not in the innovation contest' shows the largest proportion in the service sector (68%). The other two groups of non-innovators show a much more balanced distribution of enterprises between manufacturing and services, similar to that of innovators. However, when the more disaggregated sectoral profile is considered, substantial differences emerge between innovators and non-innovators. As Figure 3.2 shows, the 'barrier related' and 'non-barrier related' groups have much larger shares in the construction sector as compared to innovators (12 and 14% versus 4%, respectively), as well as in the retail and distribution sector (19% for the two groups of non-innovators versus 13% for innovators); conversely, they have a much lower proportion of companies in the knowledge-intensive service sector as compared to innovators (14% and 11% versus 23%,

respectively). All three groups of non-innovators display their highest shares in other services (in all cases above 25%).

Engagement in innovative activities

The responses from the survey allow us to measure the extent to which firms have engaged in a wide range of activities related to innovation or, in other terms, whether they have been 'innovation-active'. In particular, drawing upon responses from question 13, we are able to identify the extent to which firms engaged in any of the following seven innovation activities: (i) intramural R&D; (ii) acquisition of R&D; (iii) acquisition of machinery, equipment and software to produce new or significantly improved products; (iv) acquisition of external knowledge (e.g. licensing of patents); (v) training of personnel for the development or introduction of innovations; (vi) expenditure on design functions for the development of new or improved products or processes; and (vii) expenditures on activities for the market preparation and introduction of new or significantly improved products (including market research and launch advertising).

As explained in Section 3 above, the strict definition of non-innovators does not imply that these firms are not engaging at all in innovative activities, but simply that they have introduced neither a new nor significantly improved product or process. As our focus is on non-innovators, it is important to show that, while our targeted firms have not been successful in introducing a new product or process, they may have been innovation-active in terms of the activities listed in question 13 of the questionnaire (i.e. on the basis of the input-based definition of innovation).

Figure 4.1 shows that a substantial proportion of 'barrier-related' (75%) and 'non-barrier related' (44%) non-innovators engage in at least one of the seven innovative activities. While these percentages are significantly below those of firms strictly defined as innovators, where the large majority is innovation-active, they signal that these two groups of non-innovators have an aspiration to becoming innovators: firms in these two groups of non-innovators seem to be unequivocally within the innovation contest. Indeed, they have a significantly higher proportion of firms engaged in innovative activities as compared to firms in our third group of non-innovators (in which 80% of firms do not engage in any innovative activity).

Figure 4.1. 'Innovation-active' firms (engaging in at least 1 innovative activity)

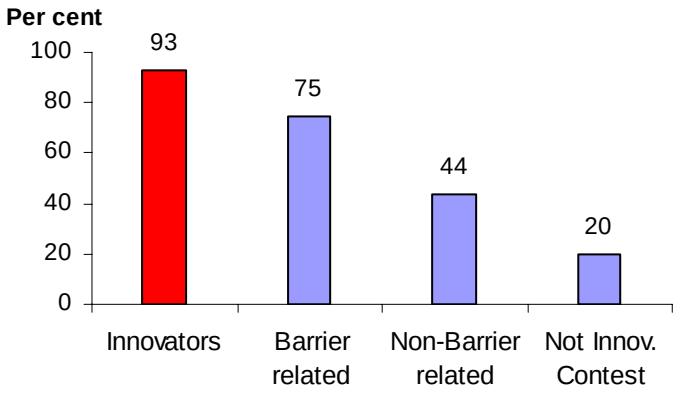


Figure 4.2. 'Innovation-active' firms by number of innovative activities they engage in

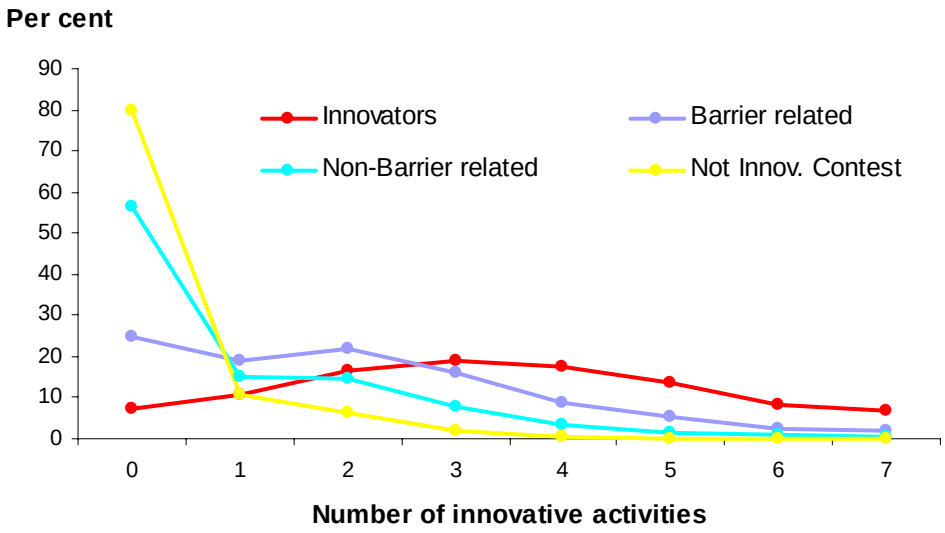


Figure 4.2 provides further information on the profile of each group with respect to the engagement in innovative activities. As expected, not only is a large proportion of innovators innovation-active, but they also engage in a larger number of innovative activities (3 on average) than non-innovators, displaying a bell-shaped distribution around the average. On the contrary, all non-innovators show a highly skewed distribution, with tiny shares of firms engaging in four or more innovative activities. However, it is relevant to point out that 'barrier related' firms (and to a lesser extent 'non-barrier related') have non-negligible shares of firms engaging in one, two or three innovative activities (for instance, in the case of 'barrier related' such proportions are: 19%, 22% and 16%, respectively).

To summarise, the profiles of the three groups of non-innovators emerge as quite distinct. For instance, it is possible to characterise the 'not in the innovation contest' group as formed by

medium-sized firms largely in 'retail and distribution' or other services (such as 'hotels and restaurants' and 'real estate' activities), and barely engaging in innovative activities. This profile is consistent with the pattern displayed by this group regarding barriers to innovation, reporting having not experienced barriers to innovation at all, and having assessed that the lack of engagement in innovative activities is largely 'due to market conditions'. The other two groups of non-innovators conform to a different pattern: besides the fact that 'barrier related' and 'non-barrier related' non-innovators are less concentrated in the service sector, these two groups are more heavily engaged in innovation-related activities.

5. Experience and assessment of barriers to innovation

In this section we compare non-innovator groups with respect to: a) the extent to which firms experience barriers; and b) the extent to which firms assess barriers as important. Once again, the group of strict innovators acts as a benchmark.

We chose not to investigate the eleven barrier items individually, but four sets of barriers, following the grouping reported by the questionnaire itself:[8] 'cost factors', 'knowledge factors', 'market factors' and 'regulation factors'. Table 1 below reports the items included within each of these four sets.

The results discussed below are presented at the level of the four sets: for instance, evidence on the extent to which a firm experiences 'cost factors' barriers is based on whether that firm has experienced at least one of the barriers included within that set. As to the importance attached to barriers, we have used the information on whether the firm assessed the importance of barrier items as 'low', 'medium' or 'high'. Similarly, a set of barriers is indicated as important when the firm has assessed at least one of the items in that set as highly important.

Table 1. The four groups of barriers to innovation

Sets of barriers to innovation	Barrier items included
Cost Factors	• Excessive perceived economic risks • Direct innovation costs too high • Cost of finance • Availability of finance
Knowledge Factors	• Lack of qualified personnel • Lack of information on technology • Lack of information on markets

[8] For a different methodological choice, focused on individual barriers, see for example Iammarino et al. (2007).

Market Factors	• Market dominated by established enterprises • Uncertain demand for innovative goods or services
Regulation Factors	• Need to meet UK Government regulation • Need to meet EU regulations

5.1. Experience and assessment of barriers: innovators vs. non-innovators

When we compare the group of innovators with the overall group of non-innovators (all our three groups combined), we find results that are in accordance with the existing literature based on innovation surveys. The evidence from the UK CIS4 shows that innovators have a much higher share of firms reporting to have experienced barriers to innovation, regardless of the type of barrier considered (Figure 5.1). A similar pattern emerges when examining the proportion of firms assessing barriers as highly important: a significantly larger proportion of innovative firms assess barriers as highly important, compared to non-innovators (Figure 5.2).

Figure 5.1. Firms experiencing barriers: innovators and non-innovators

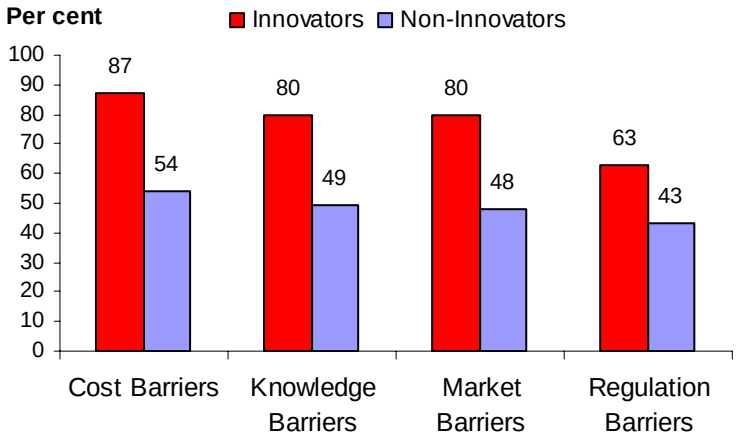
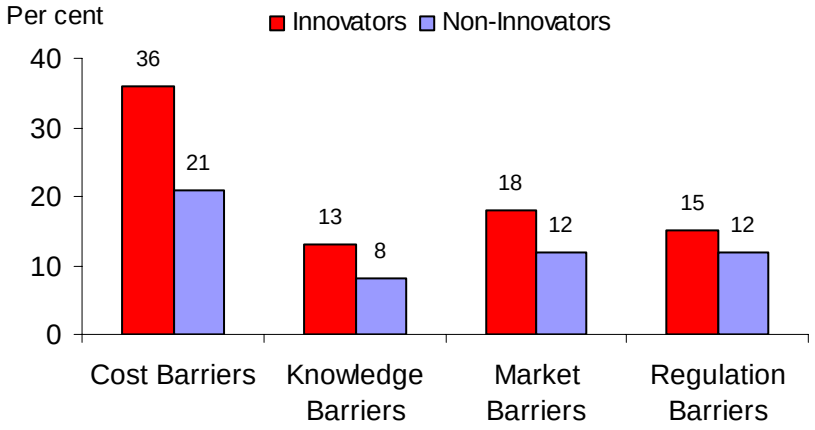


Figure 5.2. Firms assessing barriers as highly important: innovators and non-innovators



These findings are consistent with the argument that strictly defined innovative firms are more likely to experience barriers to innovation, and also to assess such obstacles as important (e.g. Arundel, 1997; Baldwin and Lin, 2002; Iammarino et al., 2007).

However, the picture is rather different when we explicitly consider the different groups of non-innovators (Figure 6.1). Differences between innovators and non-innovators are now much less clear-cut as compared to the previous figures in which all non-innovative firms were grouped together. On the one hand, it emerges that the 'barrier related' group displays a proportion of firms experiencing barriers similar to or higher than that of innovators for all barriers. Moreover, the proportion of 'non-barrier related' firms that experience barriers, while generally below the percentages of innovators and 'barrier related', is substantial.[9]

On the other hand, as Figure 6.2 reports, the 'barrier related' group displays a proportion of firms assessing barriers as highly important that is systematically higher than that of innovators, regardless of the type of barrier considered. The group of 'non-barrier related' non-innovators displays instead percentages of firms assessing barriers as important that are below those of innovators, with the exception of 'regulation barriers' (with an identical percentage for both groups of firms).

[9] Given the way we define the non innovative firms (Section 3), the third group of non-innovators (i.e. 'not in the innovation contest') does not experience any barrier to innovation. This group has therefore not been included in the following analysis.

Figure 6.1. Firms experiencing barriers by firm group

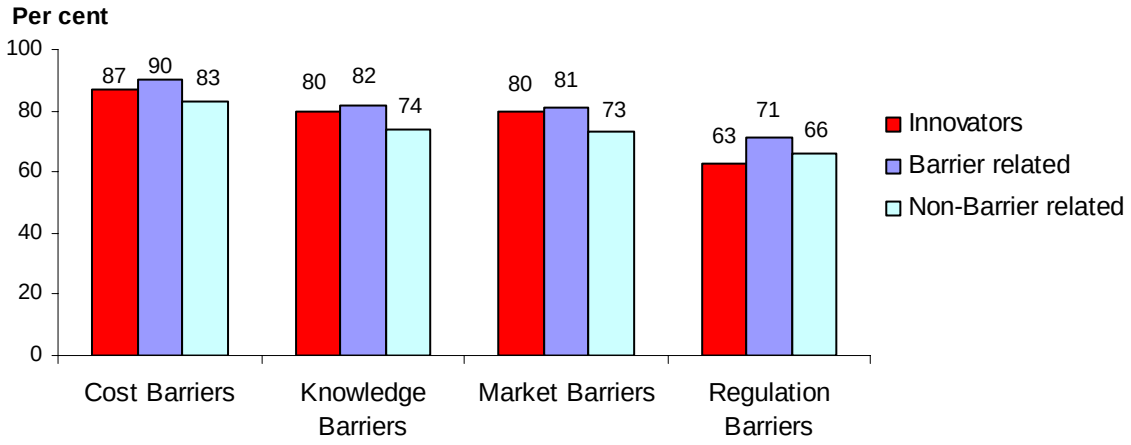
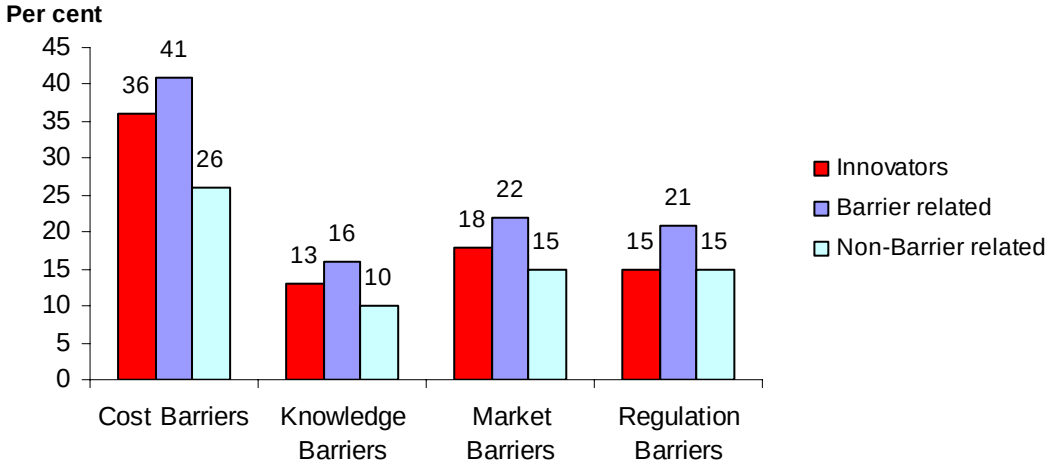


Figure 6.2. Firms assessing barriers as highly important by firm group



This evidence highlights the fact that some non-innovators not only experience barriers to a similar or greater extent than innovators but, even more critically, they also assess barriers as more important. Two issues need to be highlighted here. Firstly, the fact that the share of enterprises experiencing barriers becomes remarkably high for the two groups of non-innovators can be seen as a logical consequence of the fact that one of the three groups (i.e. 'not in the innovation contest') actually captures most of the firms that did not experience barriers. In other words, if those firms that did not experience any barrier to innovation are removed, it should not come as a surprise that the proportion of firms experiencing barriers in the two remaining groups of non-innovators rises (as compared to the overall group of non-innovators). Bearing this in mind, it is relevant to note that: a) according to the previous literature, there is no *a priori* explanation for the fact that non-innovators ('barrier related' and 'non-barrier related') behave in line with innovators in terms of the experience of

barriers; and, more importantly, b) when analysing barriers to innovation it may not be meaningful to consider all non-innovators as a single homogeneous group. Indeed, a large proportion of non-innovators are simply not interested in innovation activities, largely as a consequence of not needing to innovate in order to survive in the markets where they operate. Therefore these companies are not appropriate terms of comparison with those that do engage in innovative activities. As we have seen in Section 4, this is the case for the group labelled 'not in the innovation contest': it is clear that this group is biasing downwards the figures on experience and assessment of barriers when considering all non-innovators as a homogeneous group.

On the other hand, in connection with the argument above, it is only after experiencing barriers that companies can assess whether barriers are important. What the evidence from Figures 6.1 and 6.2 shows is that two groups of non-innovators and the group of innovators do experience barriers to a similar extent, and therefore are comparable to each other. In other words, the fact that they assess barriers differently becomes particularly meaningful in the light of the fact that they experience barriers to a similar extent.

5.2. Assessment of barriers across regions

A crucial point that needs to be addressed in our analysis is that both the propensity to innovation and the assessment of barriers are likely to be influenced by the context where firms are located. Very few of the empirical contributions mentioned in Section 2 above have investigated the regional location of the responding firms (Iammarino et al., 2007). This sub-section investigates the extent to which the differences between groups of firms in the assessment of barriers are consistent across UK regions, or whether such differences are region-specific.

First of all, Table 2 displays the distribution of the four groups of firms by region, and sums together the two groups of non-innovators that are classified as innovative active (i.e. 'barrier related' and 'non-barrier related' firms). As Table 2 shows, there are some differences across regions with respect to the firm profile. For instance, South East and Eastern England have a higher proportion of innovators as compared to most other regions, while Northern Ireland, London and North East have the largest shares of firms classified as 'not in the innovation contest'. Also, Yorkshire & Humberside and East Midlands have a comparatively high proportion of non-innovators classified as innovative active (i.e. 'non innovators in the innovation contest'), indicating that, although these two regions are not among those with a

high proportion of innovators, they do have high shares of firms that could become successful innovators if obstacles to innovation were appropriately lowered. This might have implications in the light of the analysis carried out in Section 6 below.

Table 2. Distribution of firms by group and region (%)

	INNOVATORS	NON-INNOVATORS				
Regions	(I) Innovators	(II) Barrier related	(III) Non-Barrier related	(IV) Not in the Innovation Contest	(II) + (III) Non-innovators in the Innovation Contest	Number of firms
North East	**36.4**	23.1	14.7	**25.8**	37.8	860
North West	37.0	22.8	15.1	25.1	37.9	1384
York & Humber.	38.4	24.7	16.4	20.5	**41.1**	1239
East Midlands	39.0	23.2	17.3	20.5	**40.5**	1227
West Midlands	**39.7**	22.5	15.3	22.5	37.8	1346
Eastern England	**40.4**	22.2	15.3	22.1	37.5	1281
London	39.5	20.0	14.5	**26.0**	34.5	1491
South East	**42.5**	23.4	13.7	20.5	37.1	1592
South West	**36.2**	22.4	16.7	24.7	**39.1**	1249
Wales	37.4	23.5	14.9	24.1	38.4	1011
Scotland	35.3	23.3	15.8	25.6	**39.1**	1171
Northern Ireland	37.1	18.9	15.7	**28.3**	**34.6**	1299
UK total	*38.4*	*22.4*	*15.4*	*23.7*	*37.9*	*15150*

Note: for each region, columns show the proportion of firms in each group (therefore, (I) + (II) + (III) + (IV) amounts to 100%).

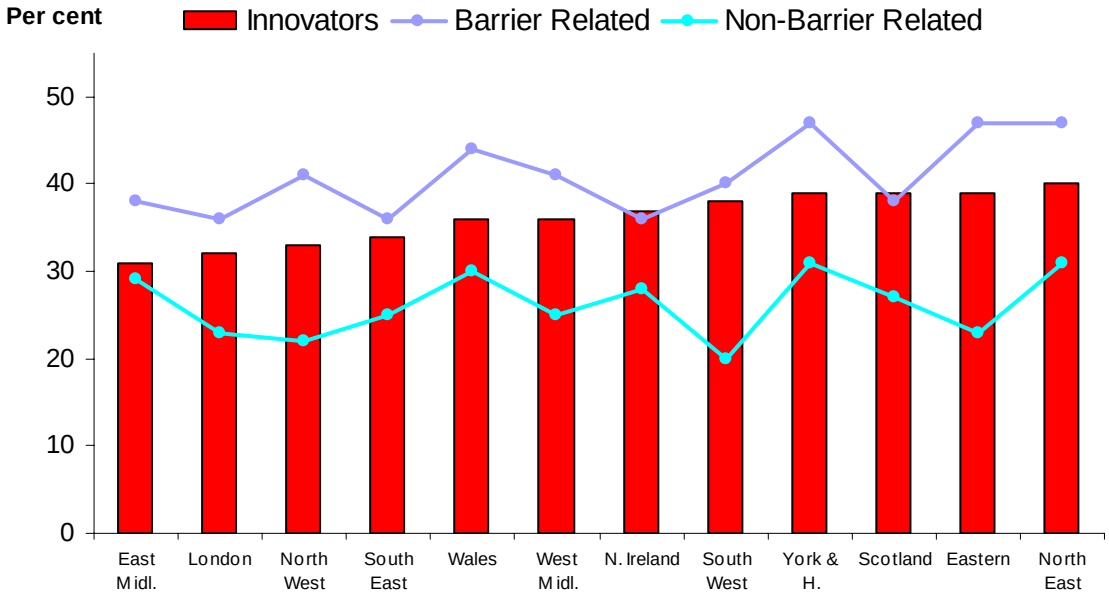
Figure 7.1 illustrates the proportion of firms in each group that rank ‘cost barriers’ as highly important by region. It shows that, on the one hand, the ‘barrier related’ group has a higher proportion of firms assessing barriers as important across all regions (with Northern Ireland and Scotland as the only exceptions, with percentages similar to that of innovators). Therefore, ‘barrier related’ firms most frequently assess cost barriers as important compared to the other groups, regardless of the region considered. The results for the other types of barriers follow a very similar pattern to what described for ‘cost barriers’ (see Figures 7.2, 7.3 and 7.4 below).

On the other hand, the variance across regions in the share of firms assessing barriers as important is generally higher for the two groups of non-innovators as compared to the group of innovators. Furthermore, the rank of regions in terms of the proportion of firms assessing barriers as important differs between the three groups, though there are a few exceptions: for instance, in the case of cost barriers, the ranking of regions is positively (and significantly) correlated between ‘barrier related’ non-innovators and innovators.

These preliminary and descriptive findings seem to indicate not only that the external environment matters in influencing the innovative choices of firms, but also that the three

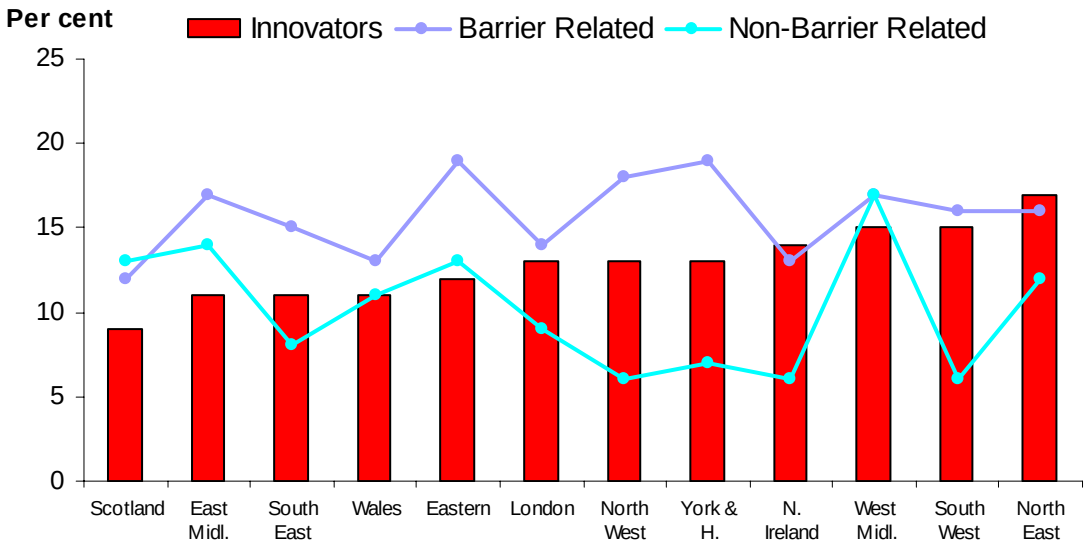
groups of firms differ in their assessment of barriers to innovation with respect to the profile of the region in which they are located. This calls for further investigation, and will be one of our future research lines.

Figure 7.1. Firms assessing barriers as highly important by region: Cost Barriers



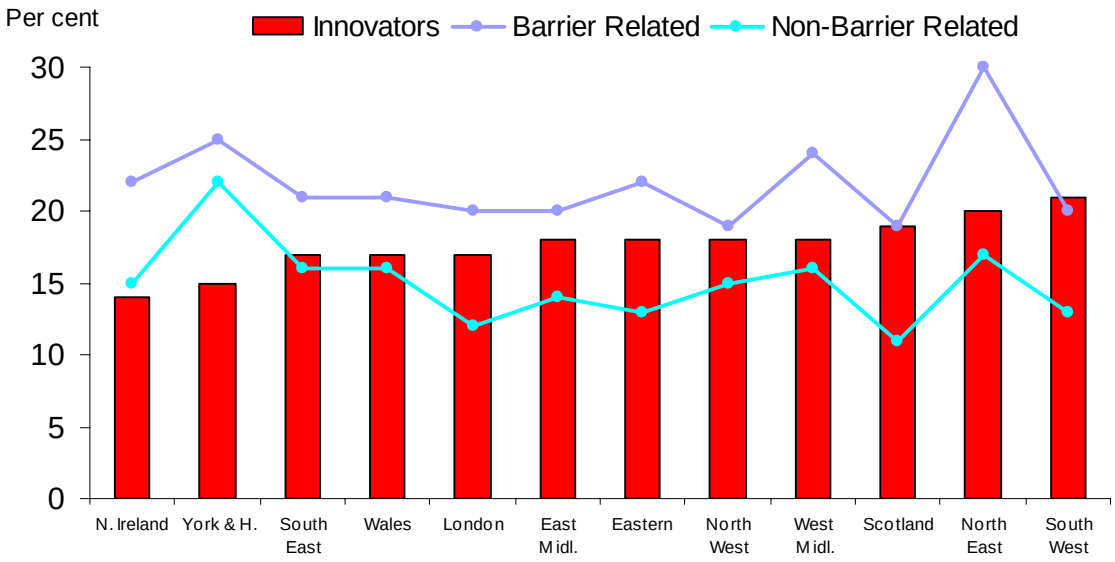
Note: Regions are ranked in ascending order according to the responses of innovators.

Figure 7.2. Firms assessing barriers as highly important by region: Knowledge Barriers



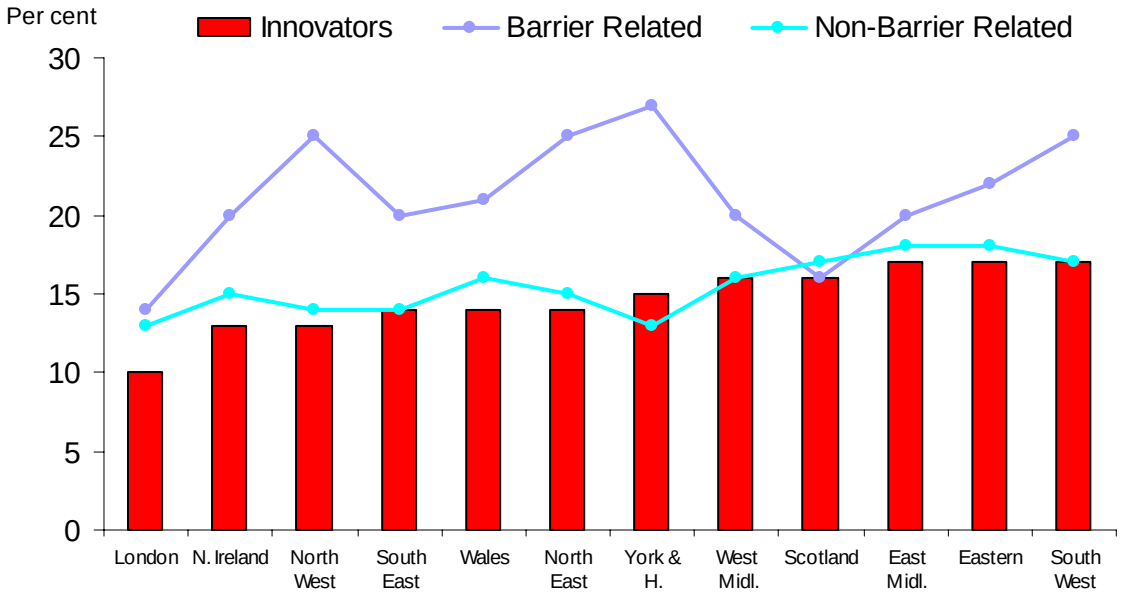
Note: Regions are ranked in ascending order according to the responses of innovators.

Figure 7.3. Firms assessing barriers as highly important by region: Market Barriers



Note: Regions are ranked in ascending order according to the responses of innovators.

Figure 7.4. Firms assessing barriers as highly important by region: Regulation Barriers



Note: Regions are ranked in ascending order according to the responses of innovators.

6. Factors influencing the assessment of barriers to innovation

This section examines two issues. First, it investigates whether the differences between groups of firms in terms of the assessment of barriers are consistent once we control for both firm and environment characteristics. Second, it examines the relationship between the assessment of barriers and the extent to which firms engage in innovative activities, and to what extent such relationship differs across groups of firms.

6.1. Assessment of barriers: do non-innovators differ from innovators?

The previous section has shown that 'barrier related' firms are more likely to assess barriers as highly important as compared to innovators (and also to 'non-barrier related' non-innovators). While that has been shown at a descriptive level, in this section we examine whether such differences are significant, once we explicitly consider a number of factors that may influence that assessment.

To do so, we consider firm and environment characteristics. Among firm characteristics, we include: a) firm size, as measured by the number of employees (log values); b) firm's degree of engagement in innovative activities (i.e. being 'innovation-active'), as measured by whether the firm has been engaged in 1 to 2, 3 to 4, or 5 to 7 innovative activities (based on question 13);[10] c) whether the firm is part of an enterprise group; d) whether the firm was established after 1st January 2000; and e) degree of internationalisation of the market served.[11] Additionally, the analysis includes regional and sectoral dummies.

Four dependent variables, one for each set of barriers, are considered. The dependent variables are dichotomous, indicating whether the firm assesses as important at least one barrier item (within each set of barriers). Our sample is composed of all innovators plus the two groups of non-innovators that have experienced at least one barrier item (i.e. 'barrier related' and 'non-barrier related' non-innovators): 11,555 observations in total – in other words, all those firms that we consider as being part of the innovation contest. A logistic regression model was applied. The results are reported in Table 3.

The results confirm that there are significant differences between the innovators (used as the reference category) and the two categories of non-innovators in terms of their assessment of

[10] The reference category in this case is that of firms that have not engaged in any of the innovative activities reported in question 13.

[11] This is a variable that takes the values 1 to 4 depending on whether the most distant market served by the company is the local market ('1'), the UK ('2'), Europe ('3') or any non-European country ('4').

barriers. Other things equal, being a 'barrier related' firm increases the probability of assessing barriers as highly important compared to innovators. Instead, a firm in the group of 'non-barrier related' non-innovators has a lower probability of assessing barriers as important compared to innovators (with the exception of regulation barriers, for which there are no significant differences).

Table 3. Logistic Regression: results
Dependent variable: whether the firm assesses at least 1 barrier as highly important

Two tailed T test: * p < 0.10; ** p < 0.05; *** p < 0.01.

Explanatory variables	**Cost related barriers**		**Knowledge related barriers**		**Market related barriers**		**Regulation related barriers**	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
1-2 Innovation Active	-0.246 ***	0.060	-0.230 ***	0.085	-0.417 ***	0.072	-0.142 *	0.075
3-4 Innovation Active	0.052	0.064	-0.009	0.090	-0.319 ***	0.077	0.015	0.081
5-7 Innovation Active	0.321 ***	0.072	0.246 **	0.100	-0.167 *	0.087	0.410 ***	0.091
LN Employees	-0.079 ***	0.015	-0.135 ***	0.023	-0.069 ***	0.019	-0.135 ***	0.021
Part of a larger company	0.025	0.046	-0.084	0.066	0.005	0.056	-0.171 ***	0.060
Start up	0.201 ***	0.056	0.095	0.077	0.150 **	0.068	-0.126 *	0.073
International market	0.003	0.021	-0.067 **	0.029	0.070 ***	0.025	-0.172 ***	0.027
Barrier related	0.330 ***	0.049	0.261 ***	0.068	0.312 ***	0.060	0.401 ***	0.063
Non Barrier related	-0.357 ***	0.065	-0.290 ***	0.094	-0.227 ***	0.062	-0.004	0.081
Constant	-0.344 ***	0.129	-1.175 ***	0.181	-1.057 ***	0.157	-1.315 ***	0.172
Regional Dummies	Included		Included		Included		Included	
Sector Dummies	Included		Included		Included		Included	
N total observations	11302		11300		11299		11299	
N (dependent var. =1)	3999		1462		2049		1873	
Log Likelihood	-7170.5		-4263.7		-5265.5		-4902.9	
Chi-square	346.7 ***		178.2 ***		166.5 ***		342.8 ***	

Table 3 shows also that the relationship between being an innovation-active firm and the importance attached to barriers is not straightforward. On the one hand, these results provide only partial support to the existing empirical literature arguing that there is a positive relationship between engagement in innovation and assessment of barriers as important. Our results show that firms that engage heavily in innovative activities are more likely to assess barriers as important as compared to those that do not engage at all (with the only exception of 'market related' barriers). However, on the other hand, Table 3 shows that such a positive relationship is non-linear, in the sense that firms need to progress beyond a certain threshold of engagement in innovative activities before a positive relationship emerges. Below such a threshold, the relationship is negative; that is, firms that do not engage at all in innovative activities are more likely to assess barriers as important as compared to those that engage moderately or slightly (i.e. in just one or two innovative activities).

The existence of a non-linear relationship between degree of engagement and assessment of barriers as important provides, in our opinion, a line of reconciliation between two conflicting interpretations: the one based on the appreciation of barriers to innovation as *revealed* by experience, and the one based on the appreciation of barriers as *deterring* innovation activities.

As explained above, by looking only at those firms that are entitled to be classified as innovative-active (those firms in the innovation contest), we avoid the distortion caused by including non-innovating firms that are not appropriate comparators. As indicated in Table A1 in the Appendix, when all firms are included the results are likely to be strongly biased, 'artificially' reinforcing the argument of the positive relationship (i.e. the *revealed* barriers story). However, once we exclude those non-innovators that are not in the innovation contest, the straight positive relationship between engagement and assessment of barriers largely vanishes, and we come closer to a non-linear relationship.[12]

Finally, by highlighting the fact that some non-innovators are more likely to assess barriers as important (as compared to innovators), we open the question of whether different groups of firms display different patterns with respect to the relationship between degree of engagement and the importance attached to innovation barriers. We turn to this analysis in the following section.

6.2. Assessment of barriers and engagement in innovative activities

This sub-section investigates the extent to which innovators and non-innovators differ in terms of the relationship between the degree of engagement in innovative activities and the assessment of barriers. We examine this relationship for each group of firms separately. In order to capture the extent to which firms assess a certain barrier group as important, we define our dependent variable as a categorical ordered one, considering the number of barrier items (within each barrier set) that are assessed as highly important.[13]

The explanatory and control variables are those used in the preceding analysis (see sub-section 6.1). In accordance with the nature of the dependent variables, ordered logistic regressions were run. The size of our samples varies across groups of firms: 5,820 observations for innovators; 2,334 for 'non-barrier related' non-innovators; and 3,401 for

[12] Table A1 in the Appendix reports the results only for the case of Cost-related barriers. The results are very similar for all types of barriers.

[13] Thus, for instance, in the case of 'cost factors' the dependent variable ranges from 0 to 4, since firms may assess either none, one, two, three or all four cost-related items as highly important.

'barrier-related' non-innovators. Tables 4, 5 and 6 display the results of the regressions for each of the three groups of firms respectively.

Table 4. Ordered Logistic Regression: Sample of *innovators*
Dependent variable: number of barrier items assessed as highly important

Explanatory variables	**Cost Related barriers**		**Knowledge related barriers**		**Market related barriers**		**Regulation related barriers**	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
1-2 Innovation Active	0.026	0.122	-0.078	0.182	0.107	0.162	-0.070	0.173
3-4 Innovation Active	0.358 ***	0.119	0.184	0.175	0.221	0.158	0.342 **	0.166
5-7 Innovation Active	0.634 ***	0.121	0.407 **	0.178	0.327 **	0.161	0.676 ***	0.168
LN Employees	-0.066 ***	0.020	-0.110 ***	0.030	-0.046 *	0.026	-0.091 ***	0.028
Part of a larger company	0.045	0.060	-0.028	0.089	0.034	0.078	-0.082	0.085
Start up	0.267 ***	0.075	0.184 *	0.107	0.244 **	0.096	-0.081	0.106
International market	-0.025	0.027	-0.079 *	0.040	0.062 *	0.035	-0.234 ***	0.038
Constant (first threshold)	0.637 ***	0.189	1.356 ***	0.275	1.559 ***	0.245	1.638 ***	0.272
Regional Dummies	Included		Included		Included		Included	
Sector Dummies	Included		Included		Included		Included	
N total observations	5793		5793		5792		5792	
Log Likelihood	-6227.7		-2654.6		-3178.9		-2806.3	
Chi-square	133.8 ***		82.3 ***		69.6 ***		156.4 ***	

Two tailed T test: * p < 0.10; ** p < 0.05; *** p < 0.01.

Table 5. Ordered Logistic regression: Sample of '*non-barrier related*' *non-innovators*
Dependent variable: number of barrier items assessed as highly important

Explanatory variables	**Cost Related barriers**		**Knowledge related barriers**		**Market related barriers**		**Regulation related barriers**	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
1-2 Innovation Active	-0.182	0.113	-0.014	0.170	-0.442 ***	0.144	0.154	0.136
3-4 Innovation Active	0.205	0.152	0.279	0.226	-0.392 *	0.210	0.421 **	0.183
5-7 Innovation Active	0.701 ***	0.248	0.902 ***	0.344	0.340	0.303	0.520 *	0.316
LN Employees	-0.108 ***	0.040	-0.239 ***	0.068	-0.016	0.048	-0.227 ***	0.053
Part of a larger company	-0.199 *	0.118	-0.077	0.183	-0.007	0.143	-0.285 *	0.150
Start up	0.217 *	0.131	0.067	0.197	0.157	0.164	0.087	0.160
International market	0.059	0.053	-0.109	0.084	0.054	0.066	0.023	0.067
Constant (first threshold)	-0.704 **	0.279	-1.282 ***	0.425	-1.724 ***	0.350	-1.189 ***	0.353
Regional Dummies	Included		Included		Included		Included	
Sector Dummies	Included		Included		Included		Included	
N total observations	2245		2245		2245		2245	
Log Likelihood	-1995.3		-860.7		-1100.9		-1134.0	
Chi-square	55.1 ***		79.9 ***		46.7 ***		53.6 ***	

Two tailed T test: * p < 0.10; ** p < 0.05; *** p < 0.01

Table 6. Ordered Logistic regression: sample of *barrier-related non-innovators*
Dependent variable: number of barrier items assessed as highly important

Explanatory variables	**Cost Related barriers**		**Knowledge related barriers**		**Market related barriers**		**Regulation related barriers**	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
1-2 Innovation Active	-0.532 ***	0.088	-0.492 ***	0.121	-0.635 ***	0.105	-0.326 ***	0.107
3-4 Innovation Active	-0.346 ***	0.098	-0.360 ***	0.136	-0.591 ***	0.120	-0.470 ***	0.126
5-7 Innovation Active	-0.147	0.133	-0.056	0.181	-0.512 ***	0.169	0.009	0.167
LN Employees	-0.111 ***	0.028	-0.125 ***	0.041	-0.135 ***	0.036	-0.177 ***	0.037
Part of a larger company	-0.030	0.080	-0.202 *	0.116	-0.062	0.101	-0.283 ***	0.106
Start up	0.201 **	0.096	0.013	0.136	0.004	0.120	-0.350 ***	0.128
International market	-0.005	0.036	0.007	0.051	0.081 *	0.044	-0.161 ***	0.048
Constant (first threshold)	0.511 **	0.207	-0.987 ***	0.291	-0.281	0.253	-0.510 *	0.277
Regional Dummies	Included		Included		Included		Included	
Sector Dummies	Included		Included		Included		Included	
N total observations	3264		3262		3262		3261	
Log Likelihood	-3882.5		-1752.8		-2077.6		-1984.4	
Chi-Square	123.4 ***		57.2 ***		96.4 ***		152.6 ***	

Two tailed T test: * p < 0.10; ** p < 0.05; *** p < 0.01.

Table 4 shows that innovators are more likely to assess a higher number of barrier items as important, the more they engage in innovative activities. Even though the intensity of the relationship varies from one barrier type to another, there is always a common pattern characterised by a positive and statistically significant relationship for all types of barriers to innovation. This result is consistent with the findings from the existing literature, and with the argument of *revealed* barriers: innovative-active firms are more likely to be exposed to barriers to innovation, and therefore more likely to assess barriers as important.

Such a pattern is also present from the results reported in Table 5. For the sample of 'non-barrier related' non-innovators our results show a positive relationship between the degree of engagement in innovative activities and the likelihood of assessing barriers as important, with the only exception of 'market-related barriers'. Therefore, for this group of non-innovators only market-related barriers seem to act as a deterrent for their engagement in innovative activities; while the other three types of barriers are perceived as important alongside firms' engagement in innovative activities.

The fact that both innovators and 'non-barrier related' non-innovators largely display a positive relationship between assessment of barriers and engagement in innovation activities, indicates that these two groups of firms increase their awareness of the importance of barriers alongside their engagement in innovative activities, rather than being deterred by barriers.

Conversely, Table 6 shows that for the group of 'barrier-related' non-innovators we can clearly reject the hypothesis of a positive relationship between assessment of barriers as

important and being innovation-active. In fact, the probability of assessing barriers as highly important does not increase with the degree of engagement in innovative activities. More importantly, in all cases there is strong evidence of a negative relationship between assessment of barriers as important and the degree of engagement in innovation activities. In other words, for 'barrier related' non-innovators, firms that do not engage at all in innovative activities show a significantly higher assessment of barriers than those that engage marginally (in 1 or 2 activities) or moderately (in 3 or 4 innovation activities). These results seem to indicate that, for this group of firms, barriers to innovation act as a deterrent to innovative activities. In other words, it is not the engagement of innovative activities that explains firms attaching greater importance to barriers; instead, this group of firms seem to be inhibited from being innovation-active as a consequence of how important barriers are perceived to be.

7. Summary and conclusions

The analysis carried out highlights different issues. Firstly, it is crucial to distinguish between non-innovating firms that have some aspiration to be innovative from those that do not find it necessary to innovate – largely as a result of the characteristics of the environment in which they operate. Our findings show that distinguishing among non-innovative firms is relevant for a number of reasons. We know that a large proportion of companies are rather indifferent about innovative activities (DTZ, 2004). As we have argued, such an attitude is the defining feature of the firms in the group we have labelled as 'not in the innovation contest'. About 80% of firms in this group have not engaged in any innovative activity, consistently with their responses indicating that innovation is not seen as necessary mainly because of the conditions of the markets in which they operate. It is thus essential to single them out when comparing innovators with non-innovators, to avoid misleading results.

As this paper has shown, when we compared innovators with the whole set of non-innovators (as if they were a homogeneous group), we found that the former are much more likely to have experienced barriers and assessed them as important. However, once we distinguish between different types of non-innovators, we observe that the picture that emerges is dramatically different. Two groups of non-innovators do experience barriers to a greater or similar degree as compared to innovators; even more importantly, firms in the 'barrier related' group assess obstacles to innovation as being more important as compared to strictly defined innovative firms.

Secondly, the paper shows that it is also critical to distinguish between two different mechanisms through which barriers to innovation operate. The first is characterised by a situation in which barriers to innovation act as factors that obstruct firms' achievements in their innovative activities – here named *revealed* barriers. The second mechanism is characterised by a situation in which barriers act as factors preventing firms from engaging in innovative activities – here called *deterring* barriers. Most of the existing literature on barriers to innovation based on innovation surveys has addressed the first type of barriers, in which firms confront obstacles to innovation alongside their engagement in innovative activities, but it has largely failed to capture the second type.

We have shown that, when all firms seeking to innovate are considered together, the relationship between assessment of barriers and engagement in innovative activities is characterised by a non-linear relationship, indicating that both the deterring and revealed components are present. That is, the assessment of barriers as important is higher at the extremes: when firms are not engaging in innovative activities and when they are engaging heavily.

When we consider innovative and non-innovative firms separately, we observe that innovators largely conform to a situation of *revealed* barriers, as well as 'non-barrier related', which follow a pattern characterised by assessing barriers as highly important alongside their engagement in innovative activities. Accordingly, the policy measures required to remove or attenuate the effects of the obstacles to innovation for these two groups of firms are likely to be related to a better management of innovation activities, in order to minimise the impact of obstacles in the course of such activities.

'Barrier-related' non-innovators, instead, conform to a pattern characterised by *deterring* barriers, and therefore, would require policy measures that facilitate the outset of innovative efforts in the first place. A detailed analysis of this issue is beyond the scope of this paper, though it is certainly an area that would deserve further attention.

A further step in our research will be an in-depth exploration of the geographical dimension of the phenomenon here considered. As seen in Section 5.2 above, a regional system component emerges in explaining the variance of responses. While these findings highlight the existence of sharp differences across regions in the extent to which firms assess barriers to innovation as important, we still need to improve our understanding about the factors driving such differences. One specific question we should pay particular attention to is related

to the extent to which non-innovators are more likely to perceive obstacles as discriminating factors, actually preventing them from innovation activities, in highly dynamic and innovative environments. While in less competitive regions there might be a tendency for firms to attach less importance to barriers, putting more emphasis on other causes underlying the lack of innovation. These questions need a careful and detailed investigation for the relevance that they could have in terms of regional innovation policy.

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Appendix 1

Table A1. Logistic regression for Cost related barriers

Dependent variable: dichotomous variable, whether the firm assesses at least 1 barrier item as highly important

	Total sample (15150 firms)		**Only firms in the innovation contest** (11555 firms)			
			Without dummies for non-innovators		With dummies for non-innovators	
Explanatory variables	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
1-2 Innovation Active	0.614 ***	0.053	-0.118 **	0.057	-0.246 ***	0.060
3-4 Innovation Active	1.053 ***	0.055	0.176 ***	0.058	0.052	0.064
5-7 Innovation Active	1.320 ***	0.063	0.423 ***	0.066	0.321 ***	0.072
LN Employees	-0.077 ***	0.015	-0.080 ***	0.015	-0.079 ***	0.015
Part of a larger company	0.087 **	0.044	0.030	0.045	0.025	0.046
Start up	0.184 ***	0.053	0.198 ***	0.056	0.201 ***	0.056
International market	0.037 *	0.020	0.001	0.020	0.003	0.021
Barrier related	---		---		0.330 ***	0.049
Non Barrier related	---		---		-0.357 ***	0.065
Constant	-1.449 ***	0.114	-0.421 ***	0.119	-0.344 ***	0.129
Regional Dummies	Included		Included		Included	
Sector Dummies	Included		Included		Included	
N valid observations	14691		11302		11302	
N (dependent var. =1)	3999		3999		3999	
Log Likelihood	-8161.5		-7235.9		-7170.5	
Chi-square	878.6 ***		216.1 ***		346.7 ***	

Two tailed T test: * p < 0.10; ** p < 0.05; *** p < 0.01.