The Role of standards, regulations and intellectual property rights in the commercialization of innovative products and services

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Abstract

The study examines the problems faced by businesses when innovating and then commercializing their innovation. It is particularly focused on the role of standards, regulations and intellectual property rights in the commercialization of innovative products and services. The analysis has been conducted based on data from the Flash Eurobarometer 394 survey. We analyse the factors affecting the likelihood of a company having problems with the cost or complexity of standards, lack of standards or problems related to intellectual property rights. The actual effects of each potential problem on the commercialization of innovative products are examined using logit and ordered logit regressions. On the one hand, costly or complex standards seem to be a deterrent to the commercialisation of innovation. This is especially evident in Portugal, Italy, Poland and France. On the other hand, a lack of standards may harm the commercial success of innovation measured by the share of turnover due to innovation. Financial or non-financial government or administrative support may be an effective way to promote the commercialisation of innovation in the case of intellectual property rights. This problem is particularly significant in the fields of information and communication, manufacturing, real estate, as well as in science and technology companies.

Keywords: Standards; intellectual property rights; innovation; commercialization.

1. Introduction

Innovations represent one of the key factors leading to increased productivity and competitiveness in the economy. There is substantial evidence that the EU as a whole is not performing well in terms of innovation and in particular is lagging behind countries such as the USA and South Korea. Another very important problem which is even more evident in the EU is concerned with the commercialization of business innovation. Despite the fact that there are a significant number of companies that try to innovate their products or services, there is still a

relatively high proportion of those who fail to effectively commercialise them. In this case innovation could mean only unnecessary costs with no immediate benefits to the firm.

It is obvious that the motivation of private enterprises to innovate is rather low in such circumstances. There are many potential barriers that could prevent firms from commercialising their innovations. The role of standards and intellectual property rights in the

commercialization of innovation is rather ambiguous. They could be seen as a significant stumbling block to, but also as some assistance with, the commercialisation of innovative products. Blind (2013) has reviewed the evidence on the linkages between standardisation and innovation, in the process looking at the role factors such as of public procurement and intellectual property rights. In general he found only very limited empirical evidence of an impact on innovation, particularly a causal impact. This is a gap in the literature this paper seeks to fill. In particular we seek to identify whether standardisation facilitates innovation or places a barrier in its way. There is also an interaction between intellectual property rights and standards on several dimensions. For examples technical standards often involve the absorption of intellectual property rights, whilst their incorporation within a standard can give added value to the patent.

In this paper we will examine such effects using a data base on firms which accesses information on individual firms' innovation. We also identify the key factors affecting the probability that a firm has problems relating to standards, regulations or intellectual property rights respectively. In the next section we will review the literature both on innovation and standards. In section 3 we will discuss the data we use in the analysis. It will be based on the Flash Eurobarometer 394 survey carried out in January and February 2014 which includes questions about innovation activities and the commercialization of innovation. In section 4 we analyses this data using logit and ordered logit regression, and then finally we conclude the paper.

2. Literature Review

There can be found several definitions of innovation and the innovation process in the literature. Schumpeter's analysis included: (i) production of a new product or an existing product in a new quality, (ii) the introduction of a new manufacturing process in production, (iii) the use of a new hither-to unknown source of raw materials, (iv) gaining new markets, and
(v) changes in the management and organization of production (Jac, 2005). These correspond quite closely to the different measures of innovation we will be using, although we further distinguish between new goods and new services.

Mulgan and Albury (2003) define innovation as the successful implementation of a new or significantly improved product or service, process, a new marketing method, or a new organizational method that will bring substantial improvement to the economy, efficiency and quality of outputs and results. According to Greenhalgh and Rogers (2010) innovation can be defined as the application of new ideas to the product, processes, or other aspects of the activities of a firm that increase "value". Once more all of these have reasonably close equivalents with the types of innovation we will analyse.

Patents are often used as a proxy for inventions as for example by Artz et al. (2010). Inventions are seen as the first step towards innovation. Zachariadis (2003) argues that R&D expenditure is mostly reflected in the number of patents and patents have a positive effect on the development of technologies, which raises economic growth. Furthermore, similar effect of patents on growth is also shown by Hudson and Minea (2013). Moreover, Lin et al. (2013) used sales from patents as an alternative measurement of the innovation output of Taiwanese manufacturing firms.

As reported by Anselin et al. (1997), the accumulation of knowledge and its spillover into productive capacity through technological change is a central them in the new theory of endogenous growth. This is in line with the Triple Hellix model, where the relationships

between universities, industry and government are the key factor for innovation and further technological development (Etzkowitz and Leydesdorff, 2000).

Innovation activities in enterprises depend on several determinants. Zemplinerova and Hromadkova (2012) mention the firm's age, size and strategic features such as being a member of a group, orientation on foreign markets. There are also certain barriers to innovation such as financing, market competition and the economic situation of the country. Again we will be capturing many of these variables in our analysis. Vieites and Calvo (2011) identified as determinants of business innovation, human resources, and other organizational factors related to research and development (centralization, specialization etc.), financial resources and innovation support, technology resources, information and knowledge management, and research and development activities. In general, we can divide potential determinants of innovation in the enterprise into internal and external. Internal factors include for example, company size, company age and export orientation. External factors might include, e.g., conditions in a particular country, the intensity of competition in the domestic market, cooperation with external institutions and financial support of innovation from the state or other institutions.

Beginning with Schumpeter (1942), many have emphasized the positive relationship between size and innovation. But there is by no means complete agreement on this and Koudelkova (2014) found no significant relationship between the company size and successful innovation in the case of small and medium enterprise in Czech Republic. However, many studies, including Cohen and Klepper (1996), do show a positive relationship between R&D intensity and the size of a company. Still other studies (Acs and Audretsch, 1988) have found a negative or (Aghion et al. 2005, Zemplinerova 2010) an inverted-U shaped relationship between size and the R&D intensity. One of the potentially most important external factors is the degree of competition. Boone and Van Dijk (1998) argue that, if R&D is effective enough (if innovation is not too costly), a rise in competition increases total R&D expenditures. Lesakova (2014) argued that small and medium enterprises (SMEs) are forced to innovate, because of permanent competitive pressures. Aghion et al. (2005) in their empirical results show an inverted-U pattern between competition and innovation. Their analysis was based on firms listed on the London Stock Exchange during the 1973-1994 period. Obviously, innovation would not be possible without sufficient financial resources to facilitate the transformation of new ideas into successful innovation. Based on the survey conducted on 857 firms Lesakova (2014) concluded that a lack of financial resources is the main barrier to innovation for SMEs in Slovakia. Klemet (2014) also confirm that the biggest obstacle for increasing the intensity of innovation in Slovakia seems to be the lack of own capital. However, the total amount of financial support is not the only problem.

Standards may perform several roles including raising the efficiency of the organisation. This is potentially the case with standards such as ISO 9000 which is related to management practices. They are a signal of organisational quality and whether or not they actually do improve quality, ISO 9000 certification is a signal of such in a world of asymmetric information
(Hudson and Orviska, 2013). In line with ISO's initial remit, such standards may serve to reduce information costs and, thereby, increase trade (Swann et al. 1996). Although often viewed as voluntary, such international quality standards are sometimes required by regulation, particularly when trading in the EU. A second type of standard is some form of minimal quality that is common with respective, for example, to food. But it is far from restricted to food. The Waste, Electrical and Electronic Equipment (WEEE) regulations make producers responsible for their products when they become waste. Related to WEEE is the RoHS Directive connected with Restrictions of Hazardous Substances in Electrical and Electronic Equipment which puts limits on the maximum permitted level of lead, mercury, cadmium, etc. in a product (Orviska

et al., 2014). Standards related to food, benefit the quality producer in tending to drive low quality producers out of the market and through signalling quality, give consumers confidence that they can safely purchase goods. Some electrical standards perform the same rule, but the WEEE regulations have not been imposed to facilitate completion but rather to achieve another objective of society – reduce environmental damage and pollution. The signalling argument applies to firms higher up the supply chain as well as consumers. This is particularly the case if standard certification reduces the need for purchasing firms to undertake their own quality control checks on supplier firms (Tirole 1988)[1]. Hence, Anderson et al. (1999) suggest, and provide empirical support for, the hypothesis that firms supplying to other firms are particularly likely to face demands for ISO certification. Governments too, often require some measure of quality certification such as ISO 9000.

Vollebergh and van der Werf (2014) found that environmental standards contribute to the effective development of innovations which reduce environmental impacts. They also argue that the same is true for many other types of standards, which could facilitate innovation and the diffusion of technologies.

3. Data And Methodology

The data from Flash Eurobarometer 394 survey have been used in the empirical analysis. This survey has been carried out in January and February 2014 and includes firms' answers on questions about innovation activities, the commercialization of innovation as well as the public support of innovation. The survey has been conducted using ad hoc telephone interviews at the request of the European Commission. All questions and answers of this survey have been summarized and graphically illustrated in European Union (2014). Together 12,108 firms from Switzerland, USA and 28 EU member states have responded to the questions. However, we used only the data for the EU countries in our regressions. All the variables used in this study are defined in an appendix.

Based on the data, Table 1 provides information on the characteristics of firms who innovate. It tells us that small firms are less likely to innovate with respect to all types of innovation.

Table 1: Different types of innovation across different types of firms in:

|	Goods	Services	Processes	Marketing	Organization	Average
All	0.38	0.39	0.35	0.32	0.33	0.354
Small	0.32	0.34	*0.24*	*0.26*	*0.25*	0.282
Export focus	**0.50**	0.37	**0.45**	0.34	0.38	0.408
Young	*0.27*	**0.43**	*0.26*	0.30	0.33	0.318
Sell to government	**0.40**	**0.45**	0.37	0.35	0.38	0.390

Notes: 5 highest correlations are emboldened and the 5 lowest italicised. Export focus is defined as those firms with an export share in excess of 10%, small are firms with 1-9 employees, young are firms started since January 2013, Source: derived from Flash Eurobarometer 394 survey.

However, this does not mean that innovation per worker or assets employed are less than in larger firms. In addition the innovative small firm may be tomorrow's large firm, as for example with Apple. Having an export focus tends to be associated with particularly large levels of innovation, apart from service innovation. In particular innovation in goods and processes is substantially stimulated. Innovation, particularly in services and organisation, is

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[1] For example, when three US car manufacturers adopted ISO 9000 procedures it replaced three separate programs that required suppliers to submit different sets of documentation and allow periodic audits by the car firms. ISO 9000 registration then became the only supplier requirement.

also stimulated by having the government as a customer. Finally, young firms tend not to innovate. Again this may be misleading, for almost by definition young firms innovated at birth. Hence they may be newer and up to date in all their activities. Despite this, they do have a high propensity to innovate in services.

Secondly, we turn to the constraints firms experience in commercialising their products or services. We analyse problems regarding commercialisation as reported by firms. The answers on the question about potential problems have been coded 1-3 where 3 means it a major problem, 2 a minor problem a 1 means it is not a problem at all. The average values for each problem are shown in the Figure 1.
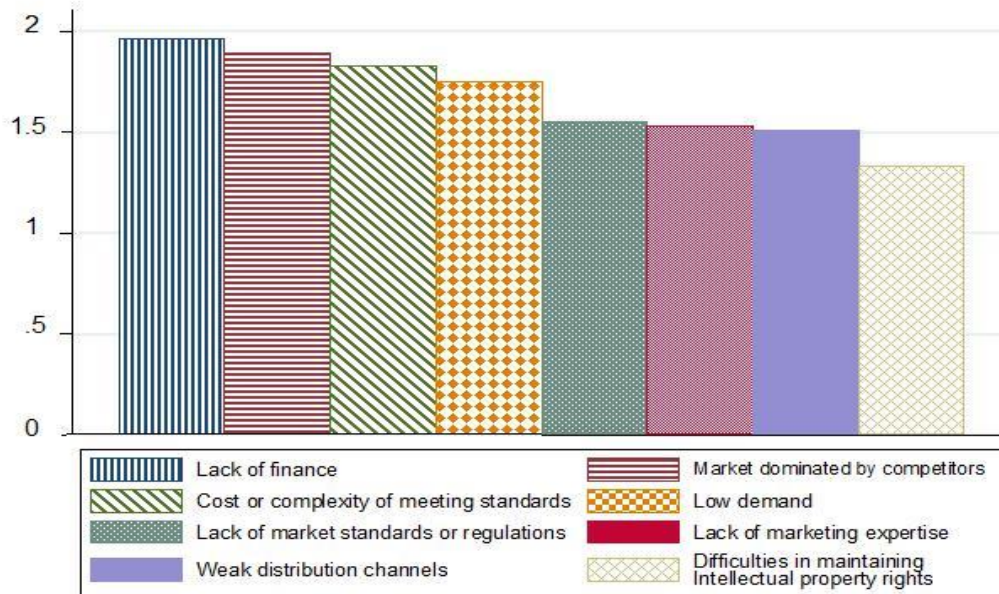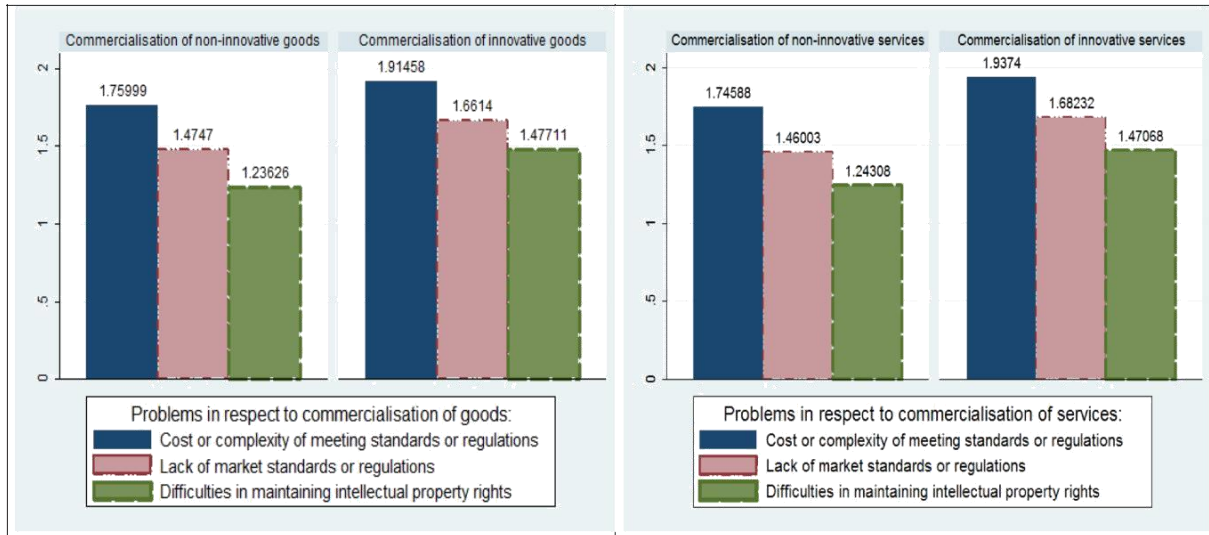

Source: Authors calculations based on data obtained from Flash Eurobarometer 394 survey.

Figure 1 Problem in the commercialisation of innovative and non-innovative products

As can be seen, the most common constraint to the commercialisation of all types of products was lack of finance. More than 33 % of firms in the sample declared this as a major problem for them. Competition seems to be the second most important factor. The cost or complexity of meeting standards or regulations is at third place. This problem is of course of particular importance for our analysis. More than 24% of firms in the sample mentioned that this is a major problem for them with respect to the commercialisation of their products and more than 31% see this factor as a minor problem. On this basis it would appear that the major problems firms face are a lack of finance, competition and complex or costly standards or regulation. On the other hand, a lack of standards appears to be a less intensive problem for most of the firms. However, the lack of standards is still either a major or minor problem for approximately 36% of firms.

When we distinguish between the commercialisation of innovative and non-innovative goods and services, as could be expected, problems with standards and intellectual property rights are more substantial for innovative products. Thus, all three problems related to standards become more crucial issues when firms try to commercialise their innovative products. This is especially true for intellectual property rights, where the difference between innovative and non-innovative goods or services is the highest. The graphical illustration of this can be seen in Figures 2 and 3.

Source: Authors calculations based on data obtained from Flash Eurobarometer 394 survey.

Figure 2 and Figure 3 Selected problems with commercialisation of innovative and non-innovative goods (left) and services (right)

Turning to differences between countries, the cost or complexity of meeting standards and regulations appears to be the most significant issue in Portugal, Italy and Poland as can be seen in Figure 4. Interestingly, the lack of market standards or regulations is perceived as the most significant problem again in Portugal, followed by Romania, Bulgaria, Cyprus and Italy as shown in Figure 5.
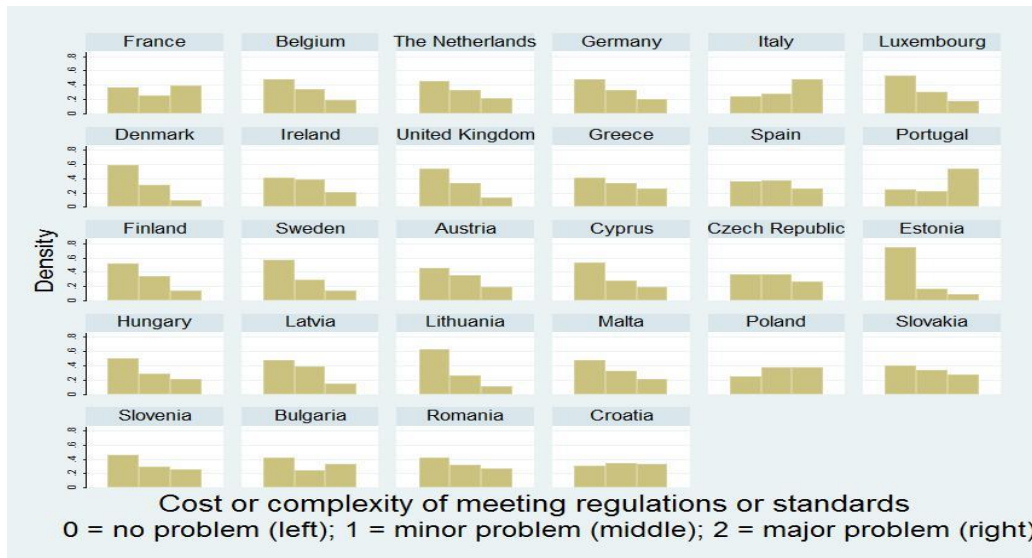
Source: Authors calculations based on data obtained from Flash Eurobarometer 394 survey.

Figure 4 Problems from cost or complexity of meeting standards or regulations in the EU countries
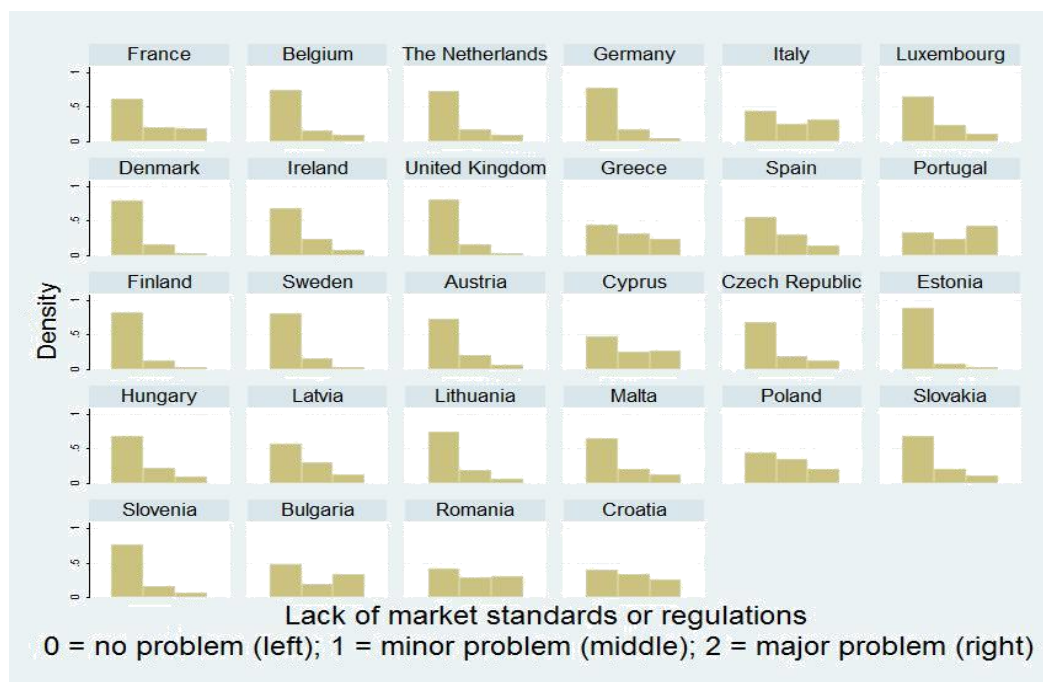
Source: Authors calculations based on data obtained from Flash Eurobarometer 394 survey.

Figure 5 Problems from a lack of market standards or regulations in the EU countries

In the next section we will examine the potential consequences of these constraints on the successful commercialisation of business innovation using logit regressions. Furthermore, we will also identify the key determinants of these problems and evaluate the effect of external support for meeting the standards or applying for intellectual property rights.

It seems probable that the problems with respect to the commercialisation of products could be different across sectors or countries. In line with this assumption we decided to examine the potential determinants of the three commercialisation problems related to standards and intellectual property rights. We seek to identify the specification of companies where this kind of problem appears to be especially significant by using ordered logit regressions. In doing this we seek to fill the gap identified by Blind (2013) as discussed earlier. In particular we seek to identify whether standardisation facilitates or places a barrier in the way of innovation and how its impact varies with the characteristics of both firms and countries.

4. Results

In the first part of the analysis, the cost or complexity of standards and regulations has been used as the dependent variable. The results, which are shown in Table 2, suggest that cost or complexity of standards is a less severe problem for wholesale, information and communication and real estate firms. The same is true for professionals and companies involved in scientific or technical activities. There seems to be an inverse U-shaped relationship between export focus and the problems with standards cost or complexity. The coefficients by country fixed-effect are in line with our previous findings. That is, the most intensive problems with the cost of standards are in Portugal, Italy and Poland.

Table 2: The results of ordered logit regression models – cost and complexity of standards

Cost or complexity of standards and regulations (0 = not a problem, 1 = a minor problem, 2 = a major problem)					
	Coef.	Country fixed effects	Coef.	Country fixed effects	Coef.
Size	-0.00001 (-0.25)	Belgium	-0.583*** (-4.13)	Hungary	-0.590*** (-4.00)
Year started	-0.089* (-1.66)	Denmark	-1.100*** (-7.76)	Latvia	-0.659*** (-4.81)
Market competition	0.076*** (3.13)	Greece	-0.192 (-1.33)	Lithuania	-1.201*** (-8.00)
Export share	0.011*** (3.67)	Spain	-0.119 (-0.89)	Malta	-0.534*** (-3.04)
Export share^2	-1.10e^{-6} *** (-3.42)	Finland	-0.782*** (-5.61)	Poland	0.420*** (3.14)
Sell to consumers	0.191*** (4.36)	France	0.233 (1.61)	Romania	-0.181 (-1.24)
Sell to companies	0.224*** (4.32)	Ireland	-0.289 (-2.08)	Slovakia	-0.087 (-0.60)
Sell to public sector	0.127*** (3.05)	Italy	0.756*** (5.29)	Slovenia	-0.441*** (-3.00)
C – Manufacturing	-0.077 (-0.75)	Luxemburg	-0.741*** (-4.25)	Cut 1	-0.243 [0.178]
D - Electricity Gas and	-0.072 (-0.35)	Netherlands	-0.451*** (-3.15)	Cut 2	1.220 [0.178]
E - Water and waste	0.045 (0.27)	Austria	-0.498 (-3.51)		
F – Construction	-0.080 (-0.78)	Portugal	0.788*** (5.17)		
G – Wholesale	-0.199** (-1.99)	Sweden	-0.902 (-6.18)		
H – Transport	0.161 (1.32)	Denmark	-0.558*** (-4.05)		
I - Accommodation and food	0.105 (0.82)	Great Britain	-0.831*** (-6.12)		
J - Information and communication	-0.562*** (-4.23)	Bulgaria	-0.042 (-0.27)		
L - Real estate	-0.331** (-2.02)	Cyprus	-0.557** (-2.26)		
M - Professional, scientific and technical activities	-0.308*** (-2.77)	Czech rep.	-0.178 (-1.28)		
Arts, entertainment and recreation	-0.039 (-0.21)	Estonia	-1.740*** (-10.79)		
Number of observations	10386	Wald X^2	870.19	Log pseudolikelihood	-10619.9

Notes: based on data obtained from Flash Eurobarometer 394 survey. Regressions done by ordered logit with standard errors corrected for heteroscedasticity. Variables are all defined in an appendix. (.) denotes z statistics, */**/*** mean significance at the 10%/5%/1% levels of significance.

Table 3: The results of ordered logit regression models – lack of market standards

Lack of standards or regulations (0 = not a problem, 1 = a minor problem, 2 = a major problem)					
	Coef.	Country fixed effects	Coef.	Country fixed effects	Coef.
Size	-0.00008 (1.29)	Belgium	-1.396*** (-8.74)	Latvia	-0.687*** (-4.83)
Year started	-0.038 (-0.65)	Denmark	-1.671*** (-10.32)	Lithuania	-1.436*** (-9.24)
Market competition	-0.005 (0.48)	Greece	-0.0287 (-0.20)	Malta	-0.936*** (-4.73)
Export share	0.006** (2.12)	Spain	-0.572*** (-4.26)	Poland	-0.112 (-0.84)
Export share^2	-8.85e^{-7} ** (-2.24)	Finland	-1.908*** (-11.35)	Romania	0.178 (1.23)
Sell to consumers	0.146*** (2.96)	France	-0.691*** (-4.76)	Slovakia	-1.023 (-6.49)
Sell to companies	0.051 (0.90)	Ireland	-1.073*** (-7.16)	Slovenia	-1.433*** (-9.07)
Sell to public sector	0.248*** (5.26)	Italy	0.088 (0.62)	Cut 1	-0.306 [0.192]
C - Manufacturing	-0.224* (-1.95)	Luxemburg	-0.995*** (-5.36)	Cut 2	1.033 [0.193]
D - Electricity Gas and	-0.148 (-0.64)	Netherlands	-1.246*** (-7.93)		
E - Water and waste	-0.152 (-0.80)	Austria	-1.308*** (-8.43)		
F - Construction	-0.241 (-0.55)	Portugal	0.564*** (3.80)		
G – Wholesale	-0.019** (-2.16)	Sweden	-1.707*** (-10.33)		
H – Transport	0.019 (0.14)	Denmark	-1.580*** (-10.46)		
I - Accommodation and food	-0.186 (-1.30)	Great Britain	-1.776*** (-11.36)		
J - Information and communication	-0.351** (-2.30)	Bulgaria	0.102 (0.65)		
K – Finance and insurance	-0.523** (-2.52)	Cyprus	0.091 (0.38)		
L - Real estate	-0.377** (-2.01)	Czech rep.	-1.110*** (-7.21)		
M - Professional, scientific and technical activities	-0.377* (-1.88)	Estonia	-2.316*** (-12.22)		
Number of observations	10182	Wald X^2	1199.87	Log pseudolikelihood	-8499.58

Notes: based on data obtained from Flash Eurobarometer 394 survey. Regressions done by ordered logit with standard errors corrected for heteroscedasticity. Variables are all defined in an appendix. (.) denotes z statistics, */**/*** mean significance at the 10%/5%/1% levels of significance.

The lack of standards and regulations may be seen as another hurdle for the commercialisation of innovative products. As it can be seen in Table 3, the lack of standards is a more intensive problem for firms that sell to final consumers and the public sector. Turning to the industrial sector, fewer problems with lack of standards are reported by companies in finance and

insurance, information and communication, real estate and wholesale. Furthermore, this problem is significantly more intensive in Portugal.

Table 4: The results of ordered logit regression models – lack of market standards

Difficulties in maintaining intellectual property rights (0 = not a problem, 1 = a minor problem, 2 = a major problem)					
	Coef.	Country fixed effects	Coef.	Country fixed effects	Coef.
Size	0.0001* (1.71)	Belgium	0.090 (0.39)	Latvia	0.325 (1.46)
Year started	0.178*** (2.62)	Denmark	0.028 (0.12)	Lithuania	0.408* (1.82)
Market competition	-0.018 (-0.56)	Greece	0.637*** (2.88)	Malta	0.150 (0.53)
Export share	0.018*** (4.85)	Spain	0.781*** (3.76)	Poland	1.114*** (5.48)
Export share^2	-1.44e^{-6} *** (-3.52)	Finland	0.037 (0.16)	Romania	1.250*** (5.75)
Sell to consumers	0.058 (0.98)	France	0.684*** (3.20)	Slovakia	0.801*** (3.64)
Sell to companies	0.133* (1.90)	Ireland	0.556** (2.50)	Slovenia	-0.240 (-0.99)
Sell to public sector	0.322*** (5.68)	Italy	1.312*** (6.35)	Cut 1	2.693 [0.269]
C – Manufacturing	0.327** (2.17)	Luxemburg	-0.061 (-0.22)	Cut 2	4.020 [0.274]
D - Electricity Gas and	-0.156 (-0.49)	Netherlands	-0.236 (-0.97)		
E - Water and waste	-0.331 (1.13)	Austria	0.616*** (2.78)		
F – Construction	0.173 (1.13)	Portugal	1.960*** (9.37)		
G – Wholesale	0.152 (1.02)	Sweden	0.131 (0.57)		
H – Transport	-0.255 (-1.35)	Denmark	0.643*** (3.05)		
I - Accommodation and food	0.224 (1.20)	Great Britain	0.049 (0.22)		
J - Information and communication	0.563*** (3.06)	Bulgaria	1.320*** (6.15)		
K - Finance and insurance	-0.254 (1.01)	Cyprus	1.050*** (3.34)		
L - Real estate	0.093** (0.39)	Czech rep.	0.430* (1.95)		
M - Professional, scientific and technical activities	0.405** (2.51)	Estonia	-1.147*** (-3.83)		
Arts, entertainment and recreation	0.713*** (2.82)	Hungary	0.165 (0.72)		
Number of observations	10024	Wald X^2	622.77	Log likelihood	-6043.72

Notes: based on data obtained from Flash Eurobarometer 394 survey. Regressions done by ordered logit with standard errors corrected for heteroscedasticity. Variables are all defined in an appendix. (.) denotes z statistics, */**/*** mean significance at the 10%/5%/1% levels of significance.

Finally, we analysed firms' characteristics which lead to problems with intellectual property rights. The results are summarized in the Table 4. It seems likely that older firms and those selling to the public sector have more problems with intellectual property rights. This is particularly evident for information and communication as well as manufacturing and real estate companies. Professionals and firms oriented on science and technology also more often face this kind of problem. Moreover, problems with intellectual property rights are significantly more often reported by firms from Portugal, Italy, Bulgaria, Romania, Poland, Czech Republic, Slovakia, Spain, Greece, France, Denmark, Austria, France and Ireland.

In the next part of the analysis we focus our attention on testing the actual effect of selected problems on the commercialisation of innovations. The results, which were estimated by logit and ordered logit with two different dependent variables, are summarized in Table 5. The dependent variable in first two regressions is a dummy variable taking a value of 1 for those firms that innovate but do not commercialize that innovation. Here we analyse the factors affecting the probability that the firm does not want to or fails to commercialise its innovation. Of course the main focus is on the variables that are related to standards or regulations.

The dependent variable in the next pair of regressions relates to the perceived share of turnover gained due to innovations. This variable is measured on an ordinal five point scale from 0% (coded as 1) to 76-100% (coded as 5). By using ordered logit regression models with this dependent variable we are able to identify those factors affecting the commercial success of innovation. In addition to the variables at the level of individual firms we also applied country-specific average variables related to standards and regulations in order to eliminate potential endogeneity problems. All variables are defined in more detail in a data appendix.

The results for the first set of regressions, suggest that more expensive or more complex standards increase the probability that a firm will fail to commercialise its innovation. This result is also evident in the case of the country-specific averages. Higher cost of standards or complexity of standards in a certain country could lead to a higher proportion of firms that innovate but do not commercialise. On the other hand, a lack of market standards in the country seems to have a significantly negative effect. However this effect has been found only at the country level, but does appear in the case of the variable which measure firms' individual perception of this problem.

The situation will partially change when we take into account the difference in commercial success of the innovation measured by the share of total turnover. In this case we take into account only those firms that innovate in the selected period of the time. As can be seen from the second set of regressions in Table 5, the cost or complexity of standards does not have any significant effect. On the other hand, the lack of market standards at country level does have a significantly negative effect on the share of turnover induced by innovation. It seems that lack of standards in the country could decrease the number of those firms that failed to commercialise their innovation, but at the same time decrease potential turnover arising from commercialised innovation. Thus, it is easier for all firms to commercialise innovation in a business environment with less standards or regulations, but the return of the innovation could in these circumstances be significantly lower. Thus standards could be seen as some kind of barrier, but when this barrier is crossed the benefits will appear in the form of higher potential revenue. Similarly, the perceived problems with maintaining intellectual property rights could be seen as the factor supporting commercial success of innovation. Those firms that have to deal with intellectual property rights increase their probability of getting higher revenue from the commercialised innovation.

Table 5: The results of logit and ordered logit regressions

Dependent variable:	Innovate but not commercialize			Share of turnover due to the innovation		
	(1)		(2)	(3)		(4)
	coef.	odds ratio	coef.	coef.	odds ratio	coef.
Size	-3.99e⁻⁶ (-0.09)	0.999	0.00001 (0.25)	0.00002 (0.40)	1.00002	0.00002 (0.27)
Year started	0.002 (1.35)	1.036	0.050 (0.60)	0.694*** (7.23)	2.002	0.121*** (6.84)
Market competition	-0.033 (-0.91)	0.967	-0.034 (-0.92)	0.123*** (2.75)	1.131	0.121*** (2.64)
Export share	0.002 (1.35)	1.002	0.0005 (0.38)	0.005*** (4.25)	1.005	0.006*** (4.59)
Sell to consumers	0.007 (0.10)	1.007	-0.060 (-0.87)	-0.028 (-0.40)	0.972	-0.344 (-0.46)
Sell to companies	-0.019 (-0.02)	0.998	0.008 (0.09)	0.244** (2.53)	1.276	-0.292*** (2.97)
Sell to public sector	0.110* (1.68)	1.116	0.108 (1.62)	0.144** (2.11)	1.155	0.161** (2.32)
Manufacturing	0.024 (0.25)	1.025	0.018 (0.18)	0.239** (2.23)	1.270	0.268** (2.47)
Retail	-0.116 (-1.28)	0.891	-0.162* (-1.67)	0.239** (2.35)	1.271	0.290*** (2.82)
Services	-0.163* (-1.77)	0.849	-0.160* (-1.71)	0.226** (2.09)	1.253	0.269** (2.47)
Professionals and science	0.277** (2.46)	1.320	0.261** (2.29)	0.290** (2.18)	1.336	0.255* (1.89)
Lack of finance	0.164*** (4.03)	1.178	0.147*** (3.54)	0.021 (0.48)	1.021	0.037 (0.83)
Lack of marketing	0.182*** (3.62)	1.200	0.187*** (3.64)	0.053 (1.04)	1.054	0.041 (0.78)
Cost or complexity of standards	0.112*** (2.67)	1.119	0.111** (2.59)	0.015 (0.34)	1.015	0.020 (0.43)
Market dominated by competitors	-0.012 (-0.29)	0.988	-0.010 (-0.24)	-0.026 (-0.60)	0.974	-0.370 (-0.82)
Low demand for your goods or services	-0.098** (-2.27)	0.907	-0.110** (-2.45)	-0.111** (-2.24)	0.895	-0.119** (-2.38)
Maintaining IPRs	0.010 (-0.18)	0.990	0.253 (0.45)	0.125** (2.31)	1.133	0.111** (2.01)
Lack of standards or regulations	0.047 (0.99)	1.049	0.451 (0.94)	0.009 (0.18)	1.009	0.013 (0.25)
Weak distribution channels	0.095* (1.91)	1.010	0.116** (2.29)	0.172*** (3.37)	1.188	0.158*** (3.03)
Country-specific variables:						
Cost or complexity of standards or regulations – country average	0.634*** (2.67)	1.886		0.360 (1.31)	1.434	
Lack of standards or regulations – country average	-0.751*** (-8.74)	0.472		-0.521** (-2.18)	0.594	
Countries fixed effects			YES			YES
Constant	-2.596*** (-8.74)	0.075	-2.350*** (-9.86)			
Observations	9468		9468	4957		4957
Log likelihood	-3835.79		-3755.66	-4615.32		-4572,90
Wald X²	119.63		280.17	140.27		225.24

Notes: based on data obtained from Flash Eurobarometer 394 survey. Regressions done by logit and ordered logit with standard errors corrected for heteroscedasticity. Variables are all defined in an appendix. (.) denotes z statistics, */**/*** mean significance at the 10%/5%/1% levels of significance. Countries fixed effect included in regressions (2) and (4).

In order to reduce problems with commercialisation, financial or non-financial support from government or administration are often used. In this part of the analysis we try to evaluate the actual effect of different types of support. Firms that receive any type of support have to

indicate whether this support has been important for the commercialisation of their innovations on a six point scale, where 1 represents that innovation would have been commercialised even without the support and 6 means that support was indispensable for commercialising the innovation. The average scores for each kind of support are graphically illustrated in Figure 6. The support for applying for or managing intellectual property rights seems to be the most useful according to firms. On the other hand support for meeting regulations or standards appears to be less important for most firms.
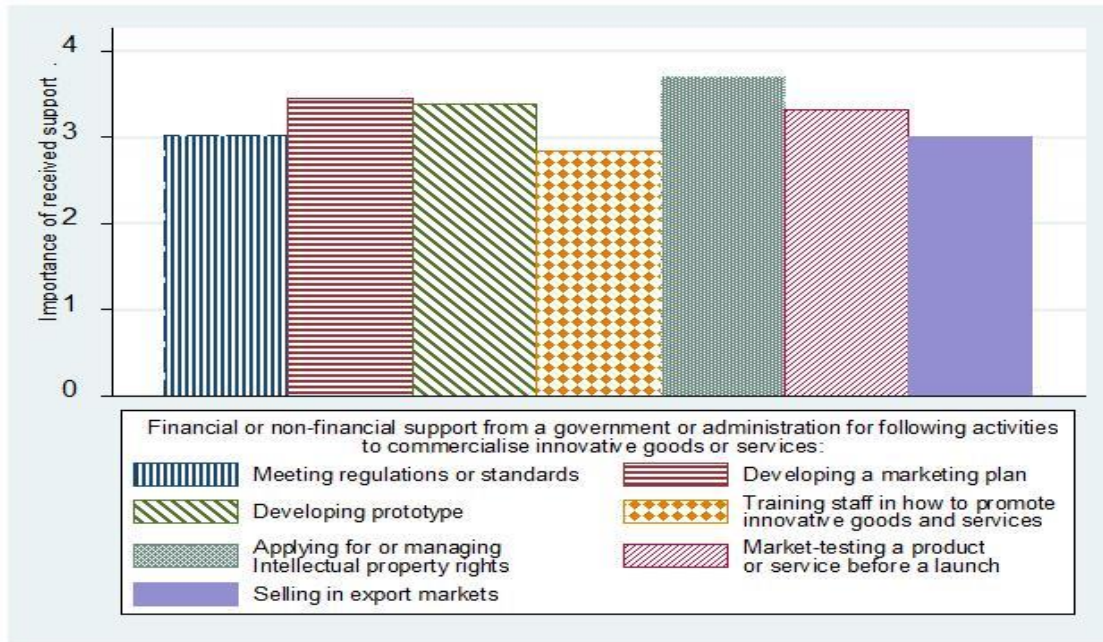
Source: Authors calculations based on data obtained from Flash Eurobarometer 394 survey.

Figure 6: The importance of different support types for commercialisation of innovation

The potential effects of each kind of support on commercial success of innovation measured by share of turnover due to innovation have been examined by an ordered logit regression model. The results of this model are shown in Table 6. As can be seen, there is a statistically significant and positive effect of the support for applying for or managing intellectual property rights. The positive effect of other types of support is rather questionable. The support for developing a marketing plan and selling in export markets is significant only at 10% level of significance.

Table 6: Results of ordered logit model – the effect of different support

Dependent variable:	Share of turnover due to innovation	
	coef.	Odds ratio
Size	9.64e-6	1.00001
	(0.15)	
Year started	0.703***	2.019
	(7.44)	
Market competition	0.083*	1.086
	(1.92)	
Export share	0.013***	1.013
	(3.07)	
Export share^2	-0.00008*	0.999
	(-1.88)	
Sell to consumers	-0.034	0.967
	(-0.49)	
Sell to companies	0.327***	1.387
	(3.50)	
Sell to public sector	0.161**	1.175
	(2.45)	
Manufacturing	0.266**	1.305
	(2.57)	
Retail	0.251**	1.285
	(2.56)	
Services	0.326***	1.385
	(3.33)	
Received support for:		
Meeting regulation or standards	0.015	1.015
	(0.10)	
Developing marketing plan	0.316*	1.372
	(1.85)	
Developing prototype	0.220	1.246
	(1.36)	
Training staff how to promote	0.087	1.091
	(0.63)	
Applying for or managing IPRs	0.863***	2.370
	(3.46)	
Market-testing	0.251	1.285
	(1.32)	
Selling in export markets	0.259*	1.296
	(1.71)	
Other	0.084	1.087
	(0.63)	
Countries fixed effects included	Yes	
Observations	5431	
Log likelihood	-5034.61	
Wald X2	268.36	

Notes: based on data obtained from Flash Eurobarometer 394 survey. Regression done by ordered logit with standard errors corrected for heteroscedasticity. Variables are all defined in an appendix. (.) denotes z statistics, */**/*** mean significance at the 10%/5%/1% levels of significance. Countries fixed effect included in regression.

5. Conclusions

The analysis has shown that costly and too complex standards could represent an obstacle to the commercialisation of innovations. On the other hand, too little standardisation could have a negative effect on potential revenues from the commercialised innovation. These results may relate to the role of standards in providing a level playing field, in particular by removing problems posed by asymmetric information facilitating the entry of inferior quality goods into the market. Thus, standards are some kind of barrier, but once innovative products pass through this barrier, higher potential revenue from this innovation could be the reward.

We have identified significant differences between countries. We have also provided evidence that in part these differences are related to the standardisation environment within countries. The cost and complexity of standards appears to be a problem especially in Portugal, Italy and Poland. This is an issue these, and indeed other governments should address. However, this problem is significantly less intensive in several sectors such as wholesale, information and communication and real estate. On the other hand, a lack of standards could be a problem especially for the firms selling to consumers and the public sector and also again for firms from Portugal. Lack of standards is less evident as a constraint in finance and insurance, information and communication, real estate and wholesale. Hence the answer to our research question is that standards, in some circumstances and if complex, can provide a barrier to innovation. But also the lack of standards can also prove to be a barrier. This should not be surprising. Standards create another regulatory hurdle innovations must clear before being successfully marketed. But standards also help new products and new firms become established by, for example, signalling quality. The conclusion also has similarities with that of Pelkmans and Render (2014) with respect to EU regulation in general that at times it be significantly stimulate innovation. However, more prescriptive regulation tends to hamper innovative activity.

The effect of intellectual property rights on the commercialisation of innovation is very similar. However, this problem is more significant in the case of older firms and those operating in the fields of information and communication, manufacturing and real estate. The problem with intellectual property rights is also evident in professionals and firms oriented on science and technology. Those firms that have initial problems with intellectual property rights or receive government or administration support for applying for or managing intellectual property rights have more commercial success with their innovations, receiving a higher share of turnover from innovative goods or services.

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Appendix 1 *Definition variables used in regression models*

Variables	Description of variables and their coding
Innovate but not commercialize	Which of the following best describes the commercialisation of innovation in your company? We have innovations, but we do not commercialise them (Coded 1) We have innovations and we commercialise them (Coded 0)
Share of turnover due to innovation	Approximately what percentage of your company's turnover was due to innovative goods and services? 0 % - coded 1; Between 1 and 25 % - coded 2; Between 26 and 50% - coded 3; Between 51 and 75 % - coded 4; Between 76 and 100% - coded 5.
Constraints to commercialisation of the company's innovative goods or services:	
Cost or complexity of standards and regulations	
Lack of standards or regulations	
Difficulties in maintaining intellectual property rights	Coded as follows: not a problem at all = 0 a minor problem =1 a major = 2
Lack of financial resources	
Lack of marketing expertise	
Market dominated by established competitors	
Low demand for your goods and services	
Weak distribution channels	
Has your company received financial or non-financial support from government or administration for any of the following activities to commercialise your innovative goods or services?	
Meeting regulation or standards	
Developing marketing plan	
Developing prototype	
Training staff how to promote	
Applying for or managing IPRs	Coded as: Yes = 1; No =0
Market-testing	
Selling in export markets	
Other support	
Size	Number of employees. (Most are small firms, the median is 13 and the 90th percentile 134).
Year started	Coded 1 if the firm was started before 1 January 2008, 2 if started between 1 January 2008 and 1 January 2013 and 3 if started after January 1 2013
Export share	The proportion of 2013 turnover which was came from exports
Sell to Consumers	Coded 1 if the firm sells to individual consumers, otherwise zero
Sell to companies	Coded 1 if the firm sells to other companies, otherwise zero.
Sell to Government	Coded 1 if the firm sells to public sector organisations, otherwise zero
Manufacturing	Coded 1 if in NACE category C
Retail	Coded 1 if in NACE category G
Services	Coded 1 if in NACE categories H/I/J/K/L/M/N/R

Source: Authors based on the Flash Eurobarometer 394 survey.

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