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Inefficiencies in Markets for Intellectual Property Rights: Experiences of Academic and Public Research Institutions

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Abstract

Universities' use of formal intellectual property rights (IPR) such as patents and registered copyright has increased steadily in the last two decades. Mainstream arguments advocating the application of IPR protection to academic research results, embedded in economic theory and policy, are based on the view that IPR marketplaces work well and allow universities to reap significant benefits.

However, evidence-based research to justify or critically evaluate these claims is lacking. Building upon an original survey of 46 universities and public research organizations in the United Kingdom, this study analyzes the quality of the institutions underpinning the markets for patents and copyright, investigating potential inefficiencies that could lead to underperformance of the IPR system. These include: (i) IPR market failures with respect to: search processes and transparency; price negotiation processes; uncertainties in the perception of the economic value of IP and the relationship with R&D cost; and (ii) institutional failures with respect to enforcement and regulation. Particular attention is paid to the role of the

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governance forms (e.g. alternative types of licensing agreements) through which IPR exchanges take place.

We find that a high share of universities report market failures in IPR transactions and that the choice of IPR governance forms matter for the market obstacles that are encountered. Given the importance of widely disseminating university research outcomes to foster innovation and economic development, the presence of inefficiencies in IPR markets suggests that such objectives could be best achieved by encouraging open distribution of knowledge, rather than privatization of academic knowledge as a best practice.

JEL: D02, D23, O31, O32, O34

Keywords: Intellectual Property (IP), IP transactions, markets, IP governance, patents, copyright, universities, public research organizations (PRO).

1. Introduction

Starting from the 1980s, policymakers have increasingly supported the view that protecting the results of academic research through intellectual property rights (IPR) is necessary for university-produced knowledge to be transferred effectively (see, for example, OECD, 2003). It was argued that the possibility to commercialize their own IP and to derive income from this activity would induce universities to be more proactive in disseminating their knowledge to the economic system, and would in turn allow industry to better exploit scientific discoveries (Eisenberg, 1996; Mowery and Sampat, 2005). Consequently, in many countries legislative measures have been passed aimed at strengthening university ownership of intellectual property (IP) with a view to encourage them to seek IPR protection and engage in IPR commercialization (see Geuna and Rossi, 2011, for an overview of legislative changes in Europe).

Although there is a growing literature on the nature and effects of university patenting activities, little attention has so far been paid to exploring how universities exchange IPR with other organizations - that is, how they engage in IPR markets - and the extent to which the institutional features of such markets allow universities to reach their strategic objectives. Understanding these issues however is important as an appraisal of the effectiveness of the legislation and policy measures that encourage universities to trade knowledge protected by IPR. It is also important in order to contribute to the ongoing debate as to whether academic knowledge is best disseminated through the traditional open science channels or through the use of IPR markets, since the arguments in favour of the latter are often dependent on the assumption that such markets function efficiently.

The present study makes an original contribution to these debates. Building upon UKNOW data¹ collected from the technology transfer offices of 46 universities and public research organizations in the United Kingdom (about 27.5% of the considered population), we perform an exploratory analysis of how efficiently and effectively these institutions use markets for IPR. In other work (Andersen and Rossi, 2010, 2011a, 2011b) we discussed how universities exchange various types of IP,

¹ The UKNOW database was developed as part of Work Package 3.2: "An IPR Regime in Support of a Knowledge Based Economy" of the UKNOW (Understanding the Relationship between Knowledge and Competitiveness in the Enlarged EU²) (2005-2009) project of the EU 6th Framework Programme.

proprietary and non-proprietary², in order to pursue different types of strategic benefits, and we suggested that non-proprietary forms of IP (such as open source and the exchange of non-patented innovations) are preferred in order to acquire external knowledge for innovation purposes and in order to transfer knowledge to external agents, while proprietary forms of IP (such as patents and copyright) are considered preferable when the objective is purely to gain income. We also found that non-proprietary forms of IP are exchanged at least as frequently as proprietary ones. In this study, we focus on proprietary IP embedded in patents or registered copyright. In particular, we explore the functioning of the markets where patents and copyright are traded, by investigating, from the universities' perspective, whether these markets suffer from inefficiencies.

The potential sources of inefficiencies that we analyze include: (i) IPR market failures with respect to: search processes and transparency; price negotiation processes; uncertainties in the perception of the economic value of IP and the relationship with R&D cost; and (ii) institutional failures with respect to enforcement and regulation. The analysis pays particular attention to the role of the governance forms through which IPR exchanges take place (e.g. alternative types of transaction agreements such as buying and selling, licensing, cross-licensing, pooling). Our findings allow us to explore ways in which the functioning of these markets could be improved, and to further contribute to the debate on the advantages and disadvantages of protecting academic research outcomes through IPR.

The article is structured as follows. In section 2, we review some of the existing literature on academic patenting and on the institutional features of IPR markets, which influence their efficiency and their effectiveness in allowing universities to reach their strategic objectives via IPR exchanges. We also discuss our approach to understanding IPR markets as institutions, in which our interest is in investigating the extent to which these markets suffer from “IPR market” and “institutional” failures, from the perspective of universities that engage in them. In section 3, we introduce the data underpinning the research. In section 4 we present and discuss the results of the empirical analysis, and in section 5 we draw some conclusions.

² In the following analysis, we use the term “proprietary IP” (or, equally, intellectual property rights, IPR) to identify IP upon which restrictions on use, sharing, copying and modification are enforced by legal means, and “non-proprietary IP” for IP on which some or all of these restrictions are relaxed.

2. Universities and IPR marketplaces: evidence and research gaps

2.1. Universities' involvement in IPR marketplaces

Universities' involvement in patenting has increased steadily in the last twenty years. At least since the 1980s, policymakers have supported the view that intellectual property rights are required for university-produced knowledge to be transferred effectively (see e.g. references in Eisenberg, 1996). It was argued that the possibility to commercialize their own IPR and to derive income from these activities would induce universities to be more proactive in disseminating their knowledge to the economic system (Eisenberg, 1996; Mowery and Sampat, 2005), and would allow them to derive extra income for their research activities (Kenney, 1986), which is especially important in a period of shrinking public budgets for higher education (Geuna and Muscio, 2009).

These and other arguments (reviewed extensively for example by Mowery et al, 2001) have underpinned the introduction of legislation directed at expanding and strengthening the application of IPRs to the outcomes of publicly-funded research, of which the Bayh-Dole Act implemented in the United States in 1980 is an early and very influential example. The Act gave US universities control of their inventions and other IP resulting from federally-funded research, and encouraged the use of formal IP protection in the form of patents. This was believed to be the best mechanism for, among other things, “providing an economic incentive for companies to pursue further development and commercialization of government sponsored R&D through corporate ventures between and among the research community, small businesses and industry” (Schacht, 2005).

Legislation aimed at similar objectives and including similar provisions has later been adopted in many other countries around the world (Geuna and Nesta, 2006). In many European countries, universities have moved away from the “professors' privilege” model of IPR assignment – according to which IPR on the outcomes of scientific research conducted at universities would be assigned to the professor-inventor, who would then be free to either apply for a patent directly or to let another beneficiary, usually, a firm, apply on his or her behalf – in favour of university ownership of IPR. Regulations that assign to universities the ownership of intellectual property arising

from government-funded research and the right to commercialize the results obtained have been implemented (with varying degrees of stringency) in Flanders (1998), Denmark (2000), Germany (2002), Austria (2002), Norway (2002) and Finland (2007). Italy is the only country that has bucked the trend, awarding ownership rights to faculty employees (Mowery and Sampat, 2005). In the UK, Cambridge maintained a model of assignment of IPRs based on the professors' privilege until very recently, and there is evidence that this mode of governance for IPR was successful, leading to intense technology exploitation on the part of local firms and supporting lively academic spinout activity (Breznitz, 2008, ref. in Kenney and Patton, 2009). Nonetheless, also Cambridge moved to a "university-owned" model of IPR governance in 2005.

As a consequence of the introduction of legislation assigning universities the right to patent publicly-funded research, and especially thanks to the establishment in most institutions of technology transfer offices that often pursue aggressive patenting policies, there have been increases in the number of university-owned patents (Geuna and Nesta 2006; Geuna and Rossi, 2010) and in universities' licensing revenues (AUTM, 2002, for the US; Geuna and Rossi, 2010, for Europe) indicating increased engagement of universities in transactions involving patents.

This is in line with a broader trend, which involves many sectors other than universities, consisting in the generalized increased use of markets for IPRs, often referred to in the literature as "markets for technology" (Arora et al, 2001; Athreye and Cantwell, 2005; Cockburn, 2007). The strategic use of IPR markets has become key to firms' economic success and sustainable corporate competitiveness (Thurrow, 1997; Chesbrough, 2003).

2.2. Market failures and institutional failures in IPR markets

The phenomenon of increased university patent ownership has attracted criticisms from academics, giving rise to an extensive literature on the negative effects of university patenting (recent comprehensive reviews of the debate can be found in Baldini, 2008, Nelson, 2004). Studies have investigated likely impacts of university patenting on the direction and quality of scientific research (as universities may eschew more risky, long term basic research in favour of more commercially

promising short term applied research projects), on the dissemination of research results (as universities may restrict the open circulation of scientific knowledge in the form of publications and research tools, limiting the further advancement of knowledge), on the quality and intensity of collaborations with industry (as universities may compete directly with firms for access to markets and litigate with them over the assignment of IPR, leading to a deterioration of their relationships), and ultimately even on the rate of innovation of the economy.

Despite the lively debate about the implications of university patenting, little attention has been paid to the problems that universities encounter when engaging in IPR markets. This is, nonetheless, a very important issue because most arguments advocating increased patenting of academic research results, and increased university ownership of such patents, are based on the assumption that the patent market works well and allows universities to reap significant benefits from engaging in it.

There are however many indications that this is not always the case. Evidence suggests that universities are often unsuccessful in reaping rewards from the privatization of academic knowledge.

First, it has been shown that income from technology transfer is very skewed, with very few universities making money from patents and licences (Charles and Conway, 2001; Bulut and Moschini, 2006): for many universities, the direct costs of IPR exceed revenues (Charles and Conway, 2001) and technology transfer offices struggle to be profitable (Kenney, 1986). It must be noted that, as universities gain experience with patenting and become more selective with their patent applications, the profitability of patent exploitation activity is increasing (see recent data for the UK presented by HEFCE/PACEC, 2010). Still, for most universities in the UK, collaborative research projects, including consultancies, are a more important source of income than licensing (D'Este and Perkmann, 2007).

Second, much patent effort in many universities does not realize value. For example, Tang et al (2009) discuss the problem of abandonment of university patents, finding evidence that 25-30% of patent applications are abandoned prior to the filing stage due to problems such as low quality of the patent, difficulty in finding a potential investor and/or the fact that the underlying technology is unsuitable for patenting. Tang et al (2009) suggest that this rate of abandonment does not indicate a failure of

the patent system as much as “further awareness of the disutility of “patenting everything that can be patented”³.

Several explanations have been proposed for the asserted inability of universities to exploit their IPRs to their full potential.

According to Macdonald (2009) one of the key problems that may explain the lack of success of many universities in exploiting the patent system for economic reward is that such system does not work well in all economic activities. The model of knowledge production and transfer based on intensive patenting works well in the pharmaceutical industry (Levin, 1986; Harabi, 1995) but it is not prevalent in most other industries, such as software and electronics, where most firms rely on trade secrets, marketing strategy and lead times to exploit technological advantage, rather than on patents (Brouwer and Kleinknecht, 1999). By adopting a model of technology transfer that is based on the experience of the pharmaceutical industry, university managers tend to overstate the importance of patents (Rappert et al, 1999). The fact that the importance of patents differs by industry (Klevorick et al., 1987) suggests that universities need different knowledge transfer procedures, methods and goals for differing industries. It must also be remembered that the sheer variety of university research activities implies that universities produce a wide range of intellectual property not all of which is suitable to be patented (Baghurst and Pollard, 2009)⁴.

Even in cases where university patents may hold value for industry, another problem is that university managers are often naïve users of the patent system, unaware that reaping its benefits requires using the system strategically (for example by engaging in defensive patenting or in amassing patent portfolios to cover specific areas of technology), or lacking the resources to do so (Macdonald, 2009). More generally,

³ The problem of under-exploitation of IPR is common to commercial firms as well. Rivette and Klein (2000) identified “a staggering \$1 trillion in [ignored] intellectual property asset wealth” in the US, while the PATVAL Survey of European inventors found that while 11% of a random sample of EPO patents had been licensed, an additional 7% could be licensed, but were not, and a study by consulting firm BTG International found that 35% of patented technologies (valued at \$115 billion) were ignored by the firms that developed them. Cockburn (2007), in a survey of US firms, finds that on average more than 1/3 of firms’ total inventory of IP is rated as being unlikely to be licensed even though the firm would be willing to transact if it could.

⁴ Examples are non-software copyrighted materials (articles, reports, books, lecture notes, presentations); software (source level code as well as executable programmes developed by researchers in the course of their research work); materials (synthesised by researchers working in the fields of chemistry and materials); database rights; cell lines; new plant or animal varieties; registered and unregistered designs; photographs and videos; research questionnaires; and finally, tacit knowledge (know-how), which is hard to codify and transfer but which is nonetheless valuable to third parties.

Rivette and Klein (2000) point to managerial myopia, inertia, and incompetence as explanations for under-exploitation of IP.

Besides the factors mentioned so far, another reason for universities failing to make the most of the IPR system may be related to the fact that markets for technology face many institutional obstacles and structural challenges. That is, even when patenting of university research outcomes is feasible, it may still be the case that universities fail to profit from their IPR exchanges due to problems and inefficiencies in the marketplace.

Mainstream economics argues that knowledge privatization is necessary in order to remedy the market failure connected to the inherently public nature of knowledge (what has been termed the “tragedy of commons”; Hardin, 1968), and assumes that the instantiation of property rights automatically gives rise to markets where they can be traded (Rivera-Batiz and Romer, 1991). For a well-functioning market to emerge, there must be no uncertainty on the quality, characteristics and value of the product that is exchanged (i.e. the good must be akin to a “commodity”); consequently, the transacting parties are able to agree on a market price that regulates the exchange efficiently. Therefore, if well-functioning IPR markets are to emerge spontaneously (Arora et al, 2001) it must hold that anyone reading the IPR document should be able to fully understand and value its contents and to implement the knowledge codified therein (Gans and Stern, 2003). If this is the case, the only requirement for transactions to be sustainable is, like for all market-based contracts (Williamson, 1975), the presence of adequate enforcement mechanisms to prevent free riders who have not purchased or licensed the IPR from exploiting the knowledge they embed, and the presence of safeguards to punish attempts to deviate from the contract terms.

In the reality of actual IPR exchanges, however, further complications arise. First, there may be considerable uncertainty around the characteristics of the intellectual asset that is exchanged. Second, as emphasized by institutional economics (Hodgson, 1988, 1999) processes of exchange are supported by networks of social relationships and by many and complex institutions. The institutions which support and influence exchange processes can be both physical infrastructures and entities (in the case of IPR, examples are patent databases, intellectual property offices, copyright and trademark libraries) as well as, very importantly, institutions in a sociological sense (social norms and rules of behaviour, whether explicitly codified into laws,

regulations and codes of practice, or informally held among a community of agents participating in the marketplace; different norms give rise to different types of markets, such as auction markets, price tag markets, medieval type regional street markets, black or unauthorized markets, and so on). Moreover, the social relationships through which exchanges take place are underpinned by individual beliefs and expectations (in relation to the other party's trustworthiness, the fairness of the contract and its price, and other aspects) which may influence the outcome and characteristics of the transactions (Bromiley and Harris, 2006). To emphasize the web of social relationships and supporting institutions that are required for processes of exchange to take place, as well as the physical and metaphorical interaction space where they unfold, in the following discussion we prefer to use the concept of "marketplaces" rather than the notion of "markets" used by mainstream economics.

Problems in the marketplace can be of different types. If markets are considered as price clearing mechanisms, they often "fail" when the characteristics of the good are not perfectly known by both buyer and seller (problems of asymmetric information; Akerlof, 1970), or when one or both parties are not fully able to capture the benefits of the exchange (problems of spillovers and externalities; Arrow, 1969). If marketplaces are considered as platforms of social relationships whose functioning is supported by historically evolving institutions, it is possible to identify at least in principle a different kind of failure, which can happen even when the "goods" traded therein fulfill all the standard assumptions: the failure of supporting institutions to ensure the efficient functioning of these marketplaces.

Both of these sets of problems (which, for simplicity, we call respectively "market" and "institutional failures") can occur when IPR is exchanged, at least in principle. Moreover, different governance forms for the exchange of IPR can be affected by these problems in different ways. Andersen and Konzelmann (2008) bring attention to the fact that specific governance forms for IPR exchange are associated with different processes of value seeking: for example, a patent cross licensing agreement may be due to the expectation to achieve strategic market positioning, whereas selling a patent may be due to gaining one-off income, and a patent pool may be due to the development of a common technological standard. Similarly, the processes of selling, buying, out-licensing or in-licensing patents may be affected by market and institutional failures in different ways.

The objective of the empirical investigation presented in this article is to shed some light on the problems that universities encounter when engaging in the marketplaces for patents and copyright, paying attention to the specificities of the governance forms through which IPR exchanges take place.

The analysis is developed in three parts.

IPR market failures: we investigate whether some key assumptions underpinning the emergence of well-functioning marketplaces are reflected in the universities' experience. First, we ask whether it is possible to claim that the parties in the exchange possess perfect and symmetric information about the good that is exchanged, and whether the markets clears rapidly thanks to the identification of potential partners in the transaction and the emergence of a market-clearing price (that is, we explore whether knowledge embedded into IPR becomes "commodified"). Second, we investigate whether the process of price setting reflects the assumptions underpinning IPR theory: that is, the argument that the (temporary) monopoly power guaranteed by IPR confers full appropriability over the invention, so that the inventor is able to extract a monopoly price that covers the R&D cost of the invention and reflects its economic value (Arrow, 1962). Our conceptual framing of IPR market failures, which has informed our data collection, is outlined in Table 2 (Part 1) and Table 3.

Institutional failures: we investigate institutional failures in the marketplace by analyzing whether the enforcement mechanisms in the marketplace function properly; whether it is possible to rule out opportunistic behavior (either by means of effective contractual safeguards, i.e. by negotiating "complete" contracts, or thanks to the presence of trust among the parties); whether there are shared social and behavioural norms that facilitate transactions by promoting shared expectations; and finally whether formal IPR regulations are adequately supporting IPR exchanges. Our conceptual framing of institutional failures, which has informed our data collection, is outlined in Table 2 (Part 2).

Role of IP governance: We also investigate the extent to which the various failures are specific to certain IP governance forms within the patent and copyright marketplaces. These include alternative licensing forms, as well as buying and selling of patents and copyright, and they are outlined in Table 1.

The analysis of the problems that universities encounter when exchanging IPR in the marketplace provides interesting suggestions for policymakers who may wish to remove, as much as possible, any obstacles to the efficient exchange of IPR, and allows us to contribute new empirical evidence towards an emerging literature on problems in markets for technology (Arora et al, 2001).

3. Data source and variables

The empirical analysis is based upon survey data on a sample of universities, colleges and public research organizations based in England, Scotland, Wales or Northern Ireland, collected between October 2008 and March 2009⁵. The UKNOW database was developed at Birkbeck College (under the coordination of Birgitte Andersen) under Work Package 3.2: "An IPR Regime in Support of a Knowledge Based Economy", as part of the UKNOW (Understanding the Relationship between Knowledge and Competitiveness in the Enlarging EU') project of the EU 6th Framework Programme (contract number CIT 028519).

The list of relevant institutions and of their respective technology transfer offices was drawn from the website of the University Companies Association (UNICO), which represents the technology exploitation companies of UK universities. The list of 120 members of UNICO was downloaded in October 2008. The details provided by UNICO are: each member organization's name and website, as well as name, email and telephone number of their contact person. This list was then integrated with the set of institutions that responded to the HEBCI 2004-05 and 2005-06 surveys (HEFCE, 2007), which includes 162 universities, colleges and public research organizations. Since no addresses or contact names were included in this list, such information was retrieved from each institution's website.

The two lists were merged and, after correcting different spellings and eliminating double entries, a final population of 169 different organizations was assembled. A mass mailing was sent out in mid November 2008, followed by three rounds of personal emails sent out between December 15th 2008 and February 28th 2009. In order to reach the target response rate, questionnaires were posted out at the

⁵ Throughout the article, we refer to this sample as "UK universities", for sake of simplicity and also because university colleges and public research organizations comprise less than 25% of the sample and of respondents, as evidenced in Table 4 presented later.

beginning of March. Respondents had a choice of different options through which they could answer the survey: filling in the questionnaire available online; returning an electronic copy of the questionnaire by email; returning a copy of the questionnaire by post or fax. We obtained 46 valid responses (27.2% response rate).

Taking into consideration several types of IP protection mechanisms (patents, copyright, open source and non-patented technology), and several governance forms for the exchange of such IP (selling, buying, out-licensing, in-licensing, cross-licensing, pooling, and so on) universities were asked questions concerning :

- the extent and intensity with which they participated in each marketplace and each governance structure (stock of IP held and number of transactions in the previous two years);
- the strategic benefits that universities seek when trading IP;
- the obstacles that universities encounter when trading IP;
- the way in which IP price is determined and its efficiency (these questions were only asked in relation to patents and copyright).

Finally, universities were requested to provide some general information: geographic localization, ownership (independent or subsidiary), size (current number of employees, current yearly turnover), research intensity (yearly expenditure in R&D), geographic extension of the organization's main market (domestic or international), and sector of activity. A few additional variables relating to organizational characteristics were derived from other sources⁶. (An overview of the respondents can be found in section 4.1.)

The present analysis builds upon the respondents' answers in relation to their experience with the exchange of patents and copyright, considering the governance forms listed in Table 1.

Table 1. IP marketplaces and governance forms considered in the analysis

IP marketplaces	Governance forms
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⁶ The number of academic staff and total staff (academic, non-academic, atypical) of the institution (relative to 2007/08), the share of academic staff employed in scientific fields (engineering and technology, medicine and natural sciences, in the same period), and the income of the institution were drawn from HESA's (the Higher Education Statistics Agency) database. The year of foundation of the technology transfer office and the number of staff employed within were drawn from the HE-BCI survey (relative to 2007).

Patents as a tool for the protection of novel ideas	Selling patents
	Out-licensing patents
	Cross licensing patents
	Participation in patent pools
	Buying patents
	In-licensing patents
Copyright as a tool for the protection of original creative expressions	Selling copyright
	Out-licensing copyright
	Buying copyright
	In licensing copyright

The questions used to perform the analysis presented in this article are those relating to : (i) participation in IPR marketplaces ; (ii) obstacles found in IPR marketplaces ; and (iii) price setting mechanisms and their efficiency. The following table lists the possible obstacles that universities were presented with (grouped according to whether they indicate failures in the assumptions of IPR theory – which we term “IPR market” failures – or failures in the institutions that support the marketplace – which we term “institutional” failures). For each marketplace and governance form, universities were asked to tick the five most important obstacles that they experienced.

Table 2. “IPR market” and “institutional” failures considered in the analysis

<i>Type of “failure”</i>	<i>Assumption tested</i>	<i>Specific obstacle investigated</i>
Part 1: IPR market failures	Perfect information about characteristics and value of IPR	Difficulty in finding the best IPR
		Difficulty in assessing degree of novelty/originality of the IPR
		Lack of clarity of IPR document
		Difficulty in assessing economic value of IPR
	Market “clears” easily	Difficulty in locating owners of IPR
		Difficulty in locating users of IPR
Difficulty in negotiating a price for IPR		
Part 2: Institutional failures	Presence of enforcement mechanisms	Excessive cost of enforcing contract
		Problems, not related to cost, with enforcing contract
	Possibility to rule out opportunistic behaviour by negotiating “complete” contracts or thanks to trust	Difficulty in negotiating the terms, not related to price, of contract
		Trust issues (opportunistic behaviour, free-riding, or similar)
	Shared behavioural norms and expectations	Different practices of firms
	Presence of adequate supporting regulations	Regulations allow too exclusive rights
International IPR regulations do not fit needs of different local markets		

Universities were also presented with several statements about the price setting process and the efficiency of the IPR price (indicative of possible market failures),

with respect to which they were asked to express their agreement or disagreement.

Table 3. Further “IPR market” failures considered in the analysis

Type of “failure”	Assumption tested	Choice options
Part 1 (cont.): IPR market failures	IPR confer (temporary) monopoly power	Price is usually set by the buyer
		Price is usually set by the seller
		Price is usually jointly negotiated between buyer and seller
		Price is usually set by third (independent) party
		Depends on circumstances: no usual way in which price is set
	IPR render knowledge perfectly appropriable and make it possible to cover R&D costs	Price of IPR usually correctly reflects economic value of invention
		Price of IPR is usually able to cover research and development (R&D) costs of invention

4. Empirical analysis

4.1. Context : respondents and their participation in IPR marketplaces

The sample includes organizations that belong to several main “types”. Most are universities, some are university colleges and other institutions of higher education (such as music conservatoires and arts colleges), and a few are public research organizations. Table 4 compares the distribution of institutions in the sample and in the set of respondents, across several main characteristics: geographical localization, size (in terms of academic staff employed), institutional type, both with respect to status and to historical origin (distinguishing between universities, other higher education institutions and public research organizations, and further subdividing universities into 5 categories according to the period in which they were founded⁷). The distribution of respondents by geographic localization, institutional type and size in terms of total staff is representative of the overall sample.

Table 4. Structure of sample and respondents

		sample (169)	respondents (46)
		%	%
geographic localization	England	82.2	89.1
	Wales	5.3	4.3
	Scotland	11.2	6.5
	Northern Ireland	1.2	0.0

⁷ The categories are the following: “old” universities (founded before the mid-XIX century); “red brick” universities (founded between the mid-XIX century and the mid-XX century); “plate glass” universities (founded between the 1960s and the end of the 1980s); “former polytechnics” (institutions formerly designated “polytechnics” which changed their status to universities in 1992); “modern” universities (founded after 1992, not formerly designated “polytechnics”).

	<i>Total</i>	<i>100</i>	<i>100</i>
type	“old” universities	5.9	8.7
	“red brick” universities	17.8	26.1
	“plate-glass” universities	13.6	15.2
	“former polytechnics”	20.7	19.6
	“modern” universities	16.6	8.7
	colleges of higher education	16.6	8.7
	public research organizations	7.7	13.0
	Other	1.2	0.0
	<i>Total</i>	<i>100</i>	<i>100</i>
size (total staff)	<500	10.7	4.3
	500-1000	13.0	10.9
	1000-5000	47.3	56.5
	>5000	24.3	28.3
	Missing	4.7	0.0
	<i>Total</i>	<i>100</i>	<i>100</i>

Of the 46 respondents, 13 do not exchange any form of IP, while 29 exchange patents and 15 exchange formally registered copyright. Of the 29 organizations that engage in the patent marketplace, most (28) engage in out-licensing patents, and more than half (17) are active in selling patents, while comparatively few engage in in-licensing (5) buying (4) cross-licensing (5) or participating in patent pools (4). Of the 15 organizations that exchange formally registered copyright, most are active in selling copyright (12) and in out-licensing it (9), while fewer are active in buying (6) and in-licensing (3) copyright. Thus, selling and out-licensing are the most frequently used governance forms for the exchange of both patents and copyright. This is confirmed by the data on IP transactions: the total stock of in-licensed patents is a small fraction (about 7%) of the total stock of owned patents, suggesting that universities tend to file their own patents rather than in-license them from other organizations. On average, in the previous two years, each university out-licensed 11 patents, sold 3.6 patents and engaged in 3.3 patent pooling agreements. No universities reported engaging in the purchase of patents in the previous two years, while each university engaged on average in 1.4 in-licensing transactions and 1.2 cross-licensing agreements. These results are in line with the conventional view of universities as original research performers, active in developing IP and transferring it to other organizations rather than in acquiring IPRs from the outside.

Moreover, the overall number of patents sold, out-licensed, cross-licensed and pooled in the previous two years constitutes only 11.4% of the university’s overall stock of own patents (excluding those that have been in-licensed) confirming that most of the

universities' patents are not commercialized.

Table 5 details the shares of different types of organizations that engage in the exchange of patents and/or copyright.

Table 5. Participation in IP marketplaces by type of organization

			<i>patents</i>	<i>copyright</i>
		N	%	%
type	"old" universities	4	75.0	75.0
	"red brick" universities	12	50.0	16.7
	"plate-glass" universities	7	57.1	42.9
	"former polytechnics"	9	88.9	44.4
	"modern" universities	4	25.0	0.0
	colleges of higher education	4	25.0	25.0
	public research organizations	6	100.0	83.3
size (total staff)	less than 500	2	50.0	50.0
	500-1000	4	50.0	25.0
	1000-5000	24	62.5	37.5
	more than 5000	16	68.8	43.8

Public research organizations, old universities founded before the XIX century and former polytechnics that have become universities in 1992, are the institutions that engage the most in exchanging patents. Conversely, colleges of higher education and "modern" universities founded after 1992 engage the least in patent exchange. Public research institutions and old universities are most active in the exchange of registered copyright, while colleges of higher education, "red brick" and "modern" universities exchange copyright the least. Greater size of the institution in terms of total staff is associated with greater engagement in patent exchange. This is consistent with other evidence which suggests that most patenting activity is done by larger, research-oriented universities ("old" universities in the UK tend to be more research-oriented, and so are public research organization) (Charles and Conway, 2001; UNICO, 2003); at the same time, the intense engagement in patenting on the part of former polytechnics is consistent with some evidence suggesting that also less research intensive universities, which are less successful in obtaining research grants, can be strongly engaged in patenting, since in order to raise funds from industry they turn to performing more applied research, leading to more patentable results (Thursby and Kemp, 2002).

4.2. IPR market failures

We first investigate whether the assumptions of mainstream economic theory about the characteristics and functioning of IPR markets are reflected in the universities' experience, and whether the exchange leads to efficient outcomes. We ask whether the assumptions about the "commodity" nature of IPR are satisfied (in particular, whether it is possible to claim that the parties in the exchange possess perfect and symmetric information about the good that is exchanged, and whether the market clears rapidly by allowing the rapid identification of a partner for the transaction and the emergence of a price), and whether the IPR system is successful in conferring a temporary monopoly power which allows the inventor to set an "efficient" price that correctly reflects the economic value of the invention and that is able to cover the R&D cost of the invention.

Several questions in our survey allows us to assess whether universities have perfect information about the IPR that they exchange. Table 6 reports the shares of universities that consider the obstacles reported in the left column as important. Shares are computed with respect to the number of universities that answered each question.

Table 6. Information failures

<i>Assumption tested</i>	<i>Specific obstacle investigated</i>	<i>Patents</i>	<i>Copyright</i>
	Number of universities that answered question	14	11
Perfect information about characteristics & value of IPR	Difficulty in finding the best IPR	28.6%	n.a.
	Difficulty in assessing degree of novelty/originality of IPR	64.3%	27.3%
	Lack of clarity of IPR document	0.0%	n.a.
	Difficulty in assessing economic value of IPR	92.9%	72.7%

The universities' answers show that the content of the IPR is generally clear and it is not too difficult for universities to identify the best patents to exchange⁸. This indicates that the patent system is successful in codifying the knowledge embedded in the patent documents, so that it can be clearly understood and transmitted⁹.

⁸ This is consistent with results discussed by Cockburn (2007) when studying patent licensing deals in the US and Canada: here, only about 10% of survey respondents cited uncertainty about the strength or scope of IP rights, and less than 5% cited other "structural" issues such as there being too many parties involved in the negotiation. What really matters is the ability to reach agreement on financial terms and non-financial terms of the licensing contract; again, consistently with results found in our survey.

⁹ Universities were not asked to agree with the statements "Difficulty in finding the best IPR" and "Lack of clarity of the IPR document" with reference to copyright as these obstacles were not considered relevant to the case of copyright.

However, it is quite difficult to assess the originality of patents, especially when selling and out-licensing them (this problem is less important in the case of copyright, where the requirements for creative expressions to be original are much less stringent than in the case of patents). A possible explanation for this is that, as knowledge is increasingly patented, it becomes increasingly common to patent inventions with smaller inventive steps and it becomes more difficult for patent examiners to certify the effective novelty of the invention with respect to the “state of the art”, sometimes leading to “bad patents” (Moore, 2006). Hence, universities may find it hard to persuade potential buyers and licensees of the novelty of the knowledge embedded in their patents. By far, the most serious problems for universities is the difficulty in assessing the economic value of the IPR (particularly when out-licensing and selling it). This may be linked to the fact that academic knowledge is often quite basic in nature, and therefore it is characterized by high uncertainty in terms of the type and amount of potential implementations that it may give rise to, as well as in terms of the time it will take for those to emerge (Nelson, 1959). It may therefore be difficult to persuade potential buyers or licensees of the value of this knowledge, in order to obtain a “fair” price. Moreover, the patent’s value usually depends on its intended utilization (Merges and Nelson, 1990) which makes it difficult to reach an objective valuation. Another reason may be lack of information (Monk, 2009): in order to arrive at an accurate valuation, the potential buyer would need to know the details of all the licenses granted on a patent, but existing licenses are frequently subject to confidentiality agreements. Consequently, the potential buyer may be unable to value the patent correctly, because it would not know if its main competitors already have licenses or not.

The difficulty in identifying potential partners for IPR transactions and in negotiating prices are discussed in table 7, which reports the shares of universities that consider the obstacles reported in the left column as important. Shares are computed with respect to the number of universities that answered each question. In the case of patents, almost 60% of universities that answered this question find it difficult to identify potential users of their patents. This may be linked to the nature of academic patents, which are often at an early stage of development and costly to commercialize, and hence few firms are willing to invest in them (i.e. “no end-user demand” problem; Jensen and Thursby, 2001); but it may also indicate prohibitively high “search costs”,

due to the time and expense associated with identifying and researching niche markets and communicating the features and benefits of the technology (Cockburn, 2007), despite the existence of tools like searchable patentable databases. According to Monk (2009) the desire on the part of buyers to maintain anonymity also limits the market. Often, interested buyers prefer to remain anonymous in order not to disclose to industry competitors information about what technology and product lines they are pursuing. Because of this, the seller may not know the identity of the potential buyer and the reasons why they are interested in the patent or license, and this may make it more difficult to negotiate the transaction.

Table 7. Market clearing failures

<i>Assumption tested</i>	<i>Specific obstacle investigated</i>	<i>Patents</i>	<i>Copyright</i>
	Number of universities that answered question	14	11
Market “clears” easily	Difficulty in locating owners of IPR	14.3%	18.2%
	Difficulty in locating users of IPR	57.1%	9.1%
	Difficulty in negotiating price for IPR	57.1%	63.6%

These search-related problems do not appear to be of great relevance in the copyright marketplace, where buyers and sellers are found quite easily.

In the case of both patents and copyright, negotiating a price proves difficult. This is probably due to the above-mentioned problem of assessing the economic value of the IPR, which gives rise to contrasting valuations of the good (Mansfield et. al., 1981; Hall and Ziedonis, 2001).

Because it is often difficult to identify potential buyers or sellers and, when these are found, it is difficult to negotiate the price, the market does not “clear” easily.

Cockburn (2007) finds similar results when studying patent licensing deals in the US and Canada: in about 1/3 of cases, the would-be transactor was unable to identify even a single potential licensor or licensee to approach (in the case of our set of universities, this problem appears to be even more serious as close to 2/3 of respondents find it difficult to identify potential users); where firms were able to identify a potential licensor/licensee, in only about 1/3 of cases, substantive negotiations over a licensing deal were entered into, and of these negotiations about 50% failed to reach an executed agreement.

As most negotiations prove to be difficult, it is interesting to investigate in more detail

what is the process through which a price eventually emerges. Tables 8 and 9 report the shares of universities that agree with the statements reported in the column on the left; shares are computed with respect to the number of universities that answered each question, and averaged across governance forms. When buying or in-licensing patents, universities perceive themselves as being the weaker party in the exchange, with the seller being able to set the price. That is, they buy or in-license patents for which there may be many potential buyers and hence the seller is in a stronger bargaining position. When universities sell, out-license, cross license or pool patents, the situation is akin to a bilateral monopoly, with a seller/licensor and a buyer/licensee negotiating to obtain a favourable price. This is probably due to academic patents being either very basic and far from potential implementation and/or embedding very specialized and advanced knowledge, so that not many firms are looking to acquire them, which leads the potential buyer to be in a stronger bargaining position.

Given that universities - when selling, out-licensing, cross-licensing or pooling patents - are not able to exploit their monopoly over patented knowledge in order to extract a high price but rather bargain the price with the other party, it is not surprising to find that few universities agree that the price negotiated correctly reflects the value of the invention and covers the cost of the R&D that produced it. That is, universities express that they are not fully able to appropriate the economic benefits from the sale of their knowledge via the use of the patent system.

Instead, when universities buy or in-license patents they find that they pay a high price (usually set by the seller) which allows the seller to cover its R&D costs (and which possibly is higher than the value of the invention).

Table 8. Patent appropriability failures

<i>Assumption tested</i>	<i>Choice options</i>	<i>Buying or in-licensing patents</i>	<i>Selling or out-licensing patents</i>	<i>Cross-licensing or pooling patents</i>
IPR confer (temporary) monopoly power	Price is usually set by buyer	12.5%	6.1%	0.0%
	Price is usually set by seller	62.5%	1.3%	0.0%
	Price is usually jointly negotiated between buyer and seller	25.0%	44.1%	100.0%
	Price is usually set by a third (independent) party	0.0%	0.0%	0.0%
	Depends on the circumstances: no usual way in which price is set	0.0%	15.1%	0.0%
IPR render	Price of IPR usually correctly reflects	37.5%	23.9%	50.0%

knowledge perfectly appropriable and allow to cover R&D costs	economic value of invention			
	Price of IPR is usually able to cover R&D costs of invention	62.5%	27.6%	12.5%

The market for copyright is also one where the price is negotiated between the parties rather than set by one of them. Having a monopoly on the knowledge exchanged, thanks to the ownership of copyright, does not ensure that the seller has the ability to set the price unilaterally. Rather, probably due to the fact that there is a limited number of potential buyers for copyrighted knowledge, buyers also have some market power, and the price is the outcome of a negotiation. This leads most universities to refute the statement that the price of copyright reflects the economic value of the invention and that it allows the inventor to cover R&D costs. It appears that the use of registered copyright does not guarantee full appropriability of the economic returns from the knowledge that is exchanged.

Table 9. Copyright appropriability failures

<i>Assumption tested</i>	<i>Choice options</i>	<i>Buying or in-licensing copyright</i>	<i>Selling or out-licensing copyright</i>
IPR confer (temporary) monopoly power	Price is usually set by buyer	0.0%	10.1%
	Price is usually set by seller	33.3%	23.7%
	Price is usually jointly negotiated between buyer and seller	58.3%	41.4%
	Price is usually set by a third (independent) party	0.0%	0.0%
	Depends on the circumstances: no usual way in which price is set	8.3%	24.7%
IPR render knowledge perfectly appropriable and allow to cover R&D costs	Price of IPR usually correctly reflects economic value of invention	41.7%	17.1%
	Price of IPR is usually able to cover R&D costs of invention	12.5%	17.4%

4.3. Institutional failures

We then investigate institutional failures in the marketplace. We ask whether enforcement mechanisms in the marketplace function properly; whether it is possible to rule out opportunistic behavior (either by means of effective contractual safeguards or thanks to the presence of trust among the parties); whether there are shared social

and behavioural norms which facilitate transactions by promoting shared expectations; and finally whether formal IPR regulations are adequately supporting IPR exchanges. Table 10 reports the shares of universities that agree that the statements reported in the column on the left identify important obstacles to exchanges in the patent or copyright marketplace. Shares are computed with respect to the number of universities that answered each question.

Table 10. Institutional failures

<i>Assumption tested</i>	<i>Specific obstacle investigated</i>	<i>Patents</i>	<i>Copyright</i>
	Number of universities that answered the question	14	11
Presence of enforcement mechanisms	Excessive cost of enforcing contract	21.4%	27.3%
	Problems, not related to cost, with enforcing contract	14.3%	0.0%
Possibility to rule out opportunistic behaviour by negotiating “complete” contracts or thanks to trust	Difficulty in negotiating the terms, not related to price, of contract	64.3%	18.2%
	Trust issues (opportunistic behaviour, free-riding, or similar)	7.0%	9.1%
Shared behavioural norms and expectations	Different practices of firms	21.4%	9.1%
Presence of adequate supporting regulations	Regulations allow too exclusive rights	0.0%	0.0%
	International IPR regulations do not fit needs of different local markets	7.1%	18.2%

The results suggest that the institutions of the marketplace are perceived as hampering IPR exchanges only by a minority of respondents. The exception, in the case of patents, is the difficulty in negotiating the (non-price) terms of the exchange contract, which is perceived as relevant by 64.3% of the universities that answered the question. This suggests that it is very difficult for universities to write contracts that guarantee terms of use that are perceived as fair by both parties.

Interestingly, enforcement costs and other difficulties are not perceived as being very important by most respondents, and it seems that shared norms of behaviour prevail. Similar patterns emerge in the case of copyright, with the difference that only 18.2% of respondents indicate the difficulty in negotiating the non-price terms of the copyright contract as an important obstacle; however, the enforcement cost of copyright is considered a problem by 27.3%.

4.4. IPR governance forms

We now turn to individual governance forms within each IPR marketplace (selling, buying, licensing, pooling, etc.). We investigate the extent to which the each type of “IPR market” and “institutional” failure (as highlighted in Tables 2 and 3) is specific to certain governance forms (outlined in Table 1). We do so by computing, for each statement investigated (highlighted as ‘Assumption tested’ in Table 11), the coefficient of variation of the “% of respondents agreeing with the statement” across all IP governance forms. Higher values of the coefficient of variation listed in Table 11 indicate greater variability (or greater disagreement) in the importance of that type of “failure” across governance forms.

Table 11. “IPR market” and “institutional” failures: variability across governance forms

<i>Type of “failure”</i>	<i>Assumption tested</i>	<i>Specific obstacle</i>	<i>patent governance forms: coefficient of variation</i>	<i>copyright governance forms: coefficient of variation</i>
IPR market failures	Perfect information about characteristics and value of IPR	Difficulty in finding the best IPR	0.8	n.a.
		Difficulty in assessing degree of novelty/originality of IPR	0.7	1.17
		Lack of clarity of IPR document	0.0	n.a.
		Difficulty in assessing economic value of IPR	0.6	0.14
	Market “clears” easily	Difficulty in locating owners of IPR	1.1	1.62
		Difficulty in locating users of IPR	0.8	1.21
Difficulty in negotiating price for IPR		0.6	0.38	
Institutional failures	Presence of enforcement mechanisms	Excessive cost of enforcing contract	1.6	0.29
		Problems, not related to cost, with enforcing contract	1.6	0.00
	Possibility to rule out opportunistic behaviour by negotiating “complete” contracts or thanks to trust	Difficulty in negotiating contract terms, not related to price	0.6	2.00
		Trust issues (opportunistic behaviour, free-riding, or similar)	2.4	1.31
	Shared behavioural norms and expectations	Different practices of firms	1.6	2.00
	Presence of adequate supporting regulations	Regulations allow too exclusive rights	0.0	0.00
		International IPR regulations do not fit needs of different local markets	1.6	0.87

In the case of patents and “institutional failures”, there appears to be great variability across governance forms with respect to: cost of enforcing the contract (found

particularly when selling and out-licensing patents); problems with enforcing the contract, not related to cost (found particularly when selling and out-licensing patents); trust issues (found particularly when buying patents); different practices of firms (found particularly when selling and out-licensing patents) and dealing with international markets (found particularly when cross-licensing and pooling patents). “IPR market failures” seem to occur to a similar extent in all governance forms, denoted by a relatively small coefficient of variation.

For copyright, in the case of “institutional failures”, there is great variability across governance forms with respect to: difficulty in negotiating the terms of the copyright contract not related to price (particularly found when out-licensing copyright); trust issues (particularly found when out-licensing copyright); different practices of firms (particularly found when selling copyright). In the case of “IPR market failures”, there is great variability across governance forms with respect to: difficulty in assessing the originality of copyright (particularly found when selling and out-licensing); difficulty in locating the owners of copyright (particularly found when buying); difficulty in locating the users of copyright (particularly found when selling and out-licensing).

5. Conclusions

Our investigation into the obstacles that universities encounter when exchanging formal IPR – patents and copyright – allows us to shed some light on the functioning and efficiency of IPR marketplaces. The main findings can be summarized as follows.

5.1. Universities report a high degree of “market failures” when exchanging patents and copyright.

Universities reject the assumption of perfect information about the value of IPR, which they find difficult to assess. Furthermore, because of the difficulty in agreeing on the value of the IPR, there are substantial difficulties in the negotiation of the price, so that the market does not clear very easily. In the case of patents, this is compounded by the difficulty in finding potential buyers for academic patents. While, in the case of patents, market failures are equally found across all IP governance forms, in the case of copyright certain problems are specific to governance forms (for instance, locating the users of copyright is a relatively important problem when out-

licensing and selling, and locating the owners of copyright is a relatively important problem when buying, difficulty in assessing the originality of the copyright is a relatively large problem when out-licensing and selling).

5.2. The price that emerges from IPR transactions does not allow the university to appropriate the full financial benefits: incentives to trade IPR resides in other strategies.

The price is usually the outcome of a negotiation between buyer and seller, both of which have some bargaining power. Consequently, the IPR seller or licensor is unable to extract a monopoly price from the transaction of the IPR. Consistently with this result, universities also find that the price that emerges from the negotiation does not make it possible to cover the R&D costs of the invention and does not reflect its perceived financial value. Thus, the incentives to exchange IPRs in the market place must be partly non-financial (such as knowledge transfer, interactive learning processes, strategic positioning, etc). In the case of patents, universities consider these problems to be particularly important when they are on the “supply” side of a transaction, that is when they sell, out-license, cross-license or pool university patents. In the case of copyright, these problems are considered quite important across all governance forms.

5.3. Universities consider “institutional failures” to be relatively less problematic.

In the case of patents, most problems having to do with the institutions that support the marketplace are considered important by only a minority of respondents. The only exception is the problem of negotiating the non-price terms of the patent, whose importance is considered quite high across most governance forms: this suggests that it is difficult for universities to agree on terms of use that are perceived as fair by both parties. Other problems are specific to certain IP governance forms, such as the cost and other difficulties of enforcing the patent contract, trust issues, different norms of behavior, and problems with international regulations.

In the case of copyright, most types of institutional failures are considered important by relatively low shares of respondents. A notable exception is the cost of enforcement of copyright, which is considered quite high relative to the value of the intellectual property being exchanged (given that infringements are difficult and costly to detect and to litigate, and even when detected the compensation for such

infringements is generally low). Other problems, which are specific to certain IP governance forms, include the difficulty in negotiating the non-price terms of the contract, trust issues and different behavioural norms.

5.4 Policy implications

The findings have several implications for policymakers interested in addressing some of the issues hampering IPR marketplaces.

On the one hand, some of the obstacles reported in the flow of academic knowledge into use could be mitigated by interventions aimed at increasing transparency in the marketplace by enhancing the circulation of information about the characteristics of IPR. Examples include: better public reporting of IP transactions and their economic impact; greater disclosure of the true ownership status of patents and licenses and provision of more information in public patent databases (e.g. ownership and assignment, licensing and litigation status, whether a patent is available for licensing or not); greater use of standardized contracts (see also Cockburn, 2007, for a discussion of possible interventions to increase the transparency of IPR marketplaces). In order to improve market clearing processes, some interventions could be aimed at facilitating the identification of potential partners in IPR transactions and at improving negotiations between the parties: for example, provision of more information about university patents and copyright that are available for sale or licensing (such information can e.g. be supplied by the researchers), and greater use of intermediaries that can help both parties to assess the value of the IPR and negotiate contracts.

On the other hand, it appears that some problems are due to the nature of academic knowledge and cannot be solved by privatizing it via patents or copyright. It is well known that, as university knowledge often tends to be quite basic in nature, it is likely to involve substantial uncertainty in terms of its scope of application (which often leads to firms' inability to value such knowledge and to fully appropriate its economic returns) and time to market (which would require firms to invest substantially in further development activities): these features of academic knowledge make IPR negotiations particularly difficult and lead to prices which do not correctly reflect the value of the underlying knowledge. Although, in the case of universities, IPR prices are not directly used to guide the allocation of resources to invention, if price signals

are wrong this could still have important consequences. The prospective returns obtained from patent sales and royalties may in theory influence the allocation of individual effort on the part of scientists, leading to insufficient or excessive scientific effort in certain areas. Whether the incentives of academics are stimulated by patent grants is controversial in practice. However, prices in the patent marketplace may have an indirect effect on the allocation of funds to university research: in fact, indicators of “economic impact” (including revenues from patenting activity) have gained increasing weight in the assessment of the performance of academic departments and research centres, which in turn affects their likelihood to obtain public research funds.

Furthermore, if universities are unable to fully appropriate the financial value of the knowledge they produce by turning it into a private good, this implies that the private firms that purchase or license this good are appropriating a relatively large share of the financial benefit from academic knowledge. That is, public funds are used to partly subsidize the production of private goods that are enjoyed by a limited number of firms rather than collectively. This could introduce distortion in the market. These problems strengthen the argument that allowing academic knowledge, especially when more general and widely applicable, to be openly disseminated may be less distortive and more socially beneficial.

Further research into universities’ participation in, and use of, markets for technology would be helpful in order to understand whether the problems identified are specific to certain types of academic research disciplines or to certain types of institutions. Research should in particular be carried out with larger samples and with focus on different units of analysis (not just technology transfer offices but also individual academics). Alternatively, looking at the demand side of the flow of academic knowledge, and in particular investigate firms’ specific difficulties when engaging in IPR market transactions with universities, would also enrich our understanding of these processes.

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