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The causal effect of including standards-related documentation into patent prior art: evidence from a recent EPO policy change*

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Abstract

The aim of this paper is to investigate the causal effect of a recent attempt undertaken by the EPO to improve the quality of the patent granting process, by including the information revealed during the standardisation-setting process into the official definition of prior art. We build counterfactuals through a twin-patents approach, exploiting the fact that the same invention is filed for patent at both the EPO and at the USPTO, where the policy change did not take place. Our empirical analysis consistently support that the policy was successful. Indeed, we find a strongly significant reduction of about 10% in the granting rates, suggesting that the process of patent granting has become more careful and selective after the policy implementation.

JEL codes: O30, O31, C21

Keywords: quality of patent granting, technological standards, policy evaluation

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1 Introduction

One of the most important criteria to receive a patent is novelty. To determine novelty, patent examiners investigate the state of the art (the so called “prior art”) at the time of the patent application or the patent priority date. Therefore, the identification of the complete prior art, both in terms of previous patents and scientific or other literature (known as non-patent literature, NPL) is of pivotal importance for the quality of the granting process and eventually, of the quality of the granted patents themselves. However, there are differences around the world in what exactly is considered to be prior art and thus in what is to be searched for and considered by patent examiners. Also, there are differences in the extent to which applicants have a duty to disclose relevant prior art to the patent office (Cotropia et al., 2013).

In the early 2000s, some examiners with extensive previous industry experience increased the awareness in the European Patent Office (EPO) that many innovations in the area of mobile telecommunications were already been discussed in standardisation setting organisations (SSOs) before being applied for as patents. While such discussions and technical contributions are usually documented by the SSOs, they were up to that point in time not considered to be part of the prior art at the EPO, as the SSOs’ meetings were not considered to be public.

In the following years, a significant and not anticipated policy change occurred at the EPO. Several patent opposition cases that went to the EPO Board of Appeals made clear that documents from standardisation setting should be regarded as prior art after all (Willingmyre, 2012). It was argued that, as long as an SSO had open membership, any party with reasonable interest could have come to the SSO’s

meetings and get access to this information (like any party that is willing to pay the subscription fee can also access papers in a academic journal). After these cases, the EPO entered into extensive collaboration with several SSOs and implemented a platform ensuring easy and prompt access to all the relevant documents to the examiners (Willingmyre, 2012). This clearly enlarged the basis for judging prior art, potentially limiting what can be considered as truly new. To be precise, that policy change was not one in which a new law or rule is institutionalised. Rather, it was one in which jurisdiction lead to a different interpretation of the concept of prior art, with practical impact on the way it was used afterwards.

It is important to stress that the potential impact of this new policy can be substantial, and should not be regarded as a mere technical issue involving a marginal and peculiar part of the IPR system. First, interviews we had with representatives of the EPO revealed that in some specific technological areas, up to 40% of the documents that “*influence the decisions on the applications come from standardisation-related documents.*”¹ Second, and perhaps more importantly, patents potentially linking with standards-related prior art are of great importance. Indeed, at a general level, technologies emerging within SSOs often involve key or path-breaking innovations. Moreover, such patents are likely candidates to become ‘standard-essential patents’ (SEPs), that are patent indispensable to any implementer of a technical standard and therefore likely to lead to hold-up scenarios and royalty stacking (Kang and Bekkers, 2015; Lemley and Shapiro, 2006). For these reasons, patents involving standards-related prior art are not only considered particularly valuable – two port-

¹Interview with EPO, 5 December 2014.

folios of mainly SEPs have recently exchanged ownership for over 4 billion Euro² – but have also been the subject of many conflicts in the telecommunications industry, and at the core of several high profile court cases (including Microsoft Corp. vs Motorola Inc.,³ and In re Innovation IP Ventures⁴). As a result, it is particularly crucial, and much more important than for an “average patent outside standards”, that standards-related patents really meet the conditions for novelty and patentability.

Yet, and notwithstanding the EPO’s sustained effort to improve the cooperation among major patent offices (the IP5, composed of USPTO, JPO, KIPO, SIPO, EPO) in the adoption of a coordinated approach in this field (including a common, standards-related documentation database, see Goudelis, 2012), the EPO’s new policy towards including SSOs documentation in the prior art is for the time being an isolated one.

In principle, the new policy implemented by the EPO can have different impacts:

- (a) On the granting rates: the EPO rejects more patents because of identified standards-related prior art;
- (b) On the so-called patent scope: patents granted by the EPO have a reduced scope, because claims are removed due to identified standards-related prior

²In 2010 a consortium that included Apple, Microsoft, Ericsson, Sony, and BlackBerry acquired an important part of the former patent portfolio of the now-defunct Canadian telecommunications firm Nortel for 4.5 billion USD. This portfolio is believed to contain a large number of essential patents for 4G mobile telecommunications. A year later, Google purchased Motorola Mobility for 12.5 billion USD, and thus acquired a patent portfolio valued by Google at 5.5 billion USD (Data on the basis of Google’s Securities and Exchange Commission filing; see CNET, July 25, 2012, “Google: Motorola’s patents are worth 5.5 billion USD.”).

³Microsoft Corp. v. Motorola, Inc., No. C10-1823, 2013 WL 2111217 (W.D. Wash. Apr. 25, 2013)(Robart, J.)

⁴In re Innovation IP Ventures, LLC Patent Litigation, No..C11-9308 2013 WL 5593609 (N.D. Ill. Sept. 27, 2013)(Holderman, J.).

art;

- (c) On the application rates: companies and other applicants chose not to apply for EPO patents when they anticipate they might not obtain the desired patent because of the presence of standards-related prior art (but might still apply for such patents in other countries).

This paper provides an quantification of the effect of the new EPO policy on the rejection rates, thus focusing on category (a) above. Our identification strategy exploits a peculiar feature of the patent system: to protect an invention in several legislations, applicants have to file a patent application in different patent offices. We can therefore take applications for the same invention in other patent offices as the natural counterfactual situation. In particular, we choose the USPTO as the locus of this quasi-natural experiment. Thus, since the policy change occurred at the EPO, but not at the USPTO, for all inventions applied for patenting at both the EPO and the USPTO we can observe the “granting outcome” both under and without the policy treatment.

This paper contributes to the literature on patent quality⁵, where quality relates to the granting process. In technological fields where patents are relevant and fragmented in property (as it is mostly the case in standards-related areas) it is of pivotal importance that granted patents meet patentability requirements, including novelty (Jaffe and Lerner, 2011; Bessen and Meurer, 2008; Graham et al., 2002). Furthermore, as the policy under examination does not only aim at improving the

⁵This is the literature that addresses how well the patent granting process works; not to be confused with the literature that concerns patent value (which sometimes also uses the word “patent quality”).

quality of the patent granting process, but also at limiting firm strategic patenting, we also contribute to the growing literature on firm's strategic behaviour in managing and building extensive SEPs patent portfolios (Leiponen, 2008; Bekkers et al., 2011; Berger et al., 2011; Kang and Bekkers, 2015)

The remainder of this paper is organised as follows. Section 2 provides more detailed information about the EPO policy change we are examining. Section 3 presents the data sources, the outcome variable, and the treatment group definitions. Section 4 presents the empirical models, main results and robustness checks. Finally, Section 5 offers conclusions and discusses the implications of our findings.

2 Standards-related prior art at the European Patent Office

Patent quality, understood as the legal and procedural aspects of patent granting (as opposed to patent value, representing the private or public value that these patent confer to their owners), has been an important topic on the agenda of patent offices. Both the USPTO and the EPO are working at improving patent quality, both in the pre-grant and post-grant procedure. In Europe, it is an important part of the mandate of the EPO Economic and Scientific Advisory Board (EPO, 2012), and reforms of the U.S. patent system has been the focus of two reports recently issued by the Federal Trade Commission (FTC, 2003) and the National Academies of Science Merrill et al. (2004).

Because novelty is a fundamental requirement for patentability, the identification

of relevant prior art is of key importance during the patent prosecution procedure. Also for the determination of another fundamental requirement, non-obviousness (i.e. the presence of an ‘inventive step’), prior art documents play an important role. In their search reports, patent examiners must report what prior art they believe to be relevant in order to assess a patent application. An important question, then, is what exactly constitutes prior art. While the precise definition of prior art may (and does) differ across legislations, the WIPO handbook on IPR describes it as follows: ‘Prior art is, in general, all the knowledge that existed prior to the relevant filing or priority date of a patent application, whether it existed by way of written or oral disclosure.’ (WIPO, 2004). The disclosure element here refers to whether the relevant knowledge is in the ‘public domain’, as indeed specifically mentioned in the definition used at the EPO: *“the state of the art shall be held to comprise everything made available to the public by means of a written or oral description, by use, or any other way, before the date of filing of the European Patent Application.”* (Article 54(2) of the European Patent Convention ⁶). Note that ‘*public*’ here does not necessarily mean it is available *for free*. For instance, even though journals can demand a subscription fee (and some academic journals demand a steep subscription fee), the information contained in articles published in such journals is generally considered to be in the public domain and, thus, it can as such form prior art. This is confirmed by decisions of the EPO Technical Board of Appeal: *“A document is made available to the public [...] if all interested parties have an opportunity of gaining knowledge of the content of the document for their own purposes, even if they do not have a right to disseminate*

⁶Available at <https://www.epo.org/law-practice/legal-texts/html/epc/2013/e/ar54.html>

it to third parties, provided these third parties would be able to obtain knowledge of the content of the document by purchasing it for themselves.“(EPO Technical Board of Appeal decision T0050/02).⁷ Information shared in a confidential setting however (e.g. where participants may have signed agreements not to disclose this information) does generally not qualify as prior art.

A seemingly more technical, but indeed crucial issue in the definition of the prior art pertains to the documentation that patent examiners actually have at their disposal to search for prior art. Given the need for very effective, efficient and conclusive searches of prior art (something for which the internet would be ill-fitted for), patent offices provide their examiners with very extensive, well-structured databases. These include – rather obviously – databases containing all existing patent applications (e.g., the PubEast and PubWest databases at the USPTO).⁸ But, in addition, also the so-called Non Patent Literature (NPL) is organised in readily available formats. The USPTO makes NPL available to the examiners in a database known as STIC (Scientific and Technical Information), offering access to an extensive number of electronic books, periodicals, conferences, standards, dissertations, and more.⁹ Similarly, the EPO developed its EPOQUE databases, containing a total of 12 million NPL documents including secondary (commercial and non-commercial) publications such as journals, conference material, books, thesis, technical reports and monographs.¹⁰ Finally, prior art as meant in patent law is of course not restricted to what

⁷All EPO appeal decision are available at <http://www.epo.org/law-practice/case-law-appeals/>

⁸http://www.uspto.gov/products/library/ptdl/services/PubWest_and_PubEAST_at_PTRCs.jsp

⁹<http://www.uspto.gov/learning-and-resources/support-centers/scientific-and-technical-information-center-stic/electronic>

¹⁰EPOQUE allows for very effective search operations throughout its whole collection (see EPO, 2003).

is available in the internal databases of the patent offices¹¹, and, thus, patent examiners may also search elsewhere. But this is often not so easy and effective, and also the precise dating of documents (which is essential for proper prior art assessment) is not easily guaranteed.

In an increasing number of technological fields, technical standards play a central role, and a lot of technology development takes place in the context of the standards development processes. However, documentation created or shared in that process, for instance technical proposals by participants for inclusion in a standard, draft standards, etc., are not made publicly available by SSOs and thus not available to patent examiners. Moreover, even if such documentation were available, the question would be raised whether such information meets the requirements for prior art because of the non-public character of SSO drafts.

This practice has raised increasing attention over time. Examiners at the EPO working in fields such as mobile telecommunications started to get increasingly concerned about not being allowed to use this growing body of potentially very relevant non-patent literature in their assessments. In addition, beyond the mere quality of the patent granting, not considering this literature practically creates an opportunity for legalised stealing of ideas. Indeed, by not including SSO-related documents in the definition of prior art open up the possibility that a company shares innovative ideas in a standards-setting context, and another company subsequently takes that idea and files a patent on it, feeling safe by knowing the shared information is not

¹¹A humorous example of that being a 1949 Donald Duck story being used as prior art against a patent on a method of raising a sunken ship, see <http://www.iusmentis.com/patents/priorart/donaldduck/>.

considered as prior art. And in fact, companies have been accused of such behaviour in the context of standards-settings (Granstrand, 1999, , p.204).¹²

In the late 1990s, however, some interesting developments took place at the EPO. At some point, a company opposed an EPO decision to grant a certain patent exactly citing preliminary documents and minutes of the meeting of a standard-developing working group (in this case, ISO/TC22/SC3/WG9, which was developing a plug for an electrical connection between a truck and a trailer) that, it was argued, were killing the novelty of the patent.¹³ In fact, these were documents that were not at the disposition of the patent examiner at the time the search report was written. While the opponent initially lost its opposition, the EPO Technical Board of Appeal in its 1999 ruling (Case T 202/97) came to the conclusion that a proposal sent to the members of an SSO working group in preparation for a meeting does not usually underlie an obligation to maintain confidentiality, and it is therefore to be considered as public. In other words, the EPO acknowledged that information shared in the standards-setting context can be considered as part of the prior art.¹⁴

Similar cases involving prior-art validity of documents discussed within standards-

¹²And now that the USPTO has recently moved away from its “first to invent” system, virtually all patent offices around the world have a “first to file” system that assigns patents to the entity that files, not to the one found to be the real inventor.

¹³In contrast to most other patent offices, the EPO has an opposition procedure, allowing any person from the public - no commercial or other interest whatsoever need be shown – can challenge a grant decision. This happens often when some prior art was not found during the grant procedure, but was known by third parties.

¹⁴The Court’s decision of 10 February 1999 in this case offers the following summary “Mit einer Tagesordnung an Mitglieder einer internationalen Normenausschuarbeitsgruppe versandter Normungsvorschlag zur Vorbereitung einer Normen-Sitzung unterliegt gewöhnlich nicht der Geheimhaltung und gilt daher als der Öffentlichkeit zugänglich.” (Translated: “A proposal for a standard, send along with the draft agenda to members of an international standards body, is generally not subject to confidentiality and should therefore be considered as publicly available.”).

settings followed in the following years before the same Technical Board of Appeal came. In 2005, the ruling was seemingly in the opposite direction in another appeal case (EPO - T 0273/02), stating that a specific preliminary standards document produced by the opponent was not to be considered as publicly available. But the decision was mostly motivated by particularities of the case in question.¹⁵ And the same happened in December 2008 (Case T 0738/04), where, again, the decision to negate public domain status to some SSO-related documents was due to uncertainty remained about the actual publication date of the preliminary standards documents (because the cover page was missing, among other things) and because of procedural irregularities. But the general principle was established that, absent specific reasons, preliminary and other of open SSOs¹⁶ are indeed to be considered publicly available and therefore be part of the state of art.¹⁷

Inspired by a desire to better deal with preliminary standards documents as prior art, and guided by the above-mentioned court cases at the EPO Technical Board of

¹⁵The opponent argued that the patented invention was already made public by a preliminary standard document in ETSI (prEN 726-3). The decision of the court that this document was not publicly available built on the findings that (i) the opponents in this case referred to a version of the ETSI directives - specifying confidentiality rules on ETSI proceedings - that was published after the priority date of the patent in question, and (ii) the preliminary standards document in question had some markings which created confusion on whether it was supposed to have a confidential status or not.

¹⁶Here we specifically refer to SSOs where membership is open to any interested party. There are many more dimension and interpretations of what 'open' SSOs are. For more details refer to Krechmer (1998), Andersen (2008), and the World Trade Organisation's (WTO) six principles (see Wijkström and McDaniels, 2013)

¹⁷Of course, different situation may emerge when such documents are (a) incomplete or not properly dated, (b) when they carried explicit notices that these were confidential documents and (c) when, in case of an opposition case, the relevant documents are correctly and timely produced. Note however, that in some private standards consortia, standards are not publicly published – even final ones – and only available to consortia members under the acceptance of a non-disclosure agreement (examples are CD-ROM, DVD and Blu-ray disc). These standards – final versions or preliminary documents – are obviously never part of the public domain.

Appeal, the EPO entered into a series of activities. Firstly, the EPO ensured itself systematic access to preliminary standardisation documents that meet the requirement for prior art. It did so by becoming directly member of several SSOs as well as by signing specific agreements with major SSOs, e.g. the two Memoranda of Understanding signed with the (European Telecommunications Standards Institute (ETSI) and the Institute of Electrical and Electronics Engineers (IEEE), and the High Level Technical Agreement with the International Telecommunications Union (ITU). These agreements involved many ways of collaborating, beyond the simple access to documentation. For instance, the EPO and ETSI agreed also to collaborate in order to improve the ETSI database of essential patents by linking this database to the EPO's patent databases (Willingmyre, 2012). Indeed, the resulting information relevant to prior art is pulled from a broad repository of documents such as (i) standards documents as finalized after discussions, agreements and voting; (ii) preliminary standards drafts that serve as a basis for discussion and voting; (iii) other temporary drafts that have been deleted after a certain period or replaced by a new, published version; (iv) contributions to working groups, most predominantly first disclosures of new technical information shortly before or during a working group meeting.

As second step towards improving the consideration of standards-related documentation, the EPO undertook a substantial process of preparation, harmonisation, classification, proper date checking, creation of bibliographical information, and technical document format and/or language translation, with the final aim at making these preliminary standardisation document part of the EPO NPL-databases, ensur-

ing they can be easily searched by patent examiners.

As a matter of fact, after some years of preparation, the ETSI-EPO NPL database – arguably the most important standards-related NPL database – was fully launched at EPO by 2004. From that moment on, patent examiners could actually access and consider standardisation-related NPL in their normal workflow. The ITU and IEEE databases were then completed and launched in 2006 and 2008, respectively.

3 Data and experimental setting

In order to assess the effect of the EPO policy change concerning the use of standards-related NPL on patent granting we use standard policy evaluation treatment effect analysis. Our identification strategy exploits the fact that the same invention can be applied for patenting both at the USPTO, where SSO-NPL documents are not provided to examiners, and at the EPO where the policy change actually took place. That is, we observe the same “unit of analysis” (patent application for a given invention) both under treatment (the EPO patent application) and without treatment (the application for the same invention at the USPTO). In this section we present the data, the definition of treated and control groups, and provide basic evidence concerning trends in our outcome variable.

3.1 Data sources and sample selection

For the empirical analysis of this study we rely upon the EPO-PATSTAT database, October 2015 edition. We linked all the records we were interested in with both the

OECD Citations database, February 2015 edition, and the OECD Patent Quality Indicators database, February 2015 edition (Squicciarini et al., 2013). We did so because the former database also has so-called XP numbers associated with NPL references, allowing us to link these patent to XP numbering ranges made available to us by European Patent Office (see below). We furthermore use data on EPO patent office actions made (see below).

3.1.1 Selection of paired patents

In order to allow for a good comparison of grants vs. non-grant outcomes between the EPO and the USPTO, we take a ‘twin-patents’ approach. That is, we consider only those innovations for which applications for getting a patent are filed at both the EPO and at the USPTO, and thus discard those innovations that are applied for only at the USPTO or only at the EPO.¹⁸

The cases of double-application for the same innovation can be identified in patent databases because the related patent applications are part of the same patent family, meaning that their national applications all refer to the same ‘priority document’ that first discloses the original invention for which the different patents are applied for. We exploit the PATSTAT DOCDB definition of patent families, allowing to identify patent pairs that are as similar as possible.¹⁹

¹⁸Patents applied for at a single patent office only, are usually ‘weak’ patents, covering inventions for which companies are aware of the difficulty to get the patent and thus usually prefer to apply only in patent offices with lower granting standards. Such patents, in other words, are very likely to not getting granted. Including such patents in our analysis could decrease the number of granted patents, possibly resulting into a systematic downward bias in the granting probability, for reasons unrelated to the policy change we are investigating.

¹⁹The PATSTAT patent database has two kinds of patent families, reflecting that patents may have more than one new element in them, and thus refer to more than one priority document.

While the large majority (86.8%) of the patent families in our dataset just contain a single EPO application and a corresponding single USPTO application, there are some families that have multiple applications at one or both the patent offices.²⁰The latter can be re-issued patents, continuation patents, divisionals, and divisionals-in-part (see Hegde et al., 2007). Although this is a small part of the overall sample, in order to build good one-EPO-to-one-USPTO matched pairs, it is important to try and select the patent applications that refer to the original invention. To this purpose, in the case of families with more than 2 patents we selected the patent application with the ‘oldest’ application date in the two patent offices. However, this is not enough to ensure a precise pair; in fact 3.7% of the selected DOCDB families still have more than two patent applications (i.e. two patents are applied on the same date at the same patent office). For this small group, the selection criteria were as follows. In case of multiple USPTO applications, we randomly selected a non-granted patent application within the family. Instead, in case of multiple EPO applications, we randomly selected a granted application. This choice is a rather conservative one, as it “plays against” the EPO policy effect. We perform a robustness check on this choice in Section 4.3.

The DOCDB patent family is ‘narrow’, since it groups all patents that share exactly the same set of priority documents. The INPADOC family instead groups all patents that share at least one priority document (see Sipapin and Kolesnikov, 1989; Dernis and Khan, 2004).

²⁰Precisely, in the data, 13.2% of the DOCDB families has more than two associated patent applications, 9.61% has three associated applications (one at the EPO and two at the USPTO, or viceversa), 2.29% has four associated applications, and this number goes further down, up to the case of one single DOCDB family that has 58 associated applications.

3.1.2 Selecting the sample period: pre and post policy change

A crucial aspect of our analysis is the identification of the timing in which the EPO new policy towards including standards-related NPL is adopted, and therefore to determine the pre- and post-treatment periods.

Given the functioning of patent procedures, in order to determine whether a given patent could be affected by the policy change or not, we need to consider the date on which the patent examiner actually investigates the application and performs its search activities for prior art, resulting in a search report. Direct information on examination dates is not available, however, and the filing date is not very informative in this respect, since the time between patent filing and patent examination can vary considerably. We can however resort to information provided by the EPO relating to the publication date. Indeed, publications of patents at EPO come with different “labels” that relate to the date in which the search report is published, which is in turn closer to the date the actual search for prior art takes place.²¹ We exploit this information taking the assumption that the actual examination takes place in the six months proceeding the publication of the search report.²² Next, since we know that, as discussed before, the ETSI-NPL database was fully working by the end of the

²¹At the EPO, a search report is (part of) an “A1” labelled publication if the search report is ready within 18 months after patent filing, or an “A3” publication if this search report is ready later than 18 months after patent filing, or an “A4” publication if a supplementary search report is produced. While the USPTO publication code system is slightly different, this is not relevant for our study because for the US patents we do not need to distinguish whether the application was examined before or after the EPO policy change.

²²We discussed this with EPO staff and they informed us that examination typically is three months before publication of the A1, A3 or A4 document. This is not only because of inevitable backlog in processing patent applications, but also the desire to let the prior art documentations in the various databases to “stabilize” themselves before an application is examined.

year 2004, but we cannot observe the exact moment of 2004 in which it started to be used by EPO patent examiners, we assume that the new NPL infrastructure became available halfway the year 2004. Therefore, we define pre- and post-treatment as follows: (1) patents applications with a search report published before 1 July 2004 cannot be affected by the policy change; (2) patents applications with a search report published after 1 January 2005 are for sure affected by the policy change; (3) we cannot with certainty determine whether the policy change affected the patents with search reports published between these two dates, and therefore we leave this gap of 6 months as the policy-implementation window between pre- and post-treatment periods.

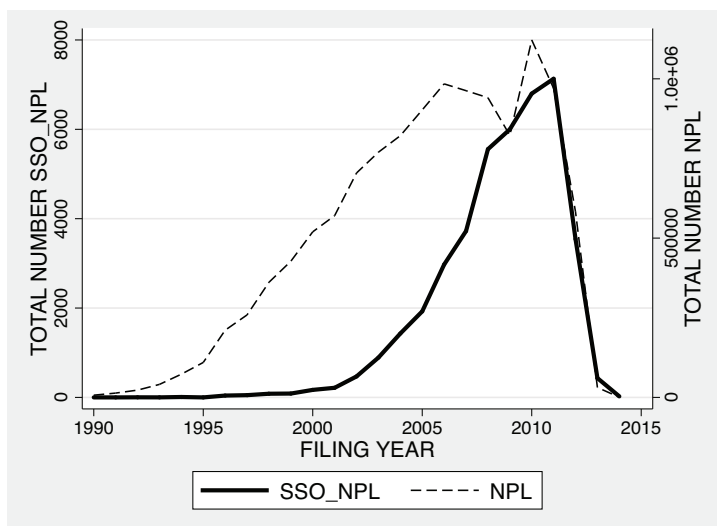


Figure 1: Total number of NPL and SSO_NPL per filing year

A confirmation of the goodness of our approach in selecting the *policy window* is in Figure 1. We observe that both “generic” non-patent literature (NPL) and SSO-

related non-patent literature (SSO_NPL) are rapidly increasing over time. SSO_NPL citations were identified through specific ‘XP numbers’ ranges (available in the OECD Citations database) that, according to EPO, are univocally associated with standard setting organizations. Figure 1 also highlights that SSO_NPL was essentially mentioned for patents filed before 2003, i.e. for patents whose applications can eventually find a publication within our policy windows. This lends further supports to our choice of the policy timing. In the robustness checks, we show that results do not change if we consider different definitions of the policy window, addressing the validity of our main assumptions about the date of production of the search reports and about the availability of the new NPL to examiners.

The pre-treatment period, and thus the dataset, starts with patents having a filing date after 1 January 2001. Going back in time is possible, but meaningless within our exercise. Indeed, before March 2000, the USPTO did not publish patent applications at all, but only grants. Thus PATSTAT does not contain information on USPTO patent publications unless they resulted in granted patents. As a result, if we use data with filing dates prior to January 2001, we artificially increase the number of families in which patents did get granted at the EPO, but the corresponding US twins appear as not granted at the USPTO. The post-treatment period ends with patents having as filing date the 31 December 2011, in order to mitigate the truncation problem arising from the lag between the time of patent application and the eventual granting.

In the robustness checks, we test whether our results are affected by choosing an earlier end date for the data. Furthermore, we also use the EPO office actions data

kindly made available to us by Prof. Dieter Harhoff to remove patents that in 2013 were still formally “PENDING”, but actually abandoned.

3.1.3 Selection of technological areas possibly affected by standardisation

A further step concerns the identification of the technological areas that can be classified as “standards-related” and, thus, include patents that are directly affected by the EPO policy change. To this purpose, we need to identify a list of IPC classes that spans technologies in which standardization is a prominent phenomenon. We did so by investigating the IPC classes of the so-called standard essential patents (SEPs). These are patents (already granted or not) declared at the SSO by their owner to be indispensable for any product that implements the standard in question.²³ Standardisation bodies usually have disclosure rules for such patents (Bekkers and Updegrave, 2013). Using a recent, public database that compiles disclosed SEPs from the 14 largest global standard setting bodies (dSEP database, see Bekkers et al., 2012, for details), we have analysed the IPC subclasses that most frequently appear in this kind of patents. As shown in Table 1, the distribution is very skewed, since five IPC sub-classes already represent 63% of all disclosed essential patents. We thus take these five classes as identifier that a patent can be considered as a standards-related patent. Notice that these IPC classes are quite large patent classes, presumably because they are dominated by telecommunications, which is a technical area that is rather cumulative of nature, and thus with many patents.

We also selected a series of patent classes that have no SEPs in them at all

²³See Bekkers and Martinelli (2012) for a similar type of selection.

(or maximum one single SEP), and can therefore be safely considered as totally unrelated to standardisation, to be used as a further control group in the empirical analysis. From all the classes meeting this requirement, we select a group of 13 classes, ensuring that the number of patents in this control set is approximately similar to that in the focal set. Table 1 clearly shows the contrast in the presence of essential patents (SEPs) between the focal set of standards-related IPC classes (STDIPC) and standard-unrelated IPC classes (non_STDIPC). We provide a specific robustness check where we enlarge the sample to include all (and not just 13) IPC classes with no SEPs (or one SEP only) as the control group.

The final working sample includes 223,639 pairs, each having one application at the EPO and one application at the USPTO, of which 133,758 pairs concern applications for patents in standards-related areas.

3.2 Outcome variable

In our analysis the dependent variable is a dummy that indicates whether for a given application (in a given patent office), a patent grant event took place, and zero otherwise. The identification of the value of this grant dummy involves some aspects worth of a brief discussion. Patent-data datasets, including PATSTAT, allow to identify the granting of a patent by looking whether, for a given patent application presented at a patent office, a related publication is issued by the patent office that certifies such a grant (for instance a ‘B1’ or ‘B2’ kind publication, or an ‘A’ kind publication in the US prior to March 2000). In contrast, one does not directly observe the reason why an application does not result into a grant, being it rejection, or

Table 1: Identifying standards-related (STDIPC) and standards-unrelated (Non_STDIPC) IPC classes

Set	IPC subclass	No. of SEPs	Short technical topic of subclass	Number of EPO applications
STDIPC set	H04L	3307	Transmission of digital information, e.g. telegraphic communication	410,629
	H04W	2439	Wireless communication networks	186,929
	H04B	2143	Transmission systems used in telecommunications	231,044
	G06F	929	Electric digital data processing	915,087
	H04M	578	Telephonic communication	143,733
	H01M	2	Processes or means for the direct conversion of chemical energy into electrical energy	116,232
	E21B	2	Earth or rock drilling	115,450
	C23C	2	Coating metallic material	105,081
	A61F	1	Filters implantable into blood vessels; prostheses; etc.	199,560
	A61M	1	Devices for introducing media into, or onto, the body	165,574
Non_STDIPC set	C08G	1	Macromolecular compounds obtained otherwise than by reactions only involving carbon-to-carbon unsaturated bonds	158,998
	C08K	1	Use of inorganic or non-macromolecular organic substances as compounding ingredients	115,081
	A01N	1	Preservation of bodies of humans or animals or plants or parts thereof biocides	111,744
	B65D	0	Containers for storage or transport of articles or materials,	229,459
	B01J	0	Chemical or physical processes, e.g. catalysis, colloid chemistry; their relevant apparatus	193,763
	C08F	0	Macromolecular compounds obtained by reactions only involving carbon-to-carbon unsaturated bonds	144,664
	C09D	0	Coating compositions, e.g. paints, varnishes or lacquers;	104,293
	F16H	0	Gearing	100,656

Source: Own calculations based on the dSEP database developed in Bekkers et al. (2012) and PATSTAT 2015

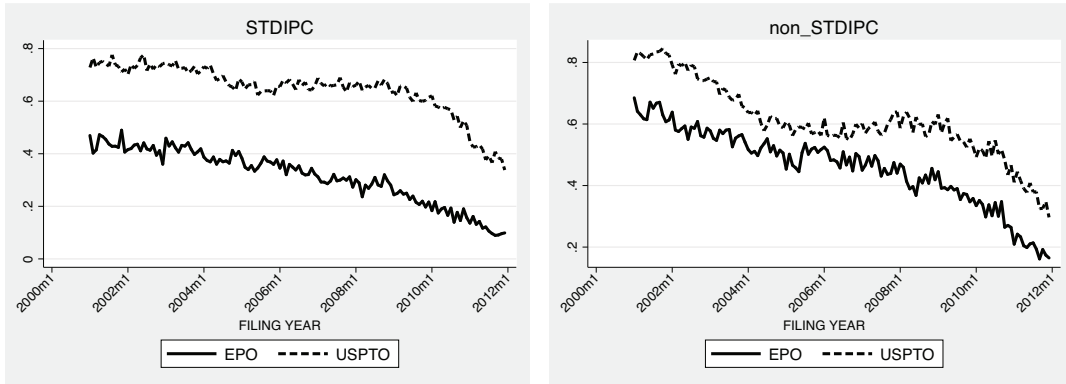


Figure 2: Monthly granting rates for standards-related technologies (left) and standards-unrelated areas (right).

abandonment of the patenting procedure by the applicant, etc. Thus, classifying a patent as “not-granted” is not trivial. For relatively old patent applications this is not an issue: when enough time has lapsed since the application date, then one can safely assume the application will never see a grant. For more recent patents, however, one simply does not know if a patent is just not yet granted, but it will, or if that will never be granted. Since we have access to October 2015 version of PATSTAT, we can only identify with certainty any grant event occurred until October 2015. However, to allow for a long enough time span from the application date to be safe in the identification of non-granted patents, we only consider patents filed up to 2011.

Figure 2 shows the granting rates we observe in the data over time at the EPO and the USPTO, distinguishing between standards-related areas (STDIPC) and areas not related to standards (non_STDIPC).

First notice that, in general, USPTO patent applications are more likely to be granted than EPO applications, both before and after the implementation of the

change in EPO policy towards standards-related NPL. This trend reflects a well known stylised fact about institutional differences between the two patent offices, with the USPTO usually more generous in granting patents. Second, in the period after the policy implementation, some differences emerge between the two technological groups emerge, beside the common decrease in the granting rates. Patent applications filed at the USPTO in areas related to standards (STDIPC) are more likely to be granted than patents filed in other areas. The opposite holds at the EPO, a fact which is already suggestive of the possible effectiveness of the new EPO policy.²⁴

4 Empirical analysis

We apply a standard policy evaluation treatment framework. We believe such an approach is appropriate as:

1. there is a relatively clear point in time when the policy was introduced: before 2004, patent examiners simply did not have SSO-related NPL documentation at their disposal;
2. the policy change was not anticipated by applicants, since there had not yet been a previous trend in the refusal of patents on the ground of SSO-related confidential NPL.²⁵;

²⁴As expected, the graph also shows that more recent years are more affected by truncation (granting rates going to zero) due to the examining lags at the patent offices.

²⁵At least, if we ignore the outcome of the individual patents subject to the two court cases discussed in Section 2.

3. the policy change was not anticipated by examiners: even if examiners knew about it, they could not change their granting “propensity” until the new SSO-related NPL documentation became part of the official body of *prior art*;

4.1 Empirical models and identification strategies

To recap, our outcome variable, Y_i , is a dummy equal to 1 if the patent application i is granted, while the treatment is whether a patent application i was filed at the EPO after 1 January 2005 (the end of the policy implementation window), and thus potentially exposed to the policy change.

The quasi-experimental setting of our analysis implies that the very same invention can be applied for patenting both at the USPTO and EPO, and we are, therefore, able to directly observe the same unit of analysis both with and without treatment. We perform several exercises incrementally leading to more precise identification of the relevant control group, and thus of the policy impact.

We first ask if there is a difference in the granting rates of standards-related patent applications between the EPO and the USPTO, in the post-policy period. To this aim, we restrict the sample to twin-applications filed only in standards-related IPC classes after 1 January 2005 and estimate the following regression

$$Y_i = \beta_0 + \delta_1 EPO_i + u_i \tag{1}$$

where EPO_i is a dummy equal to 1 if the application is filed at the EPO (and 0 if filed at the USPTO), i.e. the patent application is exposed to the policy change. In this setting the control group is composed of the twin patent application for the same

invention filed at the USPTO in the post-policy period. The coefficient δ_1 captures the effect of the policy in terms of the simple difference in granting rates between the EPO and the USPTO in the interested technological areas.

The estimated impact of the policy, however, suffers from a clear bias since the observed differences in granting propensity can be due to a number of unmeasured factors besides the policy change. For instance, as Figure 1 above highlights, the USPTO shows a generally more generous granting behavior, and there might be other institutional or contingency differences that can affect the granting outcome across the two patent offices. We therefore propose a second exercise where we apply a difference-in-difference (Diff-in-Diff) approach. We again focus on twin-patents filed in standards-related technological areas, but we now also include applications filed in the years in the pre-policy period. On this larger set of twin-applications we estimate the regression

$$Y_i = \beta_0 + \beta_1 EPO_i + \delta_0 POSTPOL_i + \delta_1 EPO_i \times POSTPOL_i + u_i \quad (2)$$

As before, the dummy EPO_i is equal to 1 if the patent application i is filed at the EPO, and here captures differences between the treated and the control group in the years before the policy change. The dummy $POSTPOL_i$ ('Post Policy') is equal to 1 if the application date is after the EPO policy change (after 1 January 2005), and zero otherwise. It therefore captures the time trend occurring in the dependent variable in the control group of the twins US patents. The coefficient of primary interest is the interaction-term coefficient δ_1 , capturing the "extra" effect on the dependent variable due to being in the treatment group (EPO) after the new policy

is implemented.

Even if the Diff-in-Diff exercise comes closer to estimate the true effect of the policy, there is also another source of variation that we can exploit. Indeed, the model in Equation (2) does not rule out the possibility that granting procedures concerning standards-related patents are systematically different across the EPO and the USPTO, above and beyond the differences arising from the new EPO policy. This calls for a difference-in-difference-in-difference (Diff-in-Diff-Diff) estimation, exploiting as control group the applications filed in technological classes unrelated to standards.²⁶ Thus, we add to the analysis all the EPO-USPTO twin applications in those areas, and estimate the following model:

$$\begin{aligned}
 Y_i = & \beta_0 + \beta_1 EPO_i + \beta_2 POSTPOL_i + \beta_3 STDIPC_i + \\
 & + \delta_1 EPO_i \times POSTPOL_i + \delta_2 EPO_i \times STDIPC_i + \delta_3 STDIPC_i \times POSTPOL_i + \\
 & + \gamma_0 EPO_i \times STDIPC_i \times POSTPOL_i + u_i
 \end{aligned} \tag{3}$$

The dummy EPO_i and $POSTPOL_i$ are defined as in the above Equation (2). We add here, alone and interacted with the other group dummies, the dummy $STDIPC_i$ ('Standards-related IPC class') which is equal to 1 for patent applications in a technological area where standards are relevant, and zero otherwise. The coefficient of primer interest is γ_0 , which identifies the effect of the EPO policy change controlling for systematic differences in the granting rates of patents in standardized technological areas as compared to patents that are not affected to the policy change.

²⁶As mentioned, these are distinguished upon their occurrences in standards-essential patents included in the dSEP database developed in Bekkers et al. (2012).

Table 2: Regression results

	Model1		Model2		Model3	
	(a)	(b)	(a)	(b)	(a)	(b)
<i>EPO</i>	-0.350*** [0.002]	-0.349*** [0.002]	-0.166*** [0.006]	-0.166*** [0.006]	-0.083*** [0.005]	-0.093*** [0.005]
<i>POST_POLICY</i>			-0.039*** [0.005]	0.060*** [0.005]	-0.149*** [0.004]	-0.029*** [0.004]
<i>EPO x POST_POLICY</i>			-0.185*** [0.007]	-0.183*** [0.007]	-0.066*** [0.006]	-0.059*** [0.006]
<i>STANDARDIZED</i>					-0.056*** [0.006]	-0.058*** [0.006]
<i>EPO x STANDARDIZED</i>					-0.082*** [0.008]	-0.080*** [0.008]
<i>EPO x POST_POLICY x STANDARDIZED</i>					-0.119*** [0.009]	-0.117*** [0.009]
<i>CONSTANT</i>	0.636*** [0.001]	0.727*** [0.007]	0.675*** [0.004]	0.677*** [0.005]	0.731*** [0.004]	0.757*** [0.004]
<i>TIME DUMMY</i>	NO	YES	NO	YES	NO	YES
Observations	243744	243744	267516	267516	447278	447278
R^2	0.123	0.152	0.120	0.146	0.091	0.119

Notes: Robust standard errors are in the parenthesis. Legend: * 10% ** 5% ***1%

We estimate the models in Equations (1), (2), and (3) via a standard OLS linear probability model with robust standard errors. For each regression we also explore a variant including a full set of year dummies, allowing for different timing of the treatment for the different treated units.

4.2 RESULTS

Table 2 shows the estimation results for the three models presented in the previous section.

Model 1a shows the estimates of Equation (1), obtained on the set of patent applications involving standards-related fields and filed after the introduction of the policy. Consistently with Figure 1, we find that the likelihood for a patent to be

granted in the post-policy period is at the EPO lower than at the USPTO. The estimated difference is a sizable 35%. The result is confirmed if we add year dummies (Model 1b).

Model 2a reports the results for estimates of Equation (2), where we still focus on standards-related areas only, but control for pre-policy trends between the two patent offices. The main finding pertains the coefficient on the interaction between *EPO* and *POSTPOL*. This shows that the likelihood to grant a patent in standards-related fields is about 18.5% lower at the EPO as compared to the USPTO in the post-policy years. The result is fully confirmed when we add dummies to control for year-specific variations (in Model 2b).

Finally, Model 3a reports the Diff-in-Diff-in-Diff specification in Equation (3), extending the counterfactual to also include the patent applications in technological areas where standardization is absent (or at least only marginally present). The estimated coefficient on the three-way interaction – capturing the effect of being a standards-related patent application (*STDIPC*) in the treated group (*EPO*) after the policy is implemented (*POSTPOL*) – tells that the EPO policy change decreases the probability of a standard-related patent to be granted by approximately 12%. The same magnitude is confirmed if we also correct for variation across years (Model 3b).

4.3 Robustness checks

We next present a series of robustness checks providing further support to our main conclusion that the policy change was indeed effective. We focus on variations of

Table 3: Robustness Checks

	18 MONTHS POLICY WINDOWS	UP TO 2009	REMOVE WITH- DRAWN PATENTS	NOT ONLY PAIRS	ALL PATENTS AS CONTROL GROUP	ANTICIPATE POLICY AT 2002	DEPENDENT VARIABLE: FAMILY SIZE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>EPO</i>	-0.080*** [0.007]	-0.083*** [0.005]	-0.065*** [0.005]	-0.074*** [0.005]	-0.121*** [0.003]	-0.107*** [0.015]	-0.001 [0.058]
<i>POST_POLICY</i>	-0.160*** [0.005]	-0.114*** [0.004]	-0.145*** [0.004]	-0.123*** [0.004]	-0.167*** [0.002]	-0.052*** [0.010]	-0.597*** [0.043]
<i>EPO x POST_POLICY</i>	-0.074*** [0.007]	-0.056*** [0.006]	0.069*** [0.006]	-0.086*** [0.006]	-0.080*** [0.003]	-0.059*** [0.015]	-0.023 [0.060]
<i>STANDARDIZED</i>	-0.064*** [0.007]	-0.056*** [0.006]	-0.062*** [0.006]	-0.026*** [0.005]	-0.086*** [0.006]	-0.124*** [0.018]	-1.952*** [0.051]
<i>EPO x STANDARDIZED</i>	-0.083*** [0.010]	-0.082*** [0.008]	-0.072*** [0.008]	-0.106*** [0.008]	-0.042*** [0.008]	-0.101*** [0.027]	0.000 [0.072]
<i>EPO x POST_POLICY x STANDARDIZED</i>	-0.119*** [0.011]	-0.130*** [0.009]	-0.095*** [0.009]	-0.095*** [0.008]	-0.113*** [0.009]	-0.042 [0.028]	-0.027 [0.075]
<i>CONSTANT</i>	0.736*** [0.004]	0.731*** [0.004]	0.728*** [0.004]	0.712*** [0.003]	0.758*** [0.002]	0.805*** [0.009]	7.309*** [0.041]
Observations	409868	359896	304536	495299	1358178	110322	409868
R^2	0.094	0.086	0.023	0.093	0.067	0.074	0.072

Notes: Robust standard errors are in the parenthesis. Legend: * 10% ** 5% ***1%

the most reliable Diff-in-Diff-in-Diff specification (including years dummies). Results are reported in Table 2.

First, we implement a different definition of the policy-window. In our main analysis, we assumed the policy change to take place on 1 July 2004. This assumption was based on talks we had with the EPO, where it was indicated that the ETSI-NPL data became available to patent examiners halfway 2004. But since they were not able to provide us with a precise data, we perform a further exercise where we widen the gap between the pre- and post-treatment period from 6 to 18 months (i.e., publication of search report between 1 January 2004 to 1 July 2005). Results, in column 1, show that the coefficient on the three-way interaction $EPO \times POST \times STDIPC$ is practically unchanged as compared to the main estimates.

Second, we address standard issue in patent empirics related to the truncation problem, that is the possibility that the final granting of a patent occurs even some years after the application date (Hall et al., 2001). This means that, towards the final year of the sample period, we might have classified as non-granted some patents for which the granting decision is still pending, once again potentially overestimating the EPO policy effect if such pending patents are, for unmeasured reasons, more frequent at the EPO in standards-related areas. We control for this issue by cutting the estimation sample in 2009. The main conclusion is confirmed: the estimated coefficient on the three-way dummy is still negative and very close to the main estimate (slightly larger, about 13%, cf. column 2).

A third concern arises concerning the observation that, as explained, patent data do not contain explicit information on rejections. We know with certainty if a patent is granted, but filed patents may look like as not granted just because a decision is still pending or because they are abandoned, during the process, by the applicants. In general, the commonly accepted presumption in empirical studies is that a patent has received a “true” rejection if a formal granting decision does not reveal after many years after the filing. We have followed this common strategy to define the zeroes in our outcome variable, but, once again, this opens up the possibility that we can mistakenly classify some patent as non granted. We can provide a check against this potential bias exploiting the data kindly made available to us by Prof. Dieter Harhoff. In these data, we can distinguish, for the entire set of PATSTAT-EPO patents and until 2013, whether a patent has been actually abandoned. We thus re-estimate our main model after dropping all the twin-applications involving an

abandoned patent. The main conclusion (in column 3) is still that the EPO-policy change has significantly lowered the granting rates. The estimated effect is sensibly lower than in the main analysis, now amounting to -9.5%.

In column 4 we address potential bias arising from our decision to focus the main estimates on patent families including only a single patent-pair. The one-EPO-to-one-USPTO patent matching performed in the main analysis, although random and conservative, may have distorted the estimated EPO-policy effect, if we turned out to select disproportionately more standards-related, not granted patents filed at the EPO. To check for this, we still perform the USPTO-EPO patent matching on the basis of the family, but we now use all the available data, allowing for one-to-more and more-to-more patent matchings involving the same invention. The estimated negative effect of the EPO policy change turns in this case slightly lower than in the main estimates, amounting to a -9.5%.

Next, we explore whether the findings are sensitive to the choice to define the control group of non-standards-related patents. In the main analysis we limited this set to 13 classes where there are no standards-essential patents (or max one), selected to ensure comparable size with respect to the focal group of standards related pairs. We re-estimate our main regression on the entire dataset, now also including patent pairs filed for in classes unrelated to standards, but previously excluded. We fully confirm our main findings (see column 5).

Finally, we perform two standard placebo-type of robustness checks. In column 6 we run a fake policy experiment. We take only the data before 1 July 2004, that is before the true policy change is implemented, and compare treated and controls

before and after a fake policy window defined from 1 July 2002 to 1 October 2002. The estimated coefficient on the three-way dummy turns out as not statistically significant, supporting the validity of our main estimates. Next, in column 7, we re-run our main model taking *FAMILY_SIZE* as the outcome. This gives the number of applications that are in the same INPADOC Family and was retrieved from OECD Patent Quality Indicators database (February 2015 edition, see Squicciarini et al., 2013). This is not supposed to be affected by the policy as it is constant across the two patent offices. And indeed, the coefficient on the three-way dummy is not significant in this further regression.

Overall, the robustness analysis confirms that the new EPO policy towards inclusion of standards-related NPL was indeed effective in reducing the granting rates in areas related to standards. The estimated effect ranges from a prudential lower bound of a 9% reduction, to an upper bound of about 13% reduction in granting probability.

5 Conclusions and policy implications

In this paper we provide an empirical assessment of the causal effect of a recent attempt undertaken by the EPO to improve the quality of the patent granting process. To do so we examine a policy change that aimed at including the information revealed during the standardisation-setting process into the official definition of *prior art*. To try and precisely identify the causal effect, we exploit the rather unique situation in which the same individual (a patent application) can be observed both

with and without treatment. Indeed, we have data on “twin” patent applications for exactly the same invention filed at both the EPO (where the policy change took place) and the USPTO (where it did not).

All the empirical analyses consistently support that the policy was indeed effective. In fact, after controlling for other relevant determinants, we find that the policy resulted into a reduction in granting probability of approximately 9-13% for patents in technical areas related to standardisation. This sizable impact suggests that the process of patent granting has become more selective and hopefully more careful after the policy implementation.

We believe our results represent a sort of lower bound estimate of the more general effect of the new EPO policy. Indeed, it is likely that the policy did not only affected the granting behaviour of EPO, but also resulted into a reduced scope of patents that do get granted and into discouraging applications at the EPO when the applicant is aware that standards-related prior art may reduce the chances to obtain the desired patent. These two other forms of impact of the new IPO policy offer opportunities for follow-up research.

We can also conjecture that the observed reduction in granting rates triggered by the new EPO could also have significantly decreased the number of patents granted for ideas that were actually invented – and shared in good faith in standardisation meetings – by other parties than the applicant, thus impacting on ‘stealing of ideas’. However, an in depth analysis of this issue would require more detailed information on the *real* inventor as opposed to the applicant, that we unfortunately do not have. This also constitutes an interesting avenue for further research.

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