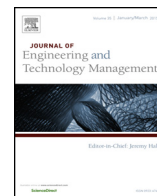




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Academic patents and technology transfer

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ABSTRACT

This paper exploits a particular facet of the US patent system, which thus far has been overlooked in the literature: the patent renewal fee scheme relating to switches from small to large entity status. Based on this observation, we are able to determine whether university patents are licensed over their enforceable lifecycle and at what point in time the licensing occurs. We find that while the funding source of patented inventions makes no difference to the propensity of an academic patent being licensed, federally sponsored patents are less likely to be licensed early compared to their non-federally funded counterparts.

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1. Introduction

Universities have long been recognized as a driving force of innovation activity (Jaffe, 1989; Adams, 1990; Mansfield, 1991). University¹ research is a significant contributor of new inventions in the industrial sector and particularly important in the area of basic research. Unlike their commercial counterparts, universities do not fully develop and commercialize their inventions; instead they license their patents and research outcomes through a variety of different licensing agreements with industrial sector firms (Hall et al., 2003).²

In 1980, Congress passed Public Law 96-517, the *University and Small Business Patent Procedures Act* of 1980, the so-called Bayh–Dole Act.³ Bayh–Dole Act sought to facilitate commercialization and transfer of discoveries made during the performance of federally-funded grants to the market. In a nutshell, the Act set a unified framework where universities could

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¹ The terms 'academic' and 'university' patent are used interchangeably throughout the paper.² Indeed, Jensen and Thursby (2001) in a survey of university technology transfer managers, find that 71% of US university inventions are of embryonic nature. Licensing agreements is one mechanism for transferring technologies; other mechanisms may include informal technology transfer, university spinoffs, other Intellectual Property (IP) ownership, and "giving it away"/placing it in the public domain.³ Prior to 1980, each US federal government agency funding research had its own patent licensing agreements and practices. The lack of uniform government patent policy and the government ownership of inventions conceived during work on a federal contract, acted as a disincentive to obtain patents and commercialize these discoveries (Eisenberg, 1996).

retain ownership of federally funded research outcomes and any revenues generated through technology transfer activities. Since the Act, most research universities have established their own Offices of Technology Transfer (OTT) to undertake these commercialization and patent monetization activities.⁴ These academic technology transfer entities use a wide range of exclusive and non-exclusive licensing agreements to monetize the intellectual property they own.

To promote academic research and long run growth in the US, federal agencies fund up to 70% of US universities' research activity (National Science Board, 2012, Fig. 5-2). The aim is to accelerate science, fuel innovation and improve the lives and welfare of the citizens. Government sponsorship of university research ensures effective transfer and commercial development of discoveries that enhance productivity and create new jobs in the US. Further, US-sponsored research discoveries could be developed by the U.S. firms making the latter capable to compete or surpass top tier peers.

In funding academic research, various important public policy issues arise and particularly whether taxpayers are receiving an adequate return on the government's research investment. While the government funds a significant chunk of academic research in the US, most taxpayers do not have access to the results of that research, which is often kept in pay-walled databases controlled by commercial publishers. Such policy issues are relevant beyond US borders as a number of European countries consider or have already adopted policies to facilitate the efficient transfer of academic technologies to the marketplace (Mowery and Sampat, 2005). Consequently, understanding the licensing outcomes and characteristics of federally funded university research is an issue of utmost importance and particularly relevant for science and technology policymakers.

To date, quantitative analysis of technology transfer activity of university patents in general and federally funded university patents in particular has been limited by the lack of publicly available data. As university technology transfer datasets are proprietary in nature, previous scholarly work in this field has focused on case study analyses of a single or a handful of large universities documenting evidence that may not hold or extend to other academic research institutions (Mowery and Ziedonis, 2001; Ziedonis, 2007; Elfenbein, 2007; Wright et al., 2014).

The purpose of this paper is to study the propensity and time length of the transferring rights of university patents to the market. The novelty of this work lies in exploiting a particular piece of information, which has been overlooked thus far and relates to a particular feature of the US patent system, i.e., the patent renewal fee structure. Based on this observation, we are able to determine whether university patents are licensed over their enforceable lifecycle and at what point in time the licensing takes place.

We therefore aim to offer to science and technology policymakers an unbiased evidence-based analysis of an extensive corpus of over 20,000 university patents granted between 1990 and 2000. With our approach, we are also able to study important issues such as characteristics of transferred patents, propensity and timing of licensing of federally funded compared to non-federally funded patents and differences in licensing outcomes for the different funding institutions that have not been adequately addressed so far in the literature.

The renewal patent fee scheme provides rich information, which can be exploited to infer academic technology transfer. Patent assignees in the United States Patent and Trademark Office (USPTO) system pay issue fees and subsequently renewal fees to maintain the enforceability of a US patent at the 3.5, 7.5 and 11.5 year after issuance; i.e., four event nodes during the patent's lifetime. The US patent system has two different patent fee structures: for small entities (for instance, non-profit institutions and small businesses) and for large entities (corporations that employ more than 500 employees). Universities have the right to pay and elect Small Entity Status (SES) fees for their patents. When a university enters into license agreement with a large corporation for a particular patent loses its small entity status for that particular patent and is obliged to pay all of that patent's subsequent fees according to the Large Entity Status (LES) patent fee schedule.

We employ this publicly available information, i.e., the switch from SES to LES status, to infer licensing of academic inventions and consequently academic transfer to the marketplace. Such a switch can take place at any of the four payment event nodes we are also able to assess the speed at which university patents are licensed. The time length of commercialization of an academic patent can be calculated by the time a patent pays for the first time LES fees, i.e., by issuance (grant) and at the first, second and third maintenance fee event corresponding to 3.5, 7.5, and 11.5 year after patent grant, respectively.

Along with the information derived from the renewal fee scheme we also use an additional piece of information that comes from the patent document wrapper, which discloses government interest statements.⁵ From this observation, we are able to distinguish the federally funded patents from the rest of the patents, the non-federally funded; i.e., patents that are

⁴ By 2009, the 180 university institutions that participated in the Association of Technology Managers (AUTM) reported that they employed over 2106 full time equivalent licensing and technology transfer personnel (AUTM, 2010). There has also been a dramatic increase in the number of invention disclosures, patents and license activity. Total invention disclosures to University Offices of Technology Transfer (OTT) by academic faculty grew from 10,987 in 1998 to 20,115 in 2008 (AUTM, 2008). In 2009, AUTM reported 20,309 invention disclosures, 18,214 patent applications and 3414 patents awarded to the 180 university institutions that participated in the 2009 Licensing Survey. While US university patents accounted for approximately 0.75% of the US patents granted to US entities in 1980, in 2005 they accounted for approximately 5% (NBER, Patent Data Project, 2013). In addition, based on the AUTM report (2005) the license income of US universities rose from \$218 million in the fiscal year of 1991 to \$1.54 billion in the fiscal year of 2009 (real values of 1991). The role of technology transfer and licensing of university inventions as well as the quality of academic technology after the Bayh–Dole Act is studied by Macho-Stadler et al. (2007) and Sampat et al. (2003), respectively.

⁵ Any research organization, which receives federal support, is obliged to include a statement at the patent application that the government has certain rights in the invention.

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