IMPROVING BAYH-DOLE: A CASE FOR INVENTOR OWNERSHIP OF FEDERALLY SPONSORED RESEARCH PATENTS

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ABSTRACT

The Bayh-Dole Act, a statute passed in 1980 to bolster U.S. innovation by providing universities and small businesses the opportunity to commercially exploit patents obtained from federally sponsored research, has received a great deal of credit for technological advances in the United States during the past few decades, while attracting surprisingly little scrutiny. While universities have nearly uniformly patted themselves on the back for the number of patents and licenses they churn out every year, scant attention has been given to whether our current system actually yields more value than either the pre-1980 status quo or any other possible structure. This Article provides a critical analysis of the benefits and costs of the Bayh-Dole Act, and proposes a scheme for shifting assignment of these patents from the universities themselves to the universities' inventors to encourage the best use of the underlying technology and to reduce inefficiencies in the patent system.

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INTRODUCTION

Over the past twenty years, scholars from a variety of backgrounds—scientists, economists, lawyers and others—have debated the effects and, ultimately, the wisdom of the Bayh-Dole Act ("Act"),[1] specifically its ramifications on university research. While most have declared the Act a success, universally citing the exponential increase in university patenting after 1980, others have derided the Act, claiming that greedy technology transfer offices and large pharmaceutical corporations squeeze new technologies, once free to all, for every penny they will yield.

This incessant debate has involved a great deal of discussion about the economic principles of monopolies, deadweight losses, anti-commons and transaction costs, among others. It seems that most legal scholars have approached the issue with their minds already made and, with few exceptions, little effort has been made to thoroughly explore the economic consequences of the Act's provisions. On the other hand, economic scholars tend to accept the current state of the law as the touchstone for their subsequent analyses without evaluating alternative statutory mechanisms for technology transfer.

This Article stages a new approach to the debate. Rather than attempting a full-fledged attack on, or defense for, the Act, this Article will determine if the Act could be improved by modifying its incentive structure. In doing so, economic principles have been applied rigorously with the hope that even the most lay reader can follow the methodology and, accordingly, object to any errors in judgment. The goal is not to end the debate but to take it another step forward.

[1] 35 U.S.C. § 200 (2006).

The following discussion is divided into five parts. Part I briefly canvasses elementary principles of patent law and the history of the Act. Part II evaluates the principal explanations given for the success of the Act, followed by other less-cited factors. Part III examines the shortcomings of the Act, while Part IV presents the thesis of this paper: a utilitarian justification for putting ownership of subject patents in the hands of their inventors. Finally, Part V addresses the strongest arguments against the proposal.

I. A BRIEF BACKGROUND

A. General Principles of Patent Law

"To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries"[2]

Authorized by our Constitution to encourage innovation, patents grant their owners the legal right to exclude all others from practicing the patented invention for a prescribed period.[3] Plaintiffs may ask for both an injunction and damages against alleged infringers.[4] While ownership is intrinsically bestowed upon the inventor, patents, like other forms of property, can be transferred by sale, gift or exchange.[5] Consequently, issues of patent ownership typically entail the contract law of the applicable state rather than federal patent law per se.[6] Additionally, patents can be licensed by their owners either exclusively or non-exclusively to other parties.[7] A non-exclusive license amounts to little more than a binding promise by the owner not to sue the licensee for infringement.[8]

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2 U.S. CONST. art. I, § 8, cl. 8.

3 35 U.S.C. § 154(a)(1) (2006) ("Every patent shall contain . . . a grant to the patentee . . . the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States . . . ."). The statutory period is currently set at 20 years from the date of filing. *Id.* § 154(a)(2).

4 *Id.* §§ 283–284.

5 *Id.* § 261; *see* 8 DONALD S. CHISUM, CHISUM ON PATENTS § 22.01, at 22-2 (Mathew Bender & Co., Inc. 2005) (1998) ("The inventor or inventors may then transfer ownership interests by written assignment to anyone . . . .").

6 CHISUM, *supra* note 5, § 22.02, at 22-4 ("For the most part, state law governs contractual obligations and transfers of property rights relating to patents.").

7 HERBERT F. SCHWARTZ, PATENT LAW AND PRACTICE § 3.I.A, at 44 (5th ed. 2006).

8 Intellectual Prop. Dev., Inc. v. TCI Cablevision of Cal., Inc., 248 F.3d 1333, 1345 (Fed Cir. 2001) (defining "nonexclusive license" as "a covenant by the patent owner not to sue the licensee for making, using, or selling the patented invention and under which the patent owner

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An exclusive license, on the other hand, not only prevents the owner from licensing the patent to third parties, but typically also gives the licensee standing to sue for infringement.[9]

B. The Bayh-Dole Act of 1980

Enacted in 1980, the University and Small Business Patent Procedures Act,[10] more commonly known by the names of its sponsors, Senators Birch Bayh and Robert Dole, created and altered several provisions in Title 35 of the United States Code to help bolster domestic innovation.[11] The Act is best known, however, for giving universities the option to retain title to patents procured in the course of federally sponsored research.[12] Prior to the Act, any patents obtained through research funded by the federal government, even if only in part, belonged to the federal agency sponsoring the project.[13]

The passage of the Act is generally credited to Congress's worry that the United States was lagging behind other nations, most notably Japan, in bringing technological innovation to industry.[14] Citing dismal statistics revealing the federal government's failure to make its intellectual property attractive to commercial businesses, Congress turned to universities and small businesses to spearhead the technology-transfer effort.[15]

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reserves the right to grant similar licenses to other entities"); *see* SCHWARTZ, *supra* note 7, § 3.I.A, at 44.

9 The exclusive licensee may be required, however, to join the owner in the suit. SCHWARTZ, *supra* note 7, § 3.I.A, at 44; *see* Fieldturf, Inc. v. Sw. Recreational Indus., Inc., 357 F.3d 1266, 1268 (Fed. Cir. 2004); Mentor H/S, Inc. v. Med. Device Alliance, Inc., 240 F.3d 1016, 1018–19 (Fed Cir. 2001).

10 Pub. L. No. 96-517, 94 Stat. 3015 (1980) (codified as amended at 35 U.S.C. §§ 200–212 (2006)).

11 S. REP. NO. 96-480, at 1, 3 (1979) ("Ultimately, it is believed that these improvements in Government patent policy will lead to greater productivity in the United States, provide new jobs for our citizens, create economic growth, foster increased competition, make Government research and development contracting more competitive, and stimulate a greater return on the billions of dollars spent each year by the Government on its research and development programs.").

12 35 U.S.C. § 202(a) (2006).

13 S. REP. NO. 96-480, at 2.

14 *See id.* at 1 ("Evidence is mounting that the United States is falling behind its international competition in the development of new products and inventions.").

15 *See id.* at 2 ("[O]f the more than 28,000 patents in the Government patent portfolio, less than 4 percent are successfully licensed."); *id.* at 30 ("[The Act] will be the vehicle that will insure that universities, nonprofit organizations, and small businesses will be able to fully partici-

But that's only half the story. During the burgeoning biomedical boom of the 1970s, universities had often successfully negotiated with the Department of Defense and the Department of Health, Education and Welfare to retain title to patents on "subject inventions," *i.e.*, inventions resulting from government-funded research.[16] Perhaps because this small taste piqued their appetite, or perhaps because the government contemplated prohibiting such arrangements entirely,[17] universities lobbied vociferously for a change in the law, and they succeeded.[18]

II. ACCOUNTING FOR THE BAYH-DOLE ACT'S APPARENT SUCCESS

While the Act has been hailed as a remarkable success, a general misconception exists regarding its effect on university research.[19] The financial incentive provided to universities by the Act fails to explain why it has proven to be a technological boon to American industry. On the contrary, the self-lauded efforts of universities in fulfilling their congressional mandate under the Act are not wholly disinterested; a truth that clouds any objective assessment of the Act's effect.[20] After addressing these points in turn, this Article will demon-

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pate in Government research and development, and will give resulting inventions a maximum chance of achieving their full commercial potentials.").

16 David C. Mowery et al., *The Effects of the Bayh-Dole Act on U.S. University Research and Technology Transfer*, *in* INDUSTRIALIZING KNOWLEDGE: UNIVERSITY-INDUSTRY LINKAGES IN JAPAN AND THE UNITED STATES 269, 273 (Lewis M. Branscomb et al. eds., 1999). These deals were referred to as "Institutional Patent Agreements," or IPAs. *Id.*

17 *Id.* at 274 ("[The Department of Health, Education and Welfare] in particular began to question the use by some U.S. universities of exclusive licenses under IPAs, and proposed limiting the ability of some universities to adopt such policies.").

18 David C. Mowery, *The Bayh-Dole Act and High-Technology Entrepreneurship in U.S. Universities: Chicken, Egg, or Something Else?*, *in* 16 ADVANCES IN THE STUDY OF ENTREPRENEURSHIP INNOVATION AND ECONOMIC GROWTH, UNIVERSITY ENTREPRENEURSHIP AND TECHNOLOGY TRANSFER: PROCESS, DESIGN, AND INTELLECTUAL PROPERTY 39, 49–51 (Gary D. Libecap ed., 2005).

19 *See, e.g.*, Rebecca Zacks, *The TR University Research Scorecard*, TECH. REV., July–Aug. 2000, at 88 (referring to the Act as the "Viagra for campus innovation").

20 *See, e.g.*, Lita Nelsen, *The Role of University Technology Transfer Operations in Assuring Access to Medicines and Vaccines in Developing Countries*, 3 YALE J. HEALTH POL'Y L. & ETHICS 301, 302 (2003) ("Most universities believe that the primary purpose of their technology transfer activities is to induce investment in university technology by private firms to bring products based on the technology to the public. A second goal at many universities is to aid local economic development by encouraging the creation of startup companies based on licenses to use their technology.").

strate how the Act has achieved success, albeit modest, according to the rather unremarkable design of its congressional advocates.[21]

A. Increases in University Patent Filings Are an Inaccurate Measure of the Success of the Bayh-Dole Act

First, many scholars have noted the sudden spike in university patenting activity after 1980, intimating that the Act has spurred university investment in research and development.[22] That universities, now having a monetary stake in government-financed intellectual property, should be patenting their work at unprecedented pre-1980 rates should come as no surprise.[23] But this figure, standing alone, does not support the proposition that more research, or more productive research, is being performed at universities. Prior to 1980, universities had little incentive to incur the costs and delays of obtaining patent protection for the fruits of government-sponsored research.[24] To draw any useful inferences about the Act's effect on university research, one would need some measure of the intellectual property that was placed freely in the public domain prior to the Act. However, such data does not exist.[25]

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21 *See, e.g.*, S. REP. NO. 96-480, at 16 (1979) ("[D]evelopment will be promoted by those having an exclusive interest . . . .").

22 *See, e.g.*, James J. Duderstadt, *Delicate Balance: Market Forces versus the Public Interest*, *in* BUYING IN OR SELLING OUT?: THE COMMERCIALIZATION OF THE AMERICAN RESEARCH UNIVERSITY 56, 67 (Donald G. Stein ed., 2004); David H. Guston, *Responsible Innovation in the Commercialized University*, *in* BUYING IN OR SELLING OUT?: THE COMMERCIALIZATION OF THE AMERICAN RESEARCH UNIVERSITY, *supra*, at 161, 163; Karen A. Holbrook & Eric C. Dahl, *Conflicting Goals and Values: When Commercialization Enters into Tenure and Promotion Decisions*, *in* BUYING IN OR SELLING OUT?: THE COMMERCIALIZATION OF THE AMERICAN RESEARCH UNIVERSITY, *supra*, at 89–90; Sheldon Krimsky, *Reforming Research Ethics in an Age of Multivested Science*, *in* BUYING IN OR SELLING OUT?: THE COMMERCIALIZATION OF THE AMERICAN RESEARCH UNIVERSITY, *supra*, at 133, 137; Arti K. Rai, *The Increasingly Proprietary Nature of Publicly Funded Biomedical Research: Benefits and Threats*, *in* BUYING IN OR SELLING OUT?: THE COMMERCIALIZATION OF THE AMERICAN RESEARCH UNIVERSITY, *supra*, at 117–18; Zacks, *supra* note 19, at 88.

23 Mowery et al., *supra* note 16, at 276.

24 Institutional Patent Agreements, Bayh-Dole's small-scale collective precursor, are the obvious exception. S. REP. NO. 96-480, at 21.

25 *See* Jeannette Colyvas et al., *How Do University Inventions Get into Practice?*, MGMT. SCI., Jan. 2002, at 61–62 (finding in many cases that "intellectual property rights did facilitate universities earning royalty income, but the technology would have been used in industry even absent patenting and licensing by the university"); Duderstadt, *supra* note 22, at 68 (questioning whether "[t]he increasing emphasis on disclosing, patenting, and licensing much of what universities naturally would have once produced and placed in the public domain" has stimulated technology transfer); *see also* Mowery, *supra* note 18, at 56 ("[E]vidence of in-

Moreover, the aggregate delay and expense attributable to the increase in post-1980 patent procurement and licensing represents a formidable rise in transaction costs associated with disseminating university-developed technology. For example, the Massachusetts Institute of Technology, which has consistently procured more patents each year than any other U.S. university, spent $16.3 million on patent expenses in 2008.[26] Over the past ten years, the university has averaged 142 patents per year, meaning that patent prosecution and licensing on a single patent now costs the Institute roughly $115,000 annually.[27] While this substantial expense may be warranted, as discussed below, it should be recognized as a cost of implementing the Act, not a measure of its success.[28]

B. The Bayh-Dole Act Fails to Foster Significant Reinvestment in University Research and Development

Since government-sponsored research pays for itself, universities have no need to invest more money in research and development. For university science and engineering departments, the federal grant poses an end in itself.[29] In fact, considering the poor return on investment that university research and de-

creased patenting and licensing by universities by itself [does not] indicate that university research discoveries are being transferred to industry more efficiently or commercialized more rapidly . . . .").

26 Mass. Inst. of Tech., Tech. Licensing Off., TLO Statistics for Fiscal Year 2008, http://web.mit.edu/tlo/www/about/office_statistics.html (last visited May 7, 2009) [hereinafter TLO Statistics].

27 Mass. Inst. of Tech, Tech. Licensing Off., Office Statistics: FY 2008, http://web.mit.edu/tlo/www/downloads/ppt/TLO_Stats_FY08.ppt (last visited May 7, 2009). Due to the significant lag—often several years—between the application for a patent and its issuance, patent-related expenses in any given year cannot be attributed to the patents issuing that year. Although the annual number patents issued to the Massachusetts Institute of Technology ("MIT") has remained relatively constant since 1999, fluctuating between a low of 121 in 2006 and a high of 160 in 2001, the university's patent expenses have steadily climbed each year, with the exception of 2003, from $5.9 million in 1999 to $14.9 million in 2008. *Id.* To provide a more meaningful approximation, therefore, the issued patents were averaged over a ten-year span. By comparison, if only the most recent year, 2008, is used, the cost comes to more than $133,000 per patent.

28 *See* Duderstadt, *supra* note 22, at 68 ("These policies may raise the costs of use of these research results in both academic and nonacademic settings . . . ."); Mowery et al., *supra* note 16, at 300 ("[M]ore of what universities naturally would have produced and placed in the public domain now is subject to more complex administrative procedures. . . . These policies may raise the costs of use of these research results in both academic and nonacademic settings . . . .").

29 *See* Rai, *supra* note 22, at 120 ("When research is publicly funded, and doing such research is the basis for career advancement, no other incentives for doing research are necessary.").

velopment typically provides, a profit-seeking university would do better to invest any unrestricted funds elsewhere.[30]

Furthermore, universities do not want a gift card good only in the Department of Pharmaceutical Chemistry; they want cash unfettered.[31] After paying any patent-related expenses and satisfying the Act's requirement that royalties be shared with the inventor,[32] universities may often steer revenues toward less lucrative departments.[33] While this might serve the greater good of human-

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30 In fiscal year 2008, for example, Harvard University received $668 million in research grants, while receiving $84.5 million in royalties—roughly a 12.6% return on equity. HARVARD UNIV., FINANCIAL REPORT: FISCAL YEAR 2008 4, 40 (2008), *available at* http://vpf-web.harvard.edu/annualfinancial. This figure is, of course, overstated, since it reflects the return not from the most recent year's research expenditures, but rather those from past years. Although the "compounding" effect should only moderately skew the calculation, since the expenditures in the most recent year will contribute to royalties for many years to come, thereby counterbalancing the distortion, one can reasonably assume that Harvard's research expenditures, not unlike its tuition rates, generally increase year-over-year. Harvard's annualized average return on investment holdings for the 30-year period ending June 30, 2008, by comparison, was 14.6%. *Id.* at 10. While Harvard's endowment has been hammered by the recent financial crisis, losing 22% of its value in the first four months of the current fiscal year, incorporating this loss only modestly lowers the annualized average return, that is, to approximately 13.8% over the past 30 years. Clifford M. Marks & June Q. Wu, *Harvard Endowment Fell 22 Percent in Four Months: Decline Dwarfs University's Previous Worst Single-Year Loss*, THE HARV. CRIMSON, Dec. 2, 2008, *available at* http://www.thecrimson.com/article.aspx?ref=525668. Although the Act technically requires income from subject inventions to be spent on further research, 35 U.S.C. § 202(c)(7)(B) (2006), this money can free up money without strings for other uses.

31 *See* Derek Bok, *The Benefits and Cost of Commercialization of the Academy*, *in* BUYING IN OR SELLING OUT?: THE COMMERCIALIZATION OF THE AMERICAN RESEARCH UNIVERSITY, *supra* note 22, at 32–33 ("Moreover, compared with many of the gifts, grants, and legislative appropriations that a university receives, commercial revenues have special value because they can generally be used for any purpose officials choose.").

32 35 U.S.C. § 202(c)(7)(B) ("Each funding agreement with a small business firm or nonprofit organization shall contain appropriate provisions to effectuate the following: . . . In the case of a nonprofit organization . . . a requirement that the contractor share royalties with the inventor . . . ."); *see* 37 C.F.R. § 401.14(k)(2) (2008) ("The *contractor* will share royalties collected on a subject invention with the inventor . . . ." (emphasis added)).

33 The University of Pennsylvania, for example, retains 30% of patent royalties for "the general support of research at the University." Univ. of Penn., Patent & Tangible Research Property Policies & Procedures of the University of Pennsylvania 2.3.1, 2.3.8 (2005), *available at* http://www.upenn.edu/research/DetailedPolicies.htm#sponsored. For an idea of how this money is used, see Holbrook & Dahl, *supra* note 22, at 93 (describing, among other things, how patent royalties at the University of Washington were used to finance the study of ancient religious manuscripts in India). Moreover, universities may circumvent their obligation to pay inventor royalties by accepting lower royalties in exchange for additional research

ity and may foster an esprit de corps among university departments, it can hardly be said to further the goals of the Act.[34]

C. The Bayh-Dole Act Has Not Prompted a Significant Increase in Monetary Incentives to Research Faculty

Alternatively, providing financial incentives to universities to develop commercially-valuable technology might also encourage universities to provide monetary rewards to income-generating faculty. Several studies have correlated faculty incentives, such as royalties or equity, to their work on commercial development and subsequent invention disclosures.[35] However, if faculty incentives alone explain the success of the Act, then why haven't universities, in order to maximize the commercial value of university research, simply allowed faculty to retain title to their inventions?

One explanation is that university faculty, in contrast to their administrative counterparts, still cherish research funds much more than royalty and license fees.[36] More importantly, leaving patent ownership with faculty eviscerates the universities' hard-fought battle to keep title from the government.

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money. Eyal Press & Jennifer Washburn, *The Kept University*, THE ATLANTIC MONTHLY, Mar. 2000, at 39, 48.

34 35 U.S.C. § 200 provides the following objectives:

> [T]o use the patent system to promote the utilization of inventions arising from federally supported research or development; to encourage maximum participation of small business firms in federally supported research and development efforts; to promote collaboration between commercial concerns and nonprofit organizations, including universities; to ensure that inventions made by nonprofit organizations and small business firms are used in a manner to promote free competition and enterprise without unduly encumbering future research and discovery; to promote the commercialization and public availability of inventions made in the United States by United States industry and labor; to ensure that the Government obtains sufficient rights in federally supported inventions to meet the needs of the Government and protect the public against nonuse or unreasonable use of inventions; and to minimize the costs of administering policies in this area.

35 U.S.C. § 200 (2006).

35 Jerry G. Thursby & Marie C. Thursby, *Pros and Cons of Faculty Participation in Licensing*, *in* UNIVERSITY ENTREPRENEURSHIP AND TECHNOLOGY TRANSFER: PROCESS, DESIGN, AND INTELLECTUAL PROPERTY, *supra* note 18, at 192–93.

36 Richard Jensen & Marie Thursby, *Proofs and Prototypes for Sale: The Licensing of University Inventions*, 91 THE AM. ECON. REV. 240, 244–45 (2001).

D. The Bayh-Dole Act's Principal Advantage Is the Exclusive License

While failing to explain the success of the Act, financial incentives do explain why universities lobbied so enthusiastically for its passage.[37] Despite rhetoric claiming that universities could more efficiently disseminate technology to industry through licensing than the federal government,[38] both Congress and universities recognized exclusive licensing as the principal advantage that universities held.[39] This advantage, as universities knew, often waxes lucrative. Although most non-exclusive licenses must be given away,[40] a single "home run" licensed exclusively can provide millions in annual revenues.[41]

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37 Mowery, *supra* note 18, at 49. *But cf.* Lita Nelsen, *The Rise of Intellectual Property Protection in the American University*, 279 SCI. 1460, 1460 (1998) (claiming, though citing no authority, that universities were included in the Act "largely as an afterthought").

38 *See, e.g.*, Holbrook & Dahl, *supra* note 22, at 90 ("Because there was no government policy regarding the ownership of these inventions, the ability of industry to adopt and develop the new technology was limited."). The most frequently-cited figures before and after the Act, which means, those from the legislative history of the Act and the Association of University Technology Managers ("AUTM") survey, create the illusion that the Act, among other things, effectively promoted non-exclusive licensing. *Compare* S. REP. NO. 96-480, at 2 (1979), *with* ASS'N OF UNIV. TECH. MANAGERS, AUTM U.S. LICENSING ACTIVITY SURVEY, FY 2007: SURVEY SUMMARY: A SURVEY OF TECHNOLOGY LICENSING (AND RELATED) ACTIVITY FOR U.S. ACADEMIC AND NONPROFIT INSTITUTIONS AND TECHNOLOGY INVESTMENT FIRMS 39 (Robert Tieckelmann et al. eds., 2008) [hereinafter AUTM U.S. LICENSING ACTIVITY SURVEY, FY 2007]. The comparison fails because the annual AUTM survey measured only the sheer number of licenses, both exclusive and non-exclusive, obtained by universities, *see* AUTM U.S. LICENSING ACTIVITY SURVEY, FY 2007, while the Senate Judiciary Committee focused strictly on the number, and percentage, of patents that were being licensed, *see* S. REP. NO. 96-480, at 2. Since each patent can yield an unlimited number of non-exclusive licenses, the AUTM survey does not reveal what percentage of subject patents universities have licensed non-exclusively.

39 S. REP. NO. 96-480, at 2 ("Universities, on the other hand, which can offer exclusive or partially exclusive licenses on their patents if necessary, have been able to successfully license 33 percent of their patent portfolios.").

40 In fiscal year 2004, of 27,322 active licenses, only 11,414 (42%) generated income. ASS'N OF UNIV. TECH. MANAGERS, AUTM U.S. LICENSING SURVEY: FY 2004: A SURVEY SUMMARY OF TECHNOLOGY LICENSING (AND RELATED) PERFORMANCE FOR U.S. ACADEMIC AND NONPROFIT INSTITUTIONS AND TECHNOLOGY INVESTMENT FIRMS 2, 3 (Ashley J. Stevens et al. eds., 2005). The AUTM survey no longer provides information on licensing income, so this comparison cannot be made for more recent years. AUTM U.S. LICENSING ACTIVITY SURVEY, FY 2007, *supra* note 38, at 41 ("For several years, this report has not discussed licensing revenue, as that is a product of having commercial utilization of university research. Further, industry is the primary point of control and commercialization and research institutions ultimately have very little control over how much revenue is generated."). *But cf.*

III. REEVALUATING THE EFFECT OF THE BAYH-DOLE ACT: A LAW AND ECONOMICS PERSPECTIVE

The Act, as its legislative history candidly acknowledges, encourages technology transfer principally through the grant of exclusive licenses, rather than the financial incentives created for universities.[42] Since many scholars still question both the necessity and propriety of selling exclusive licenses,[43] the following subsection will show, through economic principles, why the bulk of university innovation would otherwise remain unused.

A. Patents Avoid the Tragedy of the Commons by Providing a Financial Incentive for Research and Development

By creating a temporary monopoly for the inventor, the American patent system abates the disincentive existing in any "intellectual commons." Assume, for example, that the research and development of a new product would cost a company some fixed amount, $\$X_{costs}$. While producing the product would increase total welfare as long as the benefits of the product, $\$X_{benefits}$, exceed $\$X_{costs}$, the company will pursue the research and development, but only if its own payoff, $\$X_{profits}$, exceeds $\$X_{costs}$. Because the potential increase in total welfare exceeds the potential benefits to the company,[44] any value of $\$X_{costs}$ that falls in the gap between these two values, $\$X_{benefits}$ and $\$X_{profits}$, produces an in-

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Mowery et al., *supra* note 16, at 297 (finding that the most profitable licenses at Stanford University, University of California and Columbia University were licensed non-exclusively).

41 Mary L. Good, *Increased Commercialization of the Academy Following the Bayh-Dole Act of 1980*, *in* BUYING IN OR SELLING OUT?: THE COMMERCIALIZATION OF THE AMERICAN RESEARCH UNIVERSITY, *supra* note 22, at 48, 53. Consider, for example, the anti-AIDS compound d4T, developed by scientists at Yale University and licensed exclusively to Bristol-Myers Squibb. In fiscal year 2000, revenues from the drug accounted for approximately 87% of Yale's royalty income ($40 million of $46 million). YALE UNIV., ADDING VALUE TO IDEAS: 1999-2000 ANNUAL REPORT 5 (2000), *available at* http://www.yale.edu/ocr/resources/docs/ocr_report_99-00.pdf.

42 S. REP. NO. 96-480, at 28 ("The central problem seems to be that the agencies seek to issue nonexclusive licenses for these patents which are available to all interested parties. Nonexclusive licenses are generally viewed in the business community as no patent protection at all, and the response to such licenses has been lackluster.").

43 *See, e.g.*, Duderstadt, *supra* note 22, at 67–68; Mowery et al., *supra* note 16, at 275, 297.

44 In other words, if at least one buyer values the product more than she pays for it, then some portion of the welfare from the product has been realized by the consumer, rather than the producer, the company. Apart from academic constructs, this will always be true.

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efficient result.[45] To achieve a more efficient result, the patent system shrinks this gap by shifting more of the total welfare benefits to the company—first, by giving the patentee the entire market share for the product, and second, by allowing the patentee to take a larger portion of the trade surplus through price-fixing. This second feature of the patent system, the ability of patentees to fix prices, also creates the much-decried deadweight losses associated with monopolies.[46]

Figure 1 displays the relationship between quantity and price in a free market. Intuitively, the demand for any good increases as the price decreases. Because the producer must sell *every* unit cheaper to achieve additional sales, the producer's marginal revenue—the additional revenue realized by selling one more unit—decreases, albeit faster than the demand, as the price decreases.[47] On the other hand, marginal costs—the additional expense of selling one more unit—are generally thought to decrease initially with increased quantity, reflecting the dispersion of the fixed costs associated with production over a larger number of units, but then to increase as, among other things, production levels exceed the design output of the producer's fixed assets. The average cost represents the average of the sum of marginal costs for the units produced.[48] The producer surplus, equal to the price of the good less the average cost, multiplied by the quantity produced, represents the profit inuring to all producers. The consumer surplus, though not depicted in Figures 1 and 2, is the area below the demand curve and above the price line, representing how much more consumers valued the goods than what they collectively paid for them.

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45 In more colloquial terms, this outcome could be thought of as the proverbial "tragedy of the commons." A rational, *i.e.*, selfish, actor will not suffer voluntarily solely for the benefit of others.

46 That is, even though the benefit to would-be users exceeds the marginal cost of producing the additional items, the total revenue of the company would decline with any further reduction in price. For more background on the microeconomics of monopolies, see HOWELL E. JACKSON ET AL., ANALYTICAL METHODS FOR LAWYERS 335–50 (2003).

47 To see why, consider a simple example. Assume that for every dollar reduction in the price of good G, an additional unit can be sold. At a price of nine dollars, five units of good G can be sold, while at a price of eight dollars, six units can be sold. Likewise, at a price of seven dollars, seven units can be sold. The marginal revenue decreases from three dollars ($8 x 6 - $9 x 5) to one dollar ($7 x 7 - $8 x 6). If the price were further lowered to six dollars, marginal revenue would become negative ($6 x 8 - $7 x 7 = -1).

48 Mathematically, the average cost equals the integral of the marginal cost curve from zero to the number of units produced, divided by the number of units produced. Hence, the slope of the average cost curve is zero when the average cost equals the marginal cost.

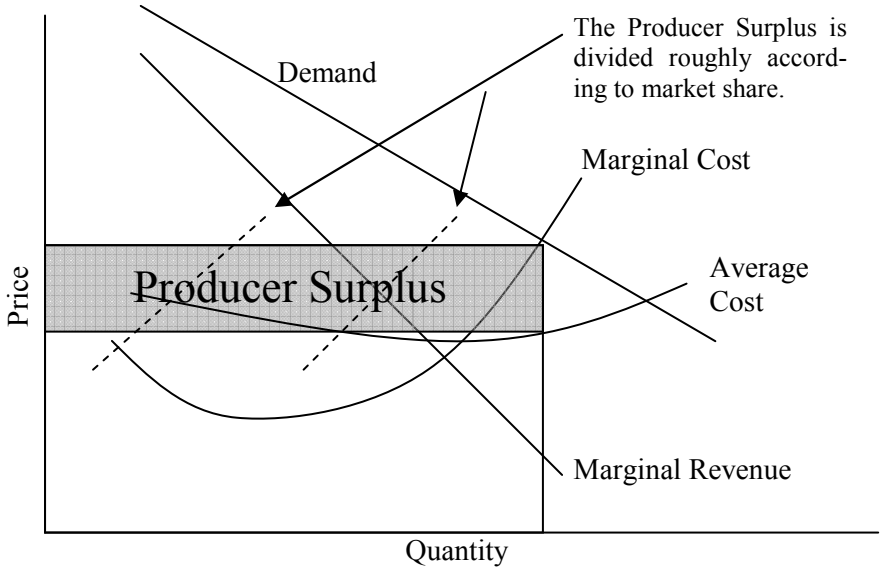

Figure 1. Relationship between quantity and price in a free market

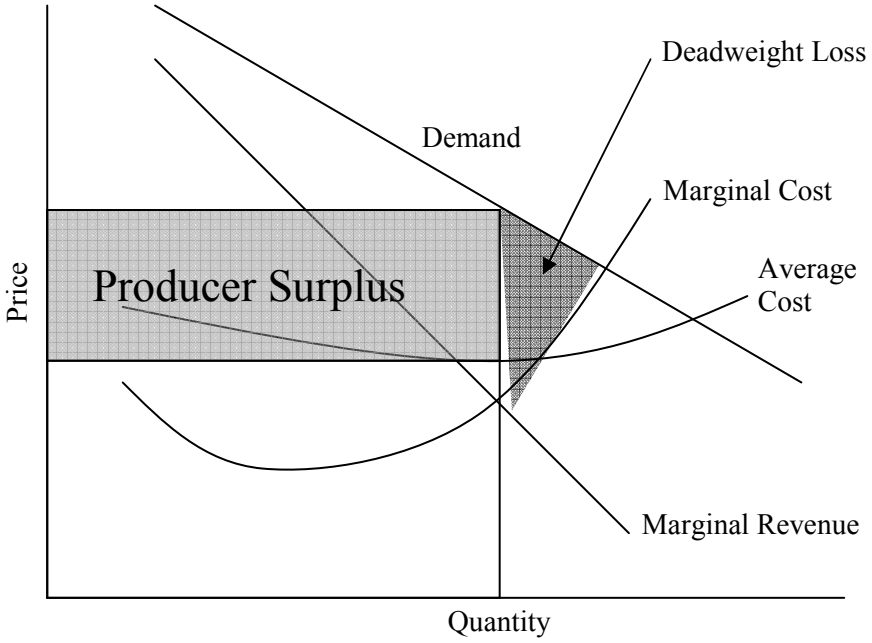

Figure 2. Relationship between quantity and price in a patent monopoly

In a free market, that is, a market with multiple producers, someone will willingly produce an additional unit as long as the price, determined by the market, exceeds the marginal cost of that unit. Therefore, the quantity produced is fixed by the intersection of the marginal cost and demand curves. Furthermore, the producer surplus is divided between producers roughly according to their market share.

In a monopoly scenario, by contrast, the sole producer can set the price as she pleases, and will accordingly do so in order to maximize her surplus. Since her profit, or surplus, declines once the marginal cost exceeds the marginal revenue, the intersection of these curves (as shown in Figure 2) marks the monopoly price, and correspondingly, the quantity. Although producer surplus has been maximized, total welfare—the sum of the producer and consumer surpluses—declines, as additional units whose demand exceeds their costs will never be produced. This "deadweight loss," unique to monopolies, is shown in Figure 2.

B. The U.S. Patent System Provides Less-than-Ideal Investment Incentives Due to the Risk of Simultaneous Development

The American patent system works on a "winner-take-all" basis. In other words, no matter how many people work independently on a particular technology, the one who "invents" first, even if only by a split-second, takes title to the state-granted monopoly.[49] Accordingly, companies must discount *ex ante* these additional incentives for research and development to account for the probability of not being the first to invent. An example will illustrate this principle. Assume that the potential benefits of drug Cx-2, which has not yet been produced, are $100, and that the cost of research and development needed to bring Cx-2 to market is $25. Being a competitive market, assume that the total surplus of Cx-2, disregarding the research and development costs,[50] will be apportioned roughly equally between consumers and producers. The gross producer surplus, that is, the $50 of surplus reaped by the manufacturers, will be apportioned among them, each according to his market share. Assuming that there are three drug companies with a roughly equal market share, no company will invest in the development of Cx-2, because the cost of the investment to

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49 *See* 35 U.S.C. §§ 102(a), (g) (2006).

50 Research and developments costs are ignored here because, in the absence of a monopoly, the price of the product will be dictated by the developer's competitors, which means, those who have only to recoup the costs of manufacture and distribution, assumed negligible for simplicity.

any one of the companies, $25, exceeds its return, $17. Our free market economy has failed, because a drug with benefits that far exceed its costs will never be produced.

With a patent, however, the developer of Cx-2 stands to gain far more. In addition to having the entire market share for the drug, the developer can set the price for the drug in order to maximize his revenue, *i.e.*, producer surplus, at the expense of not only consumer surplus, but also total surplus. In other words, the developer gets to take a much larger slice of a smaller pie. Imagine the results as something like the following example. The total surplus is reduced to $80 due to $20 of deadweight losses, while the developer significantly raises the price of Cx-2, capturing $70 in producer surplus and leaving $10 in consumer surplus. Since the developer's revenue, $70, far exceeds the cost of development, $25, we would expect him to produce the drug. Thus, the patent system helps correct the shortcomings of a free market, reducing lost welfare from $100 to $20.[51]

Unfortunately, this example overlooks the discount that all three drug companies must accord to the value of the patent. If all three work toward the development of Cx-2, all things being equal, each one holds a one-in-three chance of obtaining the patent.[52] Neglecting risk aversion, which only exacerbates the problem, the companies will value the patent at only $23, or about one-third of $70. Since the patent is valued less than the cost of production, $25, Cx-2 will remain undeveloped.

C. Exclusive Licenses on Early-Stage Technology Help Offset the Disincentive Created by the Risk of Simultaneous Development

Imagine if the companies could bid on an exclusive right to seek the patent before ever beginning development. The value of the patent would no longer be discounted, since only one company, the highest bidder, would have the legal right to pursue it. Each company should value this exclusive right at the difference between the potential producer surplus from Cx-2, $70, and the cost of production, $25. The inherent inefficiency of the "winner-take-all" aspect of our patent system would thus be circumvented.

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[51] This assumes that maximizing total surplus, and not consumer surplus, should be the intent of our market system. Once created, the wealth can be redistributed more efficiently through the tax system. For instance, a 95% income tax on corporate profits would not alter the drug company's decision to produce Cx-2. *See* JACKSON ET AL., *supra* note 46, at 368–69.

[52] The 1-in-3 chance is simply a baseline. Of course the relative advantages of each party will affect the odds.

An exclusive license on early-stage technology, the quintessential creature of the Act,[53] provides the licensee just such a right. To see why, imagine that Cx-2 works on some underlying concept discovered through federal funding in a university laboratory. Although the concept has been proven, and regardless of how much was spent doing so, someone must invest more in the development of the idea, $25, before Cx-2 finds itself on pharmacy shelves.[54] Without the Act, no one would.[55] Therefore, the Act succeeds not because of university financial incentives, but because it allows private companies to erect roadblocks to impede competing research and development efforts at a fraction of the cost of the underlying federally funded research.

If no company would invest in the development of Cx-2 without an exclusive license, one must explain the large percentage of non-exclusive licenses procured each year through the Act.[56] Simply put, the non-exclusive licenses represent inventions that have been patented at a much later stage of development by the university, *i.e.*, the invention is ready, or near ready, to market.[57] For example, if the university had already performed the additional $25 worth of research and development needed to bring Cx-2 to market, then all three drug companies would readily obtain a non-exclusive license, each expecting to receive roughly one-third of the producer surplus, $17.

The foregoing analysis yields two further implications. First, the total number of non-exclusive licenses represents a large multiple of their underlying

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53 Although, as mentioned before, the Act is best known for bestowing the commercial fruits of federally sponsored research on universities, Congress recognized exclusive licensing as the necessary mechanism for stimulating innovation. *See* S. REP. NO. 96-480, at 2 (1979).

54 *Id.* at 19 ("It has been estimated by many experts that the cost of taking a new invention from basic research through development and commercialization costs 10 times as much as did the basic research itself.").

55 *See* Colyvas et al., *supra* note 25, at 65 (finding that in many cases involving embryonic inventions, "firms may well have needed some assurance of monopoly power before investing in development and commercialization").

56 In fiscal year 2007, non-exclusive licenses composed 58.9% of the total. AUTM U.S. LICENSING ACTIVITY SURVEY, FY 2007, *supra* note 38, at 36.

57 *See* Colyvas et al., *supra* note 25, at 65 ("For the nonembryonic inventions, firms didn't need any assurance of exclusivity to pick up and use what came out of university research. They did so simply because it was profitable."). As Neils Reimers candidly stated: "Well, when you do nonexclusive licensing, in a way you're just applying a tax." Interview by Sally Smith Hughes with Neils Reimers, Director, Stanford University's Office of Technology & Licensing (May 8, 1997), http://content.cdlib.org/xtf/view?docId=kt4b69n6sc&query=tax&brand=calisphere (last visited May 22, 2009).

patents.[58] Second, non-exclusive licenses, avoiding the deadweight losses of exclusive licenses, should be preferred.[59]

IV. SHORTCOMINGS OF BAYH-DOLE

Notwithstanding its heralded success, the Act has suffered many criticisms. First, many fear that the Act has pushed universities too far towards commercialization, deterring faculty from pursuing knowledge solely for its own sake. Moreover, universities have struggled with the frequent conflicts of interest that the Act has created among their faculty. These unexpected downsides warrant a brief discussion, as the mitigating effect that any proposed change to the Act might have on them must be accounted for in the ultimate cost-benefit analysis. Lastly, and more importantly, the Act's shortcomings and how it has ultimately fallen shy of its explicit objective—to maximize domestic welfare from U.S. innovation—will be discussed.

A. Bayh-Dole Has Accelerated the Commercialization of Higher Education

While there are unquestionable benefits from wielding the powerful academic-research machine toward industrial purposes, prominent scholars have warned that the burgeoning university commercialization spawned by the Act may threaten the quality of academic research.[60] But whether or not the Act has shifted the aim of academic research, it has almost certainly triggered something of an arms race among universities.[61] For example, universities that do not ex-

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58 The multiple for any patent licensed non-exclusively will, of course, depend on the number of companies present, or sustainable, in the given industry. *See, e.g.*, Mowery et al., *supra* note 16, at 297 (approximately 59% of Stanford University's patents are licensed exclusively, compared to 90% at the University of California).

59 35 U.S.C. § 209(a)(2) (2006) ("[T]he proposed scope of exclusivity is not greater than reasonably necessary to provide the incentive for bringing the invention to practical application . . . .").

60 Bok, *supra* note 31, at 40 ("Introducing opportunities for private gain threatens to divert some researchers from exploring more interesting and intellectually challenging problems."); Donald G. Stein, *A Personal Perspective on the Selling of Academia*, *in* BUYING IN OR SELLING OUT?: THE COMMERCIALIZATION OF THE AMERICAN RESEARCH UNIVERSITY, *supra* note 22, at 1, 7 ("[T]he problem for both junior and senior faculty is that they are often forced to do 'bread and butter' research—that is, safe, noncontroversial research that generates high indirect cost returns and the possibility of a patent—rather than follow their own interests.").

61 *See* Duderstadt, *supra* note 22, at 69 (discussing how universities have abandoned the traditional "library model" in the wake of the Act, and instead strive to capture and defend their intellectual property); Mowery et al., *supra* note 16, at 270–71 ("The passage of [the Act]

ploit the potential commercial value of their research fear being left behind.[62] Unfortunately, the technology transfer offices at those universities often lack the expertise needed to assess the marketability of the invention disclosures they receive from their various university departments,[63] resulting in both missed opportunities and wasteful expenditures.[64] Consequently, this relentless pursuit of marketable innovations, far from becoming a cash cow, composes only a small fraction of university revenue,[65] and even burdens many university budgets.[66]

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hastened or caused the entry by many universities (such as Columbia) into patenting and licensing activities that they formerly avoided as a matter of policy. Our evidence also suggests that even at universities long active in patenting and licensing of faculty inventions, administrators intensified their efforts to gain access to and/or market these inventions.").

62 Bok, *supra* note 31, at 45.

63 Press & Washburn, *supra* note 33, at 47 (discussing the difficulty universities have in predicting which academic achievements will be lucrative).

64 *See, e.g.*, Fenn v. Yale Univ., 283 F. Supp. 2d 615, 625–26 (D. Conn. 2003) (revealing how a Nobel Laureate defrauded his university's technology transfer office of millions in royalty revenues while telling them "that he did not believe the invention had the potential for much commercial value because any patent issued on it would be a 'use' patent as opposed to an 'apparatus' patent"); Kucharczyk v. Regents of the Univ. of Cal., 946 F. Supp. 1419, 1443–44 (N.D. Cal. 1996) (disclosing how a technology transfer office was sued by faculty inventors for licensing a patent argued to be worth more than $200 million for a one-time fee of merely $25,000); Press & Washburn, *supra* note 33, at 47 (describing how Boston University risked almost one-fifth its endowment on a failing startup venture).

65 In fiscal year 2008, for example, royalties comprised only 2.4%, or $84.5 million, of Harvard University's total revenue of $3.5 billion. HARVARD UNIV., *supra* note 30, at 19, 40.

66 According to a 1995 study, less than half of all university technology transfer offices operate profitably. Dennis R. Trune & Lewis N. Goslin, *University Technology Transfer Programs: A Profit/Loss Analysis*, 57 TECH. FORECASTING & SOC. CHANGE 197, 201 (1998). For example, the technology transfer office of Carnegie Mellon University remains unable to sustain itself, requiring annual subsidies to cover approximately half its expenses despite substantial royalties that the university derives from its well-known Lycos technology. *See* Arthur A. Boni & S. Thomas Emerson, *An Integrated Model of University Technology Commercialization and Entrepreneurship Education*, *in* UNIVERSITY ENTREPRENEURSHIP AND TECHNOLOGY TRANSFER: PROCESS, DESIGN, AND INTELLECTUAL PROPERTY, *supra* note 18, at 241, 273; *see also* Press & Washburn, *supra* note 33, at 48 ("[D]ozens of major universities—Brandeis, West Virginia, Tufts, and Miami among them— actually spent more on legal fees in fiscal year 1997 than they earned from all licensing and patenting activity that year.").

B. Bayh-Dole Increases the Risk of Conflicts of Interest Among University Faculty

Faculty conflicts of interest, a subject receiving ever-increasing scrutiny in the age of commercialization, have typically been divided into two general categories. The first, and perhaps more egregious, involves those conflicts that compromise the integrity of empirical results.[67] While usually stemming from industry-sponsored research—most notably clinical trials—this issue could arise any time faculty members hold a financial stake in the outcome of their research.[68] Second, faculty member participation in business pursuits, such as exploiting university patents in startup ventures, draws their time and fidelity away from the more traditional roles found in a university.

Though industry-sponsored research is outside the scope of this Article, it is worth reevaluating the nature of faculty conflicts occurring in a federally funded research setting, starting from the faculty-inventor tasked with founding a university "spin-off." Though it may not be a conflict per se when the faculty-inventor splits his time between the university and his young company, the effects are clear. Given the unrealistic expectations already placed on university faculty members, time spent nurturing the new enterprise will inevitably detract from the professor's work quality at the school.[69]

Furthermore, deleterious behavior may lurk behind laboratory doors. The professor may be tempted to use university facilities to conduct experiments, or she may simply pursue, in her academic capacity, a line of research at the university germane to the interests of her company. Worse yet, she might exploit university manpower to that end.

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67 *See* David Blumenthal et al., *University-Industry Research Relationships in Biotechnology: Implications for the University*, 232 SCI. 1361, 1364 (1986); Bok, *supra* note 31, at 41 ("Finally, industry funding will sometimes compromise the integrity of research because the stakes are so high. If the outcome of a researcher's inquiry can discredit a hugely valuable drug or cast doubt on the products or the production methods of entire industries, corporate sponsors will naturally be tempted to influence the outcome. Companies endangered in this way may try to cultivate and reward "friendly" academic experts or actually harass and intimidate academic scientists who threaten to publish results damaging to their products."); Krimsky, *supra* note 22, at 147–48 (discussing concerns and policies regarding conflicts of interest at universities, especially medical research "[i]n the aftermath of Jesse Gelsinger's death, significant attention at university medical schools has focused on clinical trials and conflicts of interest").

68 *See* sources cited *supra* note 67.

69 *See* Richard M. Felder, *The Myth of the Superhuman Professor*, 82 J. ENGINEERING EDUC. 105 (1994), *available at* http://www.ncsu.edu/felder-public/Papers/Mythpap.html.

Perhaps surprisingly, such seemingly reprehensible behavior likely serves the best interests of the university. Since universities often take an equity stake in faculty spin-offs, the faculty-inventor's entrepreneurial endeavors benefit the university, albeit indirectly.[70] Moreover, directing research efforts toward commercial applications furthers the Act's mandate to bring more innovation to American industry, without compromising the university's educational duties.[71]

Considering this win-win proposition, a university's insistence on bifurcating the academic and commercial roles of their faculty-inventors may seem needless.[72] But far from disappearing, the issue has only been magnified. What began as a faculty conflict has become an institutional conflict; universities now find themselves torn between their educational and profit-seeking goals. Forcing faculty to safeguard their academic purity amounts to little more than a feeble attempt to shift the burden—and blame—back down to the faculty-inventor. Given that a man can serve but one master, university policy sends a mixed message, formalizing the impossible task faced by the faculty-inventor: to ensure the success of a fledgling enterprise without sacrificing her other obligations.[73]

In addition, universities recognize another important value at risk: their tax-exempt status.[74] University spin-offs, bearing strong resemblance to corpo-

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70 As John Sandelin, a senior associate in Stanford University's Office of Technology Licensing, recounted in 2000: "[I]nitially the department chairmen and school deans weren't thrilled by having this new activity that was diverting the attention of their faculty away from teaching and research. So how do you offset that? You make them stakeholders—you make them beneficiaries." Press & Washburn, *supra* note 33, at 46.

71 *See* S. REP. NO. 96-480, at 1, 3 (1979) ("Ultimately, it is believed that these improvements in Government patent policy will lead to greater productivity in the United States . . . and stimulate a greater return on the billions of dollars spent each year by the Government on its research and development programs.").

72 *See, e.g.*, STANFORD UNIV., FACULTY POLICY ON CONFLICT OF COMMITMENT AND INTEREST, http://www.stanford.edu/dept/DoR/rph/4-1.html ("Whenever faculty members are involved in research as part of their outside consulting or business activities, they must establish clear boundaries that separate their University and outside obligations, so as to avoid questions about their appropriate use of resources and attributions of products of their work.") (last visited Mar. 8, 2009).

73 *See, e.g.*, *id.* ("Stanford encourages faculty to become involved in the transfer of knowledge from the University laboratory into the commercial marketplace. . . . An implicit assumption underlying the University's Policy on Outside Consulting Activities by Members of the Academic Council is that such outside professional activities are a privilege and not a right and must not detract from a faculty member's full-time obligation to his or her University duties.").

74 *See* 26 U.S.C. § 501(c)(3) (2006) (exempting scientific and educational institutions, among others, from federal income taxation); Peter D. Blumberg, *From "Publish or Perish" to*

rate subsidiaries, depend on the professor-entrepreneur dichotomy to maintain some vestige of independence.[75] If a faculty-inventor is perceived as simply an agent of her parent university even when acting in a business role, the university jeopardizes the tax-exempt character of any related gains.[76] On one hand, universities can hardly be faulted for attempting to avoid taxation on their equity holdings in these ventures. Because such infant enterprises cannot afford to pay standard license fees, equity simply fills the role as a surrogate. On the other hand, the critical role played by substantial faculty involvement in the success of the enterprise belies the passive nature of the university's activity, suggesting that the company's commercial research operations, at the least, should be attributed to the university for tax purposes.[77]

Although the character of university income is principally a question of tax law, not intellectual property policy, the tax implications surrounding these companies indicate that the limited involvement of universities in their spin-offs stems more from legal and financial pragmatism than any fidelity to the selfless ideals of higher education. The flood of profit-seeking activity that the Act set in motion is perhaps checked only by fear of the Internal Revenue Service. Consequently, the ability of universities to regulate their own conflicts of interest should be questioned.

"Profit or Perish": Revenues from University Technology Transfer and the § 501(c)(3) Tax Exemption, 145 U. PA. L. REV. 89, 141–42 (1996) (advocating use of the so-called "Unrelated Business Income Tax" for university technology-transfer activities).

75 *See, e.g.*, STANFORD UNIV., UNIVERSITY INVESTMENTS IN START-UP COMPANIES INVOLVING STANFORD FACULTY, http://www.stanford.edu/dept/DoR/rph/4-5.html ("Stanford may invest in start-ups . . . under the following conditions: (1) Stanford will not act as a lead investor or syndicating agent. All investments will be as a 'passive investor.' (2) Stanford will not acquire an equity holding greater than 10% of the ownership of the company. (3) No Stanford officer is to be a member of the board, or be an officer of the company.") (last visited Mar. 8, 2009).

76 IIT Research Inst. v. United States, 9 Cl. Ct. 13, 21 (1985) (finding the university's research activities exempt from the unrelated business income tax because the university "was not involved in the commercialization of the products or processes developed as a result of its research").

77 26 C.F.R. §§ 1.501(c)(3)-(e)(1) (2008) (exempting from taxation an otherwise exempt organization that operates a trade or business in furtherance of the organization's exempt purpose); *id.* §§ 1.501(c)(3)-(d)(5)(ii), 1.512(b)-(f)(4) (excluding those activities that are merely incident to commercial or industrial operations from the definition of "research" and "scientific research," and excluding research carried on for the primary purpose of commercial or industrial application from the definition of "fundamental research").

C. Bayh-Dole's Impact on University Research Has Been Marginalized by the Practicalities of its Implementation

Aside from the unforeseen consequences of using monetary reward to shape university behavior, the Act's incentive structure underachieves even on its own terms. First, attaining faculty cooperation in the form of invention disclosures has proven a formidable challenge for technology transfer offices. Second, technology often remains unlicensed, being exploited by the university itself, due to prohibitively high transaction costs. Third, notwithstanding the strictures of the Act, universities possess a perverse incentive to license their technology exclusively, resulting in unnecessary deadweight losses.

1. Many University Faculty Refuse to Disclose Their Inventions

The success of technology transfer offices, and therefore the Act itself, clearly depends on the voluntary disclosure of inventions by university faculty. But what scant evidence exists indicates that a large number of academic scientists, for a variety of reasons, have declined to do so.[78] Some, resisting on moral grounds, regard the Act as contrary to the interests of science.[79] Others, eager to publish the results of their research, are dismayed by the delays that disclosure entails.[80] More still may be disinterested in applied research, preferring to follow where their curiosity leads.

Perhaps the most disheartening resistance, however, comes from faculty-inventors endeavoring to patent their work but choosing to circumvent the technology transfer office.[81] Because their interests accord with the Act's objective, the defiance of these faculty-inventors represents a fundamental design failure in the system. Disregarding irrationality as a possible cause, the failure presumably results from either inadequate incentives or prohibitive transaction costs. In the first case, the faculty-inventor desires higher compensation than that provided by the university. In the second case, the faculty-inventor believes

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78 University technology transfer officers estimate that less than half of all faculty inventions are disclosed. Thursby & Thursby, *supra* note 35, at 189. Note that the duty to disclose is imposed by university policy, not by the Act itself.

79 *Id.* ("[S]ome faculty may refuse to disclose for 'philosophical' reasons related to their notions of the proper role of academic scientists and engineers.").

80 *Id.* ("[O]ften [faculty] do not disclose inventions because they are unwilling to risk delaying publication in the patent and license process.").

81 *Id.* at 207 n.10 ("[F]aculty regularly attemp[t] to commercialize their inventions without using the [Technology Transfer Office].").

the university technology transfer system performs inefficiently. In support of these explanations, Professors Saul Lach and Mark Schankerman have positively correlated university inventive productivity to both faculty compensation and the efficacy of the technology transfer office.[82] Other anecdotal evidence suggests that dissatisfaction with the technology transfer office often accounts for the decision not to disclose.[83] Of course, these particular causes for a faculty-inventor's failure to disclose inventions—inadequate incentives and inefficacy of the technology transfer office—often overlap. For example, if the technology transfer office fails to obtain the fair market value for the patent license, the faculty-inventor will inevitably feel cheated.[84]

2. Inventions Must Often Be Exploited by the Universities Themselves Due to Prohibitive Transaction Costs

The transfer of technology from university to industry is further burdened by information asymmetry. More to the point, third-party businesses, lacking complete knowledge about the invention, cannot competently gauge its worth.[85] Even though the university will willingly disclose all of the information about the technology, prospective buyers must decide whether the benefit of understanding the technology justifies the sheer time and effort required to do so.[86] Unless the invention lies generally within the company's field of expertise,

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82 Saul Lach & Mark Schankerman, *Incentives and Invention in Universities* 2–3 (Nat'l Bureau of Econ. Research, Working Paper No. 9727, 2003) (showing that "technology licensing offices are more productive in private universities, suggesting that private institutions have more effective, commercially-oriented technology transfer activity" and arguing that this difference at least partially explains "the greater faculty responsiveness to royalty incentives in private universities").

83 Thursby & Thursby, *supra* note 35, at 207 n.10 ("As an example, in a private conversation with an administrator of a major research university we were told that faculty regularly (and against university regulations) attempted to commercialize their inventions without using the [technology transfer office]. The reason given was dissatisfaction with the [technology transfer office].").

84 *See* Lach & Schankerman, *supra* note 82, at 34 ("[B]ecause [technology transfer offices] in public universities are less effective at commercialising inventions, the incentive effect of higher royalty shares is muted."). What constitutes a "fair share" is not defined by the Act. *See supra* note 32.

85 Inés Macho-Stadler et al., *Licensing of University Innovations: The Role of a Technology Transfer Office* 4, *available at* http://www.diw-berlin.de/english/produkte/veranstaltungen/earie2004/papers/docs/2004-114-V01.pdf ("Firms can typically not assess the quality of the invention ex ante . . . .").

86 MICHAEL J. TREBILCOCK, THE LIMITS OF FREEDOM OF CONTRACT 103 (1993).

the answer is probably no. Often, universities, acting through spin-offs, exploit the technology themselves simply because no one else will.[87] The successful licensing of university patents to third-party businesses, furthermore, relies principally on the personal contacts of the faculty-inventor,[88] suggesting one of two implications: either the professor's goodwill among his peers mitigates the problem of imperfect information[89] or, due to the small size of the field, the faculty-inventor knows the company best-suited to exploit the technology.

3. Deadweight Losses Created by Exclusive Licenses Reduce the Benefit of Many Inventions

Finally, by sanctioning exclusive licensing, the Act forgoes an unknowable amount of potential welfare. Since the exclusive licensee as a monopolist can maximize its welfare through price-fixing, the aggregate producer surplus of non-exclusive licensees will never exceed the producer surplus of the monopoly.[90] And since producer surplus represents the value of the license, either exclusive or non-exclusive, to all buyers, exclusive licenses will always provide more revenue to universities than their non-exclusive counterparts.[91] However, as mentioned earlier, non-exclusive licenses should always be preferred to exclusive licenses in order to avoid deadweight losses.[92]

The Act, perhaps finding itself helpless to fix this problem, leaves the choice to license entirely to the discretion of universities.[93] And although the

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87 Scott Shane, *Selling University Technology: Patterns from MIT*, 48 MGMT. SCI. 122, 133 (2002) (finding that when licensing efforts to third parties fail, "university technology is likely to be licensed back to inventors because inventor commercialization mitigates the adverse selection, moral hazard, and hold-up problems that plague markets for knowledge").

88 Christina Jansen & Harrison F. Dillon, *Where Do the Leads for Licenses Come From?: Source Data From Six Institutions*, 11 J. ASS'N TECH. MANAGERS (1999), *available at* http://www.autm.net/pubs/journal/99/leads.cfm (finding that 56% of university licenses arose from faculty contacts, while only 19% were attributable to the marketing efforts of the technology transfer office); Thursby & Thursby, *supra* note 35, at 115 (showing that industry respondents viewed personal contacts with university research staff as the most important source for patent licenses).

89 *See* George J. Stigler, *The Economics of Information*, 69 J. POL. ECON. 213, 224 (1961) ("'Reputation' is a word which denotes the persistence of quality, and reputation commands a price . . . because it economizes on search.").

90 KARL E. CASE & RAY C. FAIR, PRINCIPLES OF ECONOMICS 333 (3d ed. 1994).

91 *Id.* at 329–32.

92 *See* discussion *supra* Parts III.A, IV.A.

93 35 U.S.C. § 204 gives preference to exclusive licensees manufacturing domestically. *See* Robin Marantz Henig, *To Market, to Market . . . New Patent Policy Bill Gathers Congres-*

government ultimately retains the right to require additional licensing from the university ("march-in rights"),[94] their unwillingness to invoke the right has rendered this provision a paper tiger.[95] Admittedly, the language probably provides moral force, if nothing else. Universities, not daring to flagrantly disregard their public duty, tend to license their most valuable patents non-exclusively.[96] But in less lucrative cases, the temptation to license exclusively intensifies. First, the expense of procuring and negotiating multiple non-exclusive licenses may often exceed the modest revenue generated in these situations.[97] Second, as the value of a patent decreases, the difference in potential revenue from licensing exclusively, as opposed to non-exclusively, grows.

Figures 3 and 4, below, display the relative magnitudes of producer surplus reaped from non-exclusive licenses and exclusive licenses.

sional Support, 29 BIOSCIENCE 281, 282 (1979) (describing how the sponsors of the Act dropped the "long and inefficient" process of requiring would-be licensors to first offer non-exclusive licenses).

94 35 U.S.C. § 203(a) (2006).

95 The government has yet to exercise its march-in rights. HOWARD BRODY, HOOKED: ETHICS, THE MEDICAL PROFESSION, AND THE PHARMACEUTICAL INDUSTRY 78 (2008). The National Institutes of Health, for example, have so far received three § 203 petitions. All three have been denied. In re Norvir, http://www.ott.nih.gov/policy/March-In-Norvir.pdf ; In re Petition of CellPro, Inc., http://www.nih.gov/news/pr/aug97/nihb-01.htm; In re Xalatan, http://www.ott.nih.gov/policy/March-In-Xalatan.pdf.

96 *See* Mowery et al., *supra* note 16, at 297 ("Nevertheless, the most profitable licenses at all of these universities (UC, Stanford, and Columbia) are nonexclusive licenses. . . .").

97 *See generally* Trune & Goslin, *supra* note 66. Consider also that the so-called "top five" patents generate the overwhelming majority of universities' royalties. Jensen & Thursby, *supra* note 36, at 243 (showing that the five top-earning inventions at each of the 62 universities in a survey accounted for almost 80% of gross license revenue for those universities); Mowery et al., *supra* note 16, at 280, 289, 294 (finding that the five top-earning inventions at the University of California, Columbia University and Stanford University accounted for 66%, 90% and 96%, respectively, of total licensing revenues in fiscal 1995).

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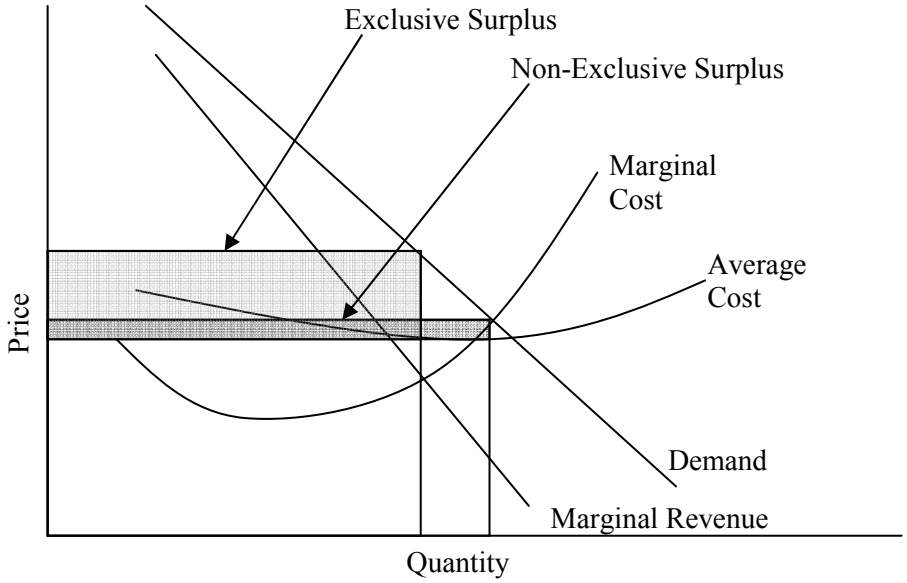

Figure 3. Less lucrative patent.

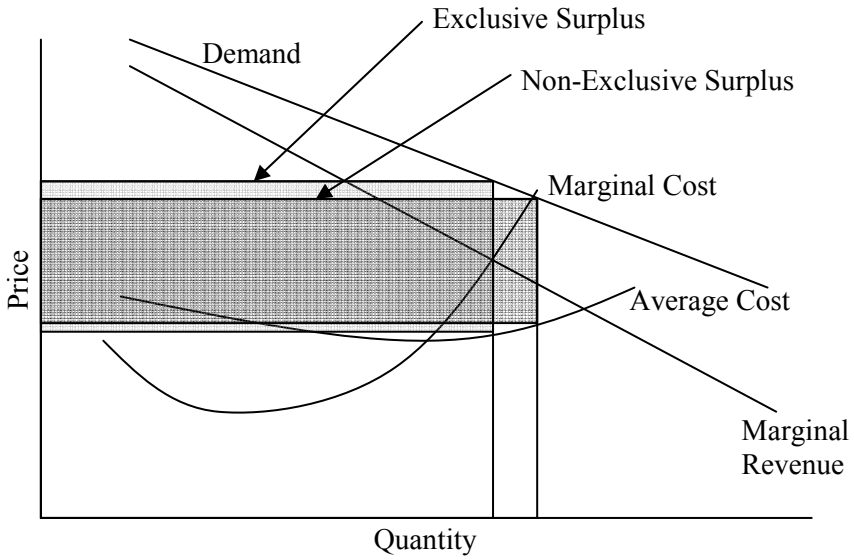

Figure 4. More lucrative patent.

Yale University's d4T patent exemplifies the "less lucrative" category.[98] Since d4T is used to treat the HIV virus, one can expect a steep, if not vertical, elasticity of demand.[99] That is, although only a small fraction of the U.S. population needs the drug, what those unfortunate persons will pay for it knows almost no bounds. But unless the producer can control the price through an exclusive license, most of the total surplus will inure to the consumers.[100] The drastic rise in profit that the exclusive license provides to the producer can be seen by comparing the shaded areas in Figure 3. Not surprisingly, Yale has licensed the d4T patent exclusively.[101]

The well-known Cohen-Boyer patents[102] of Stanford University and the University of California, on the other hand, typify the "more lucrative" category. Sales totaling over $35 billion associated with the recombinant DNA technology earned the universities more than $250 million in royalties over the life of the patents.[103] In this situation, the widespread use of the patents render the difference between licensing exclusively and non-exclusively only marginal, making the non-exclusive license much more palatable to the universities.[104] This can be seen by comparing the shaded areas in Figure 4.

V. THE CASE FOR INVENTOR OWNERSHIP

A. In the Absence of Transaction Costs, Conferring Ownership on University Inventors Should Have Negligible Effect on Systemic Incentives

In a world without transaction costs, it would make little difference whether the Act bestowed ownership of subject patents on the inventors or on

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98 U.S. Patent No. 4,978,655 (filed Dec. 17, 1986). Of course, the d4T patent, at least when licensed exclusively, could hardly be deemed "less lucrative" by any standard. *See* YALE UNIV., *supra* note 41, at 5. It is discussed here because its small consumer base coupled with a vast excess of demand over cost make it a prime candidate for exclusive licensing.

99 CASE & FAIR, *supra* note 90, at 119–20.

100 *Id.* at 126–27 (explaining the success of the OPEC cartel as a result of the inelasticity in the demand for oil).

101 YALE UNIV., *supra* note 41, at 9.

102 U.S. Patent No. 4,740,470 (filed April 20, 1984); U.S. Patent No. 4,237,224 (filed Jan. 4, 1979); U.S. Patent No. 4,468,464 (filed Nov. 9, 1978).

103 Maryann Feldman et al., *Commercializing Cohen-Boyer 1980–1997*, at 23–24 (Danish Res. Unit for Indus. Dynamics, Working Paper No. 05-21, 2005).

104 For a detailed discussion regarding the non-exclusive licensing of the Cohen-Boyer patents, see generally *id.*

the universities.[105] In that situation, academic inventors and universities could simply bargain around the default rule established by the Act. For example, since the Act now grants ownership to the university, one can expect that faculty members receive higher compensation from the university than they would if the Act had left ownership to the inventor. The fact that faculty members receive royalties and other invention-related income reveals that universities carefully structure incentives to maximize the output of their faculty. For example, if a university divided the gains from any patent equally among all faculty, their most-talented faculty members might feel less inclined to spend long evenings in the laboratory.

Graduate students, on the other hand, typically receive no additional incentives to invent. The fixed graduate-student stipend, therefore, already reflects the inventive contribution of the average graduate student. Two inferences can be derived from this fact. First, universities don't believe that incentives tied to patents would yield better results from their students. Second, the most-talented graduate students cannot distinguish themselves from their peers during the admissions process. Otherwise, they could command a premium from the school.[106]

B. Inventor Ownership is Necessary to Reduce Risk for Entrepreneur Faculty Members

Putting ethical questions aside, there is no reason to second guess the judgment of universities. After all, not only do they hold the largest stakes, they have been forces of innovation for the last two centuries. However, even if they believe that inventors don't need a larger slice of the patent pie, there are compelling arguments in support of inventor ownership.[107] First, though increased

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105 This argument proceeds from the premise that the Act would bestow ownership either on one or the other.

106 For example, assume that the average graduate student provides one unit in labor value to the university, specifically to his department's laboratory, but that one in 1000 graduate students brings 100 units in creative value. In that case, the university knows that the total inventive value provided by every 1000 students is (999 x 1) + (1 x 100) = 1099 units. Therefore, the stipend of every graduate student benefits from the average 1.099 units of inventive value that graduate students as a whole provide. But if the super-student could distinguish herself earlier from the other 999 students, she herself could reap the 100 units in creative value that she brings.

107 In fact, Professors Lach and Schankerman have given us reason to doubt universities' collective competence to maximize their own welfare, demonstrating that the benefit of increased inventor compensation would more than offset its cost for all private universities and about a quarter of public universities. Lach & Schankerman, *supra* note 82, at 24.

inventor productivity might further the Act's objective, it shouldn't be mistaken for the objective.[108] More importantly, as will be shown, the crude syllogism of the Act ignores transaction costs.

To start, the patent should ideally be owned by the party who values it most, which can be defined as the party most likely to put it to its highest and best use.[109] Given a nuclear reactor, the average person might use it to heat his bath water. Hence, he will pay no more for a nuclear reactor than an ordinary water heater. Someone willing to pay a small fortune for a reactor, however, can surely be expected to use it for more complex tasks, such as producing electricity or propulsion. Similarly, whoever pays the most for the patent foresees the largest surplus to be reaped from it.

Now consider the usual subject invention to be licensed exclusively. As mentioned before, because of incomplete information, third-party businesses must discount the value of the patent. Unfortunately, the only parties possessing perfect information are the inventors themselves who, being averse to risk, will also discount the patent's value.[110] Assume, for instance, that the invention stands only a 30% chance of success, but, if successful, will generate $100,000 in profits. A large company with diversified holdings would value the patent near $30,000 (30% x $100,000) with perfect information. The inventors, however, owning no other income-producing assets, cannot afford to lose $30,000, and will therefore assign the patent a much lower value.

To maximize the amount paid for the patent, either the large company must acquire perfect information or the inventors must become risk neutral. The Act, having attained limited success with the former solution, bears witness to the high cost of transferring esoteric technical knowledge. That leaves but one alternative.

Since the inventors are risk averse, because they stand to lose more than they own, their aversion to risk can be reduced simply by assigning them ownership of the patent. With the threat of financial ruin abated, the inventors will accord the patent a much higher value.[111] That is, they will sell the patent for a

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108 Recall that the Act seeks to "promote the utilization of inventions arising from federally supported research or development." 35 U.S.C. § 200 (2006).

109 This assumes, of course, a purely economic measure of value. According to this standard, the lives of one hundred wealthy Americans might hold more "value" than those of one million desperately poor Africans. *See* Donald G. McNeil, Jr., *Yale Pressed to Help Cut Drug Costs in Africa*, N.Y. TIMES, Mar. 12, 2001, at A3.

110 For a slightly more detailed discussion of risk aversion, see JACKSON ET AL., *supra* note 46, at 11–12.

111 In addition to explicit or implicit licensing fees, the costs of commercializing the invention include the further capital investment needed to bring the finished product to market. The

much higher price than they would have paid for it. By bringing their subjective value closer to the expected value, the probability of putting the patent into the best hands improves.

In this context, efficiency increases not because the inventors will use the invention for a more worthy task, as in the reactor scenario, but because the inventors stand a higher chance of bringing the invention successfully to market.[112] Assume that in the previous example, the inventors held a 40% chance of success (compared to 30% for the large company). The highest expected value of $40,000 will be obtained from the patent if placed in the hands of the inventors. If the university owns the patent, however, risk aversion could easily distort the free market's inherent efficiency, making the large company the highest bidder.

Of course, if a third party still values the patent more than the inventors, the inventors can sell the patent. In any case, the patent eventually winds up with the party that values it most, not only giving the new technology its best chance for success, but also obviating the need for government monitoring.[113]

To summarize, the Act's objective of maximizing domestic innovation will be realized only if subject patents are placed in the hands of those who can

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degree to which inventor ownership will reduce risk aversion, therefore, will depend on the relative magnitudes of these figures, *i.e.*, the commercial value of the patent as compared to the future costs of development. However, these figures are not independent. For late-stage technology, prospective buyers will pay more for the license precisely because less subsequent investment is required. Hence, inventor ownership will achieve the greatest effect in this context.

112 *See* Jensen & Thursby, *supra* note 36, at 243 ("[Technology transfer office] managers believe efforts by licensee-firms alone to develop embryonic inventions are unlikely to succeed. For 71 percent of the inventions licensed, respondents claim that successful commercialization requires cooperation by the inventor and the licensee in further development."); *see also* John P. Walsh et al., *Research Tool Patenting and Licensing and Biomedical Innovation*, *in* PATENTS IN THE KNOWLEDGE-BASED ECONOMY 285, 309 (Wesley M. Cohen & Stephen A. Merrill eds., 2003) ("The traditional way universities did this [technology transfer] would be to go license a large company. Those kinds of agreement [include a] . . . minimal up front [fee] and small royalty, 1–2 percent. What the experience has been then is often the large company will work on it for a while but if it doesn't look very promising, or they run into problems, which invariably they do . . . since they haven't invested much in it, they don't have a whole lot of motivation to stick with it. So, most of these licensing agreements that universities have done ended up going nowhere. The idea the university had, and other universities are beginning to do this, is to create small companies like us where the small company has every motivation to develop [one of these inventions] because it is the only intellectual property that they have.").

113 *See* 35 U.S.C. § 202(c)(5) (2006).

best use them.[114] Starting from the premise that expected value is an accurate measure of the best use, subject patents will only find their way to their "rightful" owner if the distorting effects of risk aversion are removed. Since university inventors are likely to be the most qualified, yet risk-averse, candidates for the task, assigning them patent ownership in the first instance greatly improves the odds of achieving this outcome.

VI. OPPOSING ARGUMENTS

Thus far, this Article has endeavored to show why subject inventions should be owned by their inventors, rather than the university. In essence, this conclusion is reached by first recognizing that patents should be exploited by the party that accords them the highest expected value and by demonstrating how risk aversion distorts free-market efficiency, undesirably shifting control away from the inventors. Realizing, however, that a plethora of other implications are evoked by this proposal, it is worth addressing the strongest arguments against such a change. First, it may be argued that current university patent policies requiring assignment by faculty and students would moot a transfer of ownership from universities to inventors. Second, there is the assertion that one of the Act's crown jewels—encouraging technology transfer by using revenue generated from subject inventions to fund further research and technology-transfer efforts—would be eviscerated.[115] Third, there is the concern that faculty conflicts would be exacerbated. Fourth, it is conceivable that in light of the *Madey v. Duke University*[116] decision, curiosity-driven research at universities would be stifled by private ownership of subject patents. Fifth, it is arguable that non-exclusive licensing would cease altogether.

A. Counter-Argument #1: Standard University Contract Provisions Render Any Changes in Subject-Patent Assignment Futile

Even if the Act would be improved by granting ownership of patents to their inventors, nowadays university patent provisions, which require assign-

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114 *See* Youngstown Sheet & Tube Co. v. Sawyer, 343 U.S. 579, 654 (1952) (Jackson, J., concurring) ("[T]here was worldly wisdom in the maxim attributed to Napoleon that 'The tools belong to the man who can use them.'").

115 *See* S. REP. NO. 96-480, at 30 ("[The Act] also provides that any revenues received by universities or nonprofit organizations beyond their legitimate expenses be used to fund more research. This additional money will assist not only the university or nonprofit organization, but will be a very real benefit to the public.").

116 307 F.3d 1351, 1362 (Fed. Cir. 2002); *see* discussion *infra* note 148.

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ment of student and faculty inventions to the university, seemingly moot the point.[117] This Article intends to prove, however, that the well-established doctrine of patent ownership, based upon sound policy considerations, does not compel enforcement of these provisions.

To begin, this Article proposes that three elements, or inputs, compose the modern invention: capital, labor and ingenuity.[118] Of course, any particular invention entails varying proportions of all three inputs. University inventions, for example, nearly always entail capital (university facilities and equipment) and labor (experiments), but little ingenuity may be needed. That is, some inventions will result simply from trial and error.[119] Other inventions, on the other

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117 *See* MASS. INST. OF TECH., GUIDE TO THE OWNERSHIP, DISTRIBUTION AND COMMERCIAL DEVELOPMENT OF M.I.T. TECHNOLOGY (2008) [hereinafter MIT GUIDE], *available at* http://web.mit.edu/tlo/www/downloads/pdf/guide.pdf. That guide states:

> Patents . . . developed by faculty, students, staff and others, . . . are owned by M.I.T. when either of the following applies: (1) The intellectual property was developed in the course of or pursuant to a sponsored research agreement with M.I.T.; or (2) The intellectual property was developed with significant use of funds or facilities administered by M.I.T.
>
> . . . .
>
> Generally, an invention . . . will not be considered to have been developed using M.I.T. funds or facilities if: (1) only a minimal amount of unrestricted funds have been used; and (2) the invention . . . has been developed outside of the assigned area of research of the inventor/author under a Research Assistantship or sponsored project; and (3) only a minimal amount of time has been spent using significant M.I.T. facilities or only insignificant facilities and equipment have been utilized . . . and (4) the development has been made on the personal, unpaid time of the inventor/author.

Id. at 5–7. Twenty-seven years after the passage of the Act, these assignment provisions have become virtually ubiquitous. *See, e.g.*, DUKE UNIV., DUKE UNIV. POLICY ON INTELLECTUAL PROPERTY RIGHTS 1–2 (2000), *available at* http://www.provost.duke.edu/pdfs/IntelProp.pdf; OFFICE OF THE VICE PROVOST AND DEAN OF RESEARCH, STANFORD UNIV., INVENTIONS, PATENTS AND LICENSING, *in* RESEARCH POLICY HANDBOOK 5.1 1–2 (1999), *available at* http://www.stanford.edu/dept/DoR/rph/5-1.html; OFFICE OF COOPERATIVE RESEARCH, YALE UNIVERSITY PATENT POLICY 1 (1998), *available at* http://www.yale.edu/ocr/pfg/policies/patents.html; UNIV. OF CAL., INTELLECTUAL PROPERTY AND RELATED MATTERS, *in* CONTRACT AND GRANT MANUAL 11-230, 4–6 (1990), *available at* http://www.ucop.edu/raohome/cgmanual/chap11.html#11-220.

118 While the two could be difficult to distinguish in some circumstances, labor and ingenuity should be differentiated according to the relative intensities of time (labor) and cognitive ability (ingenuity) required. Carrying out a particular set of experiments according to a faculty supervisor's directive, for example, would typify the labor component in the university environment.

119 Notably, some of these trial-and-error inventions may run afoul of the non-obviousness requirement of 35 U.S.C. § 103. *See* KSR Int'l Co. v. Teleflex, Inc., 550 U.S. 398, 421 (2007)

hand, may require little more than ingenuity, though such ideas are becoming rare. With that said, recognizing that most inventions will require all three inputs, this Article will assume that all three exist in the following discussion.

Next, this Article suggests the case law on patent ownership reflects the following underlying principle: whoever owns the three inputs owns the patent. Courts struggled for decades to sort out the question of patent ownership between employers and employees in the absence of an express contract because ownership of the inputs could not be ascertained.[120] Most often, the cases involved inventions allegedly made away from the workplace or employees implicitly "hired to invent."[121] In the former situation, the ownership of labor and resources must be determined; in the second situation, ingenuity. The "hired-to-invent" scenario proved especially troublesome. If the courts found that the employee owned the ingenuity component, then ownership could not be rightfully bestowed on either party, the employer owning the other two inputs. The "shop-right" doctrine resolved this dilemma by leaving ownership with the employee, while granting an irrevocable license to the employer.[122]

Assignment agreements, which dispelled the confusion by expressly giving ownership of the patents to the employer, naturally received a warm welcome from the judiciary.[123] Courts could presume that the employee received consideration for relinquishing any claim to future patents in this situation. In other words, the employer had explicitly purchased the ingenuity component from the employee. Figures 5 demonstrates the effect of these contracts.

("When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense.").

120 *See* CHISUM, *supra* note 5, § 22.03, at 22-10 ("The problem of ownership of patent rights that arise out of an employment relationship is an ancient but eternal one.").

121 *See generally id*. at § 22.03.

122 *See generally id.* at § 22.03[3].

123 *See, e.g.*, Cubic Corp. v. Marty, 229 Cal. Rptr. 828 (Cal. Ct. App. 1986); Grove v. Grove Valve & Regulator Co., 84 Cal. Rptr. 300 (Cal. Ct. App. 1970); Hercules Glue Co. v. Littooy, 76 P.2d 700 (Cal. Dist. Ct. App. 1938); Velsicol Corp. v. Hyman, 90 N.E.2d 717 (Ill. 1950); Thermo Electron Eng'g Corp. v. Lyczko, 151 U.S.P.Q. (BNA) 303 (Mass. Super. Ct. 1966).

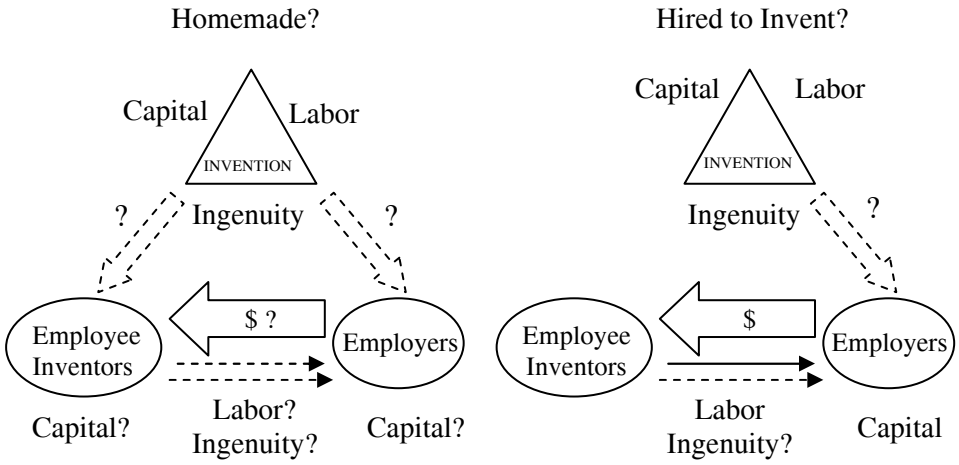

Figure 5. Effect of assignment agreement on employee inventions.

Chisum intimates that no limit exists to the freedom to contract away one's right to patent ownership.[124] This Article suggests, however, that anticipatory assignment agreements, designed to resolve the uncertainty surrounding employees hired for their mental faculty, should not be presumed enforceable outside of this context. Since most anticipatory assignment agreements are written to address this problem, that a plethora of case law sustains their enforcement comes as no wonder. When employers have attempted to expand the scope of assignment beyond this purpose, they have received less favor.[125] Patents being a rather unique form of property, courts have carefully contemplated public-policy objectives before enforcing these agreements.

As applied to most situations, the standard provisions contained in university patent policies generally reflect the normative principles underlying the doctrine of employee-employer ownership. First, these policies typically require assignment of inventions made during the course of employment or with

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124 CHISUM, *supra* note 5, § 22.03[3][f].

125 *See, e.g.*, United Shoe Mach. Co. v. La Chapelle, 99 N.E. 289, 293 (Mass. 1912) (refusing to enforce employment agreement requiring assignment for ten years following termination); J.A. Migel, Inc. v. Bachofen, 126 A. 396, 396–97 (N.J. 1924) (refusing on equitable grounds to enforce assignment agreement made on unconscionable terms); Ingersoll-Rand Co. v. Ciavatta, 524 A.2d 866, 871–72 (N.J. Super. Ct. App. Div. 1987) (refusing to enforce employment agreement requiring assignment of inventions patented within one year of termination).

the significant use of university facilities.[126] Since both faculty and graduate students serve as employees of the university, these clauses merely reiterate the common law: when the employer owns the capital and labor components of the invention, the employee may (and preferably would) expressly contract away the ingenuity component.[127]

Second, university policies also typically require assignment of inventions made through sponsored research.[128] In this case, the university, as an institution, has been "hired to invent," and has, in a sense, subcontracted its faculty and students to do the job. In fact, this scenario presents the same issue as before—whether or not the university has been contracted by a third party, the faculty and students are still serving in their employee capacities. Universities probably add this superfluous clause simply to ensure the expectations of their sponsors will not be frustrated.[129]

When applied to federally funded research, however, the justification for the anticipatory assignment agreement breaks down. Without the Act, the situation cannot be distinguished from other sponsored research contracts. The university has purchased labor and ingenuity from the inventors, and the sponsor (the federal government) has purchased labor, ingenuity and resources from the university. Since the government owns all three components, it rightfully takes title to any subsequent patents.

As shown in Figure 6, the Act breaks the logical link between the government and the patent, and then ties the patent ad hoc to the university. But the patent no more rationally belongs to the university than it does to the inventors. To say that the inventors have already been compensated for their labor and ingenuity rings hollow, for the university, too, has already been fully compensated. Consequently, the traditional rationale underlying employee anticipatory assignment agreements no longer applies.

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126 *See, e.g.*, MIT GUIDE, *supra* note 117, at 5.

127 That the graduate student simultaneously plays the dual role of client and employee makes little difference. Viewed from the business-client perspective, the price that the student pays for use of university facilities reflects his having relinquished the right to any subsequent patents, so still no reason exists not to enforce the "significant use" clause.

128 *See, e.g.*, MIT GUIDE, *supra* note 117, at 5. No distinction is typically made between government and industry sponsorship. *See, e.g.*, *id.* at 4–5.

129 Patents spawned from the industry-sponsored research are sometimes licensed exclusively, rather than assigned, to the sponsor. Even so, the university cannot legitimately license the patent if the inventor can claim ownership.

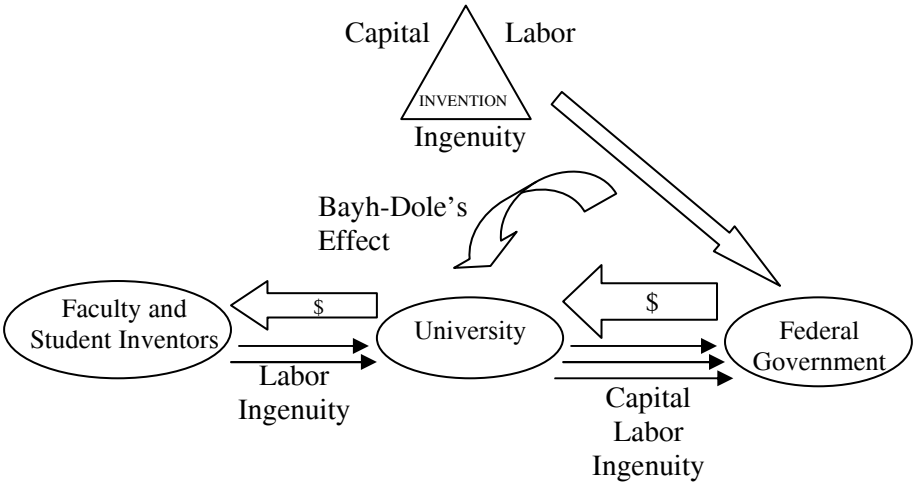

Figure 6. Relationship between the federal government and the university regarding patents under the Act.

With this ostensible common law impediment removed, Congress need not fear that inventor assignment would be mooted by university patent provisions nor that such a radical step would affront more than one hundred years of judicial wisdom. With that said, whether Congress should then expressly prohibit anticipatory assignments of Bayh-Dole subject patents[130] or rely on the courts to cooperate with the clear intent of the new statutory assignment scheme,[131] perhaps evokes separation-of-power issues more prudently left for another day.

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130 *See* Grove City Coll. v. Bell, 465 U.S. 555, 575 (1984) ("Congress is free to attach reasonable and unambiguous conditions to federal financial assistance that educational institutions are not obligated to accept."), *superseded by statute on other grounds*, Civil Rights Restoration Act, Pub. L. No. 100-259, 102 Stat. 28 (1988); *see also* Rumsfeld v. Forum for Academic & Institutional Rights, Inc., 547 U.S. 47, 59 (2006) (citing *Grove City College*, 465 U.S. at 555, 575–76 for the same proposition).

131 While federal courts (including the Federal Circuit) have made short shrift of the enforceability issue in recent university patent disputes, as the Act now stands, no reason exists to question the policy implications surrounding the issue. Trs. of the Univ. of W. Va. v. VanVoorhies, 278 F.3d 1288, 1298 (Fed. Cir. 2002) ("Under the [University personnel] policy, WVU owns all inventions that are made by University personnel or made with substantial use of University resources. . . . Thus, any inventions made by VanVoorhies pursuant to his

B. Counter-Argument #2: Transferring Patent Assignment from Universities to Inventors Wastes Additional Capital Available for Further Research and Development

As a bonus to the crux of my argument, awarding subject patents to their inventors also eradicates the danger of crafting a purely profit-seeking regime out of our higher education system. With the windfall now shifted away from universities, the infectious rapacity that the Act sparked among university administrations will quickly be cured.

But admittedly, the revenue realized from subject patents was intended to finance further investment in research and the transfer of technology from universities to industry, making the notion of a windfall more palatable.[132] By stripping the university of ownership, this added benefit is lost. Far from propagating additional research and transfer, the fruits of taxpayer-funded research would merely stuff the pockets of university research teams.

Nonetheless, leaving the question of propriety aside, this Article suggests that removing subject-patent revenue from the Bayh-Dole "life cycle," so to speak, will only marginally affect the advancement of domestic innovation. To begin, very little of this money trickles past university technology transfer offices. Professors Dennis R. Trune and Lewis N. Goslin found that less than one-half of all technology transfer offices even sustain a profit, and the average profit for universities without medical schools measured only $40,300 in 1995.[133] By contrast, the 193 institutions responding to the 2007 Association of

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graduate studies rightfully belong to WVU."); Chou v. Univ. of Chi., 254 F.3d 1347, 1356–57 (Fed. Cir. 2001) ("Although it is true that Chou never signed a contract with the University specifically obligating her to assign her inventions to the University, she accepted her academic appointment subject to the administrative policies of the University."); Fen v. Yale Univ., 283 F. Supp. 2d 615, 628–29 (D. Conn. 2003) ("University patent policies such as Yale's have long been recognized as a valid and enforceable part of the contract of employment."). Ironically, *Fenn* cites only *Chou* and *VanVoorhies* for support, though both cases were decided several years after the dispute between Dr. Fenn and Yale University began.

132 S. REP. NO. 96-480, at 30 (1979).

> Although there is no evidence of "windfall profits" having been made from any inventions that arose from federally-supported programs, the existence of the pay back provision reassures the public that their support in developing new products and technologies is taken into consideration when these patentable discoveries are successful commercially. S. 414 also provides that any revenues received by universities or nonprofit organizations beyond their legitimate expenses be used to fund more research.

Id.

133 Trune & Goslin, *supra* note 66, at 201–02.

University Technology Managers survey received an average of $1.63 million in government research funding.[134] The Act, in truth, has contributed negligibly to university research on the whole.

Moreover, the large sums spent each year to operate technology transfer offices[135] signify little more than the exorbitant cost of red tape, for most licenses are procured through contacts of the faculty-inventor anyway.[136] And far from leaning on these offices for their expertise in crafting the license agreement, many faculty-inventors negotiate, albeit against university policy, around them.[137] Countless more faculty-inventors silently seethe in dissatisfaction.[138] Technology transfer offices might well be superfluous.[139]

Of course, faculty-inventors will almost certainly file fewer patents than their administrative counterparts, being inevitably more cost conscious. But this fact alone should foster little concern. As inventors already function as the last licensing resort for technology transfer offices,[140] little chance exists for a missed opportunity (*i.e.*, a third-party license forgone). To the contrary, the faculty-inventor's discretion not to file will generally improve the overall efficiency of the system, saving significant time and money from wasteful patenting procedures.[141]

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134 *See supra* note 56 and accompanying text (summarizing the total research support from federal and industrial sources for U.S. universities, hospitals and research institutions from 1998 to 2007).

135 For example, in fiscal year 2008, MIT's Technology Licensing Office accrued more than $16 million in expenses. *See* TLO Statistics, *supra* note 26.

136 Jansen & Dillon, *supra* note 88, at 54; *see* Colyvas et al., *supra* note 25, at 66 ("[I]n most of the cases [we studied], the auspices of th[e technology transfer] office mostly were not needed to make contacts with industry, to spread information, or to induce industry interest.").

137 Thursby & Thursby, *supra* note 35, at 189 (noting faculty preference for non-disclosure in favor of faster publication).

138 WORKING GROUP ON RESEARCH TOOLS, REPORT OF THE NATIONAL INSTITUTES OF HEALTH 6 (1998), *available at* http://www.nih.gov/news/researchtools/index.htm ("Rather than seeing technology transfer professionals within their institutions as facilitators who enable them to gain access to research tools and as guardians of their best interests, they see them, in the words of one scientist, as 'paper pushers who sit on these documents and try to find errors.'").

139 *But cf.* Colyvas et al., *supra* note 25, at 66 ("The patent application process often was complex and time consuming. There were difficult questions involved in defining and protecting the university's interests in the transactions. This is mostly where the university patenting and licensing office came in.").

140 Shane, *supra* note 87, at 133.

141 Admittedly, this conclusion ignores the intangible sunken costs of faculty-inventors in the current scheme. That is, faculty having already borne the costs of publication delays and

C. Counter-Argument #3: Faculty Ownership of Subject Patents Exacerbates Potential Conflicts of Interest

Inventor ownership also risks worsening the salient conflict problem created by the Act. To curb this hazard, faculty-inventors could be excised from this proposed patent-ownership scheme, leaving ownership solely to their student-assistants. But although excluding the professor-scientist presents the most obvious solution, removing his financial incentives would severely hamper technology transfer. First, university faculty require compensation for the burden created by the Act. Second, both licensing and entrepreneurial efforts profit immeasurably from faculty participation.

Archetypal academic scientists hate the Act for two reasons. First, it delays publication, the benchmark of success for professors.[142] If faculty-inventors are excluded from patent ownership, their principal interest to publish their findings as quickly as possible will conflict directly with the interest of the remaining (student-inventor) owners. The professors, in fact, will hold the upper hand, able to disclose their work at their discretion and, presumably, be indifferent to the patenting efforts of their students.

Second, the Act generally steers research down less interesting avenues.[143] So while graduate students, eager to reap the monetary rewards of commercially valuable patents, might gravitate naturally toward applied research, nearly all rely on their faculty supervisors for research topics.[144] If their supervisors have no financial incentive to pursue applied research, they will

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general frustration associated with patent procurement will accord the patent a higher value ex post. *See* Jerry G. Thursby & Marie C. Thursby, *Who is Selling the Ivory Tower? Sources of Growth in University Licensing*, 48 MGMT. SCI., Jan. 2002, at 90 (2002). That article states:

> [O]ften [faculty] do not disclose inventions because they are unwilling to risk delaying publication in the patent and license process. . . .
>
> Faculty who specialize in basic research may not disclose because they are unwilling to spend time on the applied research and development that is often needed for businesses to be interested in licensing university inventions.

Id. at 93.

142 *See, e.g.*, *id.*

143 *See* Bok, *supra* note 31, at 40.

144 *See* Svein Kyvik & Jens-Christian Smeby, *Teaching and Research. The Relationship Between the Supervision of Graduate Students and Faculty Research Performance*, 28 HIGHER EDUC. 227, 234 (1994) (citing a physics professor who remarked: "No students come up with their own ideas for research. They do not have a good enough overview of the field to do that.").

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likely veer toward, and channel their students in the direction of, more basic research. More commercially-bent professors, on the other hand, rather than abetting their students to become wealthy entrepreneurs, will focus their energies toward more self-rewarding activities, such as consulting or even independent business ventures.[145] Graduate students will be left in the lurch as a result.

The need for faculty backing extends well beyond the laboratory. The faculty-inventor probably knows the commercial value of the patent best, information the inventors require to rationally decide whether to license the patent (in lieu of exploiting it themselves). In fact, student-inventors will unlikely find a licensee at all if left to their own devices.[146] Additionally, the faculty-inventor's succor could well mean the difference between the ultimate triumph or failure of a startup venture. As the acknowledged superior, the professor can carve up the equity among the inventors and establish the management structure according to his judgment. If he has played the game before, his experience and reputation could fetch the young company more favorable finance terms.

Moreover, all of this assumes that graduate students have contributed to the invention. Without graduate student contribution, any potential gains from inventor ownership would vanish entirely with the professor as sole inventor. Therefore, to be successful, any revision to the Act must include incentives to garner faculty cooperation.

As an alternative, the university itself, excluded already from any rights to subject inventions, can safeguard its humanistic virtues without detriment to the goals of the Act by policing the extracurricular activities of its faculty. Stanford University, for example, operated successfully under the Act for more than a decade in this manner.[147] Furthermore, bestowing patents to faculty-inventors

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145 Consider, for example, Ascent Technology, Inc., founded by MIT Professor Patrick Henry Winston and his colleagues in 1986 "to solve complex resource optimization, scheduling, and deployment problems for labor-intensive industries, such as air transportation, gaming, healthcare, hospitality, and security." Ascent Technology Inc., http://www.ascent.com/about-ascent.html (last visited Mar. 6, 2009).

146 *See* Jansen & Dillon, *supra* note 88, at 55.

147 Until 1994, Stanford's policy provided:

> Except in cases where other arrangements are required by contracts and grants or sponsored research or where other arrangements have been specifically agreed upon in writing, it shall be the policy of the University to permit employees of the University, both faculty and staff, and students to retain all rights to inventions made by them.

Mowery et al., *supra* note 16, at 290 (citing OFFICE OF TECH. LICENSING, STANFORD UNIV., THIRTEENTH ANNUAL REPORT (1982)).

outright will almost certainly alleviate the current university climate, in which universities are induced to rent out their faculty to achieve higher royalty and equity returns. Financially disinterested, the university can once again take a more aggressive part in preserving the traditional roles of its faculty.

D. Counter-Argument #4: Universities Will Be Afforded Less Protection Against Infringement Suits for Experimental Use of Patented Technology

Whatever might once have been said for the university's inalienable right to explore unhindered the nature of all things under the sun, the Federal Circuit unremorsefully dismissed this fantasy in the controversial *Madey* decision. The court established a bright-line rule regarding the experimental use exception: if research is the principal "business" of the university, however unprofitable, the university cannot claim an experimental-use defense to patent infringement.[148] Consequently, even non-commercial use of patented inventions by universities now unquestionably constitutes infringement.

To say the least, *Madey* has ignited a firestorm of controversy, many contending that, among other things, the lack of protection afforded universities for basic research into patented subject material will impede the progress of science.[149] Assuming that a university would otherwise safeguard the academic

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148 Madey v. Duke Univ., 307 F.3d 1351, 1362 (Fed. Cir. 2002). The court there stated:

> In short, regardless of whether a particular institution or entity is engaged in an endeavor for commercial gain, so long as the act is in furtherance of the alleged infringer's legitimate business and is not solely for amusement, to satisfy idle curiosity, or for strictly philosophical inquiry, the act does not qualify for the very narrow and strictly limited experimental use defense.

Id. The origin of the experimental-use exception has been attributed to an 1813 opinion by Justice Story. *See* Whittemore v. Cutter, 29 F. Cas. 1120, 1121 (C.C.D. Mass. 1813) (No. 17,600) ("[I]t could never have been the intention of the legislature to punish a man, who constructed such a machine merely for philosophical experiments, or for the purpose of ascertaining the sufficiency of the machine to produce its described effects.").

149 *See, e.g.*, Rochelle Dreyfuss, *Protecting the Public Domain of Science: Has the Time for an Experimental Use Defense Arrived?*, 46 ARIZ. L. REV. 457, 466 (2004). That publication states:

> Put these developments together and it is clear why the issues of protecting the public domain of science and creating room to experiment have become so compelling. Patentees can now own—and many think they deserve to own—entire research opportunities, rights not only in product markets, the traditional markets that patents dominate, but rights in innovation markets as well. Patentees can exploit these innovation markets by doing research. They can license others to exploit them if they so choose. But they can also leave them

interests of its institutional counterparts, transferring ownership of subject patents to private parties only aggravates this alleged hindrance. *Madey*, therefore, necessitates an evaluation of the potential effect of inventor ownership on university research.

To start, "experimental use," a rather broad, amorphous term, must be divided into its several connotations. While not attempting to exhaust the possibilities, this Article suggests four general categories of experimental use. First, the researcher might improve upon the invention (*e.g.*, the "better mouse trap") or use the technology as the cornerstone of some other invention (*e.g.*, gunpowder). This type of usage will be referred to as the "springboard" category. Second, the researcher might use the invention in an effort to design around it, the "circumvention" category. Third, the researcher may simply desire to learn more about the discovery, the "curiosity" category. Finally, the researcher may use the patented technology as a tool to carry out the research (*e.g.*, the microscope), what will be called, unsurprisingly, the "research tool" category.

Since commercial use predominantly composes the "springboard" and "circumvention" categories, these categories fall outside the scope of concern. Universities already must prevent this type of use, even by other universities. If a university holding title to a subject patent did not consent with the licensee to sue universities exploiting the patents for commercial purposes, the exclusive license would be utterly devalued. Hence, because universities themselves will not shield commercial use of their subject patents, inventor ownership does not affect university research in these contexts.

On the other hand, universities could exert more leverage with their licensees to protect use stemming purely from curiosity or, in the words of the Federal Circuit, "philosophical inquiry."[150] But even assuming this were true, it is superfluous, because bona fide "basic research" requires no protection. First, patent owners and exclusive licensees alike, aiming solely to maximize the profit from their patents, hold minimal incentive to forestall such research. These patent owners and exclusive licensees know that these researchers not only pose no competitive threat but also possess little means or desire to pay for their usage. In other words, their expected value, being entirely intangible, affords no monetary surplus. Moreover, and perhaps more important, the patent

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> unexplored. They are free to decide that the best way to earn a reward is to block further work in their fields.

Id.

150 Embrex Inc. v. Serv. Eng'g Corp., 216 F.3d 1343, 1349 (Fed. Cir. 2000).

owners stand to become the principal beneficiaries of the research, as more knowledge about their discovery inevitably increases utility.[151]

"Research tool" usage straddles the line, being obviously essential to all forms of research, both commercial and non-commercial alike.[152] While commercial use of patented research tools by universities presents the same scenario as before, the use of patented tools for curiosity-driven research evokes questions yet unaddressed. First, unlike the previous "curiosity" scenario, the patent owner here gains nothing, even potentially from the researcher's usage. Additionally, the researcher does ascribe the tool a "real" value, being necessary to her principal "business" as much as her other more tangible laboratory equipment. As a result, importing universities are sometimes obliged to pay royalties, albeit reduced, even for non-commercial use of these tools.[153] And, in response, exporting universities have displayed some willingness and efficacy in protecting the philanthropic interests of basic research.[154] Notwithstanding, as universities seem remarkably undeterred from using patented tools for noncommercial

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151 *See* Walsh et al., *supra* note 112, at 317 ("Industrial respondents all claim that university researchers, to the extent they are doing noncommercial work, are largely left alone. In fact, firms often welcome this research because it helps further develop knowledge of the patented technology. University researchers among our respondents confirm this claim.").

152 *See, e.g.*, WORKING GROUP ON RESEARCH TOOLS, *supra* note 138, at 5 ("The tools of the trade in biomedical research and development are crucial for all bench scientists, and access to new tools has a dramatic impact on the progress of research.").

153 Walsh et al., *supra* note 112, at 302.

154 *See* David P. Hamilton & Antonio Regalado, *Geron Gives Up Some Stem-Cell Rights–Wisconsin Alumni Group In Pact Aiding Research And Commercialization*, WALL ST. J., Jan. 10, 2002, at A3 (describing the settlement reached between Geron Corp. and the Wisconsin Alumni Research Foundation ("WARF"), which, among other things, afforded academic and government scientists the free use of WARF's stem-cell technology for non-commercial purposes). *But see* WORKING GROUP ON RESEARCH TOOLS, *supra* note 138, at 12. That report takes the opposite stance that

> [although] sometimes universities are constrained in the terms of license agreements and MTAs that they offer to other universities by obligations to sponsors of the research that yielded particular research tools . . . [u]niversities might, for example, retain the right to provide research tools to scientists at other universities and nonprofit institutions in the language of these agreements. . . . We detect a perception that sometimes the aggressive language in agreements is not required by sponsors or licensees at all, but simply reflects an effort on the part of universities themselves to recover as much value as possible from the distribution of their discoveries.

Id.

purposes,[155] inventor ownership of these tools will unlikely frustrate the pursuit of basic research.[156]

In sum, inventor ownership of subject patents should not further stymie experimental use by universities. First, since universities themselves already prevent commercially-oriented experimental use of subject patents, inventors pose no additional burden to these categories of research. Second, curiosity-driven research into new proofs-of-concept will likely be embraced, rather than hindered, by inventor-owners who stand to profit significantly from any follow-on discoveries. Finally, while additional privatization of research tools seemingly presents a potential threat to basic research, private companies have typically shown little interest in enjoining non-commercial use.

E. Counter-Argument #5: The Inevitable Predominance of Exclusive Licensing Will Result in Significant Deadweight Losses

As discussed earlier, non-exclusive licensing, which salvages the deadweight losses inherent to exclusive licensing, should always be preferred in the first instance. Unfortunately, monetary incentives inevitably push patent owners toward exclusive licensing, where the sole licensee can reap far more producer surplus than the sum of his non-exclusive counterparts. While universities have historically licensed some of their most lucrative patents non-exclusively, inventors cannot reasonably be expected to show the same benevolence. This sobering fact poses the greatest obstacle to inventor ownership, because any gains realized from the change in ownership might be offset by the large number of non-exclusive licenses forgone.

As a remedy to this drawback, this Article proposes a mechanism similar to the one currently used by federal agencies. That is, public notice would be given, either by passive means (*e.g.*, Federal Register)[157] or by active marketing

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155 *See* Walsh et al., *supra* note 112, at 317. Walsh notes that

> [o]ne university technology transfer officer reports that the university will indeed receive letters of notification of infringement. The respondent indicated that the typical response was effectively to ignore such letters and inform the IP holder that the university was engaged in research, did not intend to threaten the firm's commercial interests, and would not cease its research.

Id.

156 *But see* Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 SCI. 698, 699–700 (1998).

157 *See* 35 U.S.C. § 209(e) (2006). That section states:

> No exclusive or partially exclusive license may be granted [by a federal agency] unless public notice of the intention to grant an exclusive or partially

(*e.g.*, technology transfer offices), of the intent to monopolize the subject invention. After some predetermined period, if no parties showed interest in licensing the patent non-exclusively, the patent would then be turned over to the unbridled discretion of its inventors. In this way, non-exclusive licensing would claim priority over inventor ownership, notwithstanding what value the inventors accord the exclusive use of the patent.

One more snag remains. Suppose that a new invention, being of rather modest worth, would only be exploited under an exclusive license. If the patent relates to a substitute for some other patented product or process, the owner of the prior patent might happily pay a trifle for non-exclusive "use" simply to keep the technology from being developed. Ironically, the mechanism implemented to avert deadweight losses has, in this circumstance, prolonged them instead. To avoid this outcome, the system might impose a requirement for at least two non-exclusive licensees. Moreover, both to assure the earnestness of the licensees and to reimburse the inventors for their expenses, the non-exclusive licenses would not be sold for less than half the cost of the associated patent fees.

Of course, this remedial proposition should not be mistaken for an attempt to define the best features of a system for licensing subject patents non-exclusively but simply as an illustration of how the free market's propensity toward exclusive control could be surmounted. And though the solution will clearly demand thoughtful design, the benefits of inventor ownership will make it well worth the effort.

VII. CONCLUSION

Using analytical methods, this Article has endeavored not only to show how the Act has bolstered the commercial development of early-stage technology but also how a relatively minor change in the law—assigning ownership of subject patents to inventors—could dramatically benefit the overall incentive structure of our patent system. In addition, recognizing that this change will inevitably disrupt the existing equilibrium, this Article has addressed the potential side effects that warrant the most concern. Some, on closer inspection, are

> exclusive license on a federally owned invention has been provided in an appropriate manner at least 15 days before the license is granted, and the Federal agency has considered all comments received before the end of the comment period in response to that public notice.

Id.; *see* 37 C.F.R. § 404.7(a)(1)(i) (2008) (requiring disclosure of the intent to license exclusively on the Federal Register).

exposed as red herrings. Although preventing faculty conflicts and preserving experimental use present formidable challenges in theory, universities have already proven themselves capable of handling both.

Other concerns, albeit surmountable, demand more careful deliberation. First, while the logic underlying the exceptions to inventor ownership seems straightforward, Congress may wish to defer to the judgment of the courts before impetuously conditioning federal research funds on universities' acquiescence to their new strategy. By refusing to enforce the assignment provisions of university employment contracts, at least in the case of subject inventions, courts will not only give Congress an express affirmation, they will render further action by Congress unnecessary. On the other hand, even if courts continue to enforce these provisions, they will be compelled to provide a reasoned explanation upon which Congress can base any subsequent decisions.

Second, notwithstanding academic scientists' collective frustration with technology transfer offices, delegating the burden of patenting and licensing subject inventions to the inventors creates unknown risks. While university faculty members appear well-equipped, or well-enough equipped, to handle the task, one can only speculate about how many, either intimidated by or abhorrent to the process, will forgo any legal claim to their inventions.

Finally, Congress must choose warily how to encourage non-exclusive licensing in spite of inventors' innate biases toward monopolization. A passive mechanism, such as that used by federal agencies, obviously requires the least effort and expense, though its efficacy can be doubted. Unfortunately, the rate of non-exclusive licensing from the Federal Register bears little insight, since these unhopeful patents represent university discards.[158] Alternatively, Congress could juxtapose the interests of the faculty-inventors and their universities, granting the universities the first opportunity to license, albeit non-exclusively, before handing over exclusive control to the inventors. In this way, universities, or more specifically their technology transfer offices, could perform a case-by-case cost-benefit analysis, bifurcating those patents that justify only passive exposure from those that warrant more aggressive marketing efforts.

To end, consider how the implementation of the described inventor-ownership scheme might proceed. First, to lay the groundwork for the new scheme, Congress would condition any federal-research funds on agreement by the universities to allow their employee-inventors to retain title to any subject inventions assigned to them under the Bayh-Dole amendment, notwithstanding any conflicting university policies. Second, the universities, through their tech-

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158 *See* 35 U.S.C. § 202(a) (2006) (stating the university has right of first refusal, so to speak, so any patents that the federal government retains are those that the universities did not want).

nology transfer offices would be allotted a fixed period of time (*e.g.*, one month) to license the subject patent non-exclusively to at least two independent companies at a rate to each no less than half the related patent-procurement expenses. After reimbursing the inventors for expenses incurred, the university would retain for itself any excess royalties.[159] Third, if no qualifying suitors have emerged before the end of the allotted period, the subject patent would inure to the inventors without qualification. Finally, Congress would amend the tax code to provide a special rate for Bayh-Dole beneficiaries, balancing the need for inventor incentives against the interests of distributive justice.

While this is but one possibility, it attends to the concerns mentioned. Countless more possibilities can be imagined, some of which will undoubtedly carry more appeal. Yet again, this Article attempts not to draw the precise guidelines for establishing such a regime, but merely to demonstrate that inventor ownership could provide a welcome boon to the Act's incentive structure—one that should not be quickly dismissed.

[159] This provision ensures that the university will hold an adequate incentive to pursue non-exclusive licensing.